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Magnesium-based Combustion SynThesis of Advanced Materials for Energy and Space Applications

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MAGNESIUM-BASED COMBUSTION SYNTHESIS OF ADVANCED MATERIALS FOR ENERGY AND SPACE APPLICATIONS

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Dedication

A mi Papá y a mi Mamá,

y a mis hermanos.

MAGNESIUM-BASED COMBUSTION SYNTHESIS OF ADVANCED MATERIALS FOR ENERGY AND SPACE APPLICATIONS

by

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Abstract

As energy problems become more challenging, interest in low-energy-consuming methods for the fabrication of materials increases. Combustion synthesis is one such method because it is sustained by reaction heat release instead of external energy input. In the present work, combustion synthesis approaches are applied to the production of construction materials from lunar and Martian regolith and to the fabrication of magnesium silicide (Mg_2Si), a promising thermoelectric material for high-temperature applications. In both cases, magnesium (Mg) was used as one of the main reactants and similar experimental approaches were employed.

Recently, it has been proposed to use combustion of lunar regolith with Mg for the production of construction materials on the Moon. Although self-sustained combustion of JSC-1A lunar regolith simulant with Mg has been demonstrated, the reaction mechanisms are not well understood. Also, for Mars missions, it would be important to study combustion of Martian regolith with Mg. In the present work, thermoanalytical studies were conducted for mixtures of Mg with JSC-1A, JSC-Mars-1A, and Mojave Mars regolith simulants as well as with main reacting components of these materials – iron oxide and silica. Combustion of the two Martian simulants with Mg was also studied by thermodynamic calculations and combustion experiments. The mixtures based on JSC-Mars-1A exhibited higher temperatures than mixtures based on Mojave Mars, which correlates with iron oxide concentrations in the simulants. Thermoanalytical studies have shown that iron oxide plays a dominant role in the combustion of JSC-Mars-1A with Mg. However, for Mojave Mars and JSC-1A, which include more silica and less iron oxide, silica promotes reactions at lower temperatures.

In previous attempts to fabricate Mg_2Si via combustion synthesis, the thermal explosion mode was used, which required significant energy input and made it difficult to control the process and product quality. In the present work, for the first time Mg_2Si was obtained in the SHS mode of combustion synthesis, which requires much less energy and facilitates control of

the process. To enable SHS of Mg_2Si, mechanical activation of Mg/Si mixtures was employed. Combustion experiments and thermoanalytical studies revealed that the reaction between Mg and Si includes two stages of self-accelerating reaction, separated by a long period of a relatively slow diffusion of Mg and Si ions through the layer of formed Mg_2Si product. Explosive-based shockwave consolidation was used to increase the product density, and thermophysical properties of the obtained material were determined.

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Chapter 1
Introduction

1.1. Advanced Materials for Space and Energy Applications

1.1.1. Construction Materials on the Moon and Mars

The future direction of space exploration has been outlined by many different space actors. In 2015, NASA announced its space program *Journey to Mars*. The main goal of this program is to send humans to Mars by 2030 [1]. At the 67th International Astronautical Congress (2016), SpaceX announced their ambitious plans to send humans to the Red Planet at every launch window opportunity starting in 2018 [2]. The European Space Agency is currently developing a plan to create *Moon Village*, a lunar outpost where humans and robots could work together for long periods [3].

An important problem arises when looking at how humans can establish settlements on planetary surfaces. Today, the construction of structures in space is enabled by the fabrication of habitation modules on Earth. The creation of the International Space Station, as well as of any other structures in space, was limited by mass and volume, and more importantly, by launch costs. The future lunar and Martian missions will involve the construction of shelters, launch/landing pads, thermal/radiation shielding, and other structures. These missions are hardly feasible if the construction materials need to be supplied from Earth.

The approach that can solve this problem is the so-called *in situ* resource utilization (ISRU). The ISRU has the objective of converting planetary resources, *e.g.*, Martian atmosphere, into products that could be used for propulsion, human support systems, or human settlements. Historically, the production of rocket propellants has always been the main direction in the ISRU. Today, it is commonly agreed that the production of construction materials from lunar and Martian regolith is also a very important area [4]. Various solutions have been proposed, but most of those processes require large amounts of energy, which makes their

realization difficult. It is thus necessary to investigate new, low-energy-consuming processes for the fabrication of construction materials on the Moon and Mars.

1.1.2. Materials for High-temperature Thermoelectric Conversion

Thermoelectric materials are used to obtain an electric potential from a thermal gradient. The use of thermoelectrics for electric power generation is promising for various applications in automotive, aerospace, and other industries. Recently, thermoelectric convertors operating at high temperatures, such as systems for automobile waste heat recovery, have received a significant attention of researchers because they have the potential for increasing the thermal efficiency of power plants and hence decreasing fuel consumption and harmful gas emissions.

The efficiency of a thermoelectric material is characterized by the so-called thermoelectric figure of merit zT, which is a dimensionless value defined by the formula:

$$zT = \frac{S^2 T}{\rho \kappa} \quad (1)$$

where S is the Seebeck coefficient, T is the temperature, ρ is the electrical resistivity, and κ is the thermal conductivity. It is seen that in order to obtain a high zT, a material must have a high (semiconductor-like) Seebeck coefficient, a low (metal-like) electrical resistivity, and a low (glass-like) thermal conductivity. Currently, conventional thermoelectric materials have a zT value close to 1.

Common thermoelectric materials used at higher temperatures are based on lead telluride, PbTe, or cobalt antimonide, $CoSb_3$ [5]. Unfortunately, the fabrication of these materials involves complex and high-energy-consuming processes as well as toxic and expensive reactants.

Magnesium silicide, Mg_2Si, is a promising thermoelectric material for operation in the range of 200-500 °C. By enhancing Mg_2Si with the use of nanomaterials, zT values close to 1 have been obtained [6, 7]. It is attractive that Mg_2Si is a non-toxic material and its components are abundant and inexpensive. It is difficult, however, to synthesize high-quality Mg_2Si on a large scale [8]. Thus, it is necessary to investigate low-energy-consuming pathways for large-

scale fabrication of magnesium silicide, a promising high-temperature thermoelectric material. Ideally, these pathways should produce a nanostructural material because the small grains decrease the thermal conductivity while maintaining electric conductivity at the same level, thus leading to higher zT values [9].

1.2. Combustion-based Approach to the Fabrication of Advanced Materials

1.2.1. Combustion Synthesis

Combustion synthesis involves exothermic reactions between the components of the initial mixture of raw materials (usually, powders). External energy is required only for ignition, after which the heat released by the reaction sustains the process.

Combustion synthesis can occur in two modes: self-propagating high-temperature synthesis (SHS) and volume combustion synthesis (VCS) [10], see Figure 1. The SHS takes place when a mixture of exothermally reacting powders is ignited locally, *e.g.*, by a hot wire or by a laser beam, and then the combustion wave propagates over the mixture because of the reaction heat release. The VCS occurs when such a mixture is heated uniformly over the surface and then the ignition takes place virtually simultaneously in the entire volume. This mode is also called thermal explosion (TE) [11] and will be the term used throughout this work.

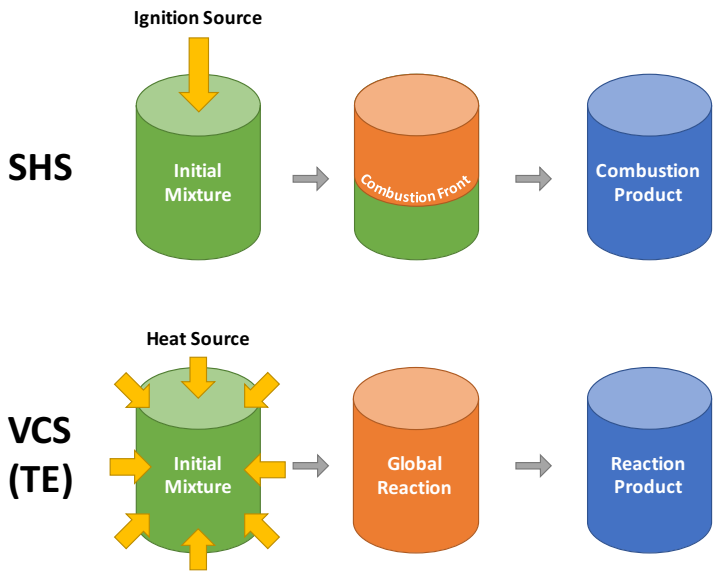

Figure 1. Combustion synthesis modes: self-propagating high-temperature synthesis (SHS) and volume combustion synthesis (VCS).

As compared with traditional material production techniques, combustion synthesis provides advantages such as low energy consumption, high-purity materials, and simple equipment. The perspectives of combustion synthesis as a method for production of advanced materials were first noticed by Merzhanov and co-workers in the 1960s [12]. Since then, dozens of materials (*e.g.*, carbides, borides, silicides, nitrides, and hydrides) have been obtained by combustion synthesis [11]. This process appears to be promising for the fabrication of both the construction materials on the planetary surfaces and the Mg_2Si-based thermoelectrics.

1.2.2. Magnesium as a Reactive Metal

Combustion synthesis usually involves reactive metals. Among the most commonly used metals are aluminum and magnesium. Aluminum provides more energy per unit mass than magnesium, which explains its wide use as an energetic additive in rocket propellants and pyrotechnics (*e.g.*, in thermites). A major drawback of aluminum in these applications and in combustion synthesis is the fact that the oxide layer on its surface is oxidation-protective. Thus, to ignite aluminum, temperatures over 2000 °C are usually required [13]. Magnesium ignites at

much lower temperatures because its oxidation leads to the formation of a non-protective oxide layer. As a result, magnesium forms exothermic mixtures with oxides of many metals and with some other elements such as boron and silicon [14, 15].

1.2.3. Combustion of Lunar Regolith Simulants with Magnesium

Combustion of lunar regolith simulants mixed with magnesium has recently been studied at the University of Texas at El Paso [16, 17, 18, 19]. The use of magnesium provides advantages such as high combustion temperatures, a sustained combustion front, low energy consumption, and high utilization of regolith. However, the mechanisms of reactions occurring during the combustion of regolith/magnesium mixtures are not well understood. As a result, it is difficult to predict combustion characteristics of many different types of regolith that may exist in different locations on the Moon and Mars. In particular, combustion of any Martian regolith simulants with magnesium has not been studied yet.

1.2.4. Combustion Synthesis of Magnesium Silicide

Magnesium silicide has been obtained by combustion synthesis using the TE mode [20, 21]. As noted above, the TE process involves heating the entire sample, which requires significant amounts of heat when the sample is large (i.e. in industrial applications). It would be attractive to use the SHS mode of combustion synthesis because this would decrease the consumed energy and facilitate control of the process. However, the magnesium/silicone mixture is low-exothermic and it is difficult to ignite it locally. Apparently, for this reason there is no report on the combustion synthesis of Mg_2Si in the SHS mode. Recently, mechanical activation (short-term high-energy ball milling) has attracted attention of researchers as a promising method for facilitating the ignition of low-exothermic mixtures [22, 23, 24, 25]. It is thus attractive to investigate the feasibility of using mechanical activation for enabling SHS of Mg_2Si.

Further, combustion synthesis products are usually porous and fragile. To produce a useful thermoelectric material, Mg_2Si obtained by combustion synthesis needs to be consolidated. An attractive solution, which also allows one to retain nanostructure of powders, is

shockwave consolidation. This process involves a controlled explosion that provides high pressures and high temperatures within fractions of second, thus avoiding the grain growth. It is thus important to investigate the feasibility of fabricating a high-quality thermoelectric material by shockwave consolidation of Mg_2Si obtained by combustion synthesis.

1.3. Objectives

The objectives of the present work are:

1. To determine the combustion characteristics of Martian regolith simulants mixed with magnesium.
2. To determine the mechanisms of reactions occurring during combustion of lunar and Martian regolith simulants with magnesium.
3. To investigate mechanically activation-assisted combustion synthesis of magnesium silicide.
4. To investigate the feasibility of using shockwave consolidation for densifying magnesium silicide.

Chapter 2
Literature Review

2.1. Construction Materials on the Moon and Mars

2.1.1. The Lunar and Martian Regolith Resources

A significant volume of information on the properties of lunar and Martian regolith has been obtained in the previous exploration of these space bodies.

On the Moon, regolith consists of silicate minerals such as olivine, pyroxene, and plagioclase, and non-silicate minerals such as ilmenite. Glass and agglutinates are also present in the lunar regolith [26]. Regolith on the Moon was formed by eruption of lava flows, continuous impacts of meteoroids, and cosmic bombardment of charged particles. Analysis of the regolith samples from Apollo and Luna missions determined that the mean grain size is in the range from 40 μm to 800 μm [27].

Martian surface consists mainly of plagioclase feldspar, low-Ca and high-Cal pyroxenes, olivine, high-silica phases, ilmenite, and magnetite, with some sulfates [28]. Various geologic processes, including the past presence of liquid water, have contributed to the weathering of the Martian regolith. According to the measurements conducted by Opportunity rover, regolith at the Meridiani Planum consists of grains <125 μm and 1 – 4.5 mm [29].

2.1.2. Regolith Simulants

2.1.2.1. Overview

Since the amount of lunar regolith delivered to Earth by Apollo and Luna missions is limited and no Mars samples are available except for several meteorites found in Antarctica, it has been recognized that it is important to develop lunar and Martian regolith simulants. Materials with similar compositions and morphology have been mined in a number of locations on Earth. The most widely used and accepted are JSC-1A lunar regolith simulant and JSC-Mars-

1A Martian regolith simulant. More recently, Mojave Mars has been recognized as another useful analog of Martian regolith.

The regolith simulants (and the actual lunar and Martian regolith) consist of several mineral phases. Quantitative mineral composition is known for JSC-1A (Table 1) but not for JSC-Mars-1A and Mojave Mars.

Table 1. Mineral composition of JSC-1A [16]

Mineral	**Formula**	**JSC-1A composition, wt %**
Anorthite	$CaAl_2Si_2O_8$	26.48
Albite	$NaAlSi_3O_8$	11.35
Orthoclase (K feldspar)	$KAlSi_3O_8$	0.07
Wollastonite	$CaSiO_3$	7.77
Enstatite	$MgSiO_3$	7.38
Ferrosilite	$FeSiO_3$	4.28
Forsterite	Mg_2SiO_4	9.08
Fayalite	Fe_2SiO_4	3.36
Glass		26.67
MgFeAl silicate		3.06
Troilite	FeS	0.17
Ilmenite	$FeTiO_3$	0.11
Calcite	$CaCO_3$	0.11
Magnetite	Fe_3O_4	0.01
Quartz	SiO_2	0.01
Others		0.07
Total		**99.98**

For simplicity, minerals can be represented as mixtures of simple oxides. This decreases the accuracy of analysis (for example, in thermodynamic calculations for mixtures of regolith with reactive metals), but allows one to compare the three simulants because a simple oxide composition is known for each of them (Table 2).

Table 2. Simple oxide compositions of JSC-1A lunar regolith, JSC-Mars-1A, and Mojave Mars regolith simulants.

Compound	**Concentration, wt%**		
	JSC-1A [30]	**JSC-Mars-1A** [31]	**Mojave Mars** [32]
SiO_2	45.7	43.48	49.4
Al_2O_3	16.2	22.09	17.1
Fe_2O_3	12.4	16.08	10.87
CaO	10	6.05	10.45
MgO	8.7	4.22	6.08
Na_2O	3.2	2.34	3.28
TiO_2	1.9	3.62	1.09

2.1.2.2. JSC-1A

JSC-1A is a lunar regolith simulant obtained from the southern side of the Merriam Crater near Flagstaff, Arizona. JSC-1A is mostly glassy, plagioclase, and olivine; it also includes traces of Ti-magnetite and spinel [33]. In terms of simple oxide representation, SiO_2, Al_2O_3, Fe_2O_3, CaO, and MgO are the major constituents of JSC-1A (see Table 2). It has been noted that the content of iron in JSC-1A is similar to the regolith in Apollo 17 landing site, but the level of iron oxidation is higher in JSC-1A because of weathering: there are large amounts of iron as Fe^{3+} and Fe^{2+} ions, while the actual lunar regolith contains only Fe^{2+} and Fe^{0} [30].

JSC-1A has been used for studies of material handling, excavation, dust control, spacesuit durability, oxygen production, and sintering to produce building blocks [34, 35, 36, 37, 38, 39].

2.1.2.3. JSC-Mars-1A

JSC-Mars-1A is a Martian regolith simulant that has been obtained from Pu'u Nene, a Pleistocene cinder cone on the Mauna Kea, Hawaii. The simulant is basaltic in nature, a <1 mm fraction of weathered volcanic ash. Allen *et al.* studied the mineral composition of JSC-Mars-1A [31]. It was found that JSC-Mars-1A is predominately Ca-feldspar and minor magnetite. Low levels of olivine, pyroxene, and glass are also present. The chemical composition of JSC-Mars-1A is in great portion SiO_2, followed by Al_2O_3 and Fe_2O_3 (see Table 2).

JSC-Mars-1A simulant has been widely accepted by research groups as an analog of the regolith in the red, bright regions of Mars [40, 41, 42]. The composition of JSC-Mars-1A is nearly identical to that of regolith in these regions except for higher content of Al_2O_3, TiO_2, and water in the simulant.

2.1.2.4. Mojave Mars

Mojave Mars regolith simulant was obtained from the Saddleback Basalt, near Boron California, in the western Mojave Desert. It has been classified as an olivine-based basalt. Plagioclase feldspar and Ca-rich pyroxene are majorly found in Mojave Mars with small amounts of ilmenite and iron-rich olivine and varied amounts of hematite [32]. Major constituents of the simulants are SiO_2, Al_2O_3, Fe_2O_3, and CaO (see Table 2).

The simulants obtained from the Saddleback Basalt are primarily used for understanding of physical surface operations. In contrast with JSC-1A, Mojave Mars has low water content, and therefore it has also been used in volatiles loss studies.

2.1.3. Methods for Making Construction Materials on the Moon and Mars

At large, the processes for making construction materials on the Moon and Mars include the addition of components to regolith or require heating regolith up to high temperatures, close

to its melting point. More specifically, the most common methods are fabrication of concrete, regolith stabilization with polymers, sintering, and combustion of regolith mixtures with energetic materials.

2.1.3.1. Concrete production

The production of concrete is one of the most studied methods for making construction materials on the Moon and Mars. There are two methods considered: water-based [43] and sulfur-based concrete [44].

The first method can be contemplated to be a conventional concrete. Just as on Earth, the concrete on the Moon will consist of aggregate, cement, and water. To make concrete, the lunar regolith can act as the aggregate, while the cement can be produced from CaO in the regolith [45]. Although the presence of water on the Moon has been confirmed, the utilization of water for concrete production may not be prioritized due to its applications in life support systems or propulsion; nonetheless, steam-based concrete has been proposed [46]. By using steam, the amount of water needed for making lunar concrete can be reduced.

On the other hand, waterless lunar concrete can be produced by replacing water and cement with sulfur. The sulfur concrete is a mixture of elemental sulfur and an aggregate, in this case, regolith. On the Moon, sulfur is available in the form of FeS, which will require reduction. Sulfur concrete was produced by heating the mixture of 65 wt% JSC-1 lunar regolith simulant and 35 wt% sulfur above 120 °C, the melting point of sulfur [47]. Recently, sulfur concrete has been obtained using JSC-Mars-1A regolith simulant and sulfur [48]. The optimal composition was 50 wt% regolith and 50 wt% sulfur. The compressive strength of the Martian concrete was close to 50 MPa. A major drawback of sulfur concrete materials is that the operation temperature is limited by the low melting point of sulfur [47].

2.1.3.2. Regolith/polymer composites

Hintze *et al.* investigated the addition of polymers into regolith [49]. The polymers were heated or UV-cured to make a stable surface. Mixtures with 10−50 wt% polymer were obtained

by dispersing a polymer over a regolith area at a rate of 0.08 to 0.31 kg/m^2. The mixtures were cured for 10 min at 200 °C using a solar concentrator. The compressive strength of the obtained materials was in the range of 0.14 to 0.55 MPa. Further tests of polymer-regolith materials are needed to determine the optimal mechanical performance.

A novel approach to regolith stabilization by adding a protein binder was proposed at Stanford University [50]. Regolith biocomposite (RBC) was fabricated using vacuum-assisted infusion of bovine serum albumin. The mixture consisting of 7 wt% protein binder showed compressive strength of 9.5 MPa. Although the protein-based approach requires a relatively small amount of binder material, more research is needed on the production of the binder in space and on the effects of radiation.

2.1.3.3. Sintering

Lunar and Martian regolith are primarily basaltic materials. Because of their high content of glass, sintering processes have been proposed to create construction materials. A common sintering process involves compacting and heating the regolith [51]. Temperatures to sinter regolith need to be as high as 1120 °C. Heating can be performed using solar concentrators [52] or microwave sintering [39].

Compressive strength of sintered regolith was tested using Minnesota Lunar Simulant (MLS-1), a simulant that contains coarse grains of plagioclase, olivine, ilmenite, titanomagnetite, and clinopyroxene, but lacks glassy agglutinate fraction [26]. Sintering MLS-1 for 1 h at 1100 °C resulted in a compressive strength of 14 MPa [53]. In another experiment, sintering at 1080 °C for 72 h achieved compressive strength of 223 MPa with a porosity of 18 vol% [51]. Although the sintering approach can result in a strong compressive performance, the energy requirements are very high.

2.1.3.4. Combustion-based methods

Martirosyan and Luss at the University of Houston studied the addition of a highly exothermic Ti/B mixture to JSC-1A lunar regolith simulant [54, 55]. The mixtures included 60

wt% Ti/B additive. Micro- and nano-sized powders of titanium and boron were tested. A self-sustained combustion was observed with both particle sizes. The use of micro-sized particles resulted in combustion temperature near 1200 °C, which resulted in partial sintering of the products [54]. On the other hand, nano-sized powders generated higher temperatures, close to 1500 °C, which resulted in well-sintered regolith [55]. It is important to note that the concentration of JSC-1A was as low as 40 wt% and it remained inert during the combustion.

Faierson *et al.* at Virginia Tech studied combustion of JSC-1A mixed with aluminum [56]. In contrast with the mixture of JSC-1A and Ti/B, aluminum can directly react with regolith. In their study, JSC-1A was mixed with Al at different ratios. The mixtures included 19.44, 24.45, 28.85, and 33.3 wt% Al. Each mixture was poured into aluminum foil crucibles of 2.5 cm diameter and 7.5 cm height. A long (30.5 cm) Nichrome wire was bent into the shape of a "U" and immersed in the mixture in order to heat it and trigger the reaction. After gradually increasing the current through the Nichrome wire from 2.5 to 22.5 A for 13 min, the combustion synthesis occurred in the thermal explosion mode. The compressive strength of the combustion products was in the range of 10 to 18 MPa. Although the reaction of aluminum with regolith was demonstrated in these experiments, a significant amount of external energy, 1400-2400 kJ/kg, was required to preheat the mixture. This is comparable with the energy released by combustion reactions in their mixtures, 1900-2000 kJ/kg according to our thermodynamic calculations. The use of a fine fraction of JSC-1A (called JSC-1AF) decreased the required external energy to 700-900 kJ/kg, but this is still a very large amount.

Another series of experiments was conducted by Faierson *et al.* using large silica crucibles capable of containing 250 g of the mixture of JSC-1A with 33.3 wt% aluminum [57]. A Nichrome wire, 66 cm or 86 cm long, was folded in a waffle pattern and immersed in the mixture. As in their aforementioned experiments, in order to initiate the reaction, it was necessary to heat the mixture providing a high electric current (up to 18-24 A) through the wire for a rather long time (7-15 min).

In Italy, Corrias *et al.* mixed lunar regolith simulant with aluminum and ilmenite ($FeTiO_3$) [58, 59]. In the mixture, aluminum reacted exothermically with ilmenite (thermite reaction), enabling a self-sustained combustion. The regolith concentration in the combustible mixtures was as low as 30 wt%. The combustion products achieved compressive strength over 20 MPa. Since only traces of ilmenite are found in JSC-1A, regolith remains virtually inert during the reaction. Therefore, enriching lunar regolith by ilmenite is necessary to guarantee combustion propagation.

Corrias *et al.* also studied the SHS process in the mixtures of Martian regolith simulant with aluminum and hematite (Fe_2O_3) [59]. The mixtures included 16 wt% aluminum, 39 wt% hematite, and either 45 wt% Mojave Mars or 32 wt% Mojave Mars and 13 wt% JSC-Mars-1. In both cases, self-propagating combustion was demonstrated. Note that the combustion propagation was only achieved with the addition of a significant amount of hematite to the mixture.

Another proposed method for activating combustion of aluminum/regolith mixtures involves the addition of polytetrafluoroethylene (Teflon) [60]. SHS was demonstrated at 12 wt% Al and 1.5 wt% Teflon. Thus, the use of Teflon as an activator is effective, though this is an additional reactant that has to be transported from Earth.

Since 2009, research at the University of Texas at El Paso has been conducted to study the reaction of lunar regolith with magnesium [16, 17, 18, 19]. Initially, the adiabatic flame temperatures for the mixtures of JSC-1A with Al, Mg, and Ti/B were calculated, see Figure 2. It was found that magnesium was advantageous over aluminum when mixed with lunar regolith simulant. For Mg, the maximum adiabatic flame temperature was 1417 °C, whereas for Al, the maximum temperature was 1293 °C, lower by 124 °C [16].

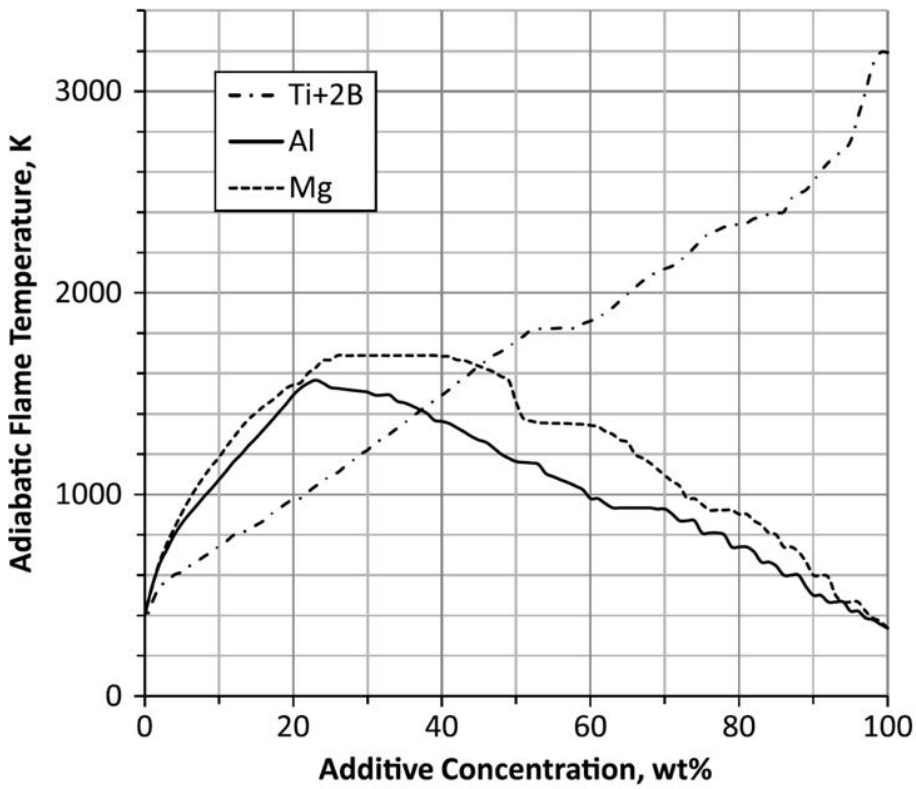

Figure 2. Adiabatic flame temperatures for mixtures of JSC-1A with different additives [16].

Combustion experiments of JSC-1A/Mg mixtures have shown that with decreasing the particle size of regolith via ball milling at 200 rpm for 2 to 4 h, a stable combustion was observed at lower concentrations of magnesium [16]. Interestingly, spin combustion was reported for the composition with 23 wt% JSC-1A that was ball-milled for 2 h [17]. By high-energy-ball milling of regolith, using a planetary-ball mill for four cycles of 10 min at 1100 rpm, the concentration of magnesium required for stable combustion propagation was decreased to 10 wt%. Note that on the Moon, grinding will be unnecessary as the actual lunar dust is very fine. Preheating the samples in argon atmosphere to 100 °C enables stable combustion with magnesium content as low as 8 wt% [19, 61].

The combustion products of JSC-1A obtained in an argon environment were porous and fragile. SHS compaction, a quasi-isostatic pressure process applied immediately after

combustion, was used to increase the density and strength of the combustion products. SHS compaction involved the use of a pressure-transmitting medium to apply pressure to the hot products. The density of the products was increased by 60-66 % with respect to non-compacted products, see Figure 3. Also, the compressive strength or the products exceeded 10 MPa, higher than the compressive strength of common bricks [19, 61].

Figure 3. Comparison of combustion products obtained in argon and SHS compaction products [19].

X-ray diffraction analysis of products collected after combustion in argon environment has identified iron silicide (FeSi), magnesia (MgO) and free silicon (Si) among the combustion products [19, 61]. The presence of such products suggests that thermite mixtures of silica (SiO_2) and iron oxide (Fe_2O_3) with magnesium play an important role in the combustion mechanism.

$$SiO_2 + 2\ Mg \rightarrow Si + 2\ MgO \qquad \Delta H^\circ_{rxn} = -146 \text{ kJ per mol Mg} \qquad (2)$$

$$Fe_2O_3 + 3\ Mg \rightarrow 2\ Fe + 3\ MgO \qquad \Delta H^\circ_{rxn} = -328 \text{ kJ per mol Mg} \qquad (3)$$

However, from Table 1, it can be noted that silica has higher concentration in the regolith, but iron oxide thermodynamically exhibits higher heat release. Therefore, it is unclear which compound plays a larger role in the combustion mechanism.

The reduction of oxides in regolith by magnesium can be assessed with an Ellingham diagram. This diagram presents the Gibbs free energy of formation, ΔG°, of various compounds

as a function of temperature, see Figure 4. When the free energy of formation is negative, the reaction is feasible and can occur spontaneously without energy input. Commonly, the layout of the diagram presents the oxide formation of metals normalized for one mole of oxygen. A greater value of $-\Delta G°$ (*i.e.* a greater absolute value of the Gibbs free energy of formation), represents a more stable oxide; whereas a lower value of $-\Delta G°$ denotes a less stable oxide. In the Ellingham diagram, it can be verified that magnesium oxides are among the most stable. For this reason, magnesium can be used to reduce oxides in regolith that have lower values of $-\Delta G°$. Analyzing the oxides shown in Table 1, one can see in Fig. 4 that magnesium reduces Fe_2O_3, Na_2O, SiO_2, and TiO_2 over the entire temperature range from 0 to 2000 °C and Al_2O_3 up to 1550 °C, but it cannot reduce CaO. It is important to note, however, that each of Fe_2O_3, SiO_2, and Al_2O_3 is present in amounts greater than 10 wt% in the different types of regolith, while concentrations of Na_2O and TiO_2 are only 2.3-3.3 wt% and 1.1-3.6 wt%, respectively. For this reason, reactions of Mg with Na_2O and TiO_2 may play only a small role during combustion. A more accurate analysis should account for actual (mineral) phases in regolith, but, as noted above, the quantitative mineral composition is known only for JSC-1A (Table 1).

No studies have been performed so far on the combustion of Martian regolith simulants with magnesium.

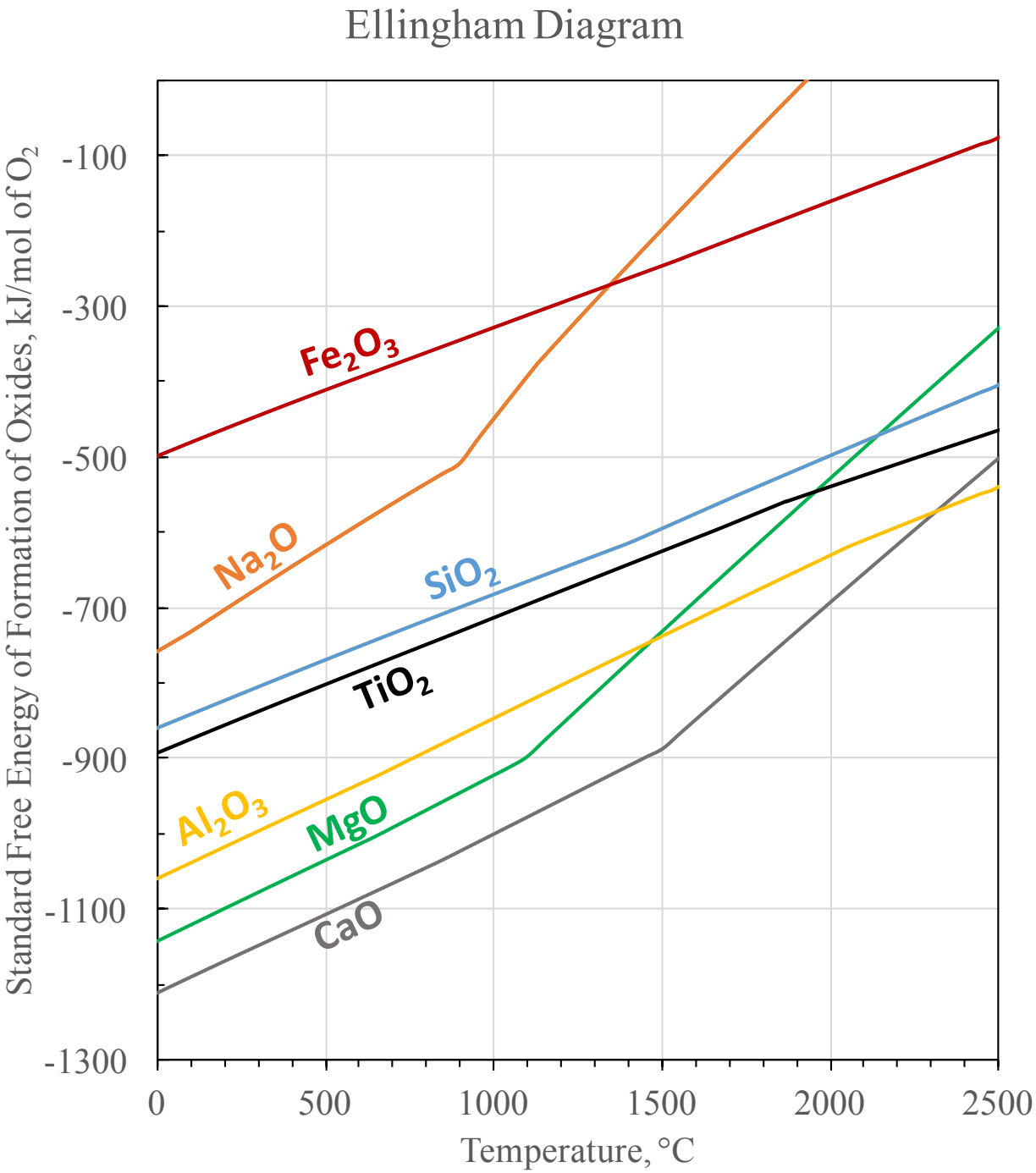

Figure 4. Ellingham diagram for some common metals [62].

2.1.4. Summary

Different approaches to making construction materials on the Moon and Mars were considered.

- Concrete production, a well-known process, could be used on the Moon and Mars, but it requires water, which is needed, first of all, for life support and propulsion systems. Sulfur concrete is a viable option, but has high material requirements, 50 wt%. Moreover, the low melting point of sulfur limits the use of sulfur concrete on illuminated regions of the Moon.
- Utilizing polymer binder materials can improve the mechanical properties of regolith. The process is simple and does not require high temperatures or high energy consumption. However, binder materials would need to be transported from Earth and can be affected by space radiation.
- Sintering regolith provides high compressive strength, but the process requires long operational times, very high temperatures, and large amounts of energy.
- Combustion-based methods offer low energy consumption and high temperatures due to exothermicity of reactions. Aluminum-based reactions have been demonstrated, but their initiation requires either high energy input or additional compounds, such as iron oxides or Teflon.
- Magnesium-based combustion synthesis with JSC-1A lunar regolith simulant has demonstrated easy ignition with low energy input, high combustion temperatures, and high utilization of regolith. Combustion of magnesium with Martian regolith simulants has not been studied yet.
- SiO_2 and Fe_2O_3 are present in lunar and Martian regolith simulants, but in different concentrations. These oxides may participate in highly exothermic thermite reactions with magnesium, which may be responsible for self-sustained combustion. However, the reaction mechanisms in regolith/Mg mixtures remain unclear. Comparison of the

combustion processes of the lunar and Martian simulants with magnesium may help clarify the roles of SiO_2 and Fe_2O_3 in the combustion mechanisms.

2.2. Magnesium Silicide

2.2.1. Synthesis of Magnesium Silicide

Magnesium silicide can be synthesized by different methods such as induction melting, mechanical alloying, solid-state reaction, spark plasma sintering, and combustion synthesis.

2.2.1.1. Induction melting

Mg_2Si has been produced by induction melting of Mg/Si mixture [63]. Before melting, a small quantity of magnesium, 2.5%, was added to compensate for Mg loss at high temperatures. The Mg/Si mixture was dynamically heated to 1105 °C in a graphite crucible using an induction-melting chamber with inert atmosphere. This process was repeated three times. The mass of the ingot produced was 100 g. The products consisted of large (over 100 μm) grains and had a low (less than 1 vol%) porosity.

2.2.1.2. Mechanical alloying

The production of Mg_2Si via mechanical alloying was analyzed by Riffel and Schilz [64]. Mechanical alloying consists of repeated high-energy mechanical impact with desirable results such as uniform microstructure and no need for preheating. In their study, a vibration mill was used to produce Mg_2Si powder from magnesium ribbon cuts and millimetric silicon bits. N-hexane was used as milling fluid. The milling time and ball-to-powder ratio (BPR) were varied from 22 to 90 h and from 2:1 to 44:1, respectively, to obtain optimal operational parameters for Mg_2Si production. It was found that high BPR, such as 44:1, and milling for 60 h resulted in full conversion to Mg_2Si. Long milling times resulted in significant contamination by tungsten carbide from the grinding media.

Niu and Lu synthesized Mg_2Si via mechanical alloying using a planetary ball mill and magnesium and silicon powders [65]. In their study, the contamination during milling from different materials, alumina and hardened steel, was analyzed. It was found that even after 30 h at 250 rpm and a BPR 20:1, full conversion to Mg_2Si was not achieved. The use of hardened

steel balls and alumina balls resulted in contamination by grinding media starting at 5 and 10 h, respectively.

Jung *et al.* conducted mechanical alloying of 99.99 % pure magnesium and silicon powders [66]. The Mg/Si mixture was milled in a planetary ball mill for 12-24 h in argon environment using hardened steel balls. Conversion was achieved after 24 h which produced Mg_2Si powder of less than 5 µm. No MgO impurities were observed after mechanical alloying. No information on contamination during milling was provided.

Recently, Bux *et al*. used an incremental milling technique to shorten the time required for the production of Mg_2Si by mechanical alloying [8]. The process involved ball milling of silicon with addition of Mg in small increments (200-500 mg) until Mg/Si stoichiometry was achieved. The process resulted in the production of 4-10 g of Mg_2Si in about 8 hours. Particle size of the obtained products was in the range of 20 nm to micron sizes. Contamination by tungsten carbide from the milling media was reported.

2.2.1.3. Solid-state reaction

The solid-state reaction method has been used for the fabrication of Mg_2Si by many researchers. Usually, before reaction, magnesium and silicon powders are ground and cold pressed into pellets. Next, the pellets are sealed in silica tubes under inert atmosphere or vacuum to avoid reaction of magnesium with oxygen. The solid-state reaction occurs during annealing the Mg/Si pellets.

Kondoh *et al.* used bulk mechanical alloying (BMA), which involved repeated extrusion and compaction of Mg/Si mixture in a die [67]. Repetition of the process breaks the oxide layers in the elemental powders and decreases the mean particle size to less than 2 µm. After 150 BMA cycles, solid-state reaction was achieved by annealing the powders at 350 °C for 1 h under vacuum. XRD analysis of the obtained products has shown full conversion to Mg_2Si with no magnesium, silicon, or impurity peaks detected.

Wang and Qin assessed the effect of milling before solid state reaction [68]. In their

study, Mg/Si mixtures were milled for 20-60 h using a planetary ball mill at 250 rpm. It was found that milling can lower the temperature of Mg_2Si formation to 180 °C. Also, milling for 20 to 70 h was beneficial for the production of nanostructured Mg_2Si powder. Annealing the milled powders for 1 h to temperatures above 450 °C was found to increase mean grain size. More importantly, it was found that long milling process resulted in contamination by iron originated from the grinding media, though the iron impurities did not affect the formation of Mg_2Si when annealing temperatures were below 450 °C. Higher annealing temperatures and surplus of Si could also lead to the formation of Fe_3Si.

Ioannou *et al*. ball milled Mg/Si mixtures for 30-60 min at 300 rpm [69]. The mixtures were heated at a slow rate of 1 °C/min to a maximum temperature between 150 and 500 °C. Additionally, the maximum temperature was hold at different durations in the range of 0 to 300 h. It was observed that mixtures milled for 60 min achieved complete conversion to Mg_2Si at annealing temperatures between 280 and 500 °C, however at the latter, peaks of unreacted silicon were present. The particle size of the product was less than 5 μm. Holding maximum temperature for 3 to 200 h was necessary for powders heated between 280 and 350 °C.

Liu *et al*. synthesized Mg_2Si with Sn and Bi dopants, which enhance thermoelectric properties [70]. The initial powders of Mg, Si, Sn, and Bi were mixed and ground by hand. Solid state reaction was carried out in vacuum twice: first at 600 °C and then at 700 °C, to generate a homogeneous distribution of the solid solution. In contrast with the ball milling approach, high annealing temperatures caused evaporation and loss of magnesium. An additional 8 wt% Mg was added to the stoichiometric mixture of Mg and Si to compensate for losses. Minimal amount of MgO impurities were identified.

Zhou and Bai have fabricated Mg_2Si by microwave heating of Mg/Si mixture to 580-630 °C and holding it for 20-40 min [71]. The heating process required 2.0-3.5 kW and the hold required 1.0-1.5 kW. Because of the high temperatures, an additional 8% Mg was necessary to compensate for losses during sintering. Impurities in the form of silicon and magnesium oxides

were observed when the mixture was heated to 630 °C and also when the temperature hold lasted 40 min.

2.2.1.4. Spark plasma sintering

Spark plasma sintering (SPS) is a technique that combines pressing and high electric current. SPS apparatus consists of an enclosed hydraulic press and a pulsed DC power supply. The enclosure enables the operations under vacuum and inert atmospheres. Before SPS, a powder is poured into a graphite die. The die is placed inside between the two press punches that are connected to electrodes. During SPS, the pulsed DC current heats the graphite die and its contents internally due to their electric resistance. Uniaxial pressing is applied simultaneously with the pulsed current. SPS can heat the sample at high heating rates. Owing to the complexity of the apparatus, products of SPS are commonly of millimetric scale and of simple shape [72].

Savary *et al.* synthetized Mg_2Si via spark plasma sintering of cold pressed MgH_2 and ball-milled silicon powders, 50-400 nm [73]. The pellet had a mass between 2 and 3 g. In their study, MgH_2 was decomposed to Mg and H_2 at 410 °C. The remaining Mg reacted with free silicon to produce Mg_2Si. The SPS process was performed in vacuum at temperatures up to 775 °C under a uniaxial maximum pressing of 50 MPa. It was found that grain size of the products was between 1 and 4 µm, with no apparent MgO phase. Unexpectedly, the Mg_2Si product obtained during SPS did not consolidate; it was a loose powder.

Arai *et al.* also demonstrated Mg_2Si synthesis from micro-sized powders of magnesium and Sb-Ge-doped silicon via SPS [74]. Magnesium and Sb-Ge doped silicon powders were initially mixed and ground. For the SPS process, the mixture was poured into a graphite die. The SPS process occurred in two steps. The mixture was first heated to 600 °C at a rate of 100 °C /min. Then, it was heated at 10 °C/min to 650 °C with a uniaxial pressure of 20 MPa. SPS process was performed under inert atmosphere. The products exhibited high purity and 99.5 % theoretical density.

A similar process to SPS, under the name of field-activated and pressure-assisted synthesis (FAPAS), was used by Meng *et al.* to produce and consolidate Mg_2Si doped with rare earth metals [75]. Initially, mixtures of magnesium, silicon, scandium, and yttrium powders were milled in a planetary ball mill for 5 h at 230 rpm and compacted into 20-mm diameter, 3-mm thick pellets. The pellets were sintered at temperatures in the range of 750-800 °C under uniaxial pressure of 50 MPa for 15 min. It was found that 5 % excess magnesium was needed due to losses during milling and synthesis. The products of FAPAS achieved a relative density of 95-97 %. The grain size measured for undoped samples was 3-4 µm, while Y-doped samples 1.5-2 µm. Moreover, impurities of MgO and elemental Si were observed for undoped and doped samples.

2.2.1.5. Combustion synthesis

Magnesium silicide has been produced via combustion synthesis in the thermal explosion mode by Horvitz *et al*. [20] A mixture of magnesium and silicon powders, less than 43 µm and 1-5 µm, respectively, was milled using a high-energy attrition mill for 1 h in an argon environment. The milled powders were cold pressed under vacuum into 99 % dense pellets. The pellet was placed between the rams of a compressive test machine, see Figure 5. Ignition was caused by preheating the rams. Temperature of the reaction was measured by two thermocouples inserted into drilled holes of the sample: one close to the edge and a second in the center. The rams were heated to 340-530 °C. The lowest ram temperature required for combustion was 355 °C.

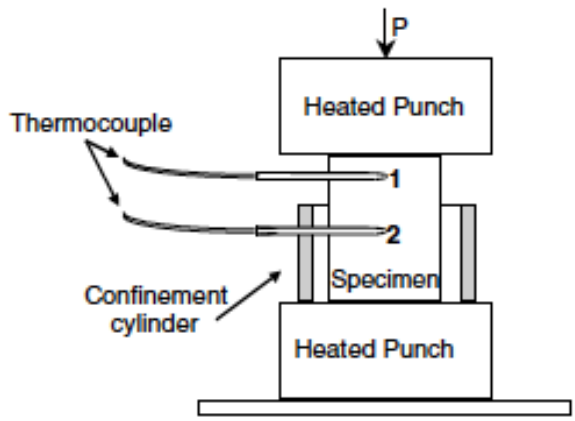

Figure 5. Schematic of the combustion synthesis setup [20].

The combustion synthesis occurred in the thermal explosion mode. At the beginning of the heating process, the temperature at the edge was higher than in the center, see Figure 6. With approaching to the ram temperature, the difference between the temperatures at the edge and in the center decreased to a zero and the subsequent rise of the temperature was occurring almost simultaneously throughout the sample (the temperature at the edge was slightly lower than in the center because of heat loss to the rams).

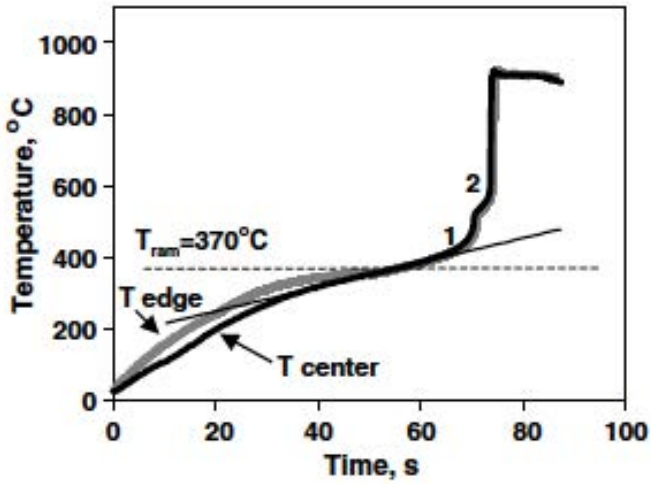

Figure 6. Temperature profiles obtained during heating [20].

As seen in Figure 6, combustion synthesis occurred in two stages. XRD analysis was performed after milling, after the first stage (the sample was quenched using cold copper plates), and after the entire process. The XRD patterns after milling indicated pure Mg and Si. After the first stage, small amounts of MgO and Mg_2Si were identified. The authors suggested that the first stage was caused by the reaction between Mg and SiO_2 layer at the surface of silicon. XRD analysis of the final products showed full conversion to Mg_2Si, with small presence of MgO impurity.

Godlewska *et al.* studied combustion synthesis of Mg_2Si from unmilled powders of Mg and Si, 840-149 µm and 149-43 µm, respectively [21, 76]. The powders were mixed and cold pressed into 2-cm-diameter, 1-cm-height pellets. The pellets were placed in resistance-heated ceramic crucibles. Thermal explosion was achieved under a dynamic vacuum of 10 Pa and was followed by annealing at 600 °C. The reaction was also studied using simultaneous thermal gravimetric and differential thermal analysis (TG-DTA). The Mg/Si mixture was heated at a rate of 10 °C/min in argon flow. The samples used in thermal analysis were either loose or compacted.

Combustion synthesis of Mg_2Si occurred in the thermal explosion mode. The products were a loose powder. The micrographs revealed that the micron-sized particles are agglomerates of particles that were smaller than initial Mg and Si particles. The loose powder form of the combustion products was explained by the volume changes during reaction, the difference in volatility of the reactants, and the vapor pressure of magnesium under vacuum. XRD analysis confirmed the presence of impurities in the form of small amounts of MgO and unreacted silicon.

As in the studies conducted by Horvitz *et al.* [20], two stages of the reaction were revealed by thermal analysis as shown in Figure 7. The second stage occurred at 550 °C in a loose powder and 580 °C in a compacted powder. Godlewska *et al*. attributed the first reaction to oxidation of the powders by impurities in the inert gas during thermal analysis [21, 76]. This was

suggested because of the broader initial peak for the loose powder sample, implying greater gas permeation in the sample as compared to a compacted sample, see Figure 7.

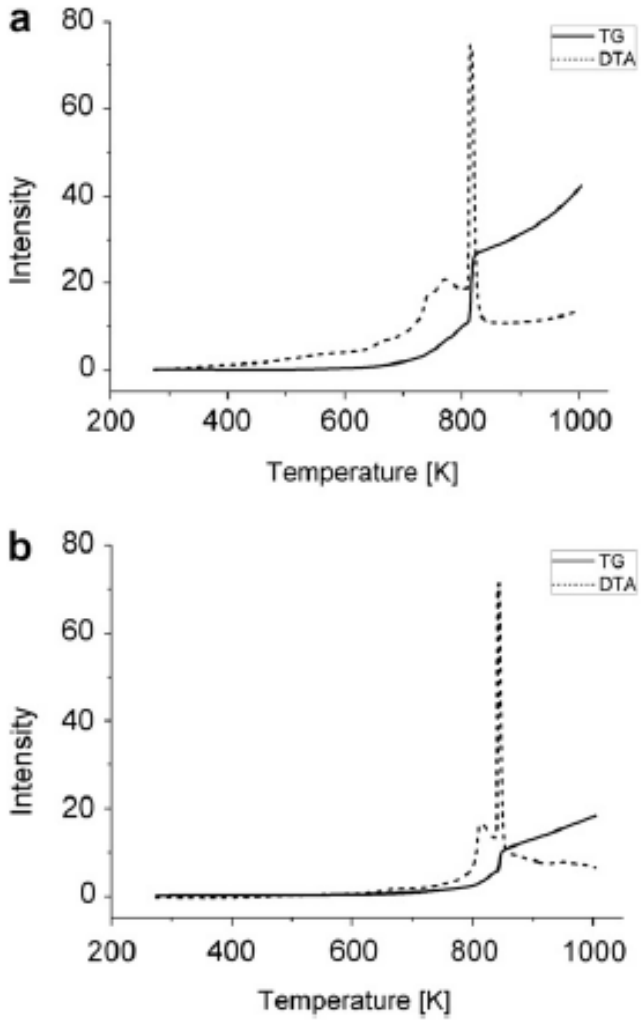

Figure 7. TG and DTA curves for Mg/Si mixture heated in argon flow; (a) loose powder and (b) compacted powder [21].

In summary, in prior studies [20, 21, 76], combustion synthesis of Mg_2Si was achieved in the thermal explosion mode. In both studies, temperature curves recorded during combustion showed two peaks of the exothermic reaction. Different explanations were given for the

existence of the low-temperature peak. More research is needed to understand the reaction between magnesium and silicon.

Based on the analysis of the results obtained [20, 21, 76], it can be suggested that thermal explosion, in fact, took place in some other aforementioned studies that involved induction melting, high-temperature annealing, and SPS. Exothermic reactions could significantly increase the temperature of the externally heated sample and result in its combustion inside the furnace or SPS apparatus.

However, the SHS mode of combustion synthesis has not been investigated yet. The SHS process, involving local ignition at one end of the sample and a self-sustained propagation of the combustion wave over the entire (possibly quite long) sample, would enable more benefits than thermal explosion. SHS can be scaled up easier as it is a better controlled process. Parameters such as particle size, mixture ratio, density of the mixture, ambient pressure influence the combustion process and can be modified to tailor the product properties [77]. Also, SHS eliminates the need for preheating the entire mixture, which results in less energy consumed. Thus, the feasibility of fabricating Mg_2Si in the SHS mode of combustion synthesis should be investigated.

2.2.2. Consolidation of Magnesium Silicide

To yield a useful material, the obtained magnesium silicide must be densified. This is especially important for combustion synthesis, which usually produces porous and fragile materials. The densification approaches involve the use of heat and pressure.

2.2.2.1. Hot pressing

Bux *et al.* hot-pressed Mg_2Si, obtained by mechanical alloying, for 1 h at 100 MPa and at temperatures exceeding 1000 K under argon and vacuum [8]. The compaction process achieved 99 % theoretical density; however, the nanopowders coalesced into larger grains.

Ioannou *et al.* used hot pressing to consolidate Mg_2Si powders obtained by solid-state reaction [69]. The temperature during compaction was 800 °C for 30 min at 80 MPa under inert

atmosphere. Relative density of 99 % was achieved. Stoichiometry measurement of the hot-pressed pellet using energy dispersive X-ray spectrometry revealed loss of magnesium during compaction.

Also, hot pressing was used by Godlewska *et al.* to densify Mg_2Si powder obtained by thermal explosion [21, 76]. The powder was compressed at 25 MPa and 860 °C for 2 h in an argon environment. Hot pressing caused grain growth, which is undesired because it leads to worse thermoelectric properties.

2.2.2.2. Spark-plasma sintering

As described above, Mg_2Si has been obtained via spark plasma sintering. SPS has also been used for consolidation of Mg_2Si powder obtained by other methods. The process involves heating Mg_2Si powder through an electric current under pressure.

After obtaining Mg_2Si via solid state reaction, Luo *et al.* used SPS at temperatures of 650-750 °C for 10 min at 40 MPa under argon atmosphere [78]. Density of the SPS product was 99.9 % theoretical density.

Hu *et al.* used SPS to consolidate Mg_2Si after being obtained via solid state reaction [79]. Consolidation occurred at 750 °C for 10 min under a pressure of 40 MPa in a 6 Pa vacuum. SPS products exhibited similar grain sizes as in the initial powders, *i.e.* 10 µm. Small oxidation during SPS was revealed by the presence of MgO in the SPS products.

Savary *et al.* used SPS to densify nano- and micron-size Mg_2Si powders obtained via microwave sintering [73]. Nanopowders had a mean particle size of 100 nm. The micron-sized powder consisted of 1 µm and 8 µm particles, 33 % and 67 %, respectively. Maximum temperature was 775 °C and the maximum applied pressure was 50 MPa. The micron-sized powder was consolidated to 99 % theoretical density. For the nanopowder, oxidation of magnesium grain boundaries and the nanostructure resulted in non-consolidated samples.

2.2.2.3. Shockwave consolidation

Shockwave consolidation is a high-pressure, high-temperature, short-duration compaction process caused by explosives. A controlled explosion provides high pressures and high temperatures within seconds. Densification and interparticle bonding occur so quickly that grain growth is suppressed. For the production of Mg_2Si materials, shockwave consolidation has not been demonstrated.

There are two approaches to shockwave consolidation [80]. The first approach is to detonate explosives that surround a thin-walled cylinder containing the SHS reaction products. The second approach is to place the explosives on a massive piston, which, upon detonation, will compact the SHS products.

Shockwave consolidation has been demonstrated for different systems, mainly with the goal of preventing grain growth and preserving nanostructures. Zhang *et al*. studied the consolidation of bulk nanostructured silver samples [81]. In their study, nano-scale (30-50 nm) and micro-scale (less than 44 μm) silver powders were cold pressed in a steel tube. For compaction, a cylinder assembly using ammonium nitrate fuel oil (ANFO) explosives was used. The results showed that consolidated nano-scale silver achieved 99.5-100 % theoretical density, whereas micro-scale sample achieved 92.5 %. After consolidation, average grain size measured was 49±22 nm, demonstrating the feasibility of maintaining a nanostructure. Micro-scale sample exhibited increased plastic deformation with few voids present, which indicated insufficient compaction energy.

Farinha *et al*. used shockwave consolidation of nanometric copper powders [82]. Two powders were used: an agglomerated nanopowder, 100 nm, and micron-sized powder, 20 μm with nanostructure. Before consolidation, the samples were placed in a steel tube in small amounts and uniaxially pressed in an argon environment. The used shockwave consolidation setup is shown in Figure 8. For nanopowders, the initial density of the powders was 38-56 % theoretical density and consolidation increased it to 80-95 % theoretical density. The SEM

observations resulted in the discovery of submicron-scale grains, which is explained by the high ductility of nano-sized copper. The initial density of the micron-sized powder was 88 % and consolidation increased it to 99 % theoretical density.

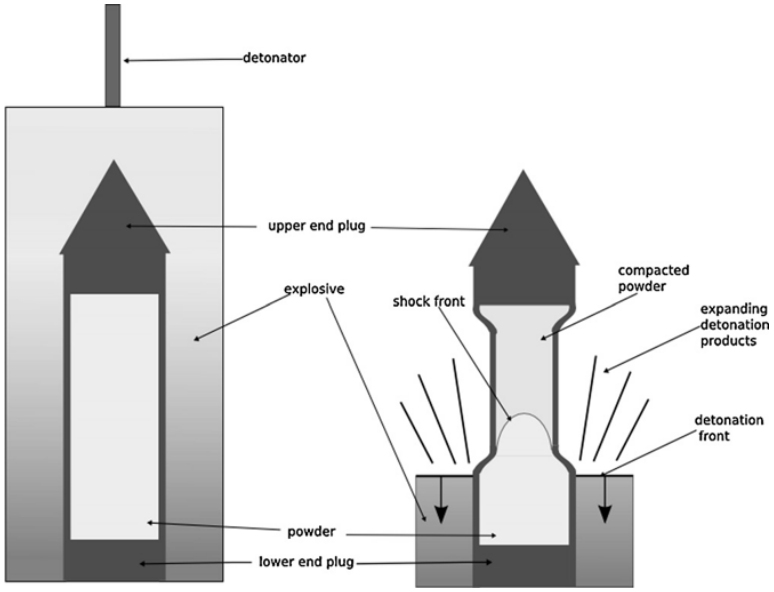

Figure 8. Shockwave consolidation setup used [82].

This brief review shows that shockwave consolidation is a promising technique for fabricating materials with small grains, which is important for the goal of obtaining good thermoelectric properties. However, there is no report on the shockwave consolidation of Mg_2Si in the literature.

2.2.3. Summary

2.2.3.1. Synthesis of Mg_2Si

- Magnesium silicide has been produced via induction melting, mechanical alloying, solid-state reaction, spark plasma sintering, and combustion synthesis.
- Mg_2Si produced via induction melting required high energy consumption and the products exhibited large grains, over 100 μm.

- Mechanical alloying of Mg_2Si requires long (over 24 hours) milling times and leads to contamination by grinding media. By milling Mg/Si mixture with incremental addition of Mg, the milling time was significantly decreased, but full conversion still required several hours of milling.
- Solid-state reaction method involves milling of magnesium and silicon powders to lower the temperature required for reaction, *i.e.* decrease external energy needed for preheating. Milling for long times results in contamination by grinding media.
- Spark plasma sintering of Mg_2Si from mixtures of silicon with MgH_2, Mg, and dopants has been demonstrated. The process allows for short operation times due to high heating rates, but the SPS products are millimetric in size and weigh a few grams. Scaling up products of SPS is challenging due to complexity of the apparatus.
- Combustion synthesis of Mg_2Si from Mg and Si was achieved in the thermal explosion mode, which required preheating the entire mixture. Temperature measurements revealed two peaks of exothermic reactions, which are not clearly understood; different explanations for the low-temperature peak were given in the literature. Combustion synthesis of Mg_2Si in SHS mode would provide many advantages over thermal explosion, but no report on SHS of Mg_2Si was found in the literature.

2.2.3.2. Consolidation of Mg_2Si

- Consolidation of Mg_2Si powders via induction melting and hot pressing exhibited grain growth caused by high and long heating/cooling regimes.
- Spark plasma sintering was used to consolidate Mg_2Si obtained by other methods. Grain growth was controlled during the process; however, consolidation of Mg_2Si nanopowders via SPS was found problematic. Micron-sized powders were consolidated at 99 % theoretical density.
- Shockwave consolidation is an attractive method for compacting powders and porous materials as it mitigates grain growth and preserves nanostructure. This is important for

the goal of fabricating materials with good thermoelectric properties. However, there is no report on the shockwave consolidation of Mg_2Si in the literature.

Chapter 3
Experimental

3.1. Facilities

3.1.1. Hot Wire Combustion Setup

Combustion synthesis experiments were conducted inside a windowed steel chamber. Figure 9 shows the experimental setup. The chamber has a diameter of 30 cm and a height of 40 cm. The chamber was evacuated using a vacuum pump (Maxima C Plus, Fisher Scientific) and filled with ultra-high-purity argon before the combustion experiment. Power and data connections were available inside through the use of feedthroughs in the chamber. Each sample was installed inside the chamber on a brass pedestal. To reduce heat losses, ceramic fiber paper (Fiberfrax) was used. Ignition of the samples was produced by a 0.43-mm-diameter tungsten coil (Midwest Tungsten Service, Inc.) heated by electric current from a DC power supply (Mastech HY3050EX). Temperature of the sample was monitored and recorded during combustion with Chromel-Alumel (type K) thermocouples connected to a USB DAQ (National Instruments). The thermocouples were prepared from thermocouple wires (diameter 254 μm), obtained from Omega Engineering, Inc. The thermocouples were placed in two-channel ceramic insulators (outer diameter: 1.6 mm, Omegatite 200, Omega Engineering). In each experiment, high-resolution video recording of the combustion process was conducted with a Sony XCD-SX90CR camera.

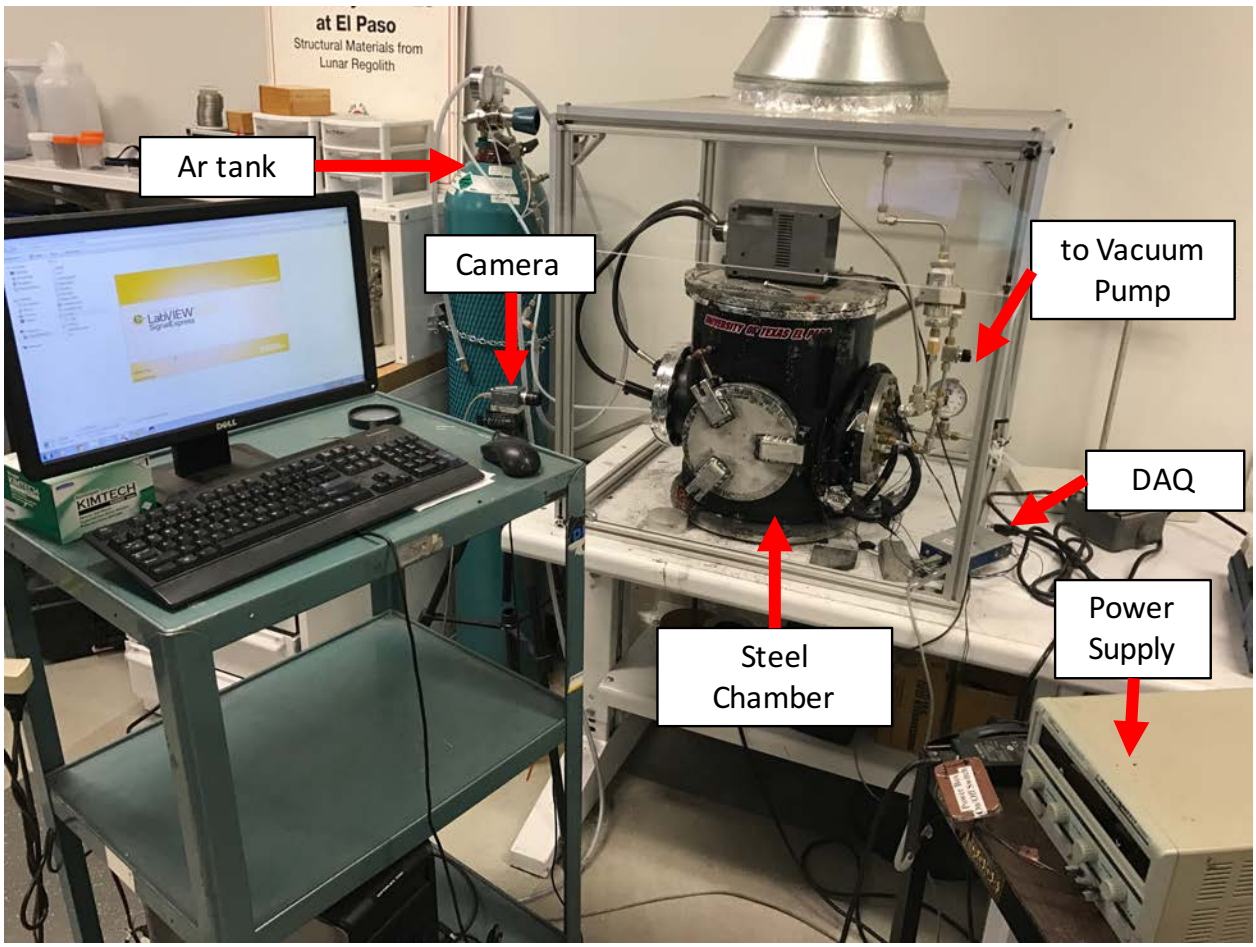

Figure 9. Combustion synthesis setup.

3.1.2. Facilities for Preparation of Samples

3.1.2.1. Mixing

Powders were mixed in a three-dimensional inversion kinematics tumbler mixer (Bioengineering Inversina 2L), shown in Figure 10. The Inversina mixer allowed for uniform mixing.

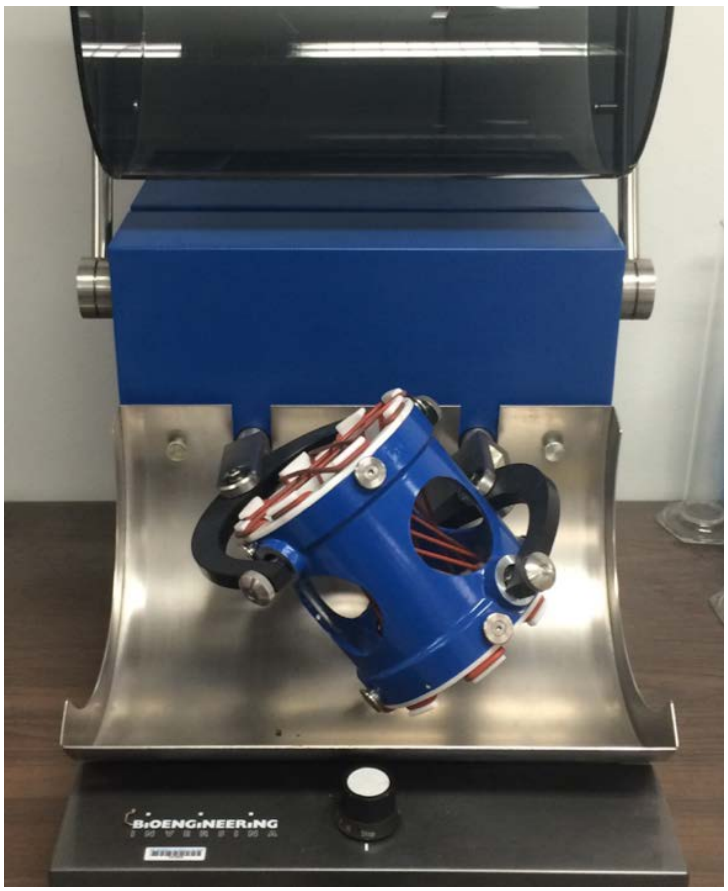

Figure 10. Bioengineering Inversina 2L mixer.

3.1.2.2. Milling

Milling was performed with a planetary ball mill (Fritsch Pulverisette 7 Premium Line), shown in Figure 11. Rotation speed, milling time, cooling time, number of cycles can be controlled and pre-programmed. Milling occurred inside zirconia-coated bowls with zirconia grinding balls. For milling in an argon environment, special “gassing” lids were used. The lids have valves for purging the bowl and filling it with argon gas.

Figure 11. Planetary ball mill (Fritsch Pulverisette 7 Premium Line).

3.1.2.3. Press

The powders were compacted into cylindrical pellets. Two different size of dies were used to compact the powders: 13 mm and 25 mm diameter. The powders were compressed using a manual, uniaxial hydraulic press (Carver).

3.1.3. Facilities for Characterization and Analysis.

3.1.3.1. Laser diffraction particle size analyzer

Particle size distributions of powders were determined with a laser diffraction particle size analyzer (Microtrac Bluewave), shown in Figure 12. Compositions of powders and combustion products were studied using Bruker D8 Discover X-ray diffractometer.

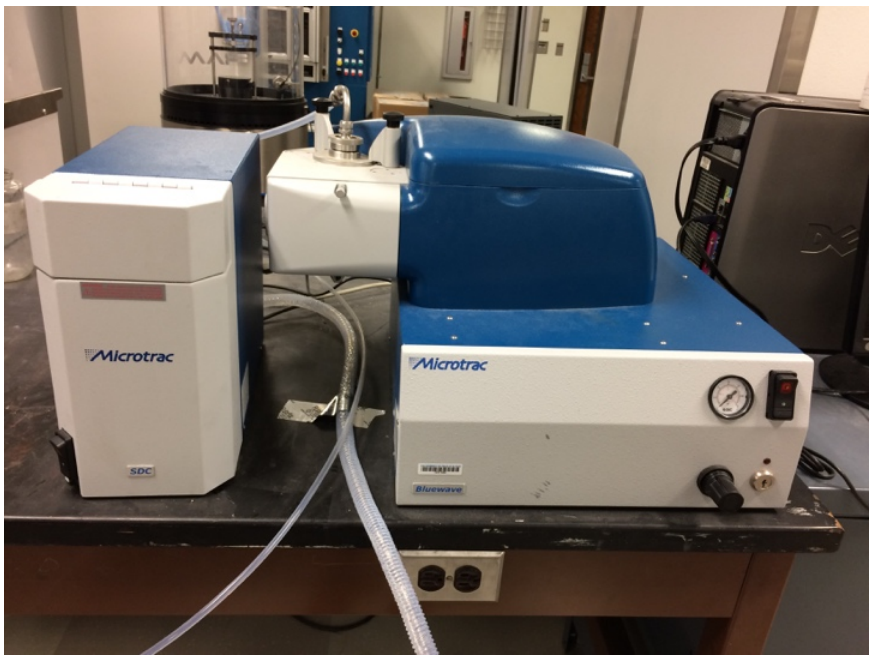

Figure 12. Particle size analyzer (Microtrac Bluewave).

3.1.3.2. Differential scanning calorimeter

A differential scanning calorimeter (Netzsch DSC 404 F1 Pegasus), see Figure 13, was used for thermal analysis of powder mixtures. It has a silicon carbide furnace, which can be used at temperatures up to 1550 °C. An argon tank was connected to the protective and purge inlets in the DSC. Gas flow rate was controlled and recorded through software. Also, a vacuum pump, connected to the DSC, evacuates air before starting a thermal analysis.

Calibration of the DSC was performed using standard materials (In, Sn, Bi, Zn, Al, and Au) obtained from the manufacturer. The temperature program for each of the standard materials consisted of three heating and two cooling segments. During each heating segment, the temperature surpassed the melting point of the material; therefore, the melting peak was obtained three times during each measurement. A heating rate of 20 °C/min, an argon flow of 20 mL/min, and alumina crucibles were used for all materials. The average melting point of each material, obtained during the temperature program, was introduced into the DSC software (Netzsch Proteus 6.1) to create a calibration file for the specific heating rate, gas flow, and crucible type.

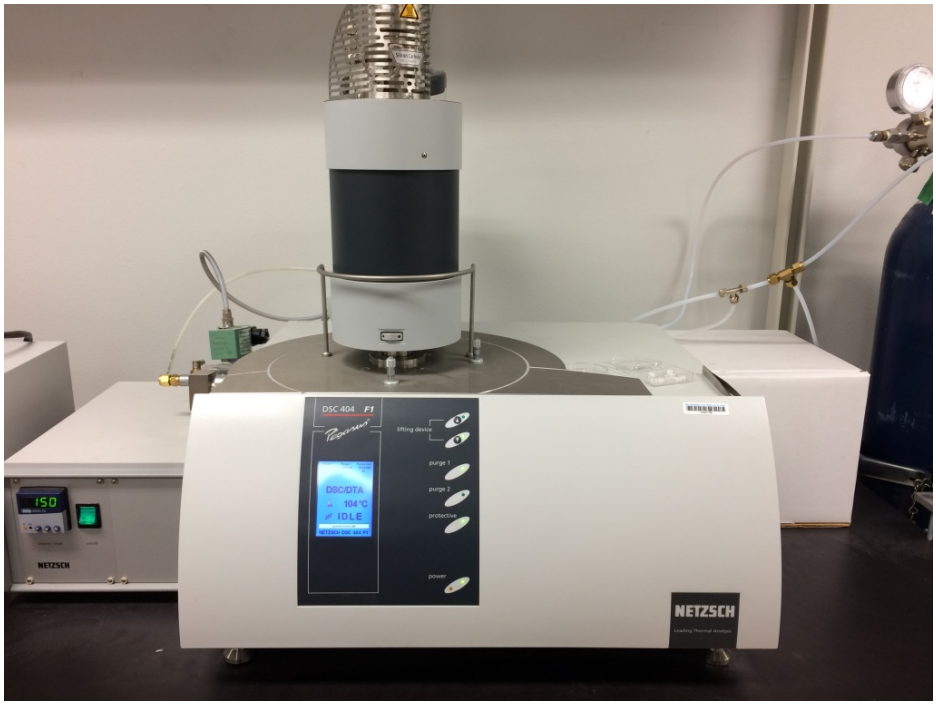

Figure 13. Differential scanning calorimeter (Netzsch DSC 404 F1 Pegasus).

3.1.3.3. Laser flash apparatus

Laser flash apparatus (Netzsch LFA 457 MicroFlash), shown in Figure 14, was used for determination of thermal conductivity by measuring thermal diffusivity and specific heat of the densified products. The LFA allows measurements from room temperature to 1100°C. A compressed argon cylinder was connected to the protective and purge inlets. Also, a vacuum pump, connected to the LFA, enables evacuation of air before starting the temperature program.

Figure 14. Laser flash apparatus (Netzsch LFA 457 MicroFlash).

3.2. Procedures for Studies of Regolith-Magnesium Combustion

3.2.1. Sample Preparation

The Martian regolith simulants, JSC-Mars-1A (lower than 1 mm, Orbitec) and Mojave Mars (NASA) were heated to 120 °C on a hot plate to remove moisture. Then, the simulants were milled in the planetary ball mill at 1100 rpm using 1.5-mm grinding balls (balls-mixture ratio 4:1). Each milling process included four cycles of 10-min milling separated by 60-min cooling pauses. After milling, the regolith simulants were mixed with magnesium powder (less than 44 µm, 99.8% pure, Sigma-Aldrich) in the Inversina mixer for 1 h in batches of 50 g. Mixtures of Martian regolith simulants with magnesium were prepared at concentrations of Mg from 10 wt% to 80 wt%, with increments of 10 wt%. The mixtures were compacted into 13-mm cylindrical pellets using the hydraulic press with a force of 19.46 kN. The height of the compacted pellets was 21-24 mm.

3.2.2. Combustion Experiments

Combustion experiments were conducted in an argon environment at 1 atm. For recording the temperature, an insulated K-type thermocouple was inserted into the pellet through a channel drilled perpendicularly to the pellet axis, as shown in Figure 15. Video recording of the combustion front was used for determination of the combustion front velocity. XRD analysis of the combustion products of the JSC-Mars-1A and Mojave Mars regolith simulants with magnesium was performed.

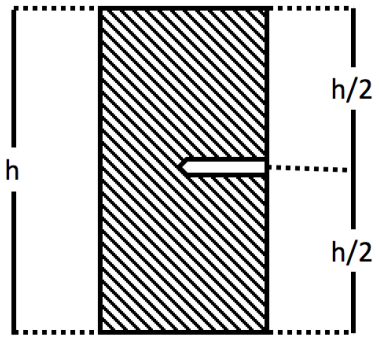

Figure 15. Schematic of a pellet with channel.

3.2.3. Thermal Analysis

Differential scanning calorimetry was used to analyze mixtures of 26 wt% Mg and 74 wt% JSC-1A (lower than 1 mm, Orbitec), JSC-Mars-1A, and Mojave Mars simulants. The samples, placed in alumina crucibles, were heated to 650 °C at a rate of 10 °C/min in argon flow at 20 mL/min.

Silica powder (SiO_2, less than 37 µm, 99.5% purity, Alpha Aesar) and iron oxide powder (Fe_2O_3, greater than 2 µm, 99% purity, Sigma–Aldrich) were used to make binary (SiO_2/Mg and Fe_2O_3/Mg) and ternary (SiO_2/Fe_2O_3/Mg) mixtures. Ternary mixtures were tested having different SiO_2−Fe_2O_3 mass ratio. All mixtures were tested under the same conditions as the regolith simulants.

3.3. Procedures for Synthesis and Consolidation of Magnesium Silicide

3.3.1. Mechanical Activation

Mechanical activation is a process used to enable the ignition of low exothermic mixtures. The entire procedure is usually called mechanical activation-assisted (or, shorter, mechanically activated) self-propagating high-temperature synthesis (MASHS). It consists of a short-duration, high-energy milling of two reagents in an inert atmosphere, performed in a planetary ball mill or a shaker mill. High-energy milling enables intermixing of reactive components on a very small scale. The fracture-welding process during milling increases the contact surface area between reactants and destroys the oxide films on their surfaces [11]. As a result, mechanical activation improves the reaction kinetics, leading to an easier ignition and stable combustion. Further, the short milling time eliminates the problem of product contamination by grinding media, typical in mechanical alloying. Therefore, it was suggested that mechanical activation the stoichiometric Mg/Si mixture would enable the synthesis of Mg_2Si in the SHS mode.

Magnesium and silicon (crystalline, less than 44 μm, 99.5% pure, Alpha Aesar) powders were mixed according to stoichiometry to form Mg_2Si in Inversina for 1 h. The mixtures were milled in the planetary ball mill at 750 rpm in argon atmosphere using 3-mm grinding balls (balls-mixture ratio: 5:1) for 20 min. The process was performed in cycles of 5 min milling and 75 min cooling pauses. After milling, the samples were analyzed using XRD.

3.3.2. Sample Preparation

The milled mixture was cold-pressed into 13-mm and 25-mm diameter pellets. The 13-mm pellets had a mass of 3.3-4.0 g and were compressed using a force of 19.6 kN, while the 25-mm pellets weighed 8 g and were compressed at 29.4 kN .

3.3.3. Combustion Experiments

Combustion experiments were conducted in an argon environment at 1 atm. The 13-mm-diameter pellets were installed on the sample holder, whereas the 25-mm-diameter were placed

on ceramic fiber (Fiberfrax). The combustion temperature of the sample was recorded using a K-type thermocouple inserted into the pellet as described in section 3.2.2. Video recording of the combustion front was used for monitoring. After SHS, the samples were analyzed using XRD.

3.3.4. Shockwave Consolidation

Mg_2Si powder (about 40 g) was compacted into a steel tube (length about 150 mm, outer diameter 20 mm, inner diameter 17 mm) in an argon filled glovebox using a 3-ton uniaxial hydraulic press. The sample tube was sealed with two steel caps and placed coaxially within the so-called explosive tube, which was then filled with ammonium nitrate fuel oil (ANFO), an explosive material (Figure 16). A third, "confinement" tube of a larger diameter was installed coaxially and the gap between the explosive and confinement tubes was filled with sand. A detonator at the top was used to initiate the explosion which applied a symmetrical high-pressure pulse that moved inward and down the sample tube, causing the tube to deform and the interior powders to consolidate into a dense, well bonded bulk material.

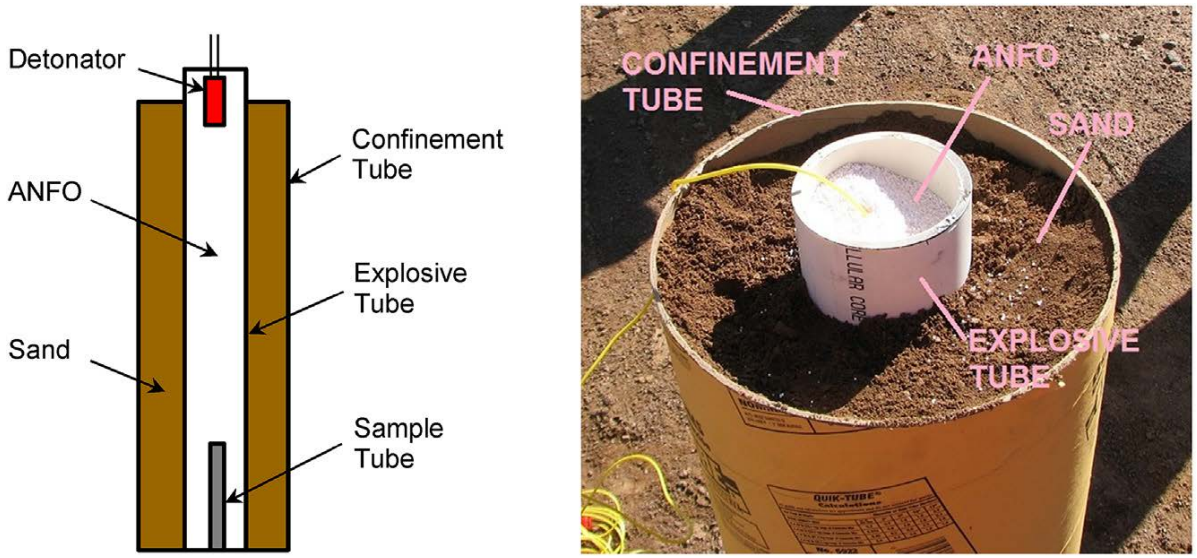

Figure 16. Schematic and photograph of the shockwave consolidation setup.

After shockwave consolidation, the sample tube was cut perpendicularly to the axis with an abrasive disk. Disks with a consolidated Mg_2Si core and a steel rim were obtained. The rim was removed by cutting it in several places until it detached from the core. The density of the core was determined by measuring the mass and dimensions of the product disks.

3.3.5. Thermal Analysis

Differential scanning calorimetry of milled Mg/Si mixtures was conducted. The mixture samples were placed in alumina crucibles. The DSC runs were conducted at heating rates of 1, 5, 10, and 20 °C/min. In each run, the argon was flowing at 20 mL/min.

The laser flash apparatus was used to measure the thermal diffusivity and the specific heat of shockwave-consolidated Mg_2Si. The sample disk has a diameter of 12.6 mm and a thickness of 3.63 mm. The measurements were taken at 50, 75, 100, 125, 150, 175, 200, and 225 °C (five tests at each temperature). The thermal expansion coefficient, required for thermal diffusivity measurements, was assumed to be equal to 1.23×10^{-5} [83].

The thermal conductivity of shockwave-consolidated Mg_2Si was calculated based on the obtained values of thermal diffusivity, specific heat, and density. In the determination of specific heat, (Pyroceram 9606, Netzsch) was used as a reference material. In addition, calculations based on the literature data for specific heat of Mg_2Si [84] were made, which changed the thermal conductivity values by less than 1%.

Chapter 4
Results and Discussion

4.1. Studies of Regolith-Magnesium Combustion

4.1.1. Thermodynamic Calculations

Thermodynamic calculations of the adiabatic flame temperature and combustion products for the mixtures of two Martian regolith simulants with magnesium and aluminum were conducted using THERMO (version 4.3) software, which is based on the Gibbs free energy minimization and contains a database of approximately 3000 compounds [85]. Of specific importance is the capability of this code to handle multi-phase thermite reactions with many compounds. This software was used for thermodynamic analysis of combustion of JSC-1A lunar regolith simulant with Mg, Al, and Ti/B additives [16]. The data obtained in the thermodynamic calculations conducted in the present work are presented in the Appendix.

The concentration of metal (Mg or Al) was varied from 0% to 100%, while initial reactants were at 298.15 K and pressure was 1 atm in all calculations. A major problem in these calculations was the fact that, as noted above, quantitative mineral compositions of JSC-Mars-1A and Mojave Mars simulants remain unknown. To enable thermodynamic calculations, these materials were represented as mixtures of simple oxides, shown in Table 2 (Chapter 2).

Figures 17 and 18 show the adiabatic flame temperatures obtained for the mixtures of JSC-Mars-1A and Mojave Mars simulants (simple oxide compositions) with Mg and Al, respectively. For comparison, the results obtained for Mg with JSC-1A (both mineral and simple oxide compositions) are also shown. It is seen that Mg exhibits higher temperatures than Al for all regolith simulants. It is also seen that the curves for Mojave Mars and JSC-1A (simple oxides) are very close to each other, while JSC-Mars-1A exhibits higher temperatures. This is apparently associated with Fe_2O_3 concentrations in the simulants. As seen in Table 2, Mojave Mars and JSC-1A contain 10.9 and 12.4 wt% Fe_2O_3, respectively, while JSC-Mars-1A contains

16.1 wt% of this oxide. The reactions of Mg and Al with Fe_2O_3 release 328 kJ per mol Mg and 424 kJ per mol Al, while those with SiO_2 release 146 kJ per mol Mg and 190 kJ per mol Al. Thus, their reactions with Fe_2O_3 are more energetic and this explains why an increase in Fe_2O_3 content increases the adiabatic flame temperature.

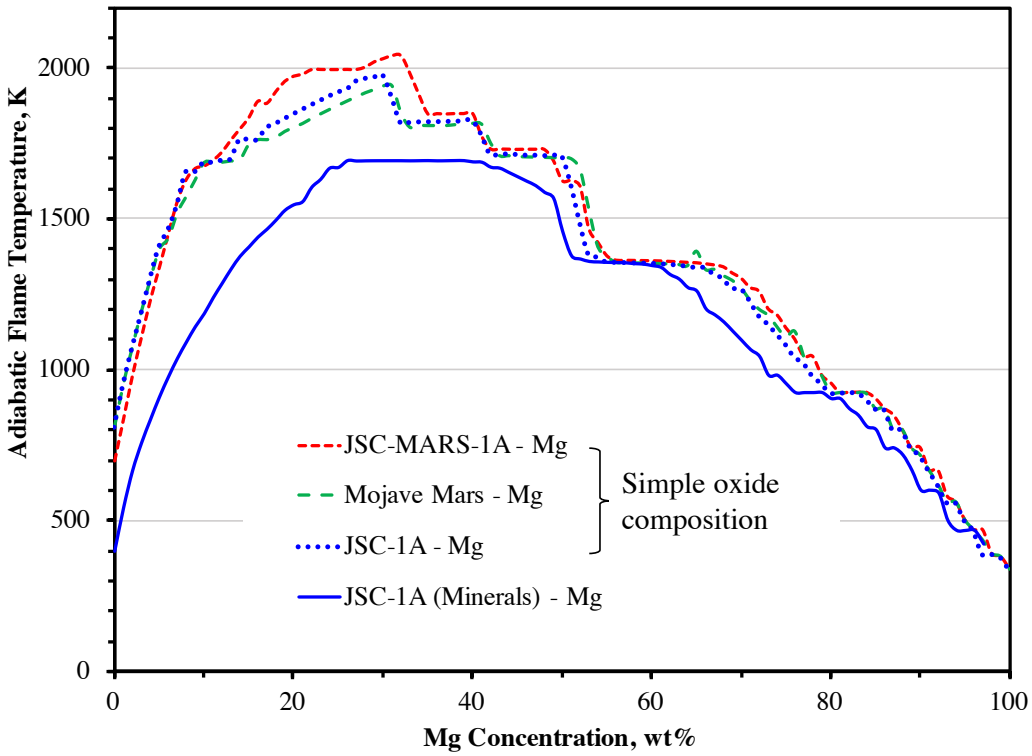

Figure 17. Adiabatic flame temperature of regolith simulants with magnesium.

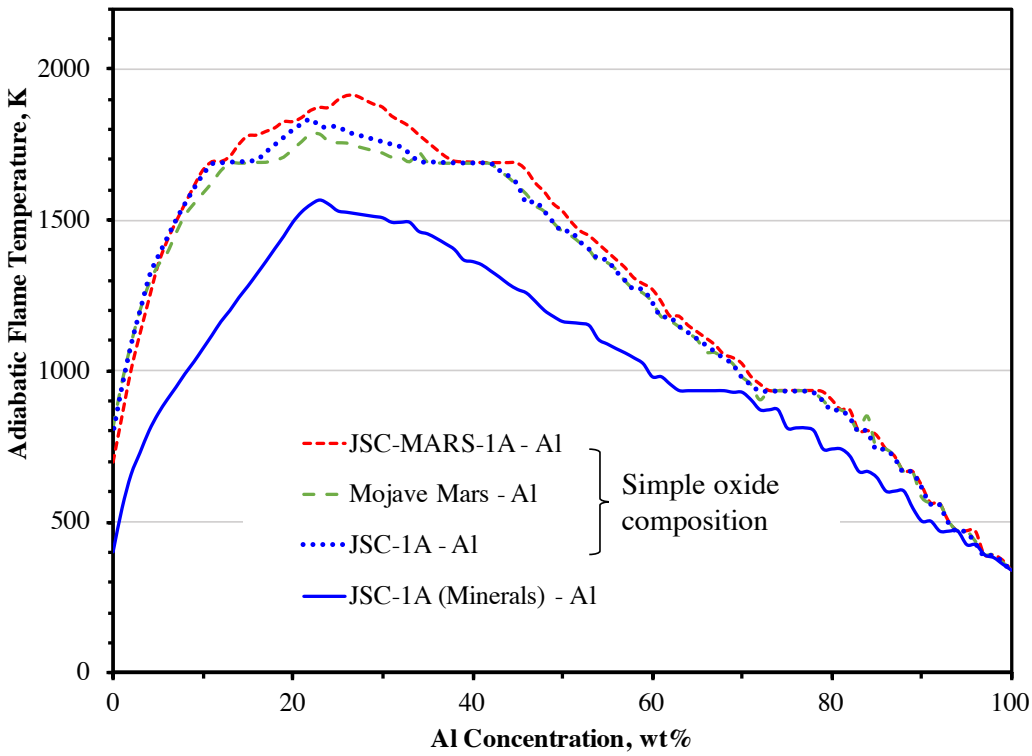

Figure 18. Adiabatic flame temperature of regolith simulants with aluminum.

Note that the substitution of actual minerals with simple oxides inevitably created an error in the adiabatic flame temperature. The comparison of the curves obtained for JSC-1A, with simple oxide and mineral compositions, shows that the simple oxide composition exhibits higher temperatures. This may be explained by the higher negative formation enthalpies of mineral phases than those of simple oxides from which these mineral phases were formed. It is reasonable to suggest that the same trend would remain for two other simulants. The fact that the use of simple oxide compositions predicts higher temperatures than the actual ones should be accounted for in the comparison with experimental results.

The thermodynamic calculations provided compositions of combustion products for all tested mixtures. For illustration, Table 3 shows the products of mixtures of the three simulants with 20 wt% Mg and 26 wt% Mg. The latter is the optimal concentration for combustion of JSC-1A/Mg mixture if the mineral composition of JSC-1A is assumed [16]. The results

presented in Table 3 were obtained for simple oxide compositions of all simulants (including JSC-1A) shown in Table 1. Note that THERMO software shows the products using molecular formulas. For easier understanding, the second column in Table 3 shows the same products as mixtures of simple oxides. The third column indicates states of the compounds: S – solid, L – liquid, and G – gas.

Table 3. Combustion products of JSC-1A, Mojave Mars, and JSC-Mars-1A with magnesium.

Compound		**State**	**Concentration, wt%**					
			20 wt% Mg			**26 wt% Mg**		
			80 wt% JSC-1A	**80 wt% JSC-Mars-1A**	**80 wt% Mojave Mars**	**74 wt% JSC-1A**	**74 wt% JSC-Mars-1A**	**74 wt% Mojave Mars**
MgO		S	29.4	2.0	7.9	32.8	30.4	31.3
$Al_2Si_2O_{13}$	$Al_2O_3 \cdot (SiO_5)_2$	S	31.0	-	-	25.7	-	-
Al_2MgO_4	$Al_2O_3 \cdot MgO$	S	-	25.2	19.3	-	23.3	17.9
Mg_2SiO_4	$(MgO)_2 \cdot SiO_2$	S	-	45.8	42.5	-	9.9	18.3
Ca_2SiO_4	$(CaO)_2 \cdot SiO_2$	S	-	7.6	13.0	-	2.5	12.0
$CaMgSi_2O_6$	$CaO \cdot MgO \cdot (SiO_2)_2$	L	-	-	-	-	11.5	-
$CaMgO_2$	$CaO \cdot MgO$	S	10.9	-	-	9.2	-	-
FeSi		S	10.6	-	-	9.8	-	-
FeSi		L	-	13.8	9.3	-	12.8	8.6
Si		S	8.1	-	-	5.5	-	-
Si		L	-	0.9	4.8	-	5.0	8.6
Si_3Ti_5		S	1.3	2.4	0.7	1.2	2.2	0.7
Mg_2Si		L	-	-	-	6.8	-	-
Al_2Ca		L	3.0	-	-	3.7	-	-
Mg		G	3.8	0.7	0.2	3.5	0.9	0.5
Na		G	1.9	1.4	2.3	1.8	1.3	2.1
SiO		G	-	0.2	-	-	0.2	0.1

Analysis of Table 3 shows that the major phases are MgO and mixtures of MgO, CaO, Al_2O_3, and SiO_2. Significant amounts of FeSi and Si as well as around 1 or 2 wt% Si_3Ti_5 and Na are also present in the products of all six mixtures. The presence of Si_3Ti_5 and Na confirms the reduction of TiO_2 and Na_2O during combustion as expected in Section 2.1.3.4. It is important that there is no iron oxide in the products, while only part of silica is reduced. This indicates that both

thermite reactions (2) and (3) occur, but there is not enough Mg for the reduction of all available silica. It can therefore be concluded that the reaction of Mg with Fe_2O_3 (3) is thermodynamically preferential under these conditions.

Comparison of the product compositions for JSC-1A represented as a mixture of simple oxides with those for JSC-1A represented as a mixture of minerals [16] shows some differences. It is reasonable to expect that if the quantitative mineral compositions of the Martian regolith simulants become known, more accurate phase compositions of products can be calculated for combustion of them with Mg, but some features, such as the preferential reduction of iron oxide, will remain.

To better understand the results obtained for the mixtures of regolith simulants with Mg and Al, thermodynamic calculations were also conducted for binary mixtures Fe_2O_3–Mg, SiO_2–Mg, Fe_2O_3–Al, and SiO_2–Al. Figure 19 and 20 present the obtained adiabatic flame temperatures for reactions with Mg and Al, respectively. It is seen that the temperatures for iron oxide-based mixtures are much higher than those for silica-based mixtures, which is explained by the higher exothermicity of Mg and Al reactions with iron oxide. Comparison with Figures 17 and 18 shows similar features of regolith-based and silica-based curves, which is apparently associated with the high concentrations of silica in the regolith simulants. Note that the temperatures for SiO_2/Mg mixtures are higher than those for SiO_2/Al mixtures, which explains why Mg exhibits higher temperatures than Al in mixtures with regolith simulants. It is also interesting that the maximum temperatures for regolith-based mixtures are similar to those for SiO_2-based mixtures, but they are achieved at low metal concentrations. This is explained by the significant energy release of the reactions between the metal and Fe_2O_3, which is available in the regolith simulants.

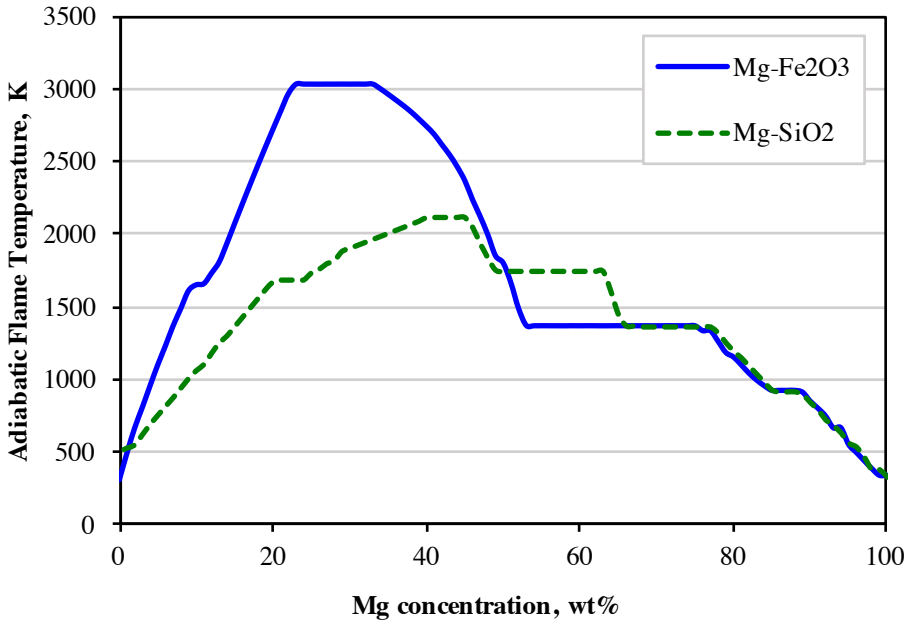

Figure 19. Adiabatic flame temperature of SiO_2 and Fe_2O_3 with magnesium.

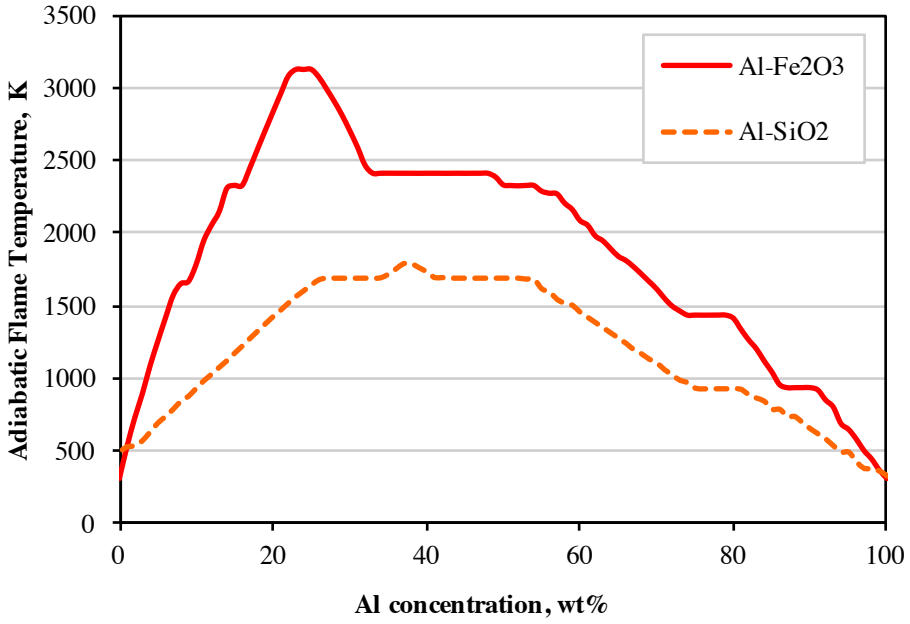

Figure 20. Adiabatic flame temperature of SiO_2 and Fe_2O_3 with aluminum.

4.1.2. Combustion Experiments with Martian Regolith Simulants

Experiments with mixtures of the Martian regolith simulants with magnesium were conducted at concentrations of Mg from 10 wt% to 80 wt%, with an increment of 10 wt%. The experiments have shown that the mixtures are combustible at Mg concentrations from 20 through 70 wt%. The front propagation velocities were in the range from 1.5 to 5 mm/s, which is similar to the observations for JSC-1A/Mg mixtures [16, 17, 18, 19]. In all experiments, significant expansion of the sample occurred during combustion. For Mojave Mars, combustion was accompanied by oscillations in the front motion and by the formation of a layered structure of the product. This effect was more significant at lower concentrations of Mg. Figure 21 shows combustion of Mojave Mars simulant mixed with magnesium at 20 wt% Mg. Note that oscillating combustion of pellets has been predicted in the theory of heterogeneous combustion and observed in combustion experiments with many low-exothermic mixtures [86, 87]. For JSC-Mars-1A, at 20 wt% Mg and 30 wt% Mg, combustion was much more vigorous than for Mojave Mars, with a relatively fast, steady motion of the front and a uniform structure of the product as shown in Figure 22.

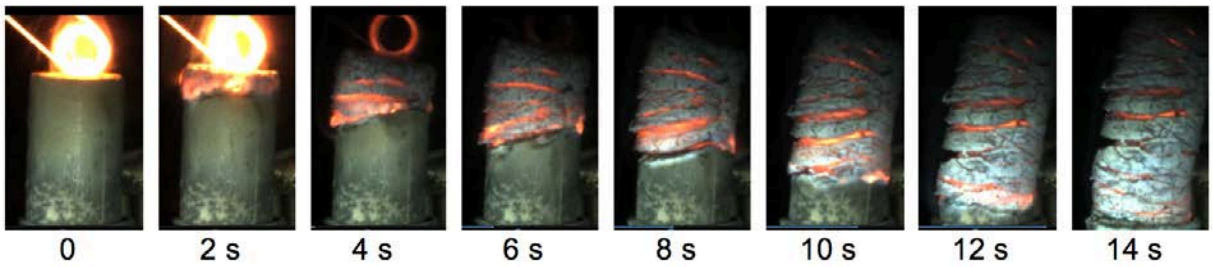

Figure 21. Combustion front propagation of Mojave Mars with 20 wt% Mg.

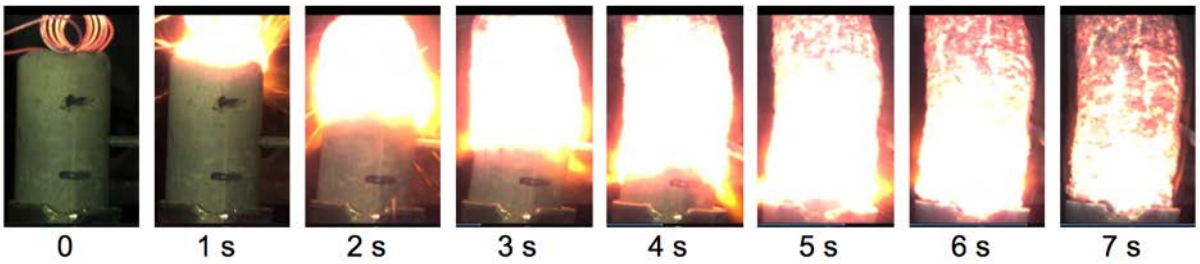

Figure 22. Combustion front propagation of JSC-Mars-1A with 20 wt% Mg.

Figure 23 shows the maximum temperatures measured during combustion of JSC-Mars-1A and Mojave Mars simulants with magnesium. For convenience, the calculated temperature curves for these two simulants, shown in Figure 17, are repeated in Figure 23. It is seen that the experimental values are lower than the predicted ones. This is explained by heat losses in the experiments and by the assumption of simple oxide compositions in the calculations, which, as mentioned above, leads to increased temperatures. The fact that at Mg concentrations of 20 wt% and 30 wt% the measured temperatures for JSC-Mars-1A were higher than those for Mojave Mars accords with the difference between the adiabatic flame temperatures of these materials, discussed in Section 4.1.1 and explained by the higher concentration of Fe_2O_3 in JSC-Mars-1A. The higher temperatures for JSC-Mars-1A also correlate with the faster combustion of this material, mentioned above.

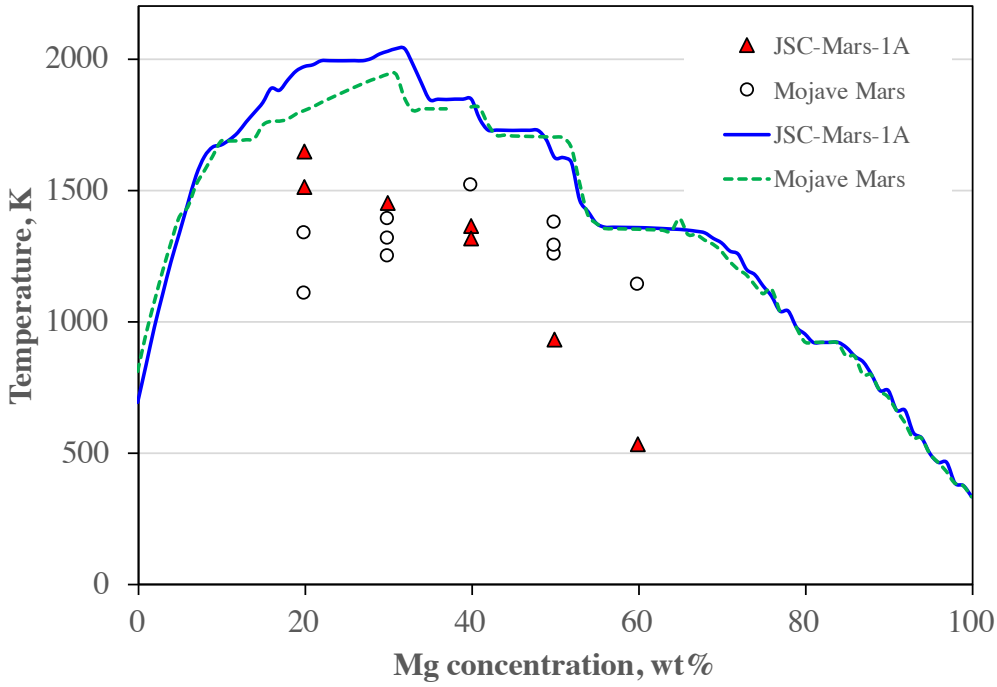

Figure 23. Maximum combustion temperature of Martian regolith simulants with Mg. Adiabatic flame temperatures shown for comparison.

The expansion of samples during combustion was apparently caused by Mg vapor, formed in the combustion front. As seen in Figure 23, the maximum temperatures in the combustion front were in a range from 1100 K to 1700 K. Since the boiling point of Mg at 1 atm is 1368 K, significant amounts of Mg vapor could form during combustion, leading to the expansion of solid products. The obtained porous products are fragile and unsuitable for use as construction materials. As noted in the Literature Review, to obtain stronger products, SHS compaction could be used as was demonstrated for JSC-1A/Mg mixtures [19, 61]. SHS compaction, however, was beyond the scope of the present work.

Figure 24 and 25 show XRD patterns of the combustion products for mixtures of the three regolith simulants with magnesium at 20 wt% and 26 wt%, respectively, while Table 4 shows the results of the peak identification. Note that some of the peaks may belong to more than one compound. Comparison of the obtained XRD patterns between each other has not indicated

any significant trend. It is seen that MgO has the highest peaks in all patterns, which is in agreement with the results of thermodynamic calculations, see Table 3. $MgAl_2O_4$ and FeSi are also present in both experimental data and calculations. However, two minerals based on Ca, Mg, and Si – akermanite $Ca_2MgSi_2O_7$ and montecillite $CaMgSiO_4$– are present in XRD patterns, but they were not predicted by thermodynamic calculations. Instead, the software predicted the formation of Mg_2SiO_4, Ca_2SiO_4, and $CaMgSi_2O_6$. This discrepancy may be caused partly by the use of simple oxides instead of mineral phases. Indeed, when the mineral composition of JSC-1A is used in calculations, the predicted products contain $Mg_2SiO_4$and $CaMgSiO_4$ for the mixture with 20 wt% Mg and Mg_2SiO_4, $CaMgSiO_4$, and $Ca_3MgSi_2O_8$ for the mixture with 26 wt% Mg. Also, the discrepancy may be associated with differences between the databases used by THERMO [88, 89] and XRD [90] software. Note, however, that simple oxide representations of akermanite and montesillite are $(CaO)_2(MgO)(SiO_2)_2$ and $(CaO)(MgO)(SiO_2)$, respectively. Comparison with simple oxide representations of predicted phases in Table 3 shows that all discussed mineral phases are formed by the same simple oxides mixed in different ratios.

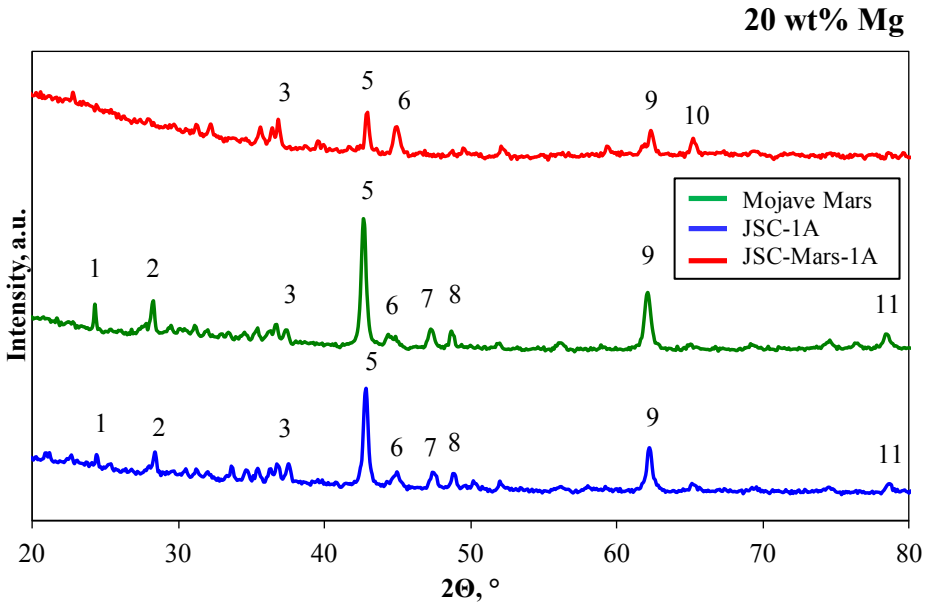

Figure 24. XRD patterns of combustion products for the three regolith simulants with 20 wt% Mg.

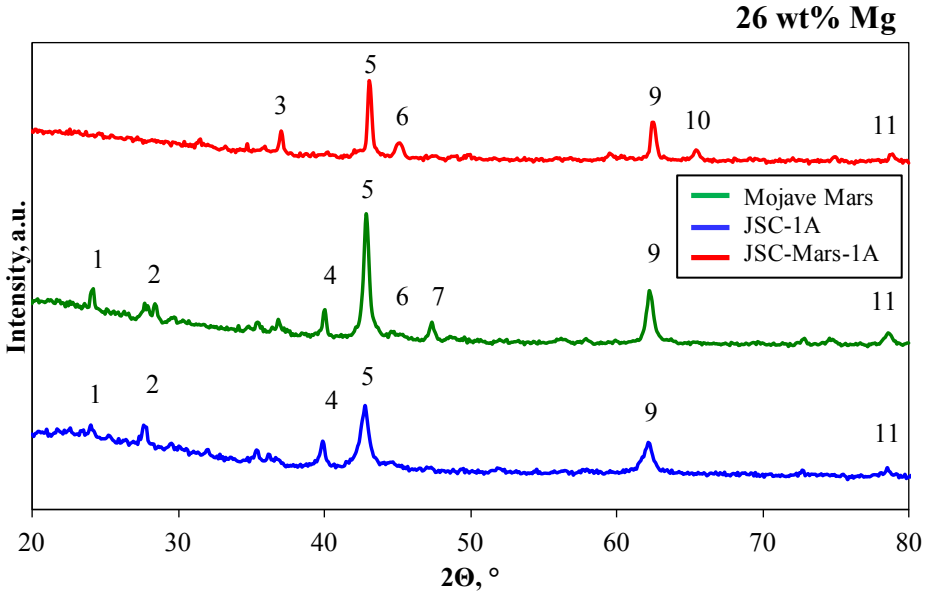

Figure 25. XRD patterns of combustion products for the three regolith simulants with 26 wt% Mg.

Table 4. Identified combustion products in XRD patterns.

Peak	Phases			
1	$Ca_2MgSi_2O_7$	$CaMgSiO_4$	Mg_2Si	
2	$MgAl_2O_4$	$CaMgSiO_4$	FeSi	Mg_2Si
3	$MgAl_2O_4$	MgO	MgO_2	
4	Al_2O_3	FeSi	Fe	Mg_2Si
5	MgO			
6	$MgAl_2O_4$	FeSi		
7	Al_2O_3	Mg_2Si		
8	Al_2O_3			
9	MgO	FeSi		
10	$MgAl_2O_4$	$Ca_2MgSi_2O_7$	Al_2O_3	Fe
11	MgO			

4.1.3. Thermal Analysis of Reactions Between Regolith Simulants and Magnesium

Figure 26 shows the DSC curve obtained for the mixture of 26 wt% Mg and 74 wt% JSC-1A at a heating rate of 10 °C/min. The curve has a distinct exothermic peak at 560 °C, which indicates that the reaction occurs at temperatures below the melting point of magnesium, 650 °C.

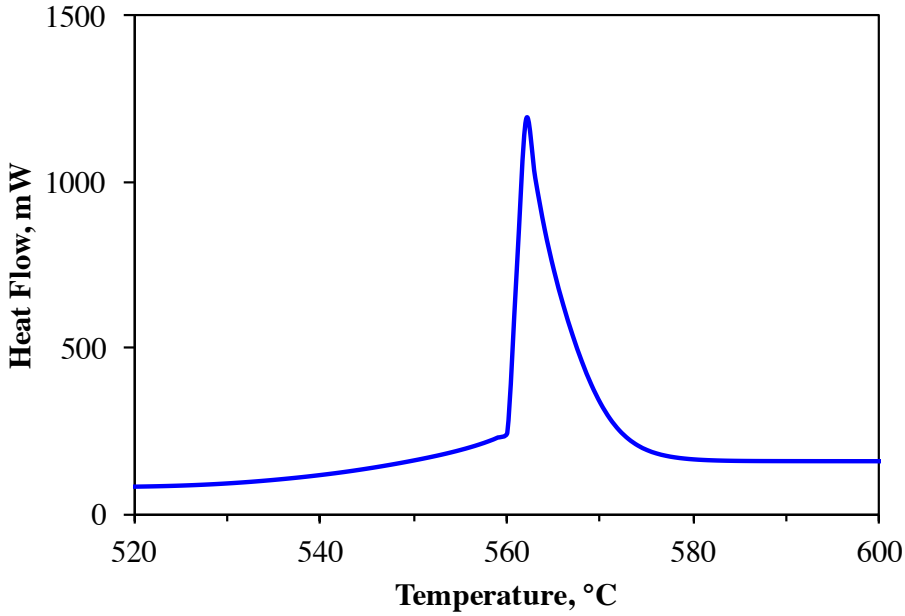

Figure 26. DSC curves for a mixture of 26 wt% Mg and 74 wt% JSC-1A.

To further investigate this reaction, the heating process, conducted at 5 °C/min, was stopped at three different temperatures: 500 °C, 550 °C, and 590 °C. XRD of the obtained products, shown in Figure 27, revealed that there was no MgO at 500 °C, while all Mg was converted to MgO at 590 °C. At 550 °C, a partial conversion of Mg to MgO was observed. These results confirm that the reaction between JSC-1A and Mg occurs when Mg is still solid.

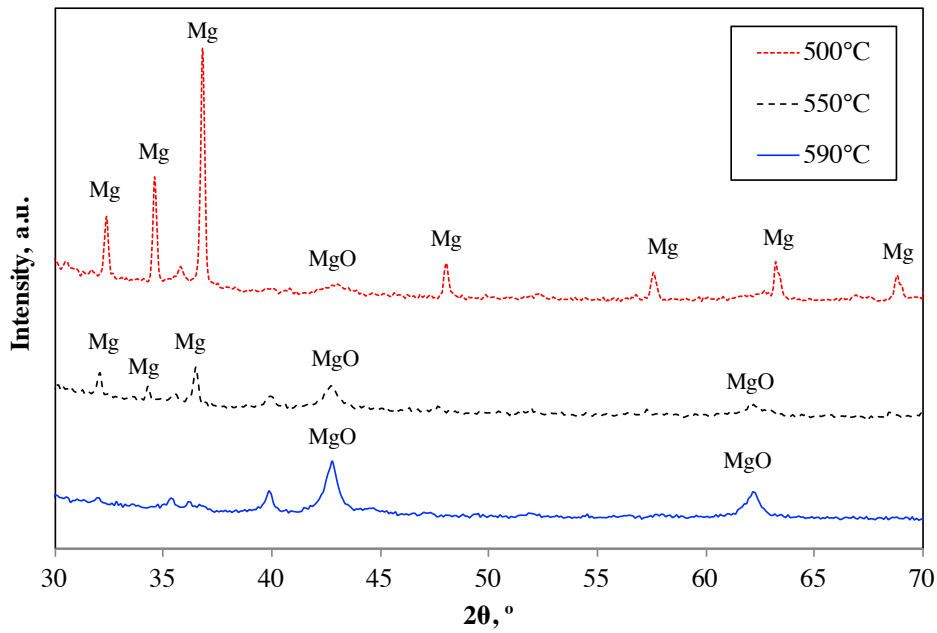

Figure 27. XRD pattern of samples heated to 500 °C, 550 °C, and 590 °C during DSC (26 wt% Mg and 74 wt% JSC-1A).

The DSC curves obtained from mixtures of JSC-1A, JSC-Mars-1A, and Mojave Mars simulants with 26 wt% Mg are presented in Figure 28. Temperature of the peak is the highest for the mixture of JSC-Mars-1A and the lowest for the mixture based on Mojave Mars.

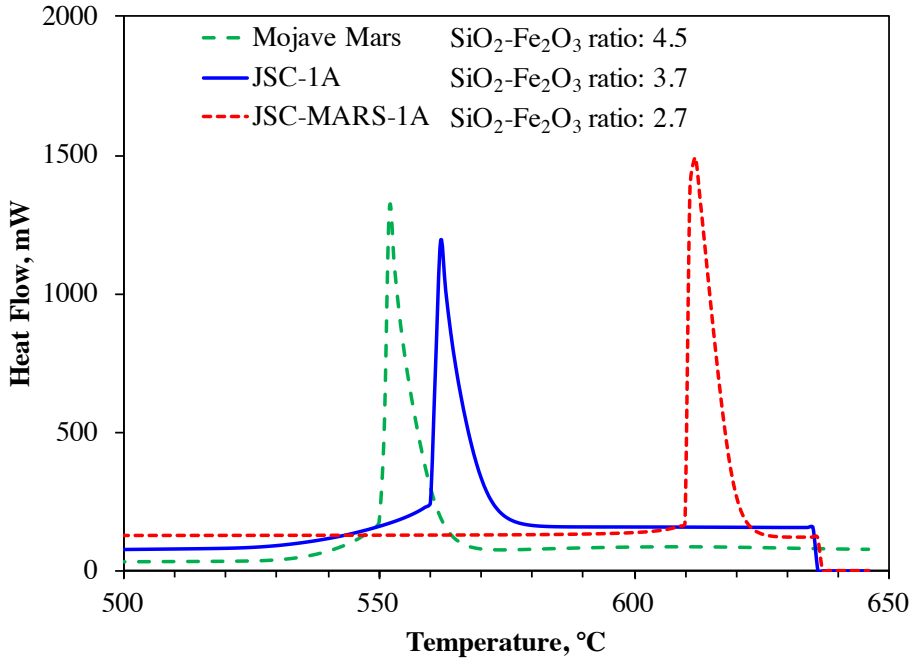

Figure 28. DSC curves for mixtures of JSC-1A, JSC-Mars-1A, and Mojave Mars simulants with Mg.

To explain this order of the peaks, compositions of the three simulants (Table 2) should be analyzed focusing on the concentrations of silica and iron oxide. For clarity, the SiO_2−Fe_2O_3 mass ratio in each simulant was calculated using the data from Table 2. The SiO_2−Fe_2O_3 mass ratio is 3.69 in JSC-1A, 2.70 in JSC-Mars-1A, and 4.54 in Mojave Mars. It is seen that the order of the DSC peaks in Figure 28 correlates with the SiO_2−Fe_2O_3 ratio: an increase in this ratio decreases the temperature of the peak.

The DSC curves of the binary mixtures of SiO_2/Mg and Fe_2O_3/Mg are presented in Figure 29. It is seen that SiO_2/Mg mixture ignites at a temperature lower by approximately 100 °C than for Fe_2O_3/Mg. Note that the peak in the mixture based on iron oxide is at about the same temperature as for the mixture based on JSC-Mars-1A (where the concentration of iron oxide is the highest), while the peak in the mixture based on silica is at a lower temperature than for mixtures with two other simulants. This implies that iron oxide plays a dominant role in the

reaction between JSC-Mars-1A and Mg, while for two other regolith simulants the increased concentration of silica decreases the temperature of the reaction.

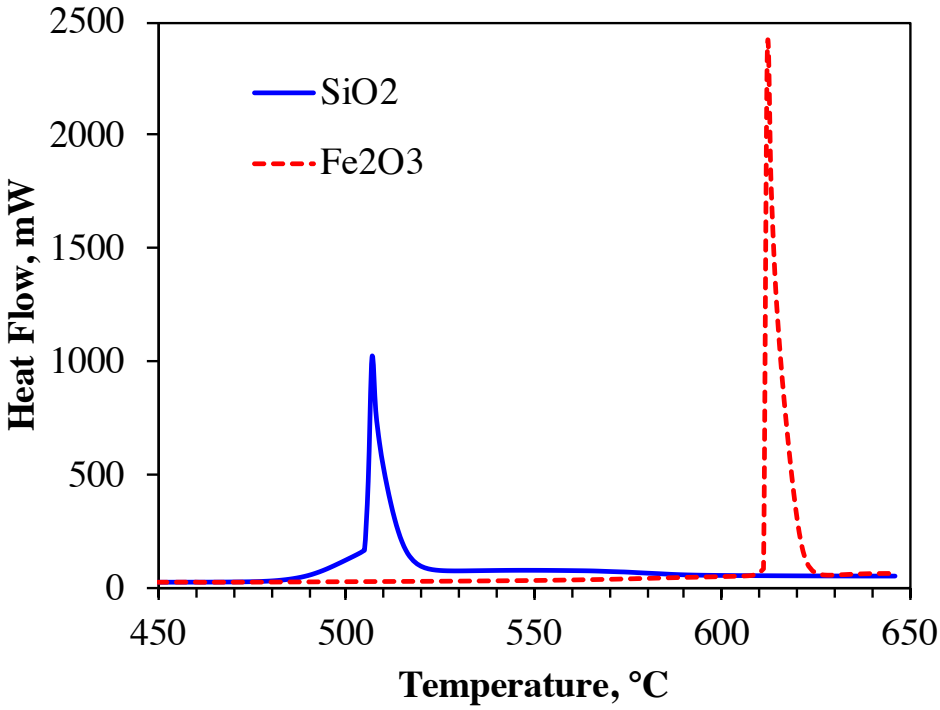

Figure 29. DSC curves for mixtures of SiO_2/Mg and Fe_2O_3/Mg.

To further verify this conclusion, DSC tests were conducted with ternary SiO_2/Fe_2O_3/Mg mixtures. Three ternary mixtures had different SiO_2−Fe_2O_3 mass ratios (2, 1, and 0.5), while the concentration of Mg was determined to simultaneously provide stoichiometry for both reactions described by (2) and (3). Thus, in other words, the mixtures had different ratios between SiO_2/Mg and Fe_2O_3/Mg thermites:

- SiO_2−Fe_2O_3 mass ratio: 2 or 71 wt% SiO_2/Mg and 29 wt% Fe_2O_3/Mg
- SiO_2−Fe_2O_3 mass ratio: 1 or 55 wt% SiO_2/Mg and 45 wt% Fe_2O_3/Mg
- SiO_2−Fe_2O_3 mass ratio: 0.5 or 38 wt% SiO_2/Mg and 62 wt% Fe_2O_3/Mg

Figure 30 shows DSC curves obtained for the three mixtures. It is seen that the temperature order of the peaks correlates with the SiO_2−Fe_2O_3 mass ratio. This confirms the

conclusion that iron oxide plays a primary role in combustion of iron-rich JSC-Mars-1A simulant with Mg, while the effect of silica is significant in combustion of iron-lean JSC-1A and Mojave Mars simulants. Thus, the iron-rich regolith exhibits higher temperatures and more vigorous combustion owing to the higher exothermicity of Fe_2O_3/Mg reaction (3), but it may be easier to ignite the iron-lean regolith simulants because SiO_2/Mg reaction (2) becomes significant at a lower temperature.

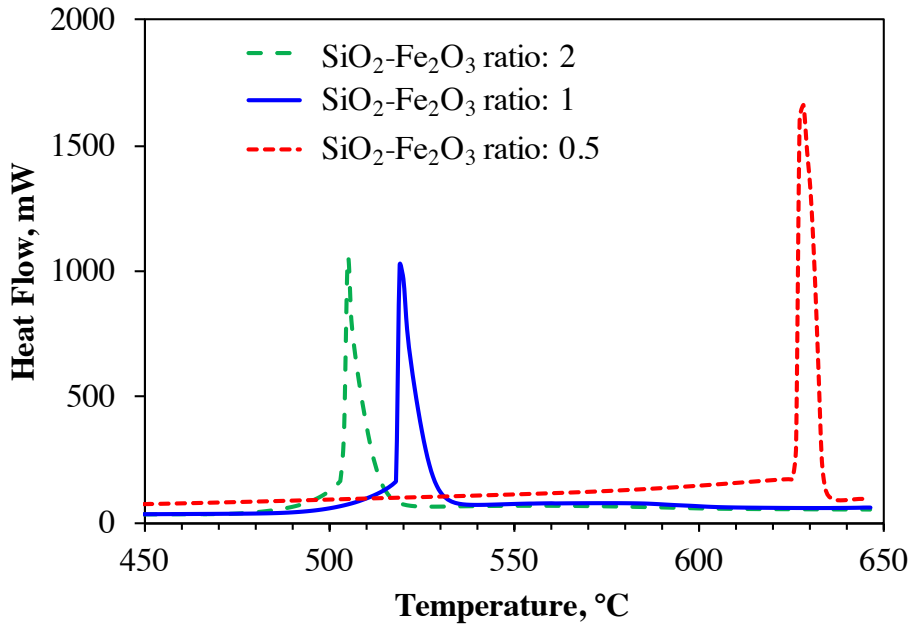

Figure 30. DSC curves for ternary mixtures of SiO_2/Fe_2O_3/Mg with different ratios.

4.1.4. Summary

Thermodynamic calculations have been conducted for combustion of two Martian regolith simulants (JSC-Mars-1A and Mojave Mars) with magnesium. The results show that mixtures of Martian regolith simulants (JSC-Mars-1A and Mojave Mars) with Mg exhibit higher adiabatic flame temperatures than their mixtures with Al (at the same concentrations of the metal). Comparison with the data for JSC-1A lunar regolith simulant shows that, in mixtures

with Mg, JSC-Mars-1A exhibits higher temperatures than Mojave Mars and JSC-1A, which correlates with Fe_2O_3 concentrations in these materials.

Experiments have confirmed that JSC-Mars-1A and Mojave Mars simulants form combustible mixtures with magnesium. The measured combustion temperatures and identified product compositions are in reasonable agreement with thermodynamic predictions. The mixtures of JSC-Mars-1A with magnesium at 20–30 wt% Mg exhibit higher temperatures and burn more vigorously than mixtures based on Mojave Mars. For Mojave Mars, combustion is accompanied by oscillations in the front motion and by the formation of a layered structure of the product. This effect is more significant at lower concentrations of Mg.

Thermoanalytical studies have shown that iron oxide plays a dominant role in the combustion of JSC-Mars-1A simulant with magnesium. However, Mg/SiO_2 mixture ignites at a temperature lower by approximately 100 °C than for Mg/Fe_2O_3. For Mojave Mars material and JSC-1A lunar regolith simulant, which include more silica and less iron oxide, silica exhibits a significant effect on the combustion, promoting reactions at lower temperatures.

4.2. Synthesis and Consolidation of Magnesium Silicide

4.2.1. Mechanical Activation

Figure 31 shows the XRD pattern of the as-milled mixture of Mg and Si powders. With the exception of small peaks of Mg_2Si and MgO, all peaks belong to the initial Mg and Si reactants. Thus, no significant reaction occurred during the milling process. The peak of MgO is apparently associated with the oxide layer on the surface of Mg particles.

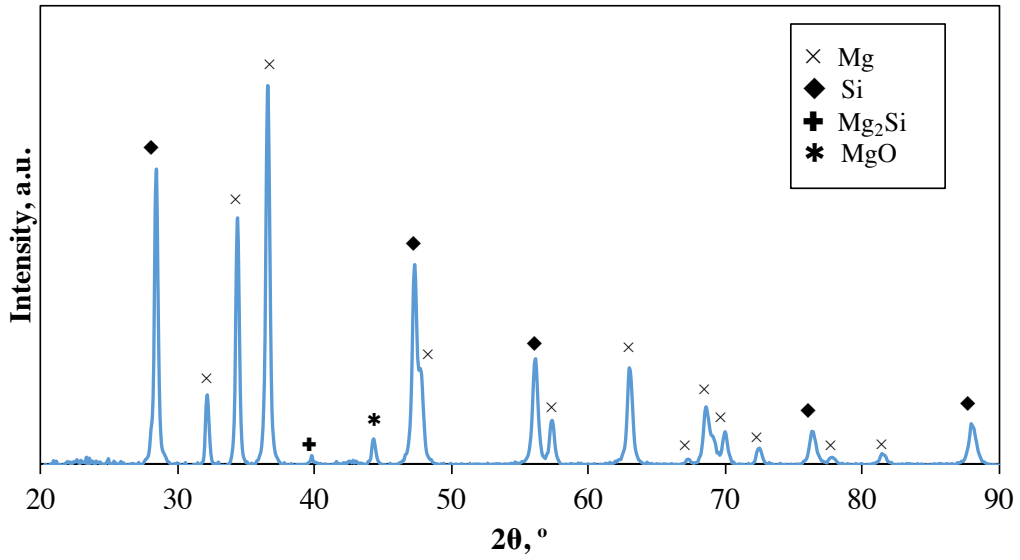

Figure 31. XRD pattern of the milled mixture of magnesium and silicon.

The particle size distribution for the Mg/Si powder after milling in the present study is shown in Figure 32. It is seen that the main peak has a maximum at 20-30 μm. The second peak was caused by the agglomeration of particles.

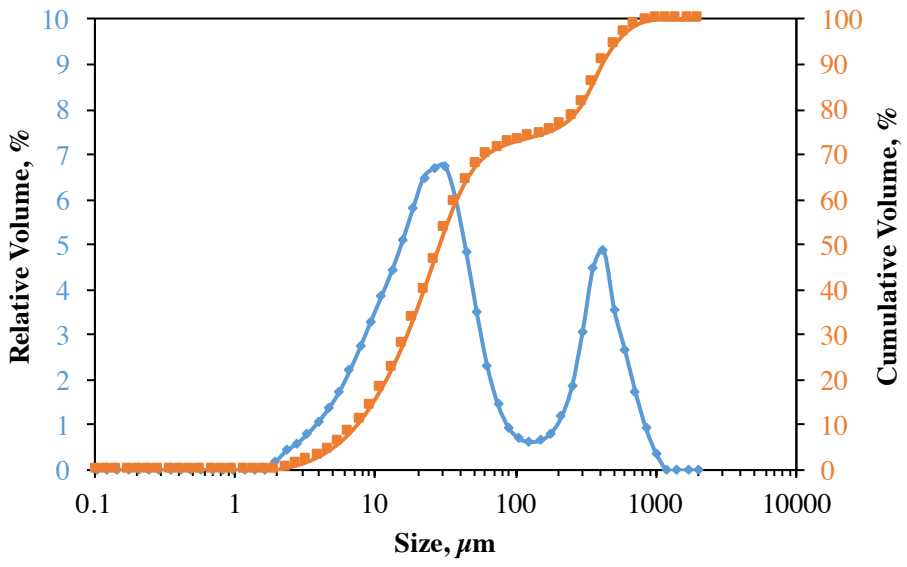

Figure 32. Particle size distribution of the milled mixture of magnesium and silicon.

4.2.2. Combustion Synthesis

Thirteen combustion experiments were conducted with 25-mm-diameter pellets made of mechanically activated Mg/Si mixture. Each pellet has a 3-g booster layer, prepared from stoichiometric titanium-boron mixture (B/Ti mole ratio: 2). All the pellets successfully ignited. Figure 33 shows a typical sequence of images of the combustion process. The first image shows a heated tungsten coil. Combustion of the booster pellets took place between the first and second images; the latter shows still glowing TiB_2 product. A long period with no visible reaction follows, see images from 10 s to 35 s. Then, rapid expansion of the sample occurs as seen in the images between 36 s and 40 s. During the expansion, the pellet cracks to several porous parts with loose powder between them. The video records clearly indicate that combustion occurs in the thermal explosion mode.

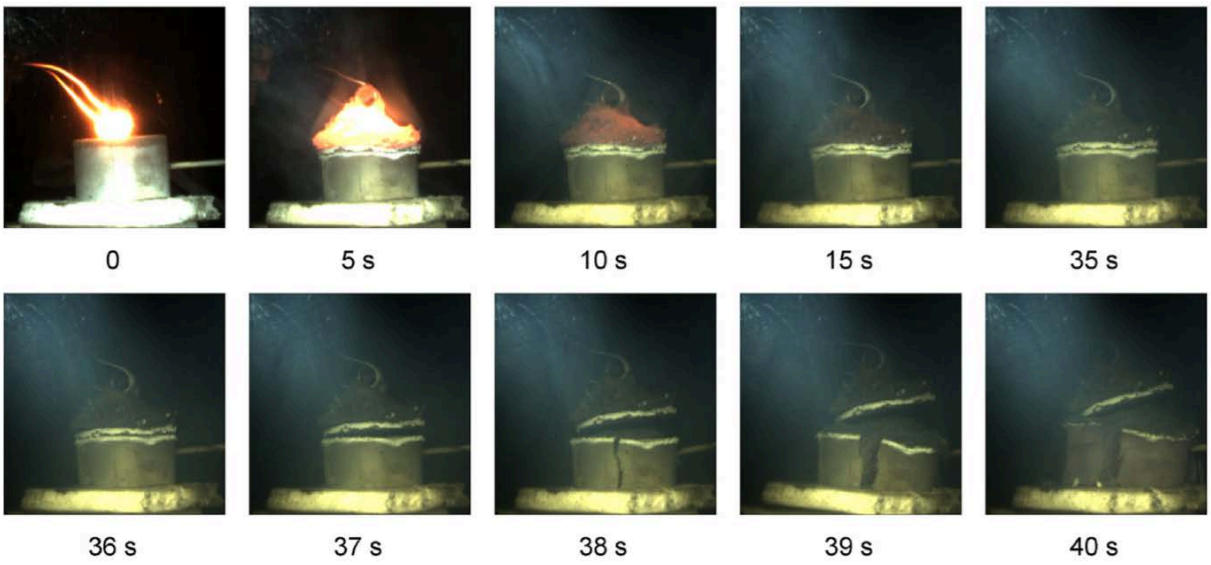

Figure 33. Combustion synthesis of the 25-mm-diameter pellets of milled mixtures (TE Mode).

Figure 34 shows a thermocouple record of the temperature in the pellet center for the same experiment. The sharp temperature rise at the beginning is caused by heat transfer from the heated coil and burning booster pellet. At t=8 s (330 °C), an inflection point indicates the effect of exothermic reaction inside Mg/Si mixture. Self-heating, however, does not lead immediately to ignition. Instead, the rate of temperature rise decreases and a rather long period of slow increase in temperature follows. From 20 s to 36 s, temperature increases from 415 °C to 440 °C, *i.e.*, only by 25 °C. Next, the temperature jumps up by 310 °C. This correlates with the expansion of the material seen in the Figure 33, 36-40 s. The maximum temperature, 750 °C, is lower by over 200 °C than the adiabatic flame temperature, apparently because of heat losses. Thus, the exothermic reaction has the following stages: acceleration (self-heating) at around 330 °C, then a relatively slow reaction until 440 °C, and finally very rapid (ignition) reaction.

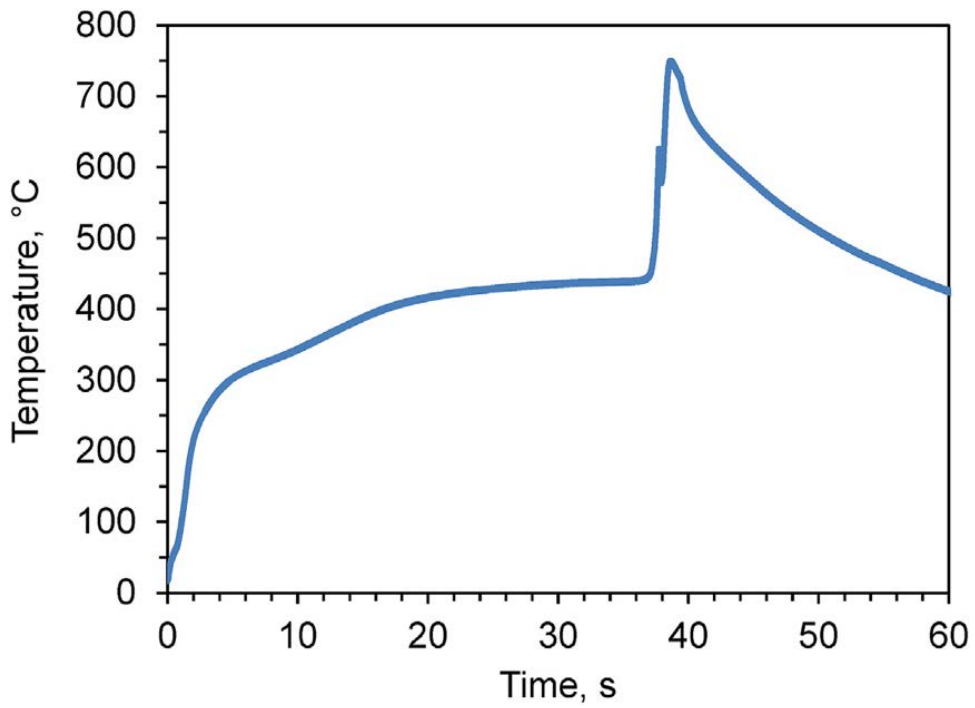

Figure 34. Temperature profile of thermal explosion mode.

Combustion experiments with 13-mm-diameter pellets were initially conducted with unmilled Mg/Si mixture, but ignition was achieved for less than 50% of samples. All subsequent experiments were conducted with milled mixtures and ignition was easily achieved in each of them.

Figure 35 shows a typical sequence of images for the combustion propagation over the milled Mg/Si mixture. It is seen the pellet burned in the SHS mode. The combustion front propagated steadily with a velocity of about 7 mm/s. The product significantly expanded during combustion propagation, but maintained the cylindrical shape and had a distinct layered structure. The relative density of the product in the SHS experiments, assuming that it was pure Mg_2Si, was 0.28-0.32, while the relative density of the initial Mg/Si mixture was 0.71-0.74.

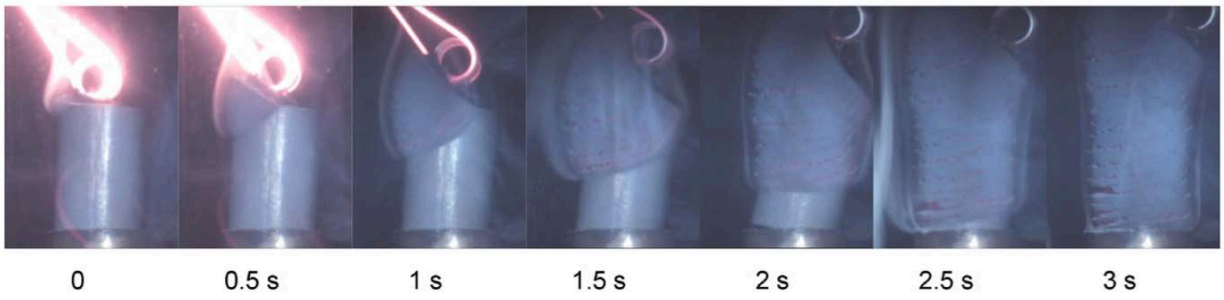

Figure 35. Combustion synthesis of the 13-mm-diameter pellets of milled mixtures (SHS Mode).

Figure 36 shows the XRD pattern of the products obtained by SHS in milled Mg/Si mixtures. It is seen that Mg_2Si is the main phase in the product. Small peaks of Si and MgO are also present, indicating that the intermetallic reaction was not 100% complete. The presence of MgO may be explained by oxidation of remaining Mg after exposing the products obtained in an argon environment to the ambient air. Note that MgO impurities were also observed in previous combustion synthesis experiments [20, 21]

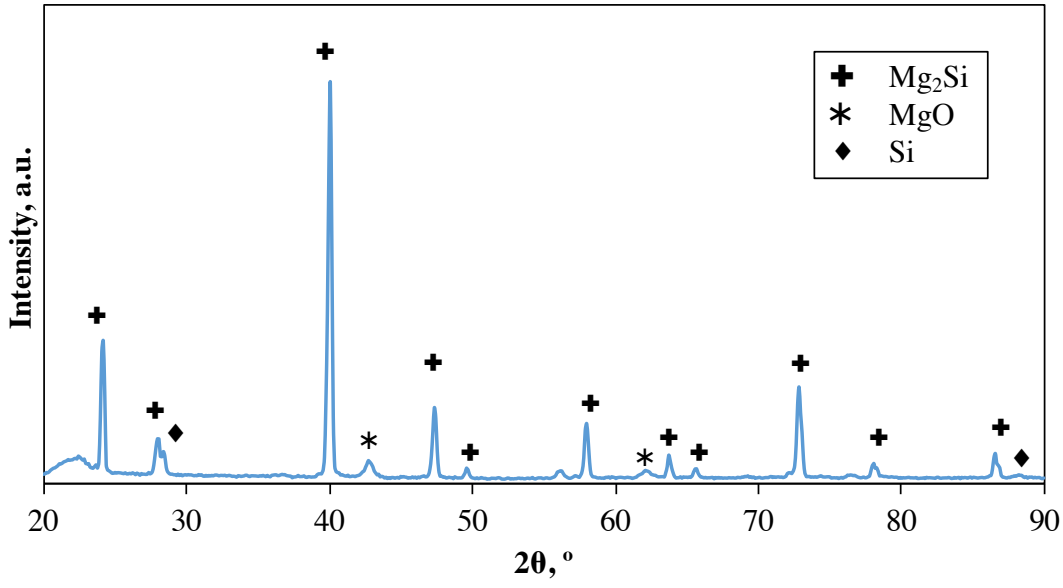

Figure 36. XRD pattern of the SHS obtained Mg_2Si.

Figure 37 shows the particle size distribution for the product, featuring a single peak at approximately 20 mm (median diameter: 17 mm; mean volume diameter: 18 mm). This correlates with the main peak for the as-milled powders (Figure 32). Note that agglomerates observed in the as-milled mixtures are not present in the product.

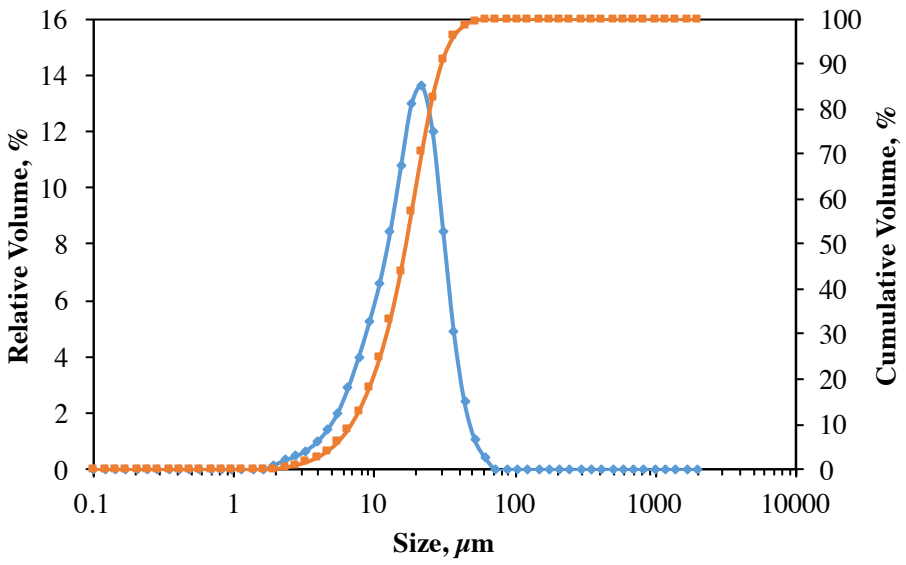

Figure 37. Particle size distribution of the SHS obtained Mg_2Si.

The thermal explosion mode observed for 25-mm-diameter pellets is similar to the combustion behavior of Mg/Si mixtures in previous experiments [20, 21], while the SHS mode, observed for 13-mm-diameter pellets, is quite different and, to our knowledge, reported for the first time for Mg-Si system. The occurrence of the two modes for the same mixture is explained by different heat transfer conditions. In the thin, 13 mm, and long pellet, heating at the top leads to a significant temperature gradient along the pellet axis because of thermal conduction over the sample and heat losses from the lateral surface. Ignition occurs in the zone with the highest temperature, *i.e.* at the top, and then the combustion wave propagates downward. In contrast, in the thick, 25 mm, and short pellet, the energy released by the booster pellet quickly heats the entire sample. At each moment of time, the temperature, and hence the reaction rate, is nearly

uniform throughout the sample, so ignition occurs in volume with no propagation of the combustion wave.

As noted above, combustion of Mg/Si mixture pellets in both SHS and thermal explosion modes is remarkable for the absence of light emission and for the large expansion (swelling) of the sample. Swelling and formation of a loose powder were reported in previous thermal explosion experiments and related to the high vapor pressure of Mg [21, 76]. Indeed, the pressure of saturated Mg vapor is about 10 Torr at 750 °C and about 100 Torr at 900 °C [91]. When magnesium particles are heated in the combustion zone and transport of the formed Mg vapor is hindered, pressure may significantly increase in the pores, leading to expansion or disintegration of the sample. The effect of changing the particle volume during the reaction is negligible according to the calculations based on the densities of Mg, Si, and Mg_2Si (1.74 g/cm^3, 2.32 g/cm^3, and 1.99 g/cm^3, respectively). Note that swelling was also observed in the experiments on combustion of lunar and Martian regolith simulants with magnesium.

Interestingly, the thermal explosion product was a loose powder [21] or comprised several pieces of porous material with some amount of loose powder (the present work), while the SHS product retained the cylindrical shape and had a layered structure. This difference is explained as follows. During thermal explosion, Mg vapor pressure increases simultaneously throughout the entire sample, leading to the large expansion in all directions. During SHS, however, increased Mg vapor pressure expands the material in the localized, relatively thin combustion front and the expanded material simply pushes the above products upward. The layered structure of the SHS product has been observed previously and explained by thermal instability (pulsations) of the combustion wave in low-exothermic mixtures [86, 87].

4.2.3. Differential Scanning Calorimetry

DSC curves, obtained for the milled Mg/Si mixture in an argon flow (20 mL/min) at heating rates of 1, 5, 10, and 20 °C/min, exhibited two exothermic peaks. Since calibration was

conducted at a heating rate of 20 °C/min, Figure 38 shows the DSC curve obtained at this heating rate. It is seen that the two peaks have maxima at approximately 250 °C and 550 °C.

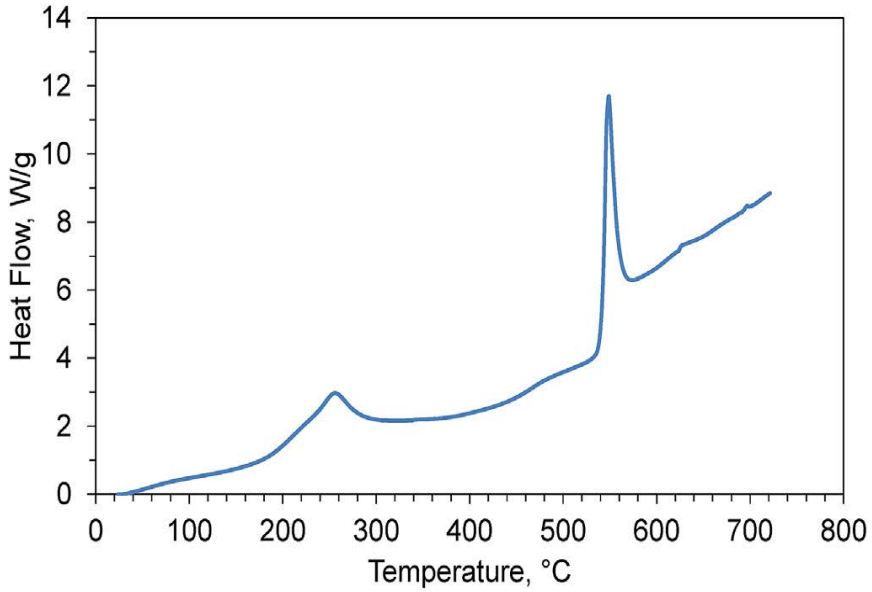

Figure 38. DSC curves of the milled Mg/Si mixture heated at 20 °C/min.

Likewise, two DSC peaks at similar temperatures were observed for Mg/Si mixtures ball-milled at 250 rpm for 20-70 h [68] and at 300 rpm for 30-60 min [69]. In contrast, DSC tests of unmilled Mg/Si mixtures revealed only a high-temperature peak (around 500 °C). Similarly, DSC tests of unmilled Mg/Si mixtures by Godlewska *et al.* have shown a large exothermic peak at 550-580 °C only [21, 76]. Based on XRD results and analysis of activation energies of the reaction and metal-oxide diffusion, Wang and Qin suggested that the low temperature peak is caused by mechanical activation components such as cracking of the oxide films, direct alloying of the both elements, grain size refinement, and defect production [68]. A similar explanation was provided by Ioannou *et al* [69].

Thus, DSC results obtained in the present work are in agreement with those obtained in the reviewed studies and the low-temperature peak is caused by mechanical activation. The existence of two reaction peaks also explains the stages of exothermic reaction observed in the

combustion experiments as described in Section 4.2.2. The initial self-heating is apparently caused by fast reaction between mechanically activated Mg and Si powders. As a result, however, a Mg_2Si layer forms and inhibits the reaction. Nevertheless, a relatively slow diffusion of metal ions through this layer is ongoing and the continuation of exothermic Mg-Si reaction eventually results in the sharp rise of both temperature and reaction rate (ignition).

4.2.4. Shockwave Consolidation

Three shockwave consolidation experiments were performed with magnesium silicide. The deformation of the tube after shockwave consolidation is shown in Figure 39. As described in Section 3.3.4, samples in the form of disks were obtained from the consolidated tubes (Figure 40). Density of each sample was determined by measuring the mass and dimensions of the product disk. The density of 1.74 g/cm^3 was achieved which corresponds to 88% of the theoretical density.

Figure 39. The sample tube before (top) and after (bottom) shockwave consolidation. Red paint seen in the top image was used for labeling. The tube in the top image does not have caps, while the tube in the bottom image has one cap.

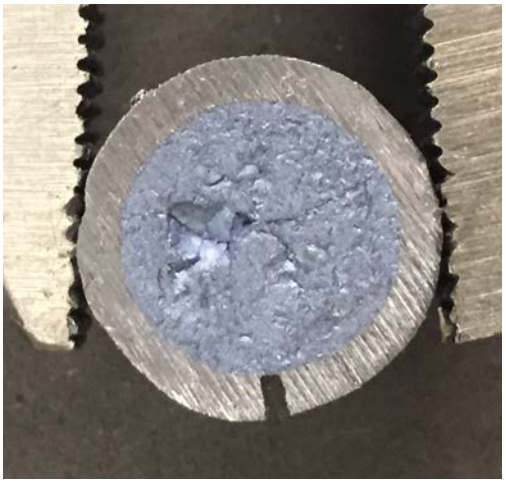

Figure 40. A sample disk in the process of detaching the rim from the sample core.

The measured thermal diffusivity and specific heat of Mg_2Si at different temperatures are shown in Table 5. The values of specific heat presented in JANAF tables [84] are also shown in Table 5.

Table 5. Thermal diffusivity and specific heat for shockwave-consolidated Mg_2Si at different temperatures.

Temperature, °C	**Diffusivity,** mm^2/s	**Specific heat,** J/g·°C	
		from measurement	from JANAF tables [84]
50	1.27	1.05	0.92
75	1.16	1.07	0.94
100	1.08	1.10	0.96
125	1.00	1.10	0.97
150	0.94	1.11	0.99
175	0.88	1.12	1.00
200	0.82	1.13	1.01
225	0.77	1.15	1.02

Note that the measurements of specific heat with the LFA have involved the comparison with a reference material (Netzsch Pyroceram 9606).

The thermal conductivity was calculated by the formula:

$$\kappa = \alpha \rho c_p \tag{4}$$

where α is the thermal diffusivity, ρ is the density, and c_p is the specific heat. The thermal conductivity was calculated using measured values of c_p and those obtained from JANAF tables, see Table 6.

Table 6. Thermal conductivity of shockwave-consolidated Mg_2Si at different temperatures.

Temperature, °C	**Thermal Conductivity,** W/m·°C	
	Using measured c_p	using c_p from JANAF tables
50	2.01	2.03
75	1.87	1.89
100	1.77	1.80
125	1.68	1.70
150	1.60	1.61
175	1.53	1.53
200	1.45	1.44
225	1.39	1.37

Measurement error was calculated to be within 5.5 %. The error accounts for standard deviation and error associated with the use of the Pyroceram reference. It is seen that the thermal conductivity is quite low: *e.g.*, 2.01 W/(m·K) at 50 °C. For comparison, for Mg_2Si consolidated by hot pressing or SPS, the reported values at 50 °C vary from 5-6 W/(m·K) [21, 76] to 9-12 W/(m·K) [69].

The low thermal conductivity of shockwave-consolidated samples may be associated with the low grain growth during consolidation or with the presence of a high-void fraction caused by insufficient densification. The latter effect could be eliminated by tuning the shockwave consolidation parameters and producing fully dense Mg_2Si materials.

4.2.5. Summary

Mechanical activation was used to facilitate the ignition of magnesium/silicon mixtures. Magnesium and silicon powders were mixed and then milled in a planetary ball mill in an argon environment. The mixtures were compacted into pellets and ignited at the top in a reaction chamber filled with argon.

Depending on the geometry and dimensions of the mixture pellet, combustion synthesis occurred in either thermal explosion or SHS mode. The time variation of temperature during combustion and DSC tests of mechanically activated Mg/Si mixture revealed that the occurring reaction is a multi-stage process. First, because of broken oxide films on Mg and Si particles and close contact of these particles, the two elements react rapidly, leading to self-heating of the sample. The next stage involves a relatively slow reaction that is controlled by diffusion of Mg and Si ions through the layer of formed Mg_2Si product. This process eventually leads to a sharp rise of temperature and reaction rate (ignition), which results in the synthesis of Mg_2Si.

Shockwave consolidation of magnesium silicide powder has been demonstrated. Thermophysical properties of the obtained material were determined using a laser flash apparatus. The thermal conductivity of consolidated Mg_2Si is quite low, which may be associated with low grain growth during shockwave consolidation and with the presence of a high void fraction due to insufficient densification in the test. Tuning the process parameters may lead to better densification of Mg_2Si.

Chapter 5
Conclusions

Magnesium-based combustion synthesis has been studied for applications to the production of construction materials from lunar and Martian regolith and to the fabrication of magnesium silicide, a promising thermoelectric material.

5.1. Studies of Regolith-Magnesium Combustion

On the Moon and Mars, combustion of regolith with magnesium is an attractive method for the production of construction materials because it offers easy, low-energy consuming ignition and high utilization of local resources.

Thermodynamic analysis has shown that mixtures of Martian regolith simulants (JSC-Mars-1A and Mojave Mars) with Mg exhibit higher adiabatic flame temperatures than their mixtures with Al (at the same concentrations of the metal). Comparison with the data for JSC-1A lunar regolith simulant shows that, in mixtures with Mg, JSC-Mars-1A exhibits higher temperatures than Mojave Mars and JSC-1A, which correlates with Fe_2O_3 concentrations in these materials.

The measured combustion temperatures and identified product compositions are in reasonable agreement with thermodynamic predictions. The mixtures of JSC-Mars-1A with magnesium at 20–30 wt% Mg exhibit higher temperatures and burn more vigorously than mixtures based on Mojave Mars. For Mojave Mars, combustion is accompanied by oscillations in the front motion and by the formation of a layered structure of the product. This effect is more significant at lower concentrations of Mg.

The reaction mechanisms during combustion of lunar and Martian regolith simulants with Mg were revealed for the first time. Thermoanalytical studies have shown that iron oxide plays a dominant role in the combustion of JSC-Mars-1A simulant with magnesium. However, Mg/SiO_2 mixture ignites at a temperature lower by approximately 100 °C than for Mg/Fe_2O_3. For Mojave

Mars material and JSC-1A lunar regolith simulant, which include more silica and less iron oxide, silica exhibits a significant effect on the combustion, promoting reactions at lower temperatures. Since regolith compositions are different in different areas of the Moon and Mars surfaces, the obtained results will enable a better understanding of the reaction characteristics in landing sites selected for future exploration missions.

5.2. Synthesis and Consolidation of Magnesium Silicide

Magnesium silicide is an attractive thermoelectric material for applications in the range of 200-500 °C. Unfortunately, large-scale production of high-quality Mg_2Si is difficult. As compared with other processing methods, combustion synthesis of Mg_2Si has advantages such as low-energy consumption and simple, inexpensive equipment. Previously, Mg_2Si was produced via combustion synthesis in the thermal explosion mode, which required significant amounts of energy input. In the present work, for the first time, Mg_2Si was obtained in the SHS mode of combustion synthesis, which is attractive because it decreases the consumed energy and facilitates control of the process.

Mechanical activation was used to facilitate the ignition of Mg/Si mixtures and thus enable the SHS mode. Mechanical activation involved milling magnesium and silicon powders in a planetary ball mill in an argon environment.

Depending on the geometry and dimensions of the mixture pellet, combustion synthesis occurred in either thermal explosion or SHS mode. The time variation of temperature during combustion and DSC tests of mechanically activated Mg/Si mixture revealed that the occurring reaction is a multi-stage process. First, because of broken oxide films on Mg and Si particles and close contact of these particles, the two elements react rapidly, leading to self-heating of the sample. The next stage involves a relatively slow reaction that is controlled by diffusion of Mg and Si ions through the layer of formed Mg_2Si product. This process eventually leads to a sharp rise of temperature and reaction rate (ignition), which results in the synthesis of Mg_2Si.

Shockwave consolidation was performed to densify Mg_2Si powders and thermophysical properties of the obtained material were determined. The thermal conductivity of consolidated Mg_2Si is quite low, which may be associated with low grain growth during shockwave consolidation and with the presence of a high void fraction due to insufficient densification in the test. Tuning the process parameters may lead to better densification of Mg_2Si.

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Appendix

Thermodynamic Calculations

Al/(JSC-1A)

```
     Content of Aluminum - 0 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           809.5040
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          75.4016
 Products entropy           (J/K)         110.3636
 Products enthalpy          (KJ)         -888.1178
 Mass  of the system        (Kg)            0.0669
  Al 2Mg 1O  4              (C)  []         0.0195
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2760
  Al 2O  5Si 1              (C)  [KIANI     0.1157
  Al 2O  5Ti 1              (C)  []         0.0441
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3936
  Fe 2O  3                  (C)[]           0.1264
  Mg 2O  6Si 2              (C)[KLINOEN     0.0247
*
     1 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           962.4405
 Gas products amount        (mol)       7.18E-0013
 Products heat capacity     (J/K)          75.3463
 Products entropy           (J/K)         122.5098
 Products enthalpy          (KJ)         -866.6316
 Mass  of the system        (Kg)            0.0659
  Al 2Fe 1O  4              (C)  []         0.1537
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2733
  Al 2O  5Si 1              (C)  [KIANI     0.0232
  Al 2O  5Ti 1              (C)  []         0.0437
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3897
  Fe 3O  4                  (C)[]           0.0527
  Mg 2O  6Si 2              (C)[KLINOEN     0.0380
  O  2Si 1                  (C)  [QUART     0.0257
*
     2 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1096.9479
 Gas products amount        (mol)       2.34E-0013
 Products heat capacity     (J/K)          76.0016
 Products entropy           (J/K)         130.4854
 Products enthalpy          (KJ)         -845.3471
 Mass  of the system        (Kg)            0.0650
  Al 2Fe 1O  4              (C)  []         0.2100
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2705
  Al 2O  5Ti 1              (C)  []         0.0426
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3858
  Fe 1                      (C)[]           0.0188
  Fe 2O  4Ti 1              (C)  [ULVIT 8.11E-0004
  Mg 2O  6Si 2              (C)[KLINOEN     0.0376
  O  2Si 1                  (C)  [CRIST     0.0340
*
     3 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1209.0112
 Gas products amount        (mol)       1.57E-0011
 Products heat capacity     (J/K)          75.4462
 Products entropy           (J/K)         135.7824
 Products enthalpy          (KJ)         -824.8742
 Mass  of the system        (Kg)            0.0640
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1816
  Al 2Fe 1O  4              (C)  []         0.1105
  Al 2Mg 1O  4              (C)  []         0.0132
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2677
  Al 2O  5Ti 1              (C)  []         0.0428
```

```
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2405
  Fe 1                      (C)[]           0.0503
  Mg 1O  3Si 1              (C)             0.0935
*
```

4 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1318.2791
 Gas products amount        (mol)       3.00E-0011
 Products heat capacity     (J/K)          75.5550
 Products entropy           (J/K)         140.2285
 Products enthalpy          (KJ)         -805.0014
 Mass  of the system        (Kg)            0.0631
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2860
  Al 2Fe 1O  4              (C)  []         0.0097
  Al 2Mg 1O  4              (C)  []         0.0674
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2650
  Al 2O  5Ti 1              (C)  []         0.0423
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1552
  Fe 1                      (C)[]           0.0818
  Mg 1O  3Si 1              (C)             0.0925
*
```

5 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1384.1694
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          75.3218
 Products entropy           (J/K)         141.7109
 Products enthalpy          (KJ)         -785.6585
 Mass  of the system        (Kg)            0.0623
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2812
  Al 2Mg 1O  4              (C)  []         0.1030
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2622
  Al 2O  5Ti 1              (C)  []         0.0419
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1551
  Fe 1                      (C)[]           0.0694
  Fe 1Si 1                  (C)[]           0.0220
  Mg 1O  3Si 1              (C)             0.0653
*
```

6 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1445.0338
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          75.0833
 Products entropy           (J/K)         142.7717
 Products enthalpy          (KJ)         -766.8012
 Mass  of the system        (Kg)            0.0614
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2646
  Al 2Mg 1O  4              (C)  []         0.1366
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2595
  Al 2O  5Ti 1              (C)  []         0.0415
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1640
  Fe 1                      (C)[]           0.0523
  Fe 1Si 1                  (C)[]           0.0463
  Mg 1O  3Si 1              (C)             0.0352
*
```

7 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1504.9125
 Gas products amount        (mol)       4.02E-0011
 Products heat capacity     (J/K)          74.8626
 Products entropy           (J/K)         143.6671
 Products enthalpy          (KJ)         -748.4635
 Mass  of the system        (Kg)            0.0606
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2481
  Al 2Mg 1O  4              (C)  []         0.1702
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2567
  Al 2O  5Ti 1              (C)  []         0.0410
```

```
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1730
  Fe 1                      (C)[]           0.0352
  Fe 1Si 1                  (C)[]           0.0706
  Mg 1O  3Si 1              (C)             0.0051
*
```

8 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1558.2746
 Gas products amount        (mol)       1.45E-0010
 Products heat capacity     (J/K)          74.5976
 Products entropy           (J/K)         144.2717
 Products enthalpy          (KJ)         -730.6285
 Mass  of the system        (Kg)            0.0598
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2661
  Al 2Mg 1O  4              (C)  []         0.1862
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2539
  Al 2O  5Ti 1              (C)  []         0.0406
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1012
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0389
  Fe 1                      (C)[]           0.0181
  Fe 1Si 1                  (C)[]           0.0950
*
```

9 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1608.6890
 Gas products amount        (mol)       2.64E-0011
 Products heat capacity     (J/K)          74.4320
 Products entropy           (J/K)         144.6980
 Products enthalpy          (KJ)         -713.3433
 Mass  of the system        (Kg)            0.0590
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2913
  Al 2Mg 1O  4              (C)  []         0.1985
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2512
  Al 2O  5Ti 1              (C)  []         0.0401
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0129
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0857
  Fe 1                      (C)[]           0.0011
  Fe 1Si 1                  (C)[]           0.1193
*
```

10 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1654.3225
 Gas products amount        (mol)       1.33E-0013
 Products heat capacity     (J/K)          73.7721
 Products entropy           (J/K)         144.4808
 Products enthalpy          (KJ)         -696.3215
 Mass  of the system        (Kg)            0.0583
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2692
  Al 2Mg 1O  4              (C)  []         0.2603
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2484
  Al 2O  5Ti 1              (C)  []         0.0071
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0235
  Ca 1O  3Si 1              (C)[WOLLAST     0.0602
  Fe 1Si 1                  (C)[]           0.1196
  Si 3Ti 5                  (C)[]           0.0116
*
```

11 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1687.5000
 Gas products amount        (mol)       1.28E-0011
 Products heat capacity     (J/K)          73.1071
 Products entropy           (J/K)         143.7742
 Products enthalpy          (KJ)         -680.0662
 Mass  of the system        (Kg)            0.0575
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2930
  Al 2Mg 1O  4              (C)  []         0.2786
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.0260
```

```
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1976
 Ca 1O  3Si 1              (C)[WOLLAST     0.0656
 Fe 1Si 1                  (C)[]           0.1183
 Si 1                      (C)[]           0.0069
 Si 3Ti 5                  (C)[]           0.0140
*
    12 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1690.3124
Gas products amount        (mol)       1.50E-0011
Products heat capacity     (J/K)          73.2921
Products entropy           (J/K)         143.0047
Products enthalpy          (KJ)         -663.6390
Mass  of the system        (Kg)            0.0568
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3963
 Al 2Mg 1O  4              (C)  []         0.2506
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.0876
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.0813
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0379
 Fe 1Si 1                  (C)[]           0.1169
 Si 1                      (L)[]           0.0156
 Si 3Ti 5                  (C)[]           0.0138
*
    13 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1692.8164     1692.5080     1693.1248
Gas products amount        (mol)       1.66E-0012    2.19E-0012    6.78E-0013
Products heat capacity     (J/K)          71.8226       71.8286       71.8114
Products entropy           (J/K)         142.5262      141.4238      144.5808
Products enthalpy          (KJ)         -648.0647     -649.9309     -644.5866
Phase transition enthalpy  (KJ)            5.3443
Mass  of the system        (Kg)            0.0561
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4211        0.4211        0.4211
 Al 2Mg 1O  4              (C)  []         0.2627        0.2627        0.2627
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1090        0.1090        0.1090
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.0389        0.0389        0.0389
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0147        0.0147        0.0147
 Fe 1Si 1                  (L)[]           0.0404        0.0000        0.1156
 Fe 1Si 1                  (C)[]           0.0752        0.1156        0.0000
 Si 1                      (L)[]           0.0243        0.0243        0.0243
 Si 3Ti 5                  (C)[]           0.0137        0.0137        0.0137
*
    14 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1693.2464     1692.9116     1693.5811
Gas products amount        (mol)       1.76E-0011    1.20E-0012    2.45E-0011
Products heat capacity     (J/K)          70.4970       70.5090       70.4920
Products entropy           (J/K)         142.0716      139.8983      142.9823
Products enthalpy          (KJ)         -632.7657     -636.4448     -631.2241
Phase transition enthalpy  (KJ)            5.2207
Mass  of the system        (Kg)            0.0554
 Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0024        0.0024        0.0024
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4301        0.4301        0.4301
 Al 2Mg 1O  4              (C)  []         0.2692        0.2692        0.2692
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1286        0.1286        0.1286
 Al 2O  3                  (C)[]           0.0089        0.0089        0.0089
 Fe 1Si 1                  (L)[]           0.0805    3.02E-0005        0.1143
 Fe 1Si 1                  (C)[]           0.0337        0.1142        0.0000
 Si 1                      (L)[]           0.0330        0.0330        0.0330
 Si 3Ti 5                  (C)[]           0.0135        0.0135        0.0135
*
    15 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1695.9413
Gas products amount        (mol)       7.59E-0011
Products heat capacity     (J/K)          69.3005
Products entropy           (J/K)         141.3829
```

```
 Products enthalpy          (KJ)         -617.8157
 Mass  of the system        (Kg)            0.0547
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0319
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3652
  Al 2Mg 1O  4              (C)  []         0.2661
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1271
  Al 2O  3                  (C)[]           0.0418
  Fe 1Si 1                  (L)[]           0.1129
  Si 1                      (L)[]           0.0417
  Si 3Ti 5                  (C)[]           0.0133
*
```

16 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1700.6826
 Gas products amount        (mol)       3.10E-0011
 Products heat capacity     (J/K)          68.8309
 Products entropy           (J/K)         140.3861
 Products enthalpy          (KJ)         -603.4258
 Mass  of the system        (Kg)            0.0541
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0210
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3822
  Al 2Mg 1O  4              (C)  []         0.2629
  Al 2O  3                  (C)[]           0.1047
  Fe 1Si 1                  (L)[]           0.1116
  Na 2O  3Si 1              (L)[]           0.0540
  Si 1                      (L)[]           0.0504
  Si 3Ti 5                  (C)[]           0.0132
*
```

17 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1727.0867
 Gas products amount        (mol)       4.27E-0010
 Products heat capacity     (J/K)          67.8521
 Products entropy           (J/K)         139.7977
 Products enthalpy          (KJ)         -589.0475
 Mass  of the system        (Kg)            0.0534
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0510
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3163
  Al 2Mg 1O  4              (C)  []         0.2598
  Al 2O  3                  (C)[]           0.1372
  Fe 1Si 1                  (L)[]           0.1103
  Na 2O  3Si 1              (L)[]           0.0533
  Si 1                      (L)[]           0.0591
  Si 3Ti 5                  (C)[]           0.0130
*
```

18 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1751.4333
 Gas products amount        (mol)       2.51E-0010
 Products heat capacity     (J/K)          66.8715
 Products entropy           (J/K)         139.1208
 Products enthalpy          (KJ)         -575.1569
 Mass  of the system        (Kg)            0.0528
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0810
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2503
  Al 2Mg 1O  4              (C)  []         0.2567
  Al 2O  3                  (C)[]           0.1697
  Fe 1Si 1                  (L)[]           0.1090
  Na 2O  3Si 1              (L)[]           0.0527
  Si 1                      (L)[]           0.0678
  Si 3Ti 5                  (C)[]           0.0129
*
```

19 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1776.0539
 Gas products amount        (mol)       2.54E-0011
 Products heat capacity     (J/K)          65.9064
```

```
 Products entropy           (J/K)         138.4494
 Products enthalpy          (KJ)         -561.5825
 Mass  of the system        (Kg)            0.0522
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1110
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1844
  Al 2Mg 1O  4              (C)  []         0.2536
  Al 2O  3                  (C)[]           0.2022
  Fe 1Si 1                  (L)[]           0.1076
  Na 2O  3Si 1              (L)[]           0.0520
  Si 1                      (L)[]           0.0765
  Si 3Ti 5                  (C)[]           0.0127
*
```

20 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1800.9490
 Gas products amount        (mol)       8.68E-0011
 Products heat capacity     (J/K)          64.9561
 Products entropy           (J/K)         137.7835
 Products enthalpy          (KJ)         -548.3151
 Mass  of the system        (Kg)            0.0516
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1410
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1185
  Al 2Mg 1O  4              (C)  []         0.2504
  Al 2O  3                  (C)[]           0.2347
  Fe 1Si 1                  (L)[]           0.1063
  Na 2O  3Si 1              (L)[]           0.0514
  Si 1                      (L)[]           0.0852
  Si 3Ti 5                  (C)[]           0.0126
*
```

21 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1820.6593
 Gas products amount        (mol)       9.23E-0011
 Products heat capacity     (J/K)          63.9864
 Products entropy           (J/K)         136.9301
 Products enthalpy          (KJ)         -535.6911
 Mass  of the system        (Kg)            0.0510
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1710
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0526
  Al 2Mg 1O  4              (C)  []         0.2473
  Al 2O  3                  (C)[]           0.2672
  Fe 1Si 1                  (L)[]           0.1050
  Na 2O  3Si 1              (L)[]           0.0508
  Si 1                      (L)[]           0.0939
  Si 3Ti 5                  (C)[]           0.0124
*
```

22 wt% Al

```
 Volume of gas products   (litres)          0.7543
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1835.0668
 Gas products amount        (mol)           0.0048
 Products heat capacity     (J/K)          62.9769
 Products entropy           (J/K)         136.2181
 Products enthalpy          (KJ)         -523.0754
 Mass  of the system        (Kg)            0.0505
1 Na 1                      (G)             0.0022        0.9968  (atm)
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1944
  Al 2Mg 1O  4              (C)  []         0.2441
  Al 2O  3                  (C)[]           0.2972
  Fe 1Si 1                  (L)[]           0.1036
  Na 2O  3Si 1              (L)[]           0.0443
  Si 1                      (L)[]           0.1019
  Si 3Ti 5                  (C)[]           0.0122
*
```

23 wt% Al

```
 Volume of gas products   (litres)          4.3694
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0285
```

```
 Products heat capacity     (J/K)          61.6617
 Products entropy           (J/K)         135.4167
 Products enthalpy          (KJ)         -510.7750
 Mass  of the system        (Kg)            0.0499
1 Mg 1                      (G)         3.72E-0005        0.0027  (atm)
1 Na 1                      (G)             0.0131        0.9973  (atm)
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1919
  Al 2Mg 1O  4              (C)  []         0.2408
  Al 2O  3                  (C)[]           0.3178
  Fe 1Si 1                  (L)[]           0.1023
  Na 2O  3Si 1              (L)[]           0.0147
  Si 1                      (L)[]           0.1072
  Si 3Ti 5                  (C)[]           0.0121
*
```

24 wt% Al

```
 Volume of gas products   (litres)          6.0801
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0396
 Products heat capacity     (J/K)          60.4844
 Products entropy           (J/K)         135.0758
 Products enthalpy          (KJ)         -497.8908
 Mass  of the system        (Kg)            0.0494
1 Mg 1                      (G)         6.25E-0005        0.0032  (atm)
1 Na 1                      (G)             0.0184        0.9968  (atm)
  Al 4Ca 1O  7              (C)  []         0.0944
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1396
  Al 2Mg 1O  4              (C)  []         0.2375
  Al 2O  3                  (C)[]           0.2827
  Fe 1Si 1                  (L)[]           0.1010
  Si 1                      (L)[]           0.1143
  Si 3Ti 5                  (C)[]           0.0119
*
```

25 wt% Al

```
 Volume of gas products   (litres)          5.9351
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0387
 Products heat capacity     (J/K)          59.2948
 Products entropy           (J/K)         134.3362
 Products enthalpy          (KJ)         -485.9668
 Mass  of the system        (Kg)            0.0488
1 Mg 1                      (G)         6.17E-0005        0.0032  (atm)
1 Na 1                      (G)             0.0181        0.9968  (atm)
  Al 4Ca 1O  7              (C)  []         0.2834
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0375
  Al 2Mg 1O  4              (C)  []         0.2344
  Al 2O  3                  (C)[]           0.1920
  Fe 1Si 1                  (L)[]           0.0997
  Si 1                      (L)[]           0.1231
  Si 3Ti 5                  (C)[]           0.0118
*
```

26 wt% Al

```
 Volume of gas products   (litres)          5.9477
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1792.9041
 Gas products amount        (mol)           0.0391
 Products heat capacity     (J/K)          58.4189
 Products entropy           (J/K)         132.9020
 Products enthalpy          (KJ)         -474.7013
 Mass  of the system        (Kg)            0.0483
1 Mg 1                      (G)         7.47E-0004        0.0379  (atm)
1 Na 1                      (G)             0.0179        0.9618  (atm)
  Al 2Ca 1                  (L)[]           0.0104
  Al 4Ca 1O  7              (C)  []         0.3209
  Al 2Mg 1O  4              (C)  []         0.2273
  Al 2O  3                  (C)[]           0.1876
  Fe 1Si 1                  (L)[]           0.0983
  Si 1                      (L)[]           0.1252
  Si 3Ti 5                  (C)[]           0.0116
*
```

```
     27 wt% Al
 Volume of gas products   (litres)          5.7626
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1784.5686
 Gas products amount        (mol)           0.0381
 Products heat capacity     (J/K)          57.8700
 Products entropy           (J/K)         131.3859
 Products enthalpy          (KJ)         -463.3438
 Mass  of the system        (Kg)            0.0478
1 Mg 1                      (G)         6.84E-0004        0.0353  (atm)
1 Na 1                      (G)             0.0177        0.9644  (atm)
  Al 2Ca 1                  (L)[]           0.0280
  Al 4Ca 1O  7              (C)  []         0.2676
  Al 2Mg 1O  4              (C)  []         0.2245
  Al 2O  3                  (C)[]           0.2295
  Fe 1Si 1                  (L)[]           0.0970
  Si 1                      (L)[]           0.1235
  Si 3Ti 5                  (C)[]           0.0115
*
     28 wt% Al
 Volume of gas products   (litres)          5.5838
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1776.2623
 Gas products amount        (mol)           0.0371
 Products heat capacity     (J/K)          57.3317
 Products entropy           (J/K)         129.9013
 Products enthalpy          (KJ)         -452.2198
 Mass  of the system        (Kg)            0.0473
1 Mg 1                      (G)         6.27E-0004        0.0329  (atm)
1 Na 1                      (G)             0.0174        0.9669  (atm)
  Al 2Ca 1                  (L)[]           0.0456
  Al 4Ca 1O  7              (C)  []         0.2143
  Al 2Mg 1O  4              (C)  []         0.2217
  Al 2O  3                  (C)[]           0.2715
  Fe 1Si 1                  (L)[]           0.0957
  Si 1                      (L)[]           0.1218
  Si 3Ti 5                  (C)[]           0.0113
*
     29 wt% Al
 Volume of gas products   (litres)          5.4109
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1767.9721
 Gas products amount        (mol)           0.0361
 Products heat capacity     (J/K)          56.8035
 Products entropy           (J/K)         128.4469
 Products enthalpy          (KJ)         -441.3253
 Mass  of the system        (Kg)            0.0468
1 Mg 1                      (G)         5.74E-0004        0.0306  (atm)
1 Na 1                      (G)             0.0172        0.9692  (atm)
  Al 2Ca 1                  (L)[]           0.0631
  Al 4Ca 1O  7              (C)  []         0.1610
  Al 2Mg 1O  4              (C)  []         0.2189
  Al 2O  3                  (C)[]           0.3136
  Fe 1Si 1                  (L)[]           0.0943
  Si 1                      (L)[]           0.1201
  Si 3Ti 5                  (C)[]           0.0111
*
     30 wt% Al
 Volume of gas products   (litres)          5.2437
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1759.7110
 Gas products amount        (mol)           0.0351
 Products heat capacity     (J/K)          56.2855
 Products entropy           (J/K)         127.0225
 Products enthalpy          (KJ)         -430.6531
 Mass  of the system        (Kg)            0.0463
1 Mg 1                      (G)         5.25E-0004        0.0285  (atm)
1 Na 1                      (G)             0.0169        0.9713  (atm)
  Al 2Ca 1                  (L)[]           0.0807
  Al 4Ca 1O  7              (C)  []         0.1078
  Al 2Mg 1O  4              (C)  []         0.2160
```

```
  Al 2O  3                  (C)[]           0.3556
  Fe 1Si 1                  (L)[]           0.0930
  Si 1                      (L)[]           0.1184
  Si 3Ti 5                  (C)[]           0.0110
*
     31 wt% Al
 Volume of gas products   (litres)          5.0819
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1751.4672
 Gas products amount        (mol)           0.0342
 Products heat capacity     (J/K)          55.7773
 Products entropy           (J/K)         125.6268
 Products enthalpy          (KJ)         -420.1966
 Mass  of the system        (Kg)            0.0459
1 Mg 1                      (G)         4.80E-0004        0.0265  (atm)
1 Na 1                      (G)             0.0167        0.9733  (atm)
  Al 2Ca 1                  (L)[]           0.0982
  Al 4Ca 1O  7              (C)  []         0.0545
  Al 2Mg 1O  4              (C)  []         0.2132
  Al 2O  3                  (C)[]           0.3976
  Fe 1Si 1                  (L)[]           0.0917
  Si 1                      (L)[]           0.1168
  Si 3Ti 5                  (C)[]           0.0108
*
     32 wt% Al
 Volume of gas products   (litres)          4.9249
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1743.2430
 Gas products amount        (mol)           0.0333
 Products heat capacity     (J/K)          55.2780
 Products entropy           (J/K)         124.2573
 Products enthalpy          (KJ)         -409.9450
 Mass  of the system        (Kg)            0.0454
1 Mg 1                      (G)         4.39E-0004        0.0246  (atm)
1 Na 1                      (G)             0.0165        0.9752  (atm)
  Al 2Ca 1                  (L)[]           0.1158
  Al 4Ca 1O  7              (C)  []         0.0012
  Al 2Mg 1O  4              (C)  []         0.2103
  Al 2O  3                  (C)[]           0.4397
  Fe 1Si 1                  (L)[]           0.0904
  Si 1                      (L)[]           0.1151
  Si 3Ti 5                  (C)[]           0.0107
*
     33 wt% Al
 Volume of gas products   (litres)          4.7924
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1720.2364
 Gas products amount        (mol)           0.0329
 Products heat capacity     (J/K)          54.5240
 Products entropy           (J/K)         122.7534
 Products enthalpy          (KJ)         -399.8908
 Mass  of the system        (Kg)            0.0449
1 Mg 1                      (G)         6.22E-0004        0.0350  (atm)
1 Na 1                      (G)             0.0162        0.9647  (atm)
  Al 2Ca 1                  (L)[]           0.0897
  Al 4Ca 1                  (L)[]           0.0390
  Al 2Mg 1O  4              (C)  []         0.2061
  Al 2O  3                  (C)[]           0.4354
  Fe 1Si 1                  (L)[]           0.0890
  Si 1                      (L)[]           0.1134
  Si 3Ti 5                  (C)[]           0.0105
*
     34 wt% Al
 Volume of gas products   (litres)          4.5722
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1694.7249
 Gas products amount        (mol)           0.0318
 Products heat capacity     (J/K)          53.7810
 Products entropy           (J/K)         121.1289
 Products enthalpy          (KJ)         -390.2695
 Mass  of the system        (Kg)            0.0445
```

```
1 Mg 1                      (G)          4.89E-0004        0.0282  (atm)
1 Na 1                      (G)              0.0160        0.9717  (atm)
  Al 2Ca 1                  (L)[]            0.0622
  Al 4Ca 1                  (L)[]            0.0796
  Al 2Mg 1O  4              (C)  []          0.2037
  Al 2O  3                  (C)[]            0.4282
  Fe 1Si 1                  (L)[]            0.0877
  Si 1                      (L)[]            0.1117
  Si 3Ti 5                  (C)[]            0.0104
*
     35 wt% Al
 Volume of gas products   (litres)           4.4541        4.4516        4.4551
 Pressure of gas products   (atm)            1.0000        1.0000        1.0000
 Temperature                (K)           1693.1494     1692.6783     1693.6205
 Gas products amount        (mol)            0.0310        0.0310        0.0310
 Products heat capacity     (J/K)           53.1720       53.1782       53.1695
 Products entropy           (J/K)          119.7948      118.4580      120.3261
 Products enthalpy          (KJ)          -380.3832     -382.6462     -379.4838
 Phase transition enthalpy  (KJ)             3.1624
1 Mg 1                      (G)          8.63E-0004    8.58E-0004    8.65E-0004
1 Na 1                      (G)              0.0302        0.0302        0.0302
  Al 2Ca 1                  (L)[]            0.0163        0.0163        0.0163
  Al 4Ca 1                  (L)[]            0.0357        0.0357        0.0357
  Al 2Mg 1O  4              (C)  []          0.0622        0.0622        0.0622
  Al 2O  3                  (C)[]            0.1823        0.1823        0.1823
  Fe 1Si 1                  (L)[]            0.0325        0.0000        0.0453
  Fe 1Si 1                  (C)[]            0.0129        0.0453        0.0000
  Si 1                      (L)[]            0.1726        0.1726        0.1726
  Si 3Ti 5                  (C)[]            0.0014        0.0014        0.0014
*
     36 wt% Al
 Volume of gas products   (litres)           4.3399        4.3389        4.3419
 Pressure of gas products   (atm)            1.0000        1.0000        1.0000
 Temperature                (K)           1692.6260     1692.2168     1693.0352
 Gas products amount        (mol)            0.0302        0.0302        0.0302
 Products heat capacity     (J/K)           52.5780       52.5809       52.5723
 Products entropy           (J/K)          118.3511      117.7370      119.5551
 Products enthalpy          (KJ)          -370.9158     -371.9553     -368.8777
 Phase transition enthalpy  (KJ)             3.0777
 Mass  of the system        (Kg)             0.0436
1 Mg 1                      (G)          4.65E-0004    4.64E-0004    4.67E-0004
1 Na 1                      (G)              0.0155        0.0155        0.0155
  Al 2Ca 1                  (L)[]            0.0075        0.0075        0.0075
  Al 4Ca 1                  (L)[]            0.1603        0.1603        0.1603
  Al 2Mg 1O  4              (C)  []          0.1976        0.1976        0.1976
  Al 2O  3                  (C)[]            0.4152        0.4152        0.4152
  Fe 1Si 1                  (L)[]            0.0287        0.0000        0.0850
  Fe 1Si 1                  (C)[]            0.0563        0.0850        0.0000
  Si 1                      (L)[]            0.1083        0.1083        0.1083
  Si 3Ti 5                  (C)[]            0.0100        0.0100        0.0100
*
     37 wt% Al
 Volume of gas products   (litres)           4.2549
 Pressure of gas products   (atm)            1.0000
 Temperature                (K)           1690.9118
 Gas products amount        (mol)            0.0297
 Products heat capacity     (J/K)           52.0324
 Products entropy           (J/K)          117.0333
 Products enthalpy          (KJ)          -361.3825
 Mass  of the system        (Kg)             0.0432
1 Mg 1                      (G)          5.65E-0004        0.0339  (atm)
1 Na 1                      (G)              0.0152        0.9659  (atm)
  Al 1                      (L)[]            0.0113
  Al 4Ca 1                  (L)[]            0.1695
  Al 2Mg 1O  4              (C)  []          0.1939
  Al 2O  3                  (C)[]            0.4093
  Fe 1Si 1                  (C)[]            0.0837
  Si 1                      (L)[]            0.1066
  Si 3Ti 5                  (C)[]            0.0099
*
     38 wt% Al
```

```
 Volume of gas products   (litres)          4.1442
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1689.9460
 Gas products amount        (mol)           0.0289
 Products heat capacity     (J/K)          51.5546
 Products entropy           (J/K)         115.7423
 Products enthalpy          (KJ)         -351.9892
 Mass  of the system        (Kg)            0.0428
1 Mg 1                      (G)         5.51E-0004        0.0336  (atm)
1 Na 1                      (G)             0.0150        0.9662  (atm)
  Al 1                      (L)[]           0.0270
  Al 4Ca 1                  (L)[]           0.1668
  Al 2Mg 1O  4              (C)  []         0.1909
  Al 2O  3                  (C)[]           0.4028
  Fe 1Si 1                  (C)[]           0.0824
  Si 1                      (C)[]           0.0130
  Si 1                      (L)[]           0.0919
  Si 3Ti 5                  (C)[]           0.0097
*
```

39 wt% Al

```
 Volume of gas products   (litres)          4.0385        4.0371        4.0392
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6650     1689.3838     1689.9461
 Gas products amount        (mol)           0.0282        0.0282        0.0282
 Products heat capacity     (J/K)          51.1223       51.3131       51.0152
 Products entropy           (J/K)         113.9973      111.0201      115.6693
 Products enthalpy          (KJ)         -343.5814     -348.6130     -340.7559
 Phase transition enthalpy  (KJ)           7.8571
 Mass  of the system        (Kg)            0.0424
1 Mg 1                      (G)         5.42E-0004    5.40E-0004    5.43E-0004
1 Na 1                      (G)             0.0148        0.0148        0.0148
  Al 1                      (L)[]           0.0427        0.0427        0.0427
  Al 4Ca 1                  (L)[]           0.1641        0.1641        0.1641
  Al 2Mg 1O  4              (C)  []         0.1878        0.1878        0.1878
  Al 2O  3                  (C)[]           0.3963        0.3963        0.3963
  Fe 1Si 1                  (C)[]           0.0811        0.0811        0.0811
  Si 1                      (C)[]           0.0371        0.1032        0.0000
  Si 1                      (L)[]           0.0661        0.0000        0.1032
  Si 3Ti 5                  (C)[]           0.0096        0.0096        0.0096
*
```

40 wt% Al

```
 Volume of gas products   (litres)          3.9349        3.9340        3.9359
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6652     1689.3840     1689.9463
 Gas products amount        (mol)           0.0275        0.0275        0.0275
 Products heat capacity     (J/K)          50.6789       50.8136       50.5233
 Products entropy           (J/K)         112.5936      110.4905      115.0209
 Products enthalpy          (KJ)         -334.8089     -338.3631     -330.7068
 Phase transition enthalpy  (KJ)           7.6563
 Mass  of the system        (Kg)            0.0420
1 Mg 1                      (G)         5.32E-0004    5.31E-0004    5.33E-0004
1 Na 1                      (G)             0.0145        0.0145        0.0145
  Al 1                      (L)[]           0.0584        0.0584        0.0584
  Al 4Ca 1                  (L)[]           0.1614        0.1614        0.1614
  Al 2Mg 1O  4              (C)  []         0.1847        0.1847        0.1847
  Al 2O  3                  (C)[]           0.3898        0.3898        0.3898
  Fe 1Si 1                  (C)[]           0.0797        0.0797        0.0797
  Si 1                      (C)[]           0.0544        0.1015    7.05E-0006
  Si 1                      (L)[]           0.0471        0.0000        0.1015
  Si 3Ti 5                  (C)[]           0.0094        0.0094        0.0094
*
```

41 wt% Al

```
 Volume of gas products   (litres)          3.8335        3.8329        3.8348
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6635     1689.3806     1689.9465
 Gas products amount        (mol)           0.0268        0.0268        0.0268
 Products heat capacity     (J/K)          50.2437       50.3233       50.0673
 Products entropy           (J/K)         111.2159      109.9709      113.9732
 Products enthalpy          (KJ)         -326.1979     -328.3019     -321.5381
 Phase transition enthalpy  (KJ)           6.7639
1 Mg 1                      (G)         8.96E-0004    8.95E-0004    8.99E-0004
```

```
1 Na 1                      (G)             0.0259        0.0259        0.0259
  Al 1                      (L)[]           0.1143        0.1143        0.1143
  Al 4Ca 1                  (L)[]           0.0447        0.0447        0.0447
  Al 2Mg 1O  4              (C)  []         0.0532        0.0532        0.0532
  Al 2O  3                  (C)[]           0.1565        0.1565        0.1565
  Fe 1Si 1                  (C)[]           0.0389        0.0389        0.0389
  Si 1                      (C)[]           0.1063        0.1480        0.0139
  Si 1                      (L)[]           0.0417        0.0000        0.1341
  Si 3Ti 5                  (C)[]           0.0012        0.0012        0.0012
*
```

42 wt% Al

```
 Volume of gas products   (litres)          3.7337        3.7335        3.7355
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6636     1689.3805     1689.9466
 Gas products amount        (mol)           0.0261        0.0261        0.0261
 Products heat capacity     (J/K)          49.8162       49.8420       49.5942
 Products entropy           (J/K)         109.8632      109.4606      113.3339
 Products enthalpy          (KJ)         -317.7439     -318.4243     -311.8784
 Phase transition enthalpy  (KJ)            6.5459
 Mass  of the system        (Kg)            0.0413
1 Mg 1                      (G)         5.13E-0004    5.13E-0004    5.16E-0004
1 Na 1                      (G)             0.0140        0.0140        0.0140
  Al 1                      (L)[]           0.0898        0.0898        0.0898
  Al 4Ca 1                  (L)[]           0.1560        0.1560        0.1560
  Al 2Mg 1O  4              (C)  []         0.1786        0.1786        0.1785
  Al 2O  3                  (C)[]           0.3768        0.3768        0.3768
  Fe 1Si 1                  (C)[]           0.0771        0.0771        0.0771
  Si 1                      (C)[]           0.0890        0.0981        0.0098
  Si 1                      (L)[]           0.0092        0.0000        0.0884
  Si 3Ti 5                  (C)[]           0.0091        0.0091        0.0091
*
```

43 wt% Al

```
 Volume of gas products   (litres)          3.5597
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1665.0000
 Gas products amount        (mol)           0.0252
 Products heat capacity     (J/K)          49.2489
 Products entropy           (J/K)         108.2220
 Products enthalpy          (KJ)         -309.9612
 Mass  of the system        (Kg)            0.0409
1 Mg 1                      (G)         4.05E-0004        0.0270  (atm)
1 Na 1                      (G)             0.0138        0.9729  (atm)
  Al 1                      (L)[]           0.1055
  Al 4Ca 1                  (L)[]           0.1534
  Al 2Mg 1O  4              (C)  []         0.1761
  Al 2O  3                  (C)[]           0.3697
  Fe 1Si 1                  (C)[]           0.0757
  Si 1                      (C)[]           0.0964
  Si 3Ti 5                  (C)[]           0.0089
*
```

44 wt% Al

```
 Volume of gas products   (litres)          3.4153
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1647.3974
 Gas products amount        (mol)           0.0245
 Products heat capacity     (J/K)          48.7028
 Products entropy           (J/K)         107.2069
 Products enthalpy          (KJ)         -301.3027
 Mass  of the system        (Kg)            0.0405
1 Mg 1                      (G)         3.38E-0004        0.0231  (atm)
1 Na 1                      (G)             0.0136        0.9768  (atm)
  Al 1                      (L)[]           0.1213
  Al 4Ca 1                  (L)[]           0.1507
  Al 2Mg 1O  4              (C)  []         0.1733
  Al 2O  3                  (C)[]           0.3629
  Fe 1Si 1                  (C)[]           0.0744
  Si 1                      (C)[]           0.0948
  Si 3Ti 5                  (C)[]           0.0088
*
```

45 wt% Al

```
 Volume of gas products   (litres)          3.2500
```

```
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1619.3257
 Gas products amount        (mol)           0.0237
 Products heat capacity     (J/K)          48.1195
 Products entropy           (J/K)         105.8911
 Products enthalpy          (KJ)         -293.3045
 Mass  of the system        (Kg)            0.0402
1 Mg 1                      (G)         2.55E-0004        0.0178  (atm)
1 Na 1                      (G)             0.0133        0.9821  (atm)
  Al 1                      (L)[]           0.1370
  Al 4Ca 1                  (L)[]           0.1480
  Al 2Mg 1O  4              (C)  []         0.1707
  Al 2O  3                  (C)[]           0.3560
  Fe 1Si 1                  (C)[]           0.0731
  Si 1                      (C)[]           0.0931
  Si 3Ti 5                  (C)[]           0.0086
*
```

46 wt% Al

```
 Volume of gas products   (litres)          3.0172
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1557.4535
 Gas products amount        (mol)           0.0228
 Products heat capacity     (J/K)          49.0584
 Products entropy           (J/K)         106.5225
 Products enthalpy          (KJ)         -306.1087
 Mass  of the system        (Kg)            0.0411
1 Mg 1                      (G)         1.31E-0004        0.0097  (atm)
1 Na 1                      (G)             0.0127        0.9903  (atm)
  Al 1                      (L)[]           0.1481
  Al 4Ca 1                  (L)[]           0.1408
  Al 2Mg 1O  4              (C)  []         0.1630
  Al 2O  3                  (C)[]           0.3690
  Fe 1Si 1                  (C)[]           0.0695
  Si 1                      (C)[]           0.0885
  Si 3Ti 5                  (C)[]           0.0082
*
```

47 wt% Al

```
 Volume of gas products   (litres)          2.9476
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1563.0704
 Gas products amount        (mol)           0.0222
 Products heat capacity     (J/K)          46.9951
 Products entropy           (J/K)         103.3012
 Products enthalpy          (KJ)         -277.7023
 Mass  of the system        (Kg)            0.0395
1 Mg 1                      (G)         1.40E-0004        0.0102  (atm)
1 Na 1                      (G)             0.0128        0.9897  (atm)
  Al 1                      (L)[]           0.1685
  Al 4Ca 1                  (L)[]           0.1426
  Al 2Mg 1O  4              (C)  []         0.1651
  Al 2O  3                  (C)[]           0.3425
  Fe 1Si 1                  (C)[]           0.0704
  Si 1                      (C)[]           0.0897
  Si 3Ti 5                  (C)[]           0.0083
*
```

.48 wt% Al

```
 Volume of gas products   (litres)          2.7979
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1530.0000
 Gas products amount        (mol)           0.0216
 Products heat capacity     (J/K)          46.4319
 Products entropy           (J/K)         101.8743
 Products enthalpy          (KJ)         -270.3222
 Mass  of the system        (Kg)            0.0391
1 Mg 1                      (G)         9.72E-0005        0.0073  (atm)
1 Na 1                      (G)             0.0126        0.9927  (atm)
  Al 1                      (L)[]           0.1842
  Al 4Ca 1                  (L)[]           0.1399
  Al 2Mg 1O  4              (C)  []         0.1622
  Al 2O  3                  (C)[]           0.3358
  Fe 1Si 1                  (C)[]           0.0691
```

```
  Si 1                      (C)[]           0.0880
  Si 3Ti 5                  (C)[]           0.0082
*
     49 wt% Al
 Volume of gas products   (litres)          2.6482
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1493.0000
 Gas products amount        (mol)           0.0209
 Products heat capacity     (J/K)          45.8676
 Products entropy           (J/K)         100.3353
 Products enthalpy          (KJ)         -263.2406
 Mass  of the system        (Kg)            0.0388
1 Mg 1                      (G)         6.35E-0005        0.0048  (atm)
1 Na 1                      (G)             0.0123        0.9951  (atm)
  Al 1                      (L)[]           0.1999
  Al 4Ca 1                  (L)[]           0.1372
  Al 2Mg 1O  4              (C)  []         0.1593
  Al 2O  3                  (C)[]           0.3291
  Fe 1Si 1                  (C)[]           0.0678
  Si 1                      (C)[]           0.0863
  Si 3Ti 5                  (C)[]           0.0080
*
     50 wt% Al
 Volume of gas products   (litres)          2.5189
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)           0.0203
 Products heat capacity     (J/K)          45.3472
 Products entropy           (J/K)          99.0191
 Products enthalpy          (KJ)         -255.9525
 Mass  of the system        (Kg)            0.0385
1 Mg 1                      (G)         4.41E-0005        0.0034  (atm)
1 Na 1                      (G)             0.0121        0.9966  (atm)
  Al 1                      (L)[]           0.2156
  Al 4Ca 1                  (L)[]           0.1345
  Al 2Mg 1O  4              (C)  []         0.1563
  Al 2O  3                  (C)[]           0.3226
  Fe 1Si 1                  (C)[]           0.0664
  Si 1                      (C)[]           0.0846
  Si 3Ti 5                  (C)[]           0.0079
*
     51 wt% Al
 Volume of gas products   (litres)          2.4477
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)           0.0197
 Products heat capacity     (J/K)          44.9629
 Products entropy           (J/K)          98.6431
 Products enthalpy          (KJ)         -247.4291
 Mass  of the system        (Kg)            0.0381
1 Mg 1                      (G)         4.32E-0005        0.0034  (atm)
1 Na 1                      (G)             0.0119        0.9966  (atm)
  Al 1                      (L)[]           0.2313
  Al 4Ca 1                  (L)[]           0.1318
  Al 2Mg 1O  4              (C)  []         0.1531
  Al 2O  3                  (C)[]           0.3161
  Fe 1Si 1                  (C)[]           0.0651
  Si 1                      (C)[]           0.0829
  Si 3Ti 5                  (C)[]           0.0077
*
     .52 wt% Al
 Volume of gas products   (litres)          2.3176
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1427.6887
 Gas products amount        (mol)           0.0191
 Products heat capacity     (J/K)          44.4445
 Products entropy           (J/K)          97.1823
 Products enthalpy          (KJ)         -240.6231
 Mass  of the system        (Kg)            0.0378
1 Na 1                      (G)             0.0116        0.9978  (atm)
  Al 1                      (L)[]           0.2470
```

```
  Al 4Ca 1                  (L)[]           0.1291
  Al 2Mg 1O  4              (C)  []         0.1501
  Al 2O  3                  (C)[]           0.3096
  Fe 1Si 1                  (C)[]           0.0638
  Si 1                      (C)[]           0.0812
  Si 3Ti 5                  (C)[]           0.0075
*
     53 wt% Al
 Volume of gas products   (litres)          2.2117
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1403.8186
 Gas products amount        (mol)           0.0186
 Products heat capacity     (J/K)          43.9846
 Products entropy           (J/K)          96.0841
 Products enthalpy          (KJ)         -233.4210
 Mass  of the system        (Kg)            0.0375
1 Na 1                      (G)             0.0114        0.9983  (atm)
  Al 1                      (L)[]           0.2627
  Al 4Ca 1                  (L)[]           0.1265
  Al 2Mg 1O  4              (C)  []         0.1470
  Al 2O  3                  (C)[]           0.3031
  Fe 1Si 1                  (C)[]           0.0624
  Si 1                      (C)[]           0.0795
  Si 3Ti 5                  (C)[]           0.0074
*
     54 wt% Al
 Volume of gas products   (litres)          2.0967
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1371.8359
 Gas products amount        (mol)           0.0180
 Products heat capacity     (J/K)          43.5051
 Products entropy           (J/K)          94.7359
 Products enthalpy          (KJ)         -226.6873
 Mass  of the system        (Kg)            0.0372
1 Na 1                      (G)             0.0111        0.9989  (atm)
  Al 1                      (L)[]           0.2784
  Al 4Ca 1                  (L)[]           0.1238
  Al 2Mg 1O  4              (C)  []         0.1439
  Al 2O  3                  (C)[]           0.2966
  Fe 1Si 1                  (C)[]           0.0611
  Si 1                      (C)[]           0.0778
  Si 3Ti 5                  (C)[]           0.0072
*
     55 wt% Al
 Volume of gas products   (litres)      3.20E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1367.3122
 Gas products amount        (mol)       2.76E-0007
 Products heat capacity     (J/K)          43.3452
 Products entropy           (J/K)          92.9348
 Products enthalpy          (KJ)         -220.6974
 Mass  of the system        (Kg)            0.0369
  Al 1                      (L)[]           0.2983
  Al 4Ca 1                  (L)[]           0.1211
  Al 2Mg 1O  4              (C)  []         0.1409
  Al 1Na 1O  2              (C)  []         0.0388
  Al 2O  3                  (C)[]           0.2579
  Fe 1Si 1                  (C)[]           0.0598
  Si 1                      (C)[]           0.0761
  Si 3Ti 5                  (C)[]           0.0071
*
     56 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1331.0918
 Gas products amount        (mol)       1.61E-0010
 Products heat capacity     (J/K)          42.8625
 Products entropy           (J/K)          91.4999
 Products enthalpy          (KJ)         -214.3182
 Mass  of the system        (Kg)            0.0366
  Al 1                      (L)[]           0.3139
```

```
  Al 4Ca 1                  (L)[]           0.1184
  Al 2Mg 1O  4              (C)  []         0.1377
  Al 1Na 1O  2              (C)  []         0.0380
  Al 2O  3                  (C)[]           0.2522
  Fe 1Si 1                  (C)[]           0.0585
  Si 1                      (C)[]           0.0745
  Si 3Ti 5                  (C)[]           0.0069
*
     57 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1300.4056
 Gas products amount        (mol)       1.18E-0011
 Products heat capacity     (J/K)          42.4128
 Products entropy           (J/K)          90.2407
 Products enthalpy          (KJ)         -207.8003
 Mass  of the system        (Kg)            0.0363
  Al 1                      (L)[]           0.3295
  Al 4Ca 1                  (L)[]           0.1157
  Al 2Mg 1O  4              (C)  []         0.1346
  Al 1Na 1O  2              (C)  []         0.0371
  Al 2O  3                  (C)[]           0.2464
  Fe 1Si 1                  (C)[]           0.0571
  Si 1                      (C)[]           0.0728
  Si 3Ti 5                  (C)[]           0.0068
*
     58 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)       1.06E-0010
 Products heat capacity     (J/K)          41.9764
 Products entropy           (J/K)          88.9901
 Products enthalpy          (KJ)         -201.3761
 Mass  of the system        (Kg)            0.0360
  Al 1                      (L)[]           0.3451
  Al 4Ca 1                  (L)[]           0.1130
  Al 2Mg 1O  4              (C)  []         0.1315
  Al 1Na 1O  2              (C)  []         0.0362
  Al 2O  3                  (C)[]           0.2407
  Fe 1Si 1                  (C)[]           0.0558
  Si 1                      (C)[]           0.0711
  Si 3Ti 5                  (C)[]           0.0066
*
     59 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)       2.09E-0011
 Products heat capacity     (J/K)          41.6540
 Products entropy           (J/K)          88.7451
 Products enthalpy          (KJ)         -193.7827
 Mass  of the system        (Kg)            0.0357
  Al 1                      (L)[]           0.3607
  Al 4Ca 1                  (L)[]           0.1103
  Al 2Mg 1O  4              (C)  []         0.1283
  Al 1Na 1O  2              (C)  []         0.0354
  Al 2O  3                  (C)[]           0.2350
  Fe 1Si 1                  (C)[]           0.0545
  Si 1                      (C)[]           0.0694
  Si 3Ti 5                  (C)[]           0.0064
*
     60 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)       3.19E-0011
 Products heat capacity     (J/K)          41.2057
 Products entropy           (J/K)          87.1833
 Products enthalpy          (KJ)         -187.9591
 Mass  of the system        (Kg)            0.0354
```

```
 Al 1                      (L)[]          0.3763
 Al 4Ca 1                  (L)[]          0.1076
 Al 2Mg 1O  4              (C)  []        0.1252
 Al 1Na 1O  2              (C)  []        0.0345
 Al 2O  3                  (C)[]          0.2292
 Fe 1Si 1                  (C)[]          0.0531
 Si 1                      (C)[]          0.0677
 Si 3Ti 5                  (C)[]          0.0063
*
```

61 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1180.0000
Gas products amount        (mol)      4.47E-0010
Products heat capacity     (J/K)         40.7414
Products entropy           (J/K)         85.2622
Products enthalpy          (KJ)        -182.6317
Mass  of the system        (Kg)           0.0352
 Al 1                      (L)[]          0.3919
 Al 4Ca 1                  (L)[]          0.1049
 Al 2Mg 1O  4              (C)  []        0.1221
 Al 1Na 1O  2              (C)  []        0.0336
 Al 2O  3                  (C)[]          0.2235
 Fe 1Si 1                  (C)[]          0.0518
 Si 1                      (C)[]          0.0660
 Si 3Ti 5                  (C)[]          0.0061
*
```

62 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1180.0000
Gas products amount        (mol)      1.59E-0011
Products heat capacity     (J/K)         40.4432
Products entropy           (J/K)         85.0508
Products enthalpy          (KJ)        -175.3591
Mass  of the system        (Kg)           0.0349
 Al 1                      (L)[]          0.4075
 Al 4Ca 1                  (L)[]          0.1022
 Al 2Mg 1O  4              (C)  []        0.1190
 Al 1Na 1O  2              (C)  []        0.0328
 Al 2O  3                  (C)[]          0.2178
 Fe 1Si 1                  (C)[]          0.0505
 Si 1                      (C)[]          0.0643
 Si 3Ti 5                  (C)[]          0.0060
*
```

63 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1148.6995
Gas products amount        (mol)      2.52E-0010
Products heat capacity     (J/K)         40.1056
Products entropy           (J/K)         82.6528
Products enthalpy          (KJ)        -170.7471
Mass  of the system        (Kg)           0.0346
 Al 1                      (L)[]          0.4594
 Al 2Ca 1                  (C)[]          0.0633
 Al 2Mg 1O  4              (C)  []        0.1158
 Al 1Na 1O  2              (C)  []        0.0319
 Al 2O  3                  (C)[]          0.2121
 Fe 1Si 1                  (C)[]          0.0492
 Si 1                      (C)[]          0.0626
 Si 3Ti 5                  (C)[]          0.0058
*
```

64 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1128.2290
Gas products amount        (mol)      1.52E-0014
Products heat capacity     (J/K)         39.7122
Products entropy           (J/K)         81.6124
Products enthalpy          (KJ)        -164.6436
```

```
 Mass  of the system        (Kg)            0.0344
  Al 1                      (L)[]           0.4669
  Al 2Ca 1                  (C)[]           0.0615
  Al 2Mg 1O  4              (C)  []         0.1127
  Al 1Na 1O  2              (C)  []         0.0311
  Al 2O  3                  (C)[]           0.2063
  Al 3Ti 1                  (C)  []         0.0112
  Fe 1Si 1                  (C)[]           0.0478
  Si 1                      (C)[]           0.0624
*
```

65 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1107.4110
 Gas products amount        (mol)       2.96E-0011
 Products heat capacity     (J/K)          39.3722
 Products entropy           (J/K)          80.7334
 Products enthalpy          (KJ)         -158.4557
 Mass  of the system        (Kg)            0.0341
  Al 1                      (L)[]           0.4817
  Al 2Ca 1                  (C)[]           0.0598
  Al 2Mg 1O  4              (C)  []         0.1096
  Al 1Na 1O  2              (C)  []         0.0302
  Al 2O  3                  (C)[]           0.2006
  Al 3Ti 1                  (C)  []         0.0109
  Fe 1Si 1                  (C)[]           0.0465
  Si 1                      (C)[]           0.0607
*
```

66 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1086.1938
 Gas products amount        (mol)       1.17E-0011
 Products heat capacity     (J/K)          39.0386
 Products entropy           (J/K)          79.8392
 Products enthalpy          (KJ)         -152.3738
 Mass  of the system        (Kg)            0.0338
  Al 1                      (L)[]           0.4965
  Al 2Ca 1                  (C)[]           0.0581
  Al 2Mg 1O  4              (C)  []         0.1064
  Al 1Na 1O  2              (C)  []         0.0293
  Al 2O  3                  (C)[]           0.1949
  Al 3Ti 1                  (C)  []         0.0106
  Fe 1Si 1                  (C)[]           0.0452
  Si 1                      (C)[]           0.0589
*
```

67 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1064.5948
 Gas products amount        (mol)       2.01E-0012
 Products heat capacity     (J/K)          38.7115
 Products entropy           (J/K)          78.9300
 Products enthalpy          (KJ)         -146.3982
 Mass  of the system        (Kg)            0.0336
  Al 1                      (L)[]           0.5113
  Al 2Ca 1                  (C)[]           0.0564
  Al 2Mg 1O  4              (C)  []         0.1033
  Al 1Na 1O  2              (C)  []         0.0285
  Al 2O  3                  (C)[]           0.1891
  Al 3Ti 1                  (C)  []         0.0103
  Fe 1Si 1                  (C)[]           0.0438
  Si 1                      (C)[]           0.0572
*
```

68 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1042.0000
 Gas products amount        (mol)       3.87E-0012
 Products heat capacity     (J/K)          38.2541
 Products entropy           (J/K)          76.8611
```

```
 Products enthalpy          (KJ)         -141.7303
 Mass  of the system        (Kg)            0.0333
  Al 1                      (L)[]           0.4851
  Al 2Ca 1                  (C)[]           0.0547
  Al 3Fe 1                  (C)  []         0.0693
  Al 2Mg 1O  4              (C)  []         0.1002
  Al 1Na 1O  2              (C)  []         0.0276
  Al 2O  3                  (C)[]           0.1834
  Al 3Ti 1                  (C)  []         0.0100
  Si 1                      (C)[]           0.0697
*
     69 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1023.0000
 Gas products amount        (mol)       2.80E-0012
 Products heat capacity     (J/K)          37.9468
 Products entropy           (J/K)          76.0888
 Products enthalpy          (KJ)         -135.7816
 Mass  of the system        (Kg)            0.0331
  Al 1                      (L)[]           0.5012
  Al 2Ca 1                  (C)[]           0.0530
  Al 3Fe 1                  (C)  []         0.0671
  Al 2Mg 1O  4              (C)  []         0.0970
  Al 1Na 1O  2              (C)  []         0.0267
  Al 2O  3                  (C)[]           0.1777
  Al 3Ti 1                  (C)  []         0.0097
  Si 1                      (C)[]           0.0675
*
     70
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       3.11E-0013
 Products heat capacity     (J/K)          37.5737
 Products entropy           (J/K)          74.4043
 Products enthalpy          (KJ)         -130.8189
 Mass  of the system        (Kg)            0.0329
  Al 1                      (L)[]           0.5173
  Al 2Ca 1                  (C)[]           0.0513
  Al 3Fe 1                  (C)  []         0.0650
  Al 2Mg 1O  4              (C)  []         0.0939
  Al 1Na 1O  2              (C)  []         0.0259
  Al 2O  3                  (C)[]           0.1719
  Al 3Ti 1                  (C)  []         0.0094
  Si 1                      (C)[]           0.0653
*
     71 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       8.78E-0015
 Products heat capacity     (J/K)          37.2645
 Products entropy           (J/K)          73.3836
 Products enthalpy          (KJ)         -125.2567
 Mass  of the system        (Kg)            0.0326
  Al 1                      (L)[]           0.5334
  Al 2Ca 1                  (C)[]           0.0496
  Al 3Fe 1                  (C)  []         0.0628
  Al 2Mg 1O  4              (C)  []         0.0908
  Al 1Na 1O  2              (C)  []         0.0250
  Al 2O  3                  (C)[]           0.1662
  Al 3Ti 1                  (C)  []         0.0091
  Si 1                      (C)[]           0.0631
*
     72 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           933.2996
 Gas products amount        (mol)       9.15E-0012
 Products heat capacity     (J/K)          37.1391
```

Products entropy	(J/K)	71.5851		
Products enthalpy	(KJ)	-120.4888		
Mass of the system	(Kg)	0.0324		
Al 1	(C)[]	0.0652		
Al 1	(L)[]	0.4843		
Al 2Ca 1	(C)[]	0.0479		
Al 3Fe 1	(C) []	0.0606		
Al 2Mg 1O 4	(C) []	0.0876		
Al 1Na 1O 2	(C) []	0.0242		
Al 2O 3	(C)[]	0.1605		
Al 3Ti 1	(C) []	0.0087		
Si 1	(C)[]	0.0610		

*

73 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.8931	932.4652	933.3210
Gas products amount	(mol)	8.00E-0015	8.00E-0015	8.00E-0015
Products heat capacity	(J/K)	37.1369	38.1676	36.7506
Products entropy	(J/K)	70.3235	64.6771	72.4393
Products enthalpy	(KJ)	-115.3063	-120.5778	-113.3310
Phase transition enthalpy	(KJ)	7.2468		
Mass of the system	(Kg)	0.0322		
Al 1	(C)[]	0.1542	0.5656	3.05E-0006
Al 1	(L)[]	0.4114	0.0000	0.5656
Al 2Ca 1	(C)[]	0.0462	0.0462	0.0462
Al 3Fe 1	(C) []	0.0585	0.0585	0.0585
Al 2Mg 1O 4	(C) []	0.0845	0.0845	0.0845
Al 1Na 1O 2	(C) []	0.0233	0.0233	0.0233
Al 2O 3	(C)[]	0.1547	0.1547	0.1547
Al 3Ti 1	(C) []	0.0084	0.0084	0.0084
Si 1	(C)[]	0.0588	0.0588	0.0588

*

72 wt% Al

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	933.2996
Gas products amount	(mol)	8.21E-0015
Products heat capacity	(J/K)	37.1236
Products entropy	(J/K)	71.6691
Products enthalpy	(KJ)	-120.4104
Mass of the system	(Kg)	0.0324
Al 1	(C)[]	0.0591
Al 1	(L)[]	0.4904
Al 2Ca 1	(C)[]	0.0479
Al 3Fe 1	(C) []	0.0606
Al 2Mg 1O 4	(C) []	0.0876
Al 1Na 1O 2	(C) []	0.0242
Al 2O 3	(C)[]	0.1605
Al 3Ti 1	(C) []	0.0087
Si 1	(C)[]	0.0610

*

73 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.8894	932.4578	933.3210
Gas products amount	(mol)	1.96E-0011	1.18E-0011	2.14E-0011
Products heat capacity	(J/K)	37.1386	38.1675	36.8946
Products entropy	(J/K)	70.3235	64.6768	71.6626
Products enthalpy	(KJ)	-115.3063	-120.5781	-114.0561
Phase transition enthalpy	(KJ)	6.5220		
Mass of the system	(Kg)	0.0322		
Al 1	(C)[]	0.1544	0.5656	0.0569
Al 1	(L)[]	0.4112	0.0000	0.5087
Al 2Ca 1	(C)[]	0.0462	0.0462	0.0462
Al 3Fe 1	(C) []	0.0585	0.0585	0.0585
Al 2Mg 1O 4	(C) []	0.0845	0.0845	0.0845
Al 1Na 1O 2	(C) []	0.0233	0.0233	0.0233
Al 2O 3	(C)[]	0.1547	0.1547	0.1547
Al 3Ti 1	(C) []	0.0084	0.0084	0.0084
Si 1	(C)[]	0.0588	0.0588	0.0588

*

74 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9059	932.4699	933.3418
Gas products amount	(mol)	2.70E-0011	1.29E-0012	4.61E-0011
Products heat capacity	(J/K)	37.1483	37.9787	36.5316
Products entropy	(J/K)	69.0186	64.4702	72.3966
Products enthalpy	(KJ)	-110.2531	-114.4995	-107.0994
Phase transition enthalpy	(KJ)	7.4001		
Mass of the system	(Kg)	0.0319		
Al 1	(C)[]	0.2479	0.5817	2.93E-0006
Al 1	(L)[]	0.3338	0.0000	0.5817
Al 2Ca 1	(C)[]	0.0444	0.0444	0.0444
Al 3Fe 1	(C) []	0.0563	0.0563	0.0563
Al 2Mg 1O 4	(C) []	0.0814	0.0814	0.0814
Al 1Na 1O 2	(C) []	0.0224	0.0224	0.0224
Al 2O 3	(C)[]	0.1490	0.1490	0.1490
Al 3Ti 1	(C) []	0.0081	0.0081	0.0081
Si 1	(C)[]	0.0566	0.0566	0.0566

*

75 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9163	932.4704	933.3621
Gas products amount	(mol)	1.91E-0011	1.74E-0011	2.12E-0011
Products heat capacity	(J/K)	37.1601	37.7923	36.4160
Products entropy	(J/K)	67.7324	64.2659	71.8120
Products enthalpy	(KJ)	-105.2691	-108.5055	-101.4604
Phase transition enthalpy	(KJ)	7.0450		
Mass of the system	(Kg)	0.0317		
Al 1	(C)[]	0.3417	0.5978	0.0403
Al 1	(L)[]	0.2561	0.0000	0.5575
Al 2Ca 1	(C)[]	0.0427	0.0427	0.0427
Al 3Fe 1	(C) []	0.0541	0.0541	0.0541
Al 2Mg 1O 4	(C) []	0.0783	0.0783	0.0783
Al 1Na 1O 2	(C) []	0.0216	0.0216	0.0216
Al 2O 3	(C)[]	0.1433	0.1433	0.1433
Al 3Ti 1	(C) []	0.0078	0.0078	0.0078
Si 1	(C)[]	0.0544	0.0544	0.0544

*

76 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9298	932.4778	933.3818
Gas products amount	(mol)	9.04E-0014	1.23E-0013	1.06E-0014
Products heat capacity	(J/K)	37.1704	37.6086	36.1023
Products entropy	(J/K)	66.4640	64.0647	72.3126
Products enthalpy	(KJ)	-100.3534	-102.5934	-94.8932
Phase transition enthalpy	(KJ)	7.7002		
Mass of the system	(Kg)	0.0315		
Al 1	(C)[]	0.4353	0.6139	2.71E-0006
Al 1	(L)[]	0.1786	0.0000	0.6139
Al 2Ca 1	(C)[]	0.0410	0.0410	0.0410
Al 3Fe 1	(C) []	0.0520	0.0520	0.0520
Al 2Mg 1O 4	(C) []	0.0751	0.0751	0.0751
Al 1Na 1O 2	(C) []	0.0207	0.0207	0.0207
Al 2O 3	(C)[]	0.1375	0.1375	0.1375
Al 3Ti 1	(C) []	0.0075	0.0075	0.0075
Si 1	(C)[]	0.0523	0.0523	0.0523

*

77 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9102	932.4664	933.3540
Gas products amount	(mol)	1.37E-0012	3.46E-0012	8.00E-0015
Products heat capacity	(J/K)	37.1761	37.9627	36.6665
Products entropy	(J/K)	68.9147	64.5983	71.7109
Products enthalpy	(KJ)	-104.9464	-108.9763	-102.3359
Phase transition enthalpy	(KJ)	6.6404		
Mass of the system	(Kg)	0.0321		

```
 Al 1                      (C)[]          0.2626        0.5778        0.0584
 Al 1                      (L)[]          0.3152        0.0000        0.5194
 Al 2Ca 1                  (C)[]          0.0383        0.0383        0.0383
 Al 3Fe 1                  (C)  []        0.0486        0.0486        0.0486
 Al 2Mg 1O  4              (C)  []        0.0702        0.0702        0.0702
 Al 1Na 1O  2              (C)  []        0.0193        0.0193        0.0193
 Al 2O  3                  (C)[]          0.1497        0.1497        0.1497
 Al 3Ti 1                  (C)  []        0.0472        0.0472        0.0472
 Si 1                      (C)[]          0.0488        0.0488        0.0488
*
    78 wt% Al
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          929.1250
 Gas products amount        (mol)      9.00E-0015
 Products heat capacity     (J/K)         37.1848
 Products entropy           (J/K)         63.5359
 Products enthalpy          (KJ)         -91.1395
 Mass  of the system        (Kg)           0.0311
 Al 1                       (C)[]          0.6460
 Al 2Ca 1                   (C)[]          0.0376
 Al 3Fe 1                   (C)  []        0.0476
 Al 2Mg 1O  4               (C)  []        0.0689
 Al 1Na 1O  2               (C)  []        0.0190
 Al 2O  3                   (C)[]          0.1261
 Al 3Ti 1                   (C)  []        0.0069
 Si 1                       (C)[]          0.0479
*
    79 wt% Al
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          903.0000
 Gas products amount        (mol)      8.00E-0015
 Products heat capacity     (J/K)         36.5152
 Products entropy           (J/K)         62.2950
 Products enthalpy          (KJ)         -86.4307
 Mass  of the system        (Kg)           0.0308
 Al 1                       (C)[]          0.6621
 Al 2Ca 1                   (C)[]          0.0359
 Al 3Fe 1                   (C)  []        0.0455
 Al 2Mg 1O  4               (C)  []        0.0657
 Al 1Na 1O  2               (C)  []        0.0181
 Al 2O  3                   (C)[]          0.1204
 Al 3Ti 1                   (C)  []        0.0066
 Si 1                       (C)[]          0.0457
*
    80 wt% Al
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          870.0000
 Gas products amount        (mol)      4.53E-0011
 Products heat capacity     (J/K)         35.7285
 Products entropy           (J/K)         60.7689
 Products enthalpy          (KJ)         -82.0218
 Mass  of the system        (Kg)           0.0306
 Al 1                       (C)[]          0.6782
 Al 2Ca 1                   (C)[]          0.0342
 Al 3Fe 1                   (C)  []        0.0433
 Al 2Mg 1O  4               (C)  []        0.0626
 Al 1Na 1O  2               (C)  []        0.0173
 Al 2O  3                   (C)[]          0.1146
 Al 3Ti 1                   (C)  []        0.0062
 Si 1                       (C)[]          0.0436
*
    81 wt% Al
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          870.0000
 Gas products amount        (mol)      8.00E-0015
 Products heat capacity     (J/K)         35.5466
 Products entropy           (J/K)         60.5930
```

```
 Products enthalpy          (KJ)          -76.4924
 Mass  of the system        (Kg)            0.0304
  Al 1                      (C)[]           0.6943
  Al 2Ca 1                  (C)[]           0.0325
  Al 3Fe 1                  (C)  []         0.0411
  Al 2Mg 1O  4              (C)  []         0.0595
  Al 1Na 1O  2              (C)  []         0.0164
  Al 2O  3                  (C)[]           0.1089
  Al 3Ti 1                  (C)  []         0.0059
  Si 1                      (C)[]           0.0414
*
     82 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.5000
 Gas products amount        (mol)       1.86E-0014
 Products heat capacity     (J/K)          34.9774
 Products entropy           (J/K)          59.5395
 Products enthalpy          (KJ)          -71.7932
 Mass  of the system        (Kg)            0.0302
  Al 1                      (C)[]           0.7104
  Al 2Ca 1                  (C)[]           0.0308
  Al 3Fe 1                  (C)  []         0.0390
  Al 2Mg 1O  4              (C)  []         0.0563
  Al 1Na 1O  2              (C)  []         0.0155
  Al 2O  3                  (C)[]           0.1032
  Al 3Ti 1                  (C)  []         0.0056
  Si 1                      (C)[]           0.0392
*
     83 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       8.75E-0015
 Products heat capacity     (J/K)          33.9479
 Products entropy           (J/K)          57.3502
 Products enthalpy          (KJ)          -68.0732
 Mass  of the system        (Kg)            0.0300
  Al 1                      (C)[]           0.7265
  Al 2Ca 1                  (C)[]           0.0291
  Al 3Fe 1                  (C)  []         0.0368
  Al 2Mg 1O  4              (C)  []         0.0532
  Al 1Na 1O  2              (C)  []         0.0147
  Al 2O  3                  (C)[]           0.0974
  Al 3Ti 1                  (C)  []         0.0053
  Si 1                      (C)[]           0.0370
*
     84 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          33.7647
 Products entropy           (J/K)          57.1964
 Products enthalpy          (KJ)          -62.7494
 Mass  of the system        (Kg)            0.0298
  Al 1                      (C)[]           0.7426
  Al 2Ca 1                  (C)[]           0.0274
  Al 3Fe 1                  (C)  []         0.0347
  Al 2Mg 1O  4              (C)  []         0.0501
  Al 1Na 1O  2              (C)  []         0.0138
  Al 2O  3                  (C)[]           0.0917
  Al 3Ti 1                  (C)  []         0.0050
  Si 1                      (C)[]           0.0348
*
     85 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       5.31E-0014
 Products heat capacity     (J/K)          32.5993
```

```
 Products entropy           (J/K)          54.3957
 Products enthalpy          (KJ)          -59.5112
 Mass  of the system        (Kg)            0.0296
  Al 1                      (C)[]           0.7587
  Al 2Ca 1                  (C)[]           0.0256
  Al 3Fe 1                  (C)  []         0.0325
  Al 2Mg 1O  4              (C)  []         0.0470
  Al 1Na 1O  2              (C)  []         0.0129
  Al 2O  3                  (C)[]           0.0860
  Al 3Ti 1                  (C)  []         0.0047
  Si 1                      (C)[]           0.0327
*
```

86 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       5.48E-0011
 Products heat capacity     (J/K)          32.4150
 Products entropy           (J/K)          54.2650
 Products enthalpy          (KJ)          -54.3112
 Mass  of the system        (Kg)            0.0294
  Al 1                      (C)[]           0.7748
  Al 2Ca 1                  (C)[]           0.0239
  Al 3Fe 1                  (C)  []         0.0303
  Al 2Mg 1O  4              (C)  []         0.0438
  Al 1Na 1O  2              (C)  []         0.0121
  Al 2O  3                  (C)[]           0.0802
  Al 3Ti 1                  (C)  []         0.0044
  Si 1                      (C)[]           0.0305
*
```

87 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           716.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          31.8513
 Products entropy           (J/K)          53.0798
 Products enthalpy          (KJ)          -49.9491
 Mass  of the system        (Kg)            0.0293
  Al 1                      (C)[]           0.7908
  Al 2Ca 1                  (C)[]           0.0222
  Al 3Fe 1                  (C)  []         0.0282
  Al 2Mg 1O  4              (C)  []         0.0407
  Al 1Na 1O  2              (C)  []         0.0112
  Al 2O  3                  (C)[]           0.0745
  Al 3Ti 1                  (C)  []         0.0041
  Si 1                      (C)[]           0.0283
*
```

88 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       1.34E-0011
 Products heat capacity     (J/K)          30.8952
 Products entropy           (J/K)          50.6475
 Products enthalpy          (KJ)          -46.4731
 Mass  of the system        (Kg)            0.0291
  Al 1                      (C)[]           0.8069
  Al 2Ca 1                  (C)[]           0.0205
  Al 3Fe 1                  (C)  []         0.0260
  Al 2Mg 1O  4              (C)  []         0.0376
  Al 1Na 1O  2              (C)  []         0.0104
  Al 2O  3                  (C)[]           0.0688
  Al 3Ti 1                  (C)  []         0.0038
  Si 1                      (C)[]           0.0261
*
```

89 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       8.00E-0015
```

```
 Products heat capacity     (J/K)          30.7156
 Products entropy           (J/K)          50.5410
 Products enthalpy          (KJ)          -41.4572
 Mass  of the system        (Kg)            0.0289
  Al 1                      (C)[]           0.8230
  Al 2Ca 1                  (C)[]           0.0188
  Al 3Fe 1                  (C)  []         0.0238
  Al 2Mg 1O  4              (C)  []         0.0344
  Al 1Na 1O  2              (C)  []         0.0095
  Al 2O  3                  (C)[]           0.0630
  Al 3Ti 1                  (C)  []         0.0034
  Si 1                      (C)[]           0.0240
*
     .90
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           619.4637
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          29.8870
 Products entropy           (J/K)          48.2932
 Products enthalpy          (KJ)          -37.8832
 Mass  of the system        (Kg)            0.0287
  Al 1                      (C)[]           0.8391
  Al 2Ca 1                  (C)[]           0.0171
  Al 3Fe 1                  (C)  []         0.0217
  Al 2Mg 1O  4              (C)  []         0.0313
  Al 1Na 1O  2              (C)  []         0.0086
  Al 2O  3                  (C)[]           0.0573
  Al 3Ti 1                  (C)  []         0.0031
  Si 1                      (C)[]           0.0218
*
     91 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          28.9150
 Products entropy           (J/K)          45.2447
 Products enthalpy          (KJ)          -34.7297
 Mass  of the system        (Kg)            0.0285
  Al 1                      (C)[]           0.8552
  Al 2Ca 1                  (C)[]           0.0154
  Al 3Fe 1                  (C)  []         0.0195
  Al 2Mg 1O  4              (C)  []         0.0282
  Al 1Na 1O  2              (C)  []         0.0078
  Al 2O  3                  (C)[]           0.0516
  Al 3Ti 1                  (C)  []         0.0028
  Si 1                      (C)[]           0.0196
*
     92 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          28.7457
 Products entropy           (J/K)          45.1716
 Products enthalpy          (KJ)          -29.8838
 Mass  of the system        (Kg)            0.0283
  Al 1                      (C)[]           0.8713
  Al 2Ca 1                  (C)[]           0.0137
  Al 3Fe 1                  (C)  []         0.0173
  Al 2Mg 1O  4              (C)  []         0.0250
  Al 1Na 1O  2              (C)  []         0.0069
  Al 2O  3                  (C)[]           0.0458
  Al 3Ti 1                  (C)  []         0.0025
  Si 1                      (C)[]           0.0174
*
     93 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
```

```
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          27.8278
 Products entropy           (J/K)          41.9049
 Products enthalpy          (KJ)          -26.7903
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8874
  Al 2Ca 1                  (C)[]           0.0120
  Al 3Fe 1                  (C)  []         0.0152
  Al 2Mg 1O  4              (C)  []         0.0219
  Al 1Na 1O  2              (C)  []         0.0060
  Al 2O  3                  (C)[]           0.0401
  Al 3Ti 1                  (C)  []         0.0022
  Si 1                      (C)[]           0.0152
*
     94 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          27.2739
 Products entropy           (J/K)          39.9759
 Products enthalpy          (KJ)          -22.9615
 Mass  of the system        (Kg)            0.0280
  Al 1                      (C)[]           0.9035
  Al 2Ca 1                  (C)[]           0.0103
  Al 3Fe 1                  (C)  []         0.0130
  Al 2Mg 1O  4              (C)  []         0.0188
  Al 1Na 1O  2              (C)  []         0.0052
  Al 2O  3                  (C)[]           0.0344
  Al 3Ti 1                  (C)  []         0.0019
  Si 1                      (C)[]           0.0131
*
     95 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       9.48E-0011
 Products heat capacity     (J/K)          27.1227
 Products entropy           (J/K)          39.9342
 Products enthalpy          (KJ)          -18.2795
 Mass  of the system        (Kg)            0.0278
  Al 1                      (C)[]           0.9196
  Al 2Ca 1                  (C)[]           0.0085
  Al 3Fe 1                  (C)  []         0.0108
  Al 2Mg 1O  4              (C)  []         0.0157
  Al 1Na 1O  2              (C)  []         0.0043
  Al 2O  3                  (C)[]           0.0287
  Al 3Ti 1                  (C)  []         0.0016
  Si 1                      (C)[]           0.0109
*
     96 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           433.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          26.5795
 Products entropy           (J/K)          37.8691
 Products enthalpy          (KJ)          -14.5642
 Mass  of the system        (Kg)            0.0276
  Al 1                      (C)[]           0.9356
  Al 2Ca 1                  (C)[]           0.0068
  Al 3Fe 1                  (C)  []         0.0087
  Al 2Mg 1O  4              (C)  []         0.0125
  Al 1Na 1O  2              (C)  []         0.0035
  Al 2O  3                  (C)[]           0.0229
  Al 3Ti 1                  (C)  []         0.0012
  Si 1                      (C)[]           0.0087
*
     97 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)           388.0000
 Gas products amount        (mol)       2.62E-0011
 Products heat capacity     (J/K)          25.9126
 Products entropy           (J/K)          34.9612
 Products enthalpy          (KJ)          -11.1704
 Mass  of the system        (Kg)            0.0275
  Al 1                      (C)[]           0.9488
  Al 4Ca 1                  (C)[]           0.0081
  Al 3Fe 1                  (C)  []         0.0065
  Al 2Mg 1O  4              (C)  []         0.0094
  Al 1Na 1O  2              (C)  []         0.0026
  Al 2O  3                  (C)[]           0.0172
  Al 3Ti 1                  (C)  []     9.38E-0004
  Si 1                      (C)[]           0.0065
*
```

98 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       9.05E-0015
 Products heat capacity     (J/K)          25.7386
 Products entropy           (J/K)          34.9049
 Products enthalpy          (KJ)           -5.9571
 Mass  of the system        (Kg)            0.0273
  Al 1                      (C)[]           0.9674
  Al 4Ca 1                  (C)[]           0.0054
  Al 3Fe 1                  (C)  []         0.0043
  Al 2Mg 1O  4              (C)  []     6.27E-0004
  Al 1Na 1O  2              (C)  []         0.0017
  Al 2O  3                  (C)[]           0.0155
  Al 3Ti 1                  (C)  []     6.24E-0004
  Si 1                      (C)[]           0.0044
*
```

99 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           370.9277
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          25.4578
 Products entropy           (J/K)          33.7858
 Products enthalpy          (KJ)           -2.6101
 Mass  of the system        (Kg)            0.0271
  Al 1                      (C)[]           0.9829
  Al 4Ca 1                  (C)[]           0.0027
  Al 3Fe 1                  (C)  []         0.0022
  Al 2Mg 1O  4              (C)  []         0.0031
  Al 1Na 1O  2              (C)  []     8.64E-0004
  Al 2O  3                  (C)[]           0.0057
  Al 3Ti 1                  (C)  []     3.13E-0004
  Si 1                      (C)[]           0.0022
*
```

100 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       1.67E-0012
 Products heat capacity     (J/K)          24.9186
 Products entropy           (J/K)          31.3558
 Products enthalpy          (KJ)            0.9453
 Mass  of the system        (Kg)            0.0270
  Al 1                      (C)[]           1.0000
*
```

Mg/(JSC-1A)

```
     Content of Magnesium - 0 wt% Mg
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           809.5028
 Gas products amount        (mol)       8.25E-0011
 Products heat capacity     (J/K)          75.4016
 Products entropy           (J/K)         110.3634
 Products enthalpy          (KJ)         -888.1178
  Al 2Mg 1O  4              (C)  []         0.0091
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.0352
  Al 2O  5Si 1              (C)  [KIANI     0.0478
  Al 2O  5Ti 1              (C)  []         0.0162
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1216
  Fe 2O  3                  (C)[]           0.0529
  Mg 2O  6Si 2              (C)[KLINOEN     0.0082
*
     1 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           951.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          75.2519
 Products entropy           (J/K)         121.5504
 Products enthalpy          (KJ)         -863.9071
  Al 2Fe 1O  4              (C)  []         0.0296
  Al 2Mg 1O  4              (C)  []         0.0076
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.0342
  Al 2O  5Si 1              (C)  [KIANI     0.0181
  Al 2O  5Ti 1              (C)  []         0.0158
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1183
  Fe 3O  4                  (C)[]           0.0245
  Mg 2O  6Si 2              (C)[KLINOEN     0.0222
*
     2 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1072.2877
 Gas products amount        (mol)       1.28E-0011
 Products heat capacity     (J/K)          75.5458
 Products entropy           (J/K)         128.8211
 Products enthalpy          (KJ)         -840.8951
 Mass  of the system        (Kg)            0.0646
  Al 2Fe 1O  4              (C)  []         0.1838
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2705
  Al 2O  5Ti 1              (C)  []         0.0026
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3858
  Fe 1                      (C)[]           0.0026
  Fe 2O  4Ti 1              (C)  [ULVIT     0.0500
  Mg 2O  4Si 1              (C)             0.0362
  Mg 2O  6Si 2              (C)[KLINOEN     0.0686
*
     3 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1184.0000
 Gas products amount        (mol)       6.70E-0014
 Products heat capacity     (J/K)          75.5388
 Products entropy           (J/K)         134.0278
 Products enthalpy          (KJ)         -818.6450
 Mass  of the system        (Kg)            0.0635
  Al 2Fe 1O  4              (C)  []         0.1434
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2677
  Al 2O  5Ti 1              (C)  []         0.0428
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3818
  Fe 1                      (C)[]           0.0261
  Fe 1O  1                  (C)[]           0.0175
  Mg 1O  3Si 1              (C)             0.0258
```

```
  Mg 2O  4Si 1              (C)             0.0949
*
```

4 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1300.5894
 Gas products amount        (mol)       2.92E-0014
 Products heat capacity     (J/K)          75.3082
 Products entropy           (J/K)         138.5222
 Products enthalpy          (KJ)         -796.7658
 Mass  of the system        (Kg)            0.0625
  Al 2Fe 1O  4              (C)  []         0.1102
  Al 2Mg 1O  4              (C)  []         0.0260
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2650
  Al 2O  5Ti 1              (C)  []         0.0423
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3779
  Fe 1                      (C)[]           0.0495
  Mg 1O  3Si 1              (C)             0.0013
  Mg 2O  4Si 1              (C)             0.1278
*
```

5 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1407.6824
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          75.0526
 Products entropy           (J/K)         142.0173
 Products enthalpy          (KJ)         -775.7863
 Mass  of the system        (Kg)            0.0615
  Al 2Fe 1O  4              (C)  []         0.0345
  Al 2Mg 1O  4              (C)  []         0.0867
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2622
  Al 2O  5Ti 1              (C)  []         0.0419
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3740
  Fe 1                      (C)[]           0.0729
  Mg 1O  3Si 1              (C)             0.0013
  Mg 2O  4Si 1              (C)             0.1265
*
```

6 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)       5.19E-0013
 Products heat capacity     (J/K)          74.6424
 Products entropy           (J/K)         143.4486
 Products enthalpy          (KJ)         -755.3301
 Mass  of the system        (Kg)            0.0605
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2057
  Al 2Mg 1O  4              (C)  []         0.0086
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2595
  Al 2O  5Ti 1              (C)  []         0.0415
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1517
  Fe 1                      (C)[]           0.0765
  Fe 1Si 1                  (C)[]           0.0099
  Mg 2O  4Si 1              (C)             0.2467
*
```

7 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1544.6505
 Gas products amount        (mol)       2.94E-0011
 Products heat capacity     (J/K)          74.0730
 Products entropy           (J/K)         144.6098
 Products enthalpy          (KJ)         -735.7279
 Mass  of the system        (Kg)            0.0596
  Al 2Mg 1O  4              (C)  []         0.1126
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2567
  Al 2O  5Ti 1              (C)  []         0.0410
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2220
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1041
  Fe 1                      (C)[]           0.0635
```

```
  Fe 1Si 1                  (C)[]           0.0282
  Mg 2O  4Si 1              (C)             0.1720
*
     8 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1600.7193
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          73.7181
 Products entropy           (J/K)         145.1989
 Products enthalpy          (KJ)         -716.6343
 Mass  of the system        (Kg)            0.0587
  Al 2Mg 1O  4              (C)  []         0.1114
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2539
  Al 2O  5Ti 1              (C)  []         0.0406
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1238
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1722
  Fe 1                      (C)[]           0.0504
  Fe 1Si 1                  (C)[]           0.0464
  Mg 2O  4Si 1              (C)             0.2012
*
     9 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1655.8296
 Gas products amount        (mol)       9.63E-0011
 Products heat capacity     (J/K)          73.5257
 Products entropy           (J/K)         145.6814
 Products enthalpy          (KJ)         -698.1220
 Mass  of the system        (Kg)            0.0578
  Al 2Mg 1O  4              (C)  []         0.1101
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2512
  Al 2O  5Ti 1              (C)  []         0.0401
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0256
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.2403
  Fe 1                      (C)[]           0.0374
  Fe 1Si 1                  (C)[]           0.0647
  Mg 2O  4Si 1              (C)             0.2305
*
     10 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1687.8267     1687.3957     1688.2577
 Gas products amount        (mol)       1.08E-0011    8.00E-0015    6.26E-0011
 Products heat capacity     (J/K)          74.1981       73.1000       79.4500
 Products entropy           (J/K)         146.0226      144.9903      150.9599
 Products enthalpy          (KJ)         -680.1517     -681.9276     -671.6580
 Phase transition enthalpy  (KJ)           10.2696
 Mass  of the system        (Kg)            0.0569
  Al 2Mg 1O  4              (C)  []         0.1161        0.1176        0.1089
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.0233       -0.0000        0.1346
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1790        0.2165        0.0000
  Al 2O  5Ti 1              (C)  []         0.0397        0.0397        0.0397
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0584        0.0000        0.3377
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.2138        0.2560        0.0120
  Fe 1                      (C)[]           0.0244        0.0244        0.0244
  Fe 1Si 1                  (C)[]           0.0830        0.0830        0.0830
  Mg 2O  4Si 1              (C)             0.2562        0.2555        0.2598
  Na 2O  3Si 1              (L)[]           0.0062        0.0074       -0.0000
*
     11 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1687.6013     1687.1988     1688.0039
 Gas products amount        (mol)       1.23E-0011    7.56E-0011    1.54E-0012
 Products heat capacity     (J/K)          75.7985       72.1824       76.4156
 Products entropy           (J/K)         146.2894      142.8972      146.8684
 Products enthalpy          (KJ)         -662.7147     -668.5637     -661.7165
 Phase transition enthalpy  (KJ)            6.8472
 Mass  of the system        (Kg)            0.0561
  Al 2Mg 1O  4              (C)  []         0.1107        0.1281        0.1077
```

```
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1137        0.0000        0.1331
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.0249        0.1705        0.0000
  Al 2O  5Ti 1              (C)  []         0.0392        0.0392        0.0392
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2007        0.0000        0.2350
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1081        0.2531        0.0834
  Fe 1                      (C)[]           0.0113        0.0113        0.0113
  Fe 1Si 1                  (C)[]           0.1012        0.1012        0.1012
  Mg 2O  4Si 1              (C)             0.2876        0.2790        0.2891
  Na 2O  3Si 1              (L)[]           0.0026        0.0175        0.0000
*
```

12 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1695.0212
 Gas products amount        (mol)       2.18E-0011
 Products heat capacity     (J/K)          73.6224
 Products entropy           (J/K)         146.4398
 Products enthalpy          (KJ)         -645.9653
 Mass  of the system        (Kg)            0.0553
  Al 2Mg 1O  4              (C)  []         0.1092
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1316
  Al 2O  5Ti 1              (C)  []         0.0353
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1384
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1503
  Fe 1Si 1                  (L)[]           0.1169
  Mg 2O  4Si 1              (C)             0.3170
  Si 3Ti 5                  (C)[]           0.0012
*
```

13 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1698.2777
 Gas products amount        (mol)       1.96E-0010
 Products heat capacity     (J/K)          74.9464
 Products entropy           (J/K)         146.5678
 Products enthalpy          (KJ)         -629.0788
 Mass  of the system        (Kg)            0.0545
  Al 2Mg 1O  4              (C)  []         0.1939
  Al 2O  5Ti 1              (C)  []         0.0084
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2318
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0800
  Fe 1Si 1                  (L)[]           0.1156
  Mg 2O  4Si 1              (C)             0.3038
  Na 2O  3Si 1              (L)[]           0.0559
  Si 3Ti 5                  (C)[]           0.0107
*
```

14 wt% Mg

```
 Volume of gas products   (litres)          0.2726        0.0000        5.1743
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1763.4216     1762.9489     1763.8944
 Gas products amount        (mol)           0.0018    4.40E-0010        0.0346
 Products heat capacity     (J/K)          72.7776       72.7175       73.8587
 Products entropy           (J/K)         146.0590      145.8381      150.0305
 Products enthalpy          (KJ)         -613.3503     -613.7881     -605.4797
 Phase transition enthalpy  (KJ)            8.3084
 Mass  of the system        (Kg)            0.0537
1 Mg 1                      (G)         1.39E-0005    1.01E-0012    2.64E-0004
1 Na 1                      (G)         7.67E-0004    1.15E-0010        0.0146
  Al 2Mg 1O  4              (C)  []         0.1982        0.1982        0.1982
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1470        0.1415        0.2467
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1349        0.1424        0.0000
  Ca 2O  4Si 1              (C)  [BETA]     0.0019        0.0000        0.0365
  Fe 1Si 1                  (L)[]           0.1143        0.1143        0.1143
  Mg 2O  4Si 1              (C)             0.3319        0.3304        0.3594
  Na 2O  3Si 1              (L)[]           0.0532        0.0552        0.0166
  Si 1                      (L)[]           0.0044        0.0046       -0.0000
  Si 3Ti 5                  (C)[]           0.0135        0.0135        0.0135
*
```

15 wt% Mg

```
 Volume of gas products   (litres)          3.6976        0.0000        7.2253
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
```

```
 Temperature                (K)          1763.2802     1762.9952     1763.5651
 Gas products amount        (mol)           0.0247    3.42E-0011        0.0483
 Products heat capacity     (J/K)          70.6906       69.8908       71.4536
 Products entropy           (J/K)         145.2469      142.2510      148.1050
 Products enthalpy          (KJ)         -597.8089     -603.7929     -592.0999
 Phase transition enthalpy  (KJ)           11.6930
 Mass  of the system        (Kg)            0.0530
1 Mg 1                      (G)         2.19E-0004    3.96E-0012    4.27E-0004
1 Na 1                      (G)             0.0105    5.75E-0012        0.0206
  Al 2Mg 1O  4              (C)  []         0.1959        0.1959        0.1959
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1126        0.0362        0.1854
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1053        0.2156        0.0000
  Ca 2O  4Si 1              (C)  [BETA]     0.0304        0.0000        0.0594
  Fe 1Si 1                  (L)[]           0.1129        0.1129        0.1129
  Mg 2O  4Si 1              (C)             0.3844        0.3602        0.4074
  Na 2O  3Si 1              (L)[]           0.0267        0.0546        0.0000
  Si 1                      (L)[]           0.0079        0.0113        0.0047
  Si 3Ti 5                  (C)[]           0.0133        0.0133        0.0133
*
```

16 wt% Mg

```
 Volume of gas products   (litres)          6.6929        3.2978        7.0410
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1762.9738     1762.6640     1763.2836
 Gas products amount        (mol)           0.0448        0.0221        0.0471
 Products heat capacity     (J/K)          68.4511       67.9566       68.5018
 Products entropy           (J/K)         144.2598      141.3376      144.5594
 Products enthalpy          (KJ)         -582.6928     -589.2287     -582.0228
 Phase transition enthalpy  (KJ)            7.2059
 Mass  of the system        (Kg)            0.0522
1 Mg 1                      (G)         3.98E-0004    1.80E-0004    4.20E-0004
1 Na 1                      (G)             0.0193        0.0095        0.0203
  Al 2Mg 1O  4              (C)  []         0.1935        0.1935        0.1935
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0711        0.0000        0.0783
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0222        0.2389        0.0000
  Ca 2O  4Si 1              (C)  [BETA]     0.0910        0.0000        0.1003
  Fe 1Si 1                  (L)[]           0.1116        0.1116        0.1116
  Mg 2O  4Si 1              (C)             0.4632        0.3895        0.4707
  Na 2O  3Si 1              (L)[]           0.0027        0.0286        0.0000
  Si 1                      (L)[]           0.0118        0.0149        0.0115
  Si 3Ti 5                  (C)[]           0.0132        0.0132        0.0132
*
```

17 wt% Mg

```
 Volume of gas products   (litres)          7.5443
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1802.3357
 Gas products amount        (mol)           0.0494
 Products heat capacity     (J/K)          66.3405
 Products entropy           (J/K)         143.5107
 Products enthalpy          (KJ)         -567.8465
 Mass  of the system        (Kg)            0.0515
1 Mg 1                      (G)             0.0020        0.0880  (atm)
1 Na 1                      (G)             0.0201        0.9120  (atm)
  Al 2Mg 1O  4              (C)  []         0.1912
  Ca 2O  4Si 1              (C)  [BETA]     0.1299
  Fe 1Si 1                  (L)[]           0.1103
  Mg 1O  1                  (C)[]           0.0053
  Mg 2O  4Si 1              (C)             0.5108
  Si 1                      (L)[]           0.0173
  Si 3Ti 5                  (C)[]           0.0130
*
```

18 wt% Mg

```
 Volume of gas products   (litres)          7.4952
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1815.8986
 Gas products amount        (mol)           0.0487
 Products heat capacity     (J/K)          65.3921
 Products entropy           (J/K)         142.4782
 Products enthalpy          (KJ)         -553.7416
 Mass  of the system        (Kg)            0.0508
1 Mg 1                      (G)             0.0023        0.0984  (atm)
1 Na 1                      (G)             0.0198        0.9016  (atm)
```

```
  Al 2Mg 1O  4              (C)  []         0.1889
  Ca 2O  4Si 1              (C)  [BETA]     0.1284
  Fe 1Si 1                  (L)[]           0.1090
  Mg 1O  1                  (C)[]           0.0443
  Mg 2O  4Si 1              (C)             0.4706
  Si 1                      (L)[]           0.0239
  Si 3Ti 5                  (C)[]           0.0129
*
```

19 wt% Mg

```
 Volume of gas products   (litres)          7.4921
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1832.4492
 Gas products amount        (mol)           0.0482
 Products heat capacity     (J/K)          64.4821
 Products entropy           (J/K)         141.5982
 Products enthalpy          (KJ)         -539.7682
 Mass  of the system        (Kg)            0.0502
1 Mg 1                      (G)             0.0026        0.1127  (atm)
1 Na 1                      (G)             0.0196        0.8873  (atm)
  Al 2Mg 1O  4              (C)  []         0.1866
  Ca 2O  4Si 1              (C)  [BETA]     0.1268
  Fe 1Si 1                  (L)[]           0.1076
  Mg 1O  1                  (C)[]           0.0829
  Mg 2O  4Si 1              (C)             0.4306
  Si 1                      (L)[]           0.0304
  Si 3Ti 5                  (C)[]           0.0127
*
```

20 wt% Mg

```
 Volume of gas products   (litres)          7.4913
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1847.9209
 Gas products amount        (mol)           0.0478
 Products heat capacity     (J/K)          63.5861
 Products entropy           (J/K)         140.7008
 Products enthalpy          (KJ)         -526.2206
 Mass  of the system        (Kg)            0.0495
1 Mg 1                      (G)             0.0030        0.1276  (atm)
1 Na 1                      (G)             0.0194        0.8724  (atm)
  Al 2Mg 1O  4              (C)  []         0.1843
  Ca 2O  4Si 1              (C)  [BETA]     0.1252
  Fe 1Si 1                  (L)[]           0.1063
  Mg 1O  1                  (C)[]           0.1216
  Mg 2O  4Si 1              (C)             0.3907
  Si 1                      (L)[]           0.0369
  Si 3Ti 5                  (C)[]           0.0126
*
```

21 wt% Mg

```
 Volume of gas products   (litres)          7.5036
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1863.1406
 Gas products amount        (mol)           0.0475
 Products heat capacity     (J/K)          62.7086
 Products entropy           (J/K)         139.8217
 Products enthalpy          (KJ)         -513.0211
 Mass  of the system        (Kg)            0.0489
1 Mg 1                      (G)             0.0034        0.1439  (atm)
1 Na 1                      (G)             0.0191        0.8560  (atm)
  Al 2Mg 1O  4              (C)  []         0.1820
  Ca 2O  4Si 1              (C)  [BETA]     0.1237
  Fe 1Si 1                  (L)[]           0.1050
  Mg 1O  1                  (C)[]           0.1600
  Mg 2O  4Si 1              (C)             0.3509
  Si 1                      (L)[]           0.0435
  Si 3Ti 5                  (C)[]           0.0124
*
```

22 wt% Mg

```
 Volume of gas products   (litres)          7.5309
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1878.1123
 Gas products amount        (mol)           0.0473
 Products heat capacity     (J/K)          61.8485
```

```
 Products entropy           (J/K)         138.9614
 Products enthalpy          (KJ)         -500.1505
 Mass  of the system        (Kg)            0.0483
1 Mg 1                      (G)             0.0039        0.1618  (atm)
1 Na 1                      (G)             0.0189        0.8381  (atm)
  Al 2Mg 1O  4              (C)  []         0.1797
  Ca 2O  4Si 1              (C)  [BETA]     0.1221
  Fe 1Si 1                  (L)[]           0.1036
  Mg 1O  1                  (C)[]           0.1983
  Mg 2O  4Si 1              (C)             0.3113
  Si 1                      (L)[]           0.0499
  Si 3Ti 5                  (C)[]           0.0122
*
```

23 wt% Mg

```
 Volume of gas products   (litres)          7.5722
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1892.7990
 Gas products amount        (mol)           0.0472
 Products heat capacity     (J/K)          61.0056
 Products entropy           (J/K)         138.1185
 Products enthalpy          (KJ)         -487.6024
 Mass  of the system        (Kg)            0.0477
1 Mg 1                      (G)             0.0044        0.1809  (atm)
1 Na 1                      (G)             0.0186        0.8190  (atm)
  Al 2Mg 1O  4              (C)  []         0.1774
  Ca 2O  4Si 1              (C)  [BETA]     0.1205
  Fe 1Si 1                  (L)[]           0.1023
  Mg 1O  1                  (C)[]           0.2365
  Mg 2O  4Si 1              (C)             0.2718
  Si 1                      (L)[]           0.0564
  Si 3Ti 5                  (C)[]           0.0121
*
```

24 wt% Mg

```
 Volume of gas products   (litres)          7.6312
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1907.1739
 Gas products amount        (mol)           0.0472
 Products heat capacity     (J/K)          60.1787
 Products entropy           (J/K)         137.2937
 Products enthalpy          (KJ)         -475.3580
 Mass  of the system        (Kg)            0.0471
1 Mg 1                      (G)             0.0049        0.2017  (atm)
1 Na 1                      (G)             0.0184        0.7982  (atm)
  Al 2Mg 1O  4              (C)  []         0.1751
  Ca 2O  4Si 1              (C)  [BETA]     0.1190
  Fe 1Si 1                  (L)[]           0.1010
  Mg 1O  1                  (C)[]           0.2744
  Mg 2O  4Si 1              (C)             0.2325
  Si 1                      (L)[]           0.0628
  Si 3Ti 5                  (C)[]           0.0119
*
```

25 wt% Mg

```
 Volume of gas products   (litres)          7.7117
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1921.3264
 Gas products amount        (mol)           0.0473
 Products heat capacity     (J/K)          59.3679
 Products entropy           (J/K)         136.4923
 Products enthalpy          (KJ)         -463.3980
 Mass  of the system        (Kg)            0.0465
1 Mg 1                      (G)             0.0055        0.2242  (atm)
1 Na 1                      (G)             0.0181        0.7757  (atm)
  Al 2Mg 1O  4              (C)  []         0.1728
  Ca 2O  4Si 1              (C)  [BETA]     0.1174
  Fe 1Si 1                  (L)[]           0.0997
  Mg 1O  1                  (C)[]           0.3121
  Mg 2O  4Si 1              (C)             0.1933
  Si 1                      (L)[]           0.0692
  Si 3Ti 5                  (C)[]           0.0118
*
```

26 wt% Mg

```
 Volume of gas products   (litres)          7.7037
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1930.3222
 Gas products amount        (mol)           0.0471
 Products heat capacity     (J/K)          58.5515
 Products entropy           (J/K)         135.4999
 Products enthalpy          (KJ)         -452.1251
 Mass  of the system        (Kg)            0.0460
1 Mg 1                      (G)             0.0060        0.2394  (atm)
1 Na 1                      (G)             0.0179        0.7605  (atm)
  Al 2Mg 1O  4              (C)  []         0.1705
  Ca 2O  4Si 1              (C)  [BETA]     0.1158
  Fe 1Si 1                  (L)[]           0.0983
  Mg 1O  1                  (C)[]           0.3506
  Mg 2O  4Si 1              (C)             0.1536
  Si 1                      (L)[]           0.0757
  Si 3Ti 5                  (C)[]           0.0116
*
```

27 wt% Mg

```
 Volume of gas products   (litres)          8.1573
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1957.0113
 Gas products amount        (mol)           0.0492
 Products heat capacity     (J/K)          57.8256
 Products entropy           (J/K)         135.3262
 Products enthalpy          (KJ)         -439.5659
 Mass  of the system        (Kg)            0.0454
1 Mg 1                      (G)             0.0076        0.2901  (atm)
1 Na 1                      (G)             0.0177        0.7097  (atm)
  Al 2Mg 1O  4              (C)  []         0.1682
  Ca 2O  4Si 1              (C)  [BETA]     0.1143
  Fe 1Si 1                  (L)[]           0.0970
  Mg 1O  1                  (C)[]           0.3848
  Mg 2O  4Si 1              (C)             0.1175
  Si 1                      (L)[]           0.0814
  Si 3Ti 5                  (C)[]           0.0115
*
```

28 wt% Mg

```
 Volume of gas products   (litres)          8.2090
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1966.0159
 Gas products amount        (mol)           0.0492
 Products heat capacity     (J/K)          57.0407
 Products entropy           (J/K)         134.4035
 Products enthalpy          (KJ)         -428.7597
 Mass  of the system        (Kg)            0.0449
1 Mg 1                      (G)             0.0082        0.3092  (atm)
1 Na 1                      (G)             0.0174        0.6906  (atm)
  Al 2Mg 1O  4              (C)  []         0.1659
  Ca 2O  4Si 1              (C)  [BETA]     0.1127
  Fe 1Si 1                  (L)[]           0.0957
  Mg 1O  1                  (C)[]           0.4226
  Mg 2O  4Si 1              (C)             0.0783
  Si 1                      (L)[]           0.0878
  Si 3Ti 5                  (C)[]           0.0113
*
```

29 wt% Mg

```
 Volume of gas products   (litres)          8.0954
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1969.1973
 Gas products amount        (mol)           0.0485
 Products heat capacity     (J/K)          56.2504
 Products entropy           (J/K)         133.2365
 Products enthalpy          (KJ)         -418.7249
 Mass  of the system        (Kg)            0.0444
1 Mg 1                      (G)             0.0084        0.3162  (atm)
1 Na 1                      (G)             0.0172        0.6836  (atm)
  Al 2Mg 1O  4              (C)  []         0.1636
  Ca 2O  4Si 1              (C)  [BETA]     0.1111
  Fe 1Si 1                  (L)[]           0.0943
  Mg 1O  1                  (C)[]           0.4619
```

```
  Mg 2O  4Si 1              (C)              0.0378
  Si 1                      (L)[]            0.0945
  Si 3Ti 5                  (C)[]            0.0111
*
     30 wt% Mg
 Volume of gas products   (litres)           8.2902
 Pressure of gas products   (atm)            1.0000
 Temperature                (K)           1978.0929
 Gas products amount        (mol)            0.0494
 Products heat capacity     (J/K)           55.4948
 Products entropy           (J/K)          132.4485
 Products enthalpy          (KJ)          -408.2219
 Mass  of the system        (Kg)             0.0438
1 Mg 1                      (G)              0.0095        0.3462  (atm)
1 Na 1                      (G)              0.0169        0.6536  (atm)
  Al 2Mg 1O  4              (C)  []          0.1613
  Ca 2O  4Si 1              (C)  [BETA]      0.1096
  Fe 1Si 1                  (L)[]            0.0930
  Mg 1O  1                  (C)[]            0.4981
  Si 1                      (L)[]            0.1006
  Si 3Ti 5                  (C)[]            0.0110
*
     31 wt% Mg
 Volume of gas products   (litres)          11.8908
 Pressure of gas products   (atm)            1.0000
 Temperature                (K)           1905.4386
 Gas products amount        (mol)            0.0736
 Products heat capacity     (J/K)           54.3092
 Products entropy           (J/K)          131.9794
 Products enthalpy          (KJ)          -397.1503
 Mass  of the system        (Kg)             0.0433
1 Mg 1                      (G)              0.0236        0.5715  (atm)
1 Na 1                      (G)              0.0167        0.4277  (atm)
  Al 2Mg 1O  4              (C)  []          0.1590
  Ca 2O  4Si 1              (C)  [BETA]      0.1079
  Fe 1Si 1                  (L)[]            0.0917
  Mg 1O  1                  (C)[]            0.4911
  Si 1                      (L)[]            0.0992
  Si 3Ti 5                  (C)[]            0.0108
*
     32 wt% Mg
 Volume of gas products   (litres)          14.9896
 Pressure of gas products   (atm)            1.0000
 Temperature                (K)           1819.1577
 Gas products amount        (mol)            0.0972
 Products heat capacity     (J/K)           53.1139
 Products entropy           (J/K)          131.0091
 Products enthalpy          (KJ)          -386.9979
 Mass  of the system        (Kg)             0.0429
1 Ca 1                      (G)          1.33E-0004        0.0015  (atm)
1 Mg 1                      (G)              0.0376        0.6828  (atm)
1 Na 1                      (G)              0.0165        0.3157  (atm)
  Al 2Mg 1O  4              (C)  []          0.1567
  Ca 2O  4Si 1              (C)  [BETA]      0.1062
  Fe 1Si 1                  (L)[]            0.0904
  Mg 1O  1                  (C)[]            0.4842
  Si 1                      (L)[]            0.0977
  Si 3Ti 5                  (C)[]            0.0107
*
     33 wt% Mg
 Volume of gas products   (litres)          15.2324
 Pressure of gas products   (atm)            1.0000
 Temperature                (K)           1820.1033
 Gas products amount        (mol)            0.0987
 Products heat capacity     (J/K)           52.4136
 Products entropy           (J/K)          130.2379
 Products enthalpy          (KJ)          -376.6068
 Mass  of the system        (Kg)             0.0424
1 Ca 1                      (G)          1.42E-0004        0.0015  (atm)
1 Mg 1                      (G)              0.0394        0.6956  (atm)
1 Na 1                      (G)              0.0162        0.3028  (atm)
```

```
  Al 2Ca 1                  (L)[]           0.0096
  Al 2Mg 1O  4              (C)  []         0.1399
  Ca 2O  4Si 1              (C)  [BETA]     0.0958
  Fe 1Si 1                  (L)[]           0.0890
  Mg 1O  1                  (C)[]           0.5017
  Si 1                      (L)[]           0.0977
  Si 3Ti 5                  (C)[]           0.0105
*
```

35 wt% Mg

```
 Volume of gas products   (litres)         14.8679
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1821.7983
 Gas products amount        (mol)           0.0963
 Products heat capacity     (J/K)          51.0888
 Products entropy           (J/K)         128.1680
 Products enthalpy          (KJ)         -357.5567
 Mass  of the system        (Kg)            0.0415
1 Ca 1                      (G)         1.43E-0004        0.0015  (atm)
1 Mg 1                      (G)             0.0397        0.7037  (atm)
1 Na 1                      (G)             0.0157        0.2947  (atm)
  Al 2Ca 1                  (L)[]           0.0312
  Al 2Mg 1O  4              (C)  []         0.1025
  Ca 2O  4Si 1              (C)  [BETA]     0.0728
  Fe 1Si 1                  (L)[]           0.0864
  Mg 1O  1                  (C)[]           0.5432
  Si 1                      (L)[]           0.0981
  Si 3Ti 5                  (C)[]           0.0102
*
```

36 wt% Mg

```
 Volume of gas products   (litres)         14.7225
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1822.6325
 Gas products amount        (mol)           0.0953
 Products heat capacity     (J/K)          50.4466
 Products entropy           (J/K)         127.1872
 Products enthalpy          (KJ)         -348.3014
 Mass  of the system        (Kg)            0.0410
1 Ca 1                      (G)         1.44E-0004        0.0015  (atm)
1 Mg 1                      (G)             0.0400        0.7083  (atm)
1 Na 1                      (G)             0.0155        0.2901  (atm)
  Al 2Ca 1                  (L)[]           0.0420
  Al 2Mg 1O  4              (C)  []         0.0840
  Ca 2O  4Si 1              (C)  [BETA]     0.0615
  Fe 1Si 1                  (L)[]           0.0850
  Mg 1O  1                  (C)[]           0.5636
  Si 1                      (L)[]           0.0983
  Si 3Ti 5                  (C)[]           0.0100
*
```

37 wt% Mg

```
 Volume of gas products   (litres)         14.5177
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1823.3436
 Gas products amount        (mol)           0.0939
 Products heat capacity     (J/K)          49.8195
 Products entropy           (J/K)         126.1813
 Products enthalpy          (KJ)         -339.3242
 Mass  of the system        (Kg)            0.0406
1 Ca 1                      (G)         1.45E-0004        0.0016  (atm)
1 Mg 1                      (G)             0.0400        0.7118  (atm)
1 Na 1                      (G)             0.0152        0.2866  (atm)
  Al 2Ca 1                  (L)[]           0.0529
  Al 2Mg 1O  4              (C)  []         0.0652
  Ca 2O  4Si 1              (C)  [BETA]     0.0499
  Fe 1Si 1                  (L)[]           0.0837
  Mg 1O  1                  (C)[]           0.5846
  Si 1                      (L)[]           0.0985
  Si 3Ti 5                  (C)[]           0.0099
*
```

38 wt% Mg

```
 Volume of gas products   (litres)         14.3075
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)          1824.0478
 Gas products amount        (mol)           0.0925
 Products heat capacity     (J/K)          49.2059
 Products entropy           (J/K)         125.1896
 Products enthalpy          (KJ)         -330.5473
 Mass  of the system        (Kg)            0.0402
1 Ca 1                      (G)         1.45E-0004        0.0016  (atm)
1 Mg 1                      (G)             0.0400        0.7151  (atm)
1 Na 1                      (G)             0.0150        0.2833  (atm)
  Al 2Ca 1                  (L)[]           0.0638
  Al 2Mg 1O  4              (C)  []         0.0463
  Ca 2O  4Si 1              (C)  [BETA]     0.0383
  Fe 1Si 1                  (L)[]           0.0824
  Mg 1O  1                  (C)[]           0.6056
  Si 1                      (L)[]           0.0987
  Si 3Ti 5                  (C)[]           0.0097
*
```

39 wt% Mg

```
 Volume of gas products   (litres)         14.0987
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1824.7054
 Gas products amount        (mol)           0.0911
 Products heat capacity     (J/K)          48.6052
 Products entropy           (J/K)         124.2160
 Products enthalpy          (KJ)         -321.9614
 Mass  of the system        (Kg)            0.0397
1 Ca 1                      (G)         1.45E-0004        0.0016  (atm)
1 Mg 1                      (G)             0.0400        0.7184  (atm)
1 Na 1                      (G)             0.0148        0.2800  (atm)
  Al 2Ca 1                  (L)[]           0.0748
  Al 2Mg 1O  4              (C)  []         0.0274
  Ca 2O  4Si 1              (C)  [BETA]     0.0267
  Fe 1Si 1                  (L)[]           0.0811
  Mg 1O  1                  (C)[]           0.6266
  Si 1                      (L)[]           0.0989
  Si 3Ti 5                  (C)[]           0.0096
*
```

40 wt% Mg

```
 Volume of gas products   (litres)         14.6084
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1827.9795
 Gas products amount        (mol)           0.0943
 Products heat capacity     (J/K)          47.9994
 Products entropy           (J/K)         123.8033
 Products enthalpy          (KJ)         -312.5616
 Mass  of the system        (Kg)            0.0393
1 Ca 1                      (G)         1.56E-0004        0.0016  (atm)
1 Mg 1                      (G)             0.0428        0.7348  (atm)
1 Na 1                      (G)             0.0145        0.2635  (atm)
  Al 2Ca 1                  (L)[]           0.0836
  Al 2Mg 1O  4              (C)  []         0.0118
  Ca 2O  4Si 1              (C)  [BETA]     0.0171
  Fe 1Si 1                  (L)[]           0.0797
  Mg 1O  1                  (C)[]           0.6422
  Si 1                      (L)[]           0.0987
  Si 3Ti 5                  (C)[]           0.0094
*
```

41 wt% Mg

```
 Volume of gas products   (litres)         14.8264
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1781.8334
 Gas products amount        (mol)           0.0981
 Products heat capacity     (J/K)          47.2270
 Products entropy           (J/K)         122.1258
 Products enthalpy          (KJ)         -305.6280
 Mass  of the system        (Kg)            0.0389
1 Ca 1                      (G)         2.19E-0004        0.0022  (atm)
1 Mg 1                      (G)             0.0460        0.7515  (atm)
1 Na 1                      (G)             0.0143        0.2463  (atm)
  Al 2Ca 1                  (L)[]           0.0899
  Ca 1Mg 1O  2              (C)  []         0.0107
```

```
  Fe 1Si 1                  (L)[]           0.0784
  Mg 1O  1                  (C)[]           0.6514
  Si 1                      (L)[]           0.0998
  Si 3Ti 5                  (C)[]           0.0093
*
     42 wt% Mg
 Volume of gas products   (litres)         16.7734
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1715.1072
 Gas products amount        (mol)           0.1153
 Products heat capacity     (J/K)          46.4068
 Products entropy           (J/K)         121.4382
 Products enthalpy          (KJ)         -296.8962
 Mass  of the system        (Kg)            0.0385
1 Ca 1                      (G)         2.30E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0578        0.7941  (atm)
1 Na 1                      (G)             0.0140        0.2040  (atm)
  Al 2Ca 1                  (L)[]           0.0883
  Ca 1Mg 1O  2              (C)  []         0.0105
  Fe 1Si 1                  (L)[]           0.0771
  Mg 1O  1                  (C)[]           0.6403
  Mg 2Si 1                  (L)             0.0070
  Si 1                      (L)[]           0.0956
  Si 3Ti 5                  (C)[]           0.0091
*
     43 wt% Mg
 Volume of gas products   (litres)         15.9291
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1714.2172
 Gas products amount        (mol)           0.1096
 Products heat capacity     (J/K)          46.0871
 Products entropy           (J/K)         120.3106
 Products enthalpy          (KJ)         -289.0544
 Mass  of the system        (Kg)            0.0381
1 Ca 1                      (G)         2.19E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0551        0.7892  (atm)
1 Na 1                      (G)             0.0138        0.2088  (atm)
  Al 2Ca 1                  (L)[]           0.0868
  Ca 1Mg 1O  2              (C)  []         0.0104
  Fe 1Si 1                  (L)[]           0.0757
  Mg 1O  1                  (C)[]           0.6293
  Mg 2Si 1                  (L)             0.0367
  Si 1                      (L)[]           0.0830
  Si 3Ti 5                  (C)[]           0.0090
*
     44 wt% Mg
 Volume of gas products   (litres)         16.2154
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1715.9048
 Gas products amount        (mol)           0.1115
 Products heat capacity     (J/K)          45.6863
 Products entropy           (J/K)         119.9998
 Products enthalpy          (KJ)         -280.0030
 Mass  of the system        (Kg)            0.0378
1 Ca 1                      (G)         2.28E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0573        0.7983  (atm)
1 Na 1                      (G)             0.0136        0.1998  (atm)
  Al 2Ca 1                  (L)[]           0.0853
  Ca 1Mg 1O  2              (C)  []         0.0101
  Fe 1Si 1                  (L)[]           0.0744
  Mg 1O  1                  (C)[]           0.6183
  Mg 2Si 1                  (L)             0.0588
  Si 1                      (L)[]           0.0732
  Si 3Ti 5                  (C)[]           0.0088
*
     45 wt% Mg
 Volume of gas products   (litres)         14.9120
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1713.7920
 Gas products amount        (mol)           0.1026
 Products heat capacity     (J/K)          45.4172
```

```
 Products entropy           (J/K)         118.5623
 Products enthalpy          (KJ)         -273.0705
 Mass  of the system        (Kg)            0.0374
1 Ca 1                      (G)         2.08E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0525        0.7871  (atm)
1 Na 1                      (G)             0.0133        0.2110  (atm)
  Al 2Ca 1                  (L)[]           0.0838
  Ca 1Mg 1O  2              (C)  []         0.0100
  Fe 1Si 1                  (L)[]           0.0731
  Mg 1O  1                  (C)[]           0.6072
  Mg 2Si 1                  (L)             0.0919
  Si 1                      (L)[]           0.0594
  Si 3Ti 5                  (C)[]           0.0086
*
```

46 wt% Mg

```
 Volume of gas products   (litres)         20.4623
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1793.0745
 Gas products amount        (mol)           0.1346
 Products heat capacity     (J/K)          48.2845
 Products entropy           (J/K)         127.5246
 Products enthalpy          (KJ)         -302.7619
 Mass  of the system        (Kg)            0.0402
1 Ca 1                      (G)         3.34E-0004        0.0025  (atm)
1 Mg 1                      (G)             0.0684        0.8411  (atm)
1 Na 1                      (G)             0.0120        0.1564  (atm)
  Al 2Ca 1                  (L)[]           0.0757
  Ca 1Mg 1O  2              (C)  []         0.0087
  Fe 1Si 1                  (L)[]           0.0661
  Mg 1O  1                  (C)[]           0.6292
  Si 1                      (L)[]           0.0674
  Si 3Ti 5                  (C)[]           0.0722
*
```

46 wt% Mg

```
 Volume of gas products   (litres)         20.4623
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1793.0776
 Gas products amount        (mol)           0.1346
 Products heat capacity     (J/K)          48.2845
 Products entropy           (J/K)         127.5247
 Products enthalpy          (KJ)         -302.7617
 Mass  of the system        (Kg)            0.0402
1 Ca 1                      (G)         3.34E-0004        0.0025  (atm)
1 Mg 1                      (G)             0.0684        0.8411  (atm)
1 Na 1                      (G)             0.0120        0.1564  (atm)
  Al 2Ca 1                  (L)[]           0.0757
  Ca 1Mg 1O  2              (C)  []         0.0087
  Fe 1Si 1                  (L)[]           0.0661
  Mg 1O  1                  (C)[]           0.6292
  Si 1                      (L)[]           0.0674
  Si 3Ti 5                  (C)[]           0.0722
*
```

47 wt% Mg

```
 Volume of gas products   (litres)         13.3094
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1711.4806
 Gas products amount        (mol)           0.0917
 Products heat capacity     (J/K)          44.8217
 Products entropy           (J/K)         116.4246
 Products enthalpy          (KJ)         -258.4877
 Mass  of the system        (Kg)            0.0367
1 Ca 1                      (G)         1.86E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0471        0.7750  (atm)
1 Na 1                      (G)             0.0128        0.2231  (atm)
  Al 2Ca 1                  (L)[]           0.0807
  Ca 1Mg 1O  2              (C)  []         0.0097
  Fe 1Si 1                  (L)[]           0.0704
  Mg 1O  1                  (C)[]           0.5851
  Mg 2Si 1                  (L)             0.1514
  Si 1                      (L)[]           0.0342
  Si 3Ti 5                  (C)[]           0.0083
```

```
*
     48 wt% Mg
 Volume of gas products   (litres)         12.4755
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0860
 Products heat capacity     (J/K)          44.5364
 Products entropy           (J/K)         115.3406
 Products enthalpy          (KJ)         -251.4811
 Mass  of the system        (Kg)            0.0363
1 Ca 1                      (G)         1.73E-0004        0.0018  (atm)
1 Mg 1                      (G)             0.0442        0.7670  (atm)
1 Na 1                      (G)             0.0126        0.2311  (atm)
  Al 2Ca 1                  (L)[]           0.0792
  Ca 1Mg 1O  2              (C)  []         0.0095
  Fe 1Si 1                  (L)[]           0.0691
  Mg 1O  1                  (C)[]           0.5740
  Mg 2Si 1                  (L)             0.1816
  Si 1                      (L)[]           0.0215
  Si 3Ti 5                  (C)[]           0.0082
*
     49 wt% Mg
 Volume of gas products   (litres)         12.1222
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0836
 Products heat capacity     (J/K)          44.2207
 Products entropy           (J/K)         114.6189
 Products enthalpy          (KJ)         -244.0200
 Mass  of the system        (Kg)            0.0360
1 Ca 1                      (G)         1.70E-0004        0.0018  (atm)
1 Mg 1                      (G)             0.0433        0.7671  (atm)
1 Na 1                      (G)             0.0123        0.2311  (atm)
  Al 2Ca 1                  (L)[]           0.0777
  Ca 1Mg 1O  2              (C)  []         0.0093
  Fe 1Si 1                  (L)[]           0.0678
  Mg 1O  1                  (C)[]           0.5630
  Mg 2Si 1                  (L)             0.2084
  Si 1                      (L)[]           0.0100
  Si 3Ti 5                  (C)[]           0.0080
*
     50 wt% Mg
 Volume of gas products   (litres)         12.3442
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0851
 Products heat capacity     (J/K)          43.8615
 Products entropy           (J/K)         114.2918
 Products enthalpy          (KJ)         -236.0479
 Mass  of the system        (Kg)            0.0357
1 Ca 1                      (G)         1.77E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0451        0.7777  (atm)
1 Na 1                      (G)             0.0121        0.2204  (atm)
  Al 2Ca 1                  (L)[]           0.0762
  Ca 1Mg 1O  2              (C)  []         0.0091
  Fe 1Si 1                  (L)[]           0.0664
  Mg 1O  1                  (C)[]           0.5520
  Mg 2Si 1                  (L)             0.2310
  Si 3Ti 5                  (C)[]           0.0079
*
     51 wt% Mg
 Volume of gas products   (litres)         15.3414
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1619.3755
 Gas products amount        (mol)           0.1117
 Products heat capacity     (J/K)          42.9570
 Products entropy           (J/K)         112.9383
 Products enthalpy          (KJ)         -229.8417
 Mass  of the system        (Kg)            0.0353
1 Ca 1                      (G)         1.93E-0004        0.0015  (atm)
1 Mg 1                      (G)             0.0642        0.8354  (atm)
```

```
1 Na 1                      (G)             0.0119        0.1631  (atm)
  Al 2Ca 1                  (L)[]           0.0746
  Ca 1Mg 1O  2              (C)  []         0.0089
  Fe 1Si 1                  (C)[]           0.0651
  Mg 1O  1                  (C)[]           0.5410
  Mg 2Si 1                  (L)             0.2264
  Si 3Ti 5                  (C)[]           0.0077
*
     52 wt% Mg
 Volume of gas products   (litres)         17.8667
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1493.0000
 Gas products amount        (mol)           0.1411
 Products heat capacity     (J/K)          41.9441
 Products entropy           (J/K)         111.7548
 Products enthalpy          (KJ)         -223.1636
 Mass  of the system        (Kg)            0.0350
1 Mg 1                      (G)             0.0857        0.8745  (atm)
1 Na 1                      (G)             0.0116        0.1253  (atm)
  Al 2Ca 1                  (L)[]           0.0731
  Ca 1Si 1                  (C)  []         0.0064
  Fe 1Si 1                  (C)[]           0.0638
  Mg 1O  1                  (C)[]           0.5372
  Mg 2Si 1                  (L)             0.2146
  Si 3Ti 5                  (C)[]           0.0075
*
     53 wt% Mg
 Volume of gas products   (litres)         19.5369
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1382.4990
 Gas products amount        (mol)           0.1667
 Products heat capacity     (J/K)          41.0327
 Products entropy           (J/K)         110.7077
 Products enthalpy          (KJ)         -215.9691
 Mass  of the system        (Kg)            0.0347
1 Mg 1                      (G)             0.1048        0.8969  (atm)
1 Na 1                      (G)             0.0114        0.1029  (atm)
  Al 2Ca 1                  (L)[]           0.0716
  Ca 1Si 1                  (C)  []         0.0063
  Fe 1Si 1                  (C)[]           0.0625
  Mg 1O  1                  (C)[]           0.5260
  Mg 2Si 1                  (L)             0.2101
  Si 3Ti 5                  (C)[]           0.0074
*
     54 wt% Mg
 Volume of gas products   (litres)         22.3351
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1373.8613
 Gas products amount        (mol)           0.1917
 Products heat capacity     (J/K)          40.1786
 Products entropy           (J/K)         108.2715
 Products enthalpy          (KJ)         -210.6404
 Mass  of the system        (Kg)            0.0344
1 Mg 1                      (G)             0.1238        0.9130  (atm)
1 Na 1                      (G)             0.0111        0.0868  (atm)
  Al 2Ca 1                  (L)[]           0.0701
  Ca 1Si 1                  (C)  []         0.0061
  Fe 1Si 1                  (C)[]           0.0611
  Mg 1O  1                  (C)[]           0.5148
  Mg 2Si 1                  (C)             0.2056
  Si 3Ti 5                  (C)[]           0.0072
*
     55 wt% Mg
 Volume of gas products   (litres)         21.3772
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1357.0252
 Gas products amount        (mol)           0.1858
 Products heat capacity     (J/K)          39.9534
 Products entropy           (J/K)         107.1180
 Products enthalpy          (KJ)         -203.6359
 Mass  of the system        (Kg)            0.0341
```

```
1 Mg 1                      (G)             0.1210        0.9130  (atm)
1 Na 1                      (G)             0.0109        0.0868  (atm)
  Al 2Ca 1                  (L)[]           0.0685
  Ca 1Si 1                  (C)  []         0.0060
  Fe 1Si 1                  (C)[]           0.0598
  Mg 1                      (L)[]           0.0218
  Mg 1O  1                  (C)[]           0.5036
  Mg 2Si 1                  (C)             0.2012
  Si 3Ti 5                  (C)[]           0.0071
*
```

56 wt% Mg

```
 Volume of gas products   (litres)         19.4213
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1356.3146
 Gas products amount        (mol)           0.1689
 Products heat capacity     (J/K)          39.9282
 Products entropy           (J/K)         105.4067
 Products enthalpy          (KJ)         -197.5411
 Mass  of the system        (Kg)            0.0338
1 Mg 1                      (G)             0.1103        0.9072  (atm)
1 Na 1                      (G)             0.0106        0.0926  (atm)
  Al 2Ca 1                  (L)[]           0.0670
  Ca 1Si 1                  (C)  []         0.0059
  Fe 1Si 1                  (C)[]           0.0585
  Mg 1                      (L)[]           0.0516
  Mg 1O  1                  (C)[]           0.4925
  Mg 2Si 1                  (C)             0.1967
  Si 3Ti 5                  (C)[]           0.0069
*
```

57 wt% Mg

```
 Volume of gas products   (litres)         17.7922
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1355.5593
 Gas products amount        (mol)           0.1548
 Products heat capacity     (J/K)          39.8689
 Products entropy           (J/K)         103.9621
 Products enthalpy          (KJ)         -191.2280
 Mass  of the system        (Kg)            0.0335
1 Mg 1                      (G)             0.1014        0.9020  (atm)
1 Na 1                      (G)             0.0104        0.0979  (atm)
  Al 2Ca 1                  (L)[]           0.0655
  Ca 1Si 1                  (C)  []         0.0057
  Fe 1Si 1                  (C)[]           0.0571
  Mg 1                      (L)[]           0.0795
  Mg 1O  1                  (C)[]           0.4813
  Mg 2Si 1                  (C)             0.1922
  Si 3Ti 5                  (C)[]           0.0068
*
```

58 wt% Mg

```
 Volume of gas products   (litres)         15.9440
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1354.5134
 Gas products amount        (mol)           0.1388
 Products heat capacity     (J/K)          39.8387
 Products entropy           (J/K)         102.3308
 Products enthalpy          (KJ)         -185.3091
 Mass  of the system        (Kg)            0.0332
1 Mg 1                      (G)             0.0909        0.8942  (atm)
1 Na 1                      (G)             0.0102        0.1056  (atm)
  Al 2Ca 1                  (L)[]           0.0640
  Ca 1Si 1                  (C)  []         0.0056
  Fe 1Si 1                  (C)[]           0.0558
  Mg 1                      (L)[]           0.1090
  Mg 1O  1                  (C)[]           0.4701
  Mg 2Si 1                  (C)             0.1877
  Si 3Ti 5                  (C)[]           0.0066
*
```

59 wt% Mg

```
 Volume of gas products   (litres)         14.6242
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1353.8350
```

```
 Gas products amount        (mol)           0.1274
 Products heat capacity     (J/K)          39.7526
 Products entropy           (J/K)         101.1415
 Products enthalpy          (KJ)         -178.9338
 Mass  of the system        (Kg)            0.0329
1 Mg 1                      (G)             0.0836        0.8884  (atm)
1 Na 1                      (G)             0.0099        0.1114  (atm)
  Al 2Ca 1                  (L)[]           0.0624
  Ca 1Si 1                  (C)  []         0.0055
  Fe 1Si 1                  (C)[]           0.0545
  Mg 1                      (L)[]           0.1354
  Mg 1O  1                  (C)[]           0.4589
  Mg 2Si 1                  (C)             0.1833
  Si 3Ti 5                  (C)[]           0.0064
*
```

60 wt% Mg

```
 Volume of gas products   (litres)         13.5810
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1353.1337
 Gas products amount        (mol)           0.1184
 Products heat capacity     (J/K)          39.6382
 Products entropy           (J/K)         100.1798
 Products enthalpy          (KJ)         -172.3857
 Mass  of the system        (Kg)            0.0326
1 Mg 1                      (G)             0.0780        0.8838  (atm)
1 Na 1                      (G)             0.0097        0.1160  (atm)
  Al 2Ca 1                  (L)[]           0.0609
  Ca 1Si 1                  (C)  []         0.0054
  Fe 1Si 1                  (C)[]           0.0532
  Mg 1                      (L)[]           0.1601
  Mg 1O  1                  (C)[]           0.4477
  Mg 2Si 1                  (C)             0.1788
  Si 3Ti 5                  (C)[]           0.0063
*
```

61 wt% Mg

```
 Volume of gas products   (litres)         11.9378
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1351.6187
 Gas products amount        (mol)           0.1042
 Products heat capacity     (J/K)          39.5729
 Products entropy           (J/K)          97.7531
 Products enthalpy          (KJ)         -167.9624
 Mass  of the system        (Kg)            0.0323
1 Mg 1                      (G)             0.0683        0.8724  (atm)
1 Na 1                      (G)             0.0094        0.1274  (atm)
  Al 2Ca 1                  (C)[]           0.0594
  Ca 1Si 1                  (C)  []         0.0052
  Fe 1Si 1                  (C)[]           0.0518
  Mg 1                      (L)[]           0.1888
  Mg 1O  1                  (C)[]           0.4365
  Mg 2Si 1                  (C)             0.1743
  Si 3Ti 5                  (C)[]           0.0061
*
```

62 wt% Mg

```
 Volume of gas products   (litres)         10.3568
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1349.7163
 Gas products amount        (mol)           0.0905
 Products heat capacity     (J/K)          39.5262
 Products entropy           (J/K)          96.3489
 Products enthalpy          (KJ)         -162.2628
 Mass  of the system        (Kg)            0.0321
1 Mg 1                      (G)             0.0589        0.8581  (atm)
1 Na 1                      (G)             0.0092        0.1417  (atm)
  Al 2Ca 1                  (C)[]           0.0579
  Ca 1Si 1                  (C)  []         0.0051
  Fe 1Si 1                  (C)[]           0.0505
  Mg 1                      (L)[]           0.2173
  Mg 1O  1                  (C)[]           0.4253
  Mg 2Si 1                  (C)             0.1698
  Si 3Ti 5                  (C)[]           0.0060
```

```
*
     63 wt% Mg
 Volume of gas products   (litres)          8.8288
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1347.0590
 Gas products amount        (mol)           0.0773
 Products heat capacity     (J/K)          39.4762
 Products entropy           (J/K)          94.9679
 Products enthalpy          (KJ)         -156.6654
 Mass  of the system        (Kg)            0.0318
1 Mg 1                      (G)             0.0496        0.8396  (atm)
1 Na 1                      (G)             0.0090        0.1602  (atm)
  Al 2Ca 1                  (C)[]           0.0564
  Ca 1Si 1                  (C)  []         0.0050
  Fe 1Si 1                  (C)[]           0.0492
  Mg 1                      (L)[]           0.2456
  Mg 1O  1                  (C)[]           0.4141
  Mg 2Si 1                  (C)             0.1654
  Si 3Ti 5                  (C)[]           0.0058
*
     64 wt% Mg
 Volume of gas products   (litres)          7.2872
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1343.3727
 Gas products amount        (mol)           0.0640
 Products heat capacity     (J/K)          39.4295
 Products entropy           (J/K)          93.5432
 Products enthalpy          (KJ)         -151.2456
 Mass  of the system        (Kg)            0.0315
1 Mg 1                      (G)             0.0401        0.8131  (atm)
1 Na 1                      (G)             0.0087        0.1868  (atm)
  Al 2Ca 1                  (C)[]           0.0548
  Ca 1Si 1                  (C)  []         0.0048
  Fe 1Si 1                  (C)[]           0.0478
  Mg 1                      (L)[]           0.2742
  Mg 1O  1                  (C)[]           0.4029
  Mg 2Si 1                  (C)             0.1609
  Si 3Ti 5                  (C)[]           0.0057
*
     65 wt% Mg
 Volume of gas products   (litres)          6.0186
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1338.8688
 Gas products amount        (mol)           0.0530
 Products heat capacity     (J/K)          39.3533
 Products entropy           (J/K)          92.3182
 Products enthalpy          (KJ)         -145.6751
 Mass  of the system        (Kg)            0.0313
1 Mg 1                      (G)             0.0322        0.7825  (atm)
1 Na 1                      (G)             0.0085        0.2173  (atm)
  Al 2Ca 1                  (C)[]           0.0533
  Ca 1Si 1                  (C)  []         0.0047
  Fe 1Si 1                  (C)[]           0.0465
  Mg 1                      (L)[]           0.3011
  Mg 1O  1                  (C)[]           0.3917
  Mg 2Si 1                  (C)             0.1564
  Si 3Ti 5                  (C)[]           0.0055
*
     66 wt% Mg
 Volume of gas products   (litres)          6.0028
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1338.8337
 Gas products amount        (mol)           0.0529
 Products heat capacity     (J/K)          39.3551
 Products entropy           (J/K)          92.3040
 Products enthalpy          (KJ)         -145.6941
 Mass  of the system        (Kg)            0.0313
1 Mg 1                      (G)             0.0321        0.7820  (atm)
1 Na 1                      (G)             0.0085        0.2179  (atm)
  Al 2Ca 1                  (C)[]           0.0533
  Ca 1Si 1                  (C)  []         0.0047
```

```
  Fe 1Si 1                  (C)[]           0.0465
  Mg 1                      (L)[]           0.3012
  Mg 1O  1                  (C)[]           0.3917
  Mg 2Si 1                  (C)             0.1564
  Si 3Ti 5                  (C)[]           0.0055
*
     67 wt% Mg
 Volume of gas products   (litres)          3.3816
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1317.1206
 Gas products amount        (mol)           0.0303
 Products heat capacity     (J/K)          39.1966
 Products entropy           (J/K)          89.3988
 Products enthalpy          (KJ)         -135.4799
 Mass  of the system        (Kg)            0.0308
1 Mg 1                      (G)             0.0155        0.6469  (atm)
1 Na 1                      (G)             0.0080        0.3530  (atm)
  Al 2Ca 1                  (C)[]           0.0503
  Ca 1Si 1                  (C)  []         0.0045
  Fe 1Si 1                  (C)[]           0.0438
  Mg 1                      (L)[]           0.3560
  Mg 1O  1                  (C)[]           0.3693
  Mg 2Si 1                  (C)             0.1475
  Si 3Ti 5                  (C)[]           0.0052
*
     68 wt% Mg
 Volume of gas products   (litres)          2.6493
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1303.2740
 Gas products amount        (mol)           0.0240
 Products heat capacity     (J/K)          39.0508
 Products entropy           (J/K)          88.3316
 Products enthalpy          (KJ)         -130.0143
 Mass  of the system        (Kg)            0.0305
1 Mg 1                      (G)             0.0109        0.5710  (atm)
1 Na 1                      (G)             0.0077        0.4289  (atm)
  Al 2Ca 1                  (C)[]           0.0487
  Ca 1Si 1                  (C)  []         0.0043
  Fe 1Si 1                  (C)[]           0.0425
  Mg 1                      (L)[]           0.3796
  Mg 1O  1                  (C)[]           0.3582
  Mg 2Si 1                  (C)             0.1430
  Si 3Ti 5                  (C)[]           0.0050
*
     69 wt% Mg
 Volume of gas products   (litres)          1.8288
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)           0.0170
 Products heat capacity     (J/K)          38.8778
 Products entropy           (J/K)          86.5947
 Products enthalpy          (KJ)         -125.4956
 Mass  of the system        (Kg)            0.0303
1 Mg 1                      (G)             0.0057        0.4182  (atm)
1 Na 1                      (G)             0.0075        0.5817  (atm)
  Al 2Ca 1                  (C)[]           0.0472
  Ca 1Si 1                  (C)  []         0.0042
  Fe 1Si 1                  (C)[]           0.0412
  Mg 1                      (L)[]           0.4038
  Mg 1O  1                  (C)[]           0.3470
  Mg 2Si 1                  (C)             0.1385
  Si 3Ti 5                  (C)[]           0.0049
*
     70 wt% Mg
 Volume of gas products   (litres)          1.7556
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)           0.0163
 Products heat capacity     (J/K)          38.6954
 Products entropy           (J/K)          86.5001
 Products enthalpy          (KJ)         -118.9722
```

```
 Mass  of the system        (Kg)            0.0300
1 Mg 1                      (G)             0.0055        0.4181  (atm)
1 Na 1                      (G)             0.0073        0.5819  (atm)
  Al 2Ca 1                  (C)[]           0.0457
  Ca 1Si 1                  (C)  []         0.0041
  Fe 1Si 1                  (C)[]           0.0399
  Mg 1                      (L)[]           0.4231
  Mg 1O  1                  (C)[]           0.3358
  Mg 2Si 1                  (C)             0.1341
  Si 3Ti 5                  (C)[]           0.0047
*
     71 wt% Mg
 Volume of gas products   (litres)          1.3195
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)           0.0127
 Products heat capacity     (J/K)          38.4748
 Products entropy           (J/K)          84.8667
 Products enthalpy          (KJ)         -114.4732
 Mass  of the system        (Kg)            0.0298
1 Mg 1                      (G)             0.0029        0.2807  (atm)
1 Na 1                      (G)             0.0070        0.7193  (atm)
  Al 2Ca 1                  (C)[]           0.0442
  Ca 1Si 1                  (C)  []         0.0039
  Fe 1Si 1                  (C)[]           0.0385
  Mg 1                      (L)[]           0.4447
  Mg 1O  1                  (C)[]           0.3246
  Mg 2Si 1                  (C)             0.1296
  Si 3Ti 5                  (C)[]           0.0046
*
     72 wt% Mg
 Volume of gas products   (litres)          1.0431
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)           0.0104
 Products heat capacity     (J/K)          38.2184
 Products entropy           (J/K)          83.0235
 Products enthalpy          (KJ)         -110.2605
 Mass  of the system        (Kg)            0.0296
1 Mg 1                      (G)             0.0014        0.1637  (atm)
1 Na 1                      (G)             0.0068        0.8362  (atm)
  Al 2Ca 1                  (C)[]           0.0426
  Ca 1Si 1                  (C)  []         0.0038
  Fe 1Si 1                  (C)[]           0.0372
  Mg 1                      (L)[]           0.4653
  Mg 1O  1                  (C)[]           0.3134
  Mg 2Si 1                  (C)             0.1251
  Si 3Ti 5                  (C)[]           0.0044
*
     73 wt% Mg
 Volume of gas products   (litres)      4.10E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1152.8797
 Gas products amount        (mol)       4.20E-0008
 Products heat capacity     (J/K)          38.0845
 Products entropy           (J/K)          81.1962
 Products enthalpy          (KJ)         -106.0529
 Mass  of the system        (Kg)            0.0294
  Al 2Ca 1                  (C)[]           0.0411
  Ca 1Si 1                  (C)  []         0.0036
  Fe 1Si 1                  (C)[]           0.0359
  Mg 1                      (L)[]           0.4857
  Mg 1O  1                  (C)[]           0.3022
  Mg 2Si 1                  (C)             0.1207
  Na 1                      (L)[]           0.0065
  Si 3Ti 5                  (C)[]           0.0042
*
     74 wt% Mg
 Volume of gas products   (litres)      1.05E-0007
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1119.1238
```

```
 Gas products amount        (mol)       1.11E-0009
 Products heat capacity     (J/K)          37.8447
 Products entropy           (J/K)          80.0574
 Products enthalpy          (KJ)         -101.1070
 Mass  of the system        (Kg)            0.0291
  Al 2Ca 1                  (C)[]           0.0396
  Ca 1Si 1                  (C)  []         0.0035
  Fe 1Si 1                  (C)[]           0.0345
  Mg 1                      (L)[]           0.5048
  Mg 1O  1                  (C)[]           0.2910
  Mg 2Si 1                  (C)             0.1162
  Na 1                      (L)[]           0.0063
  Si 3Ti 5                  (C)[]           0.0041
*
```

75 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1085.1617
 Gas products amount        (mol)       4.32E-0010
 Products heat capacity     (J/K)          37.6113
 Products entropy           (J/K)          78.8894
 Products enthalpy          (KJ)          -96.2514
 Mass  of the system        (Kg)            0.0289
  Al 2Ca 1                  (C)[]           0.0381
  Ca 1Si 1                  (C)  []         0.0034
  Fe 1Si 1                  (C)[]           0.0332
  Mg 1                      (L)[]           0.5238
  Mg 1O  1                  (C)[]           0.2798
  Mg 2Si 1                  (C)             0.1117
  Na 1                      (L)[]           0.0060
  Si 3Ti 5                  (C)[]           0.0039
*
```

76 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1042.0000
 Gas products amount        (mol)       3.21E-0011
 Products heat capacity     (J/K)          37.3657
 Products entropy           (J/K)          77.3685
 Products enthalpy          (KJ)          -91.8201
 Mass  of the system        (Kg)            0.0287
  Al 2Ca 1                  (C)[]           0.0366
  Ca 1Si 1                  (C)  []         0.0032
  Fe 1Si 1                  (C)[]           0.0319
  Mg 1                      (L)[]           0.5429
  Mg 1O  1                  (C)[]           0.2686
  Mg 2Si 1                  (C)             0.1072
  Na 1                      (L)[]           0.0058
  Si 3Ti 5                  (C)[]           0.0038
*
```

77 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1023.0000
 Gas products amount        (mol)       9.11E-0015
 Products heat capacity     (J/K)          37.1775
 Products entropy           (J/K)          76.6874
 Products enthalpy          (KJ)          -86.5638
 Mass  of the system        (Kg)            0.0285
  Al 2Ca 1                  (C)[]           0.0350
  Ca 1Si 1                  (C)  []         0.0031
  Fe 1Si 1                  (C)[]           0.0306
  Mg 1                      (L)[]           0.5619
  Mg 1O  1                  (C)[]           0.2574
  Mg 2Si 1                  (C)             0.1028
  Na 1                      (L)[]           0.0056
  Si 3Ti 5                  (C)[]           0.0036
*
```

78 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

Temperature	(K)	980.0000
Gas products amount	(mol)	4.44E-0010
Products heat capacity	(J/K)	36.9467
Products entropy	(J/K)	75.1051
Products enthalpy	(KJ)	-82.2780
Mass of the system	(Kg)	0.0283
Al 2Ca 1	(C)[]	0.0335
Ca 1Si 1	(C) []	0.0030
Fe 1Si 1	(C)[]	0.0292
Mg 1	(L)[]	0.5810
Mg 1O 1	(C)[]	0.2462
Mg 2Si 1	(C)	0.0983
Na 1	(L)[]	0.0053
Si 3Ti 5	(C)[]	0.0035

*

79 wt% Mg

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	955.0000
Gas products amount	(mol)	2.95E-0011
Products heat capacity	(J/K)	36.7592
Products entropy	(J/K)	74.1666
Products enthalpy	(KJ)	-77.3989
Mass of the system	(Kg)	0.0281
Al 2Ca 1	(C)[]	0.0320
Ca 1Si 1	(C) []	0.0028
Fe 1Si 1	(C)[]	0.0279
Mg 1	(L)[]	0.6000
Mg 1O 1	(C)[]	0.2350
Mg 2Si 1	(C)	0.0938
Na 1	(L)[]	0.0051
Si 3Ti 5	(C)[]	0.0033

*

80 wt% Mg

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	922.9169	922.8124	923.0213
Gas products amount	(mol)	9.26E-0015	1.41E-0014	8.00E-0015
Products heat capacity	(J/K)	36.2520	35.0479	36.5646
Products entropy	(J/K)	71.7315	67.0944	72.9357
Products enthalpy	(KJ)	-73.9662	-78.2463	-72.8548
Phase transition enthalpy	(KJ)	5.3915		
Mass of the system	(Kg)	0.0279		
Al 2Ca 1	(C)[]	0.0305	0.0305	0.0305
Ca 1Si 1	(C) []	0.0027	0.0027	0.0027
Fe 1Si 1	(C)[]	0.0266	0.0266	0.0266
Mg 1	(C)[]	0.1140	0.5528	0.0000
Mg 1	(L)[]	0.5051	0.0663	0.6191
Mg 1O 1	(C)[]	0.2238	0.2238	0.2238
Mg 2Si 1	(C)	0.0894	0.0894	0.0894
Na 1	(L)[]	0.0048	0.0048	0.0048
Si 3Ti 5	(C)[]	0.0031	0.0031	0.0031

*

81 wt% Mg

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	922.9292	922.8391	923.0194
Gas products amount	(mol)	4.19E-0011	7.35E-0011	1.48E-0011
Products heat capacity	(J/K)	35.7204	34.8844	36.4357
Products entropy	(J/K)	70.2004	66.9810	72.9550
Products enthalpy	(KJ)	-69.7569	-72.7285	-67.2144
Phase transition enthalpy	(KJ)	5.5140		
Mass of the system	(Kg)	0.0276		
Al 2Ca 1	(C)[]	0.0289	0.0289	0.0289
Ca 1Si 1	(C) []	0.0026	0.0026	0.0026
Fe 1Si 1	(C)[]	0.0252	0.0252	0.0252
Mg 1	(C)[]	0.2626	0.5696	0.0000
Mg 1	(L)[]	0.3755	0.0685	0.6381
Mg 1O 1	(C)[]	0.2127	0.2127	0.2127
Mg 2Si 1	(C)	0.0849	0.0849	0.0849
Na 1	(L)[]	0.0046	0.0046	0.0046

```
  Si 3Ti 5                  (C)[]           0.0030        0.0030        0.0030
*
     82 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           922.9403      922.8632      923.0174
 Gas products amount        (mol)       3.26E-0011    1.06E-0014    1.07E-0010
 Products heat capacity     (J/K)          35.1970       34.7090       36.3087
 Products entropy           (J/K)          68.6929       66.8137       72.9743
 Products enthalpy          (KJ)          -65.6110      -67.3455      -61.6593
 Phase transition enthalpy  (KJ)           5.6862
 Mass  of the system        (Kg)           0.0275
  Al 2Ca 1                  (C)[]           0.0274        0.0274        0.0274
  Ca 1Si 1                  (C)  []         0.0024        0.0024        0.0024
  Fe 1Si 1                  (C)[]           0.0239        0.0239        0.0239
  Mg 1                      (C)[]           0.4112        0.5917        0.0000
  Mg 1                      (L)[]           0.2459        0.0654        0.6572
  Mg 1O  1                  (C)[]           0.2015        0.2015        0.2015
  Mg 2Si 1                  (C)             0.0804        0.0804        0.0804
  Na 1                      (L)[]           0.0044        0.0044        0.0044
  Si 3Ti 5                  (C)[]           0.0028        0.0028        0.0028
*
     83 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           922.9565      922.8848      923.0282
 Gas products amount        (mol)       1.11E-0011    2.04E-0012    5.49E-0011
 Products heat capacity     (J/K)          34.6809       34.3690       36.1837
 Products entropy           (J/K)          67.2069       66.0055       72.9938
 Products enthalpy          (KJ)          -61.5236      -62.6325      -56.1822
 Phase transition enthalpy  (KJ)           6.4502
 Mass  of the system        (Kg)           0.0273
  Al 2Ca 1                  (C)[]           0.0259        0.0259        0.0259
  Ca 1Si 1                  (C)  []         0.0023        0.0023        0.0023
  Fe 1Si 1                  (C)[]           0.0226        0.0226        0.0226
  Mg 1                      (C)[]           0.5599        0.6762        0.0000
  Mg 1                      (L)[]           0.1163    1.73E-0006        0.6762
  Mg 1O  1                  (C)[]           0.1903        0.1903        0.1903
  Mg 2Si 1                  (C)             0.0760        0.0760        0.0760
  Na 1                      (L)[]           0.0041        0.0041        0.0041
  Si 3Ti 5                  (C)[]           0.0027        0.0027        0.0027
*
     84 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           903.0000
 Gas products amount        (mol)       1.41E-0010
 Products heat capacity     (J/K)          34.0042
 Products entropy           (J/K)          65.1356
 Products enthalpy          (KJ)          -58.0458
 Mass  of the system        (Kg)           0.0271
  Al 2Ca 1                  (C)[]           0.0244
  Ca 1Si 1                  (C)  []         0.0022
  Fe 1Si 1                  (C)[]           0.0213
  Mg 1                      (C)[]           0.6952
  Mg 1O  1                  (C)[]           0.1791
  Mg 2Si 1                  (C)             0.0715
  Na 1                      (L)[]           0.0039
  Si 3Ti 5                  (C)[]           0.0025
*
     85 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           870.0000
 Gas products amount        (mol)       1.56E-0010
 Products heat capacity     (J/K)          33.5028
 Products entropy           (J/K)          63.7600
 Products enthalpy          (KJ)          -53.9608
 Mass  of the system        (Kg)           0.0269
  Al 2Ca 1                  (C)[]           0.0228
  Ca 1Si 1                  (C)  []         0.0020
```

```
  Fe 1Si 1                  (C)[]           0.0199
  Mg 1                      (C)[]           0.7143
  Mg 1O  1                  (C)[]           0.1679
  Mg 2Si 1                  (C)             0.0670
  Na 1                      (L)[]           0.0036
  Si 3Ti 5                  (C)[]           0.0024
*
     86 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           870.0000
 Gas products amount        (mol)       3.65E-0012
 Products heat capacity     (J/K)          33.3426
 Products entropy           (J/K)          63.6461
 Products enthalpy          (KJ)          -48.8360
 Mass  of the system        (Kg)            0.0267
  Al 2Ca 1                  (C)[]           0.0213
  Ca 1Si 1                  (C)  []         0.0019
  Fe 1Si 1                  (C)[]           0.0186
  Mg 1                      (C)[]           0.7333
  Mg 1O  1                  (C)[]           0.1567
  Mg 2Si 1                  (C)             0.0626
  Na 1                      (L)[]           0.0034
  Si 3Ti 5                  (C)[]           0.0022
*
     87 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       1.48E-0012
 Products heat capacity     (J/K)          32.4492
 Products entropy           (J/K)          60.7812
 Products enthalpy          (KJ)          -46.0773
 Mass  of the system        (Kg)            0.0265
  Al 2Ca 1                  (C)[]           0.0198
  Ca 1Si 1                  (C)  []         0.0018
  Fe 1Si 1                  (C)[]           0.0173
  Mg 1                      (C)[]           0.7524
  Mg 1O  1                  (C)[]           0.1455
  Mg 2Si 1                  (C)             0.0581
  Na 1                      (L)[]           0.0031
  Si 3Ti 5                  (C)[]           0.0020
*
     88 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       2.72E-0013
 Products heat capacity     (J/K)          32.2892
 Products entropy           (J/K)          60.6835
 Products enthalpy          (KJ)          -41.0810
 Mass  of the system        (Kg)            0.0263
  Al 2Ca 1                  (C)[]           0.0183
  Ca 1Si 1                  (C)  []         0.0016
  Fe 1Si 1                  (C)[]           0.0159
  Mg 1                      (C)[]           0.7714
  Mg 1O  1                  (C)[]           0.1343
  Mg 2Si 1                  (C)             0.0536
  Na 1                      (L)[]           0.0029
  Si 3Ti 5                  (C)[]           0.0019
*
     89 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       5.08E-0013
 Products heat capacity     (J/K)          31.4908
 Products entropy           (J/K)          58.1074
 Products enthalpy          (KJ)          -38.0613
 Mass  of the system        (Kg)            0.0261
  Al 2Ca 1                  (C)[]           0.0168
```

```
  Ca 1Si 1                  (C)  []         0.0015
  Fe 1Si 1                  (C)[]           0.0146
  Mg 1                      (C)[]           0.7905
  Mg 1O  1                  (C)[]           0.1231
  Mg 2Si 1                  (C)             0.0492
  Na 1                      (L)[]           0.0027
  Si 3Ti 5                  (C)[]           0.0017
*
     90 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           716.0000
 Gas products amount        (mol)       4.95E-0012
 Products heat capacity     (J/K)          31.0738
 Products entropy           (J/K)          56.9959
 Products enthalpy          (KJ)          -33.9394
 Mass  of the system        (Kg)            0.0260
  Al 2Ca 1                  (C)[]           0.0152
  Ca 1Si 1                  (C)  []         0.0014
  Fe 1Si 1                  (C)[]           0.0133
  Mg 1                      (C)[]           0.8095
  Mg 1O  1                  (C)[]           0.1119
  Mg 2Si 1                  (C)             0.0447
  Na 1                      (L)[]           0.0024
  Si 3Ti 5                  (C)[]           0.0016
*
     91 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       2.76E-0011
 Products heat capacity     (J/K)          30.3627
 Products entropy           (J/K)          54.6555
 Products enthalpy          (KJ)          -30.6935
 Mass  of the system        (Kg)            0.0258
  Al 2Ca 1                  (C)[]           0.0137
  Ca 1Si 1                  (C)  []         0.0012
  Fe 1Si 1                  (C)[]           0.0120
  Mg 1                      (C)[]           0.8286
  Mg 1O  1                  (C)[]           0.1007
  Mg 2Si 1                  (C)             0.0402
  Na 1                      (L)[]           0.0022
  Si 3Ti 5                  (C)[]           0.0014
*
     92 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           619.4111
 Gas products amount        (mol)       2.05E-0014
 Products heat capacity     (J/K)          29.7057
 Products entropy           (J/K)          52.4642
 Products enthalpy          (KJ)          -27.3068
 Mass  of the system        (Kg)            0.0256
  Al 2Ca 1                  (C)[]           0.0122
  Ca 1Si 1                  (C)  []         0.0011
  Fe 1Si 1                  (C)[]           0.0106
  Mg 1                      (C)[]           0.8476
  Mg 1O  1                  (C)[]           0.0895
  Mg 2Si 1                  (C)             0.0357
  Na 1                      (L)[]           0.0019
  Si 3Ti 5                  (C)[]           0.0013
*
     93 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       6.49E-0011
 Products heat capacity     (J/K)          28.8872
 Products entropy           (J/K)          49.4549
 Products enthalpy          (KJ)          -24.3530
 Mass  of the system        (Kg)            0.0254
```

```
 Al 2Ca 1                  (C)[]           0.0107
 Ca 1Si 1                  (C)  []     9.46E-0004
 Fe 1Si 1                  (C)[]           0.0065
 Fe 2Ti 1                  (C)  []         0.0027
 Mg 1                      (C)[]           0.8645
 Mg 1O  1                  (C)[]           0.0783
 Mg 2Si 1                  (C)             0.0347
 Na 1                      (L)[]           0.0017
*
    94 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           560.0000
Gas products amount        (mol)       8.00E-0015
Products heat capacity     (J/K)          28.7351
Products entropy           (J/K)          49.4205
Products enthalpy          (KJ)          -19.7097
Mass  of the system        (Kg)            0.0253
 Al 2Ca 1                  (C)[]           0.0091
 Ca 1Si 1                  (C)  []     8.09E-0004
 Fe 1Si 1                  (C)[]           0.0055
 Fe 2Ti 1                  (C)  []         0.0023
 Mg 1                      (C)[]           0.8839
 Mg 1O  1                  (C)[]           0.0672
 Mg 2Si 1                  (C)             0.0297
 Na 1                      (L)[]           0.0015
*
    95 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           500.0100
Gas products amount        (mol)       8.00E-0015
Products heat capacity     (J/K)          27.9088
Products entropy           (J/K)          46.1868
Products enthalpy          (KJ)          -16.8214
Mass  of the system        (Kg)            0.0251
 Al 2Ca 1                  (C)[]           0.0076
 Ca 1Si 1                  (C)  []     6.76E-0004
 Fe 1Si 1                  (C)[]           0.0046
 Fe 2Ti 1                  (C)  []         0.0019
 Mg 1                      (C)[]           0.9032
 Mg 1O  1                  (C)[]           0.0560
 Mg 2Si 1                  (C)             0.0248
 Na 1                      (L)[]           0.0012
*
    96 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           467.0000
Gas products amount        (mol)       1.90E-0013
Products heat capacity     (J/K)          27.3860
Products entropy           (J/K)          44.2868
Products enthalpy          (KJ)          -13.2002
Mass  of the system        (Kg)            0.0249
 Al 2Ca 1                  (C)[]           0.0061
 Ca 1Si 1                  (C)  []     5.38E-0004
 Fe 1Si 1                  (C)[]           0.0037
 Fe 2Ti 1                  (C)  []         0.0015
 Mg 1                      (C)[]           0.9226
 Mg 1O  1                  (C)[]           0.0448
 Mg 2Si 1                  (C)             0.0198
 Na 1                      (L)[]       9.68E-0004
*
    97 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           388.0000
Gas products amount        (mol)       8.00E-0015
Products heat capacity     (J/K)          26.3222
Products entropy           (J/K)          39.3182
Products enthalpy          (KJ)          -10.8361
```

```
 Mass  of the system        (Kg)            0.0248
  Al 2Ca 1                  (C)[]           0.0046
  Ca 1Si 1                  (C)  []     4.04E-0004
  Fe 1Si 1                  (C)[]           0.0028
  Fe 2Ti 1                  (C)  []         0.0012
  Mg 1                      (C)[]           0.9419
  Mg 1O  1                  (C)[]           0.0336
  Mg 2Si 1                  (C)             0.0149
  Na 1                      (L)[]       7.26E-0004
*
```

98 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          26.1949
 Products entropy           (J/K)          39.3363
 Products enthalpy          (KJ)           -6.4052
 Mass  of the system        (Kg)            0.0246
  Al 2Ca 1                  (C)[]           0.0030
  Ca 1Si 1                  (C)  []     2.71E-0004
  Fe 1Si 1                  (C)[]           0.0018
  Fe 2Ti 1                  (C)  []     7.71E-0004
  Mg 1                      (C)[]           0.9613
  Mg 1O  1                  (C)[]           0.0224
  Mg 2Si 1                  (C)             0.0099
  Na 1                      (L)[]       4.84E-0004
*
```

99 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           379.0141
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          25.9653
 Products entropy           (J/K)          38.7447
 Products enthalpy          (KJ)           -2.2680
 Mass  of the system        (Kg)            0.0245
  Al 2Ca 1                  (C)[]           0.0015
  Ca 1Si 1                  (C)  []     1.37E-0004
  Fe 1Si 1                  (C)[]       9.26E-0004
  Fe 2Ti 1                  (C)  []     3.85E-0004
  Mg 1                      (C)[]           0.9806
  Mg 1O  1                  (C)[]           0.0112
  Mg 2Si 1                  (C)             0.0049
  Na 1                      (L)[]       2.42E-0004
*
```

100 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       8.00E-0015
 Products heat capacity     (J/K)          25.3585
 Products entropy           (J/K)          35.7450
 Products enthalpy          (KJ)            0.9638
 Mass  of the system        (Kg)            0.0243
  Mg 1                      (C)[]           1.0000
*
```

Al/(JSC-Mars-1A)

```
     Content of Aluminum - 0 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           695.4691
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          78.7796
 Products entropy           (J/K)         106.0605
 Products enthalpy          (KJ)         -962.7387
 Mass  of the system        (Kg)            0.0732
  Al 3Ca 1Na 1O 16Si 5      (C)  [LABRA     0.0176
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1938
  Al 2O  5Si 1              (C)  [KIANI     0.2159
  Al 2O  5Ti 1              (C)  []         0.0842
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2316
  Fe 2O  3                  (C)[]           0.1643
  O  2Si 1                  (C)[]           0.0927
*
     1 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.5000
 Gas products amount        (mol)       1.58E-0011
 Products heat capacity     (J/K)          82.2207
 Products entropy           (J/K)         121.6123
 Products enthalpy          (KJ)         -937.2088
 Mass  of the system        (Kg)            0.0720
  Al 3Ca 1Na 1O 16Si 5      (C)  [LABRA     0.0174
  Al 2Fe 1O  4              (C)  []         0.1129
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1918
  Al 2O  5Si 1              (C)  [KIANI     0.1385
  Al 2O  5Ti 1              (C)  []         0.0834
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2293
  Fe 3O  4                  (C)[]           0.1071
  O  2Si 1                  (C)[]           0.0937
  O  2Si 1                  (C)  [QUART     0.0259
*
     2 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1000.5286
 Gas products amount        (mol)       3.78E-0014
 Products heat capacity     (J/K)          79.6316
 Products entropy           (J/K)         132.5982
 Products enthalpy          (KJ)         -912.4569
 Mass  of the system        (Kg)            0.0708
  Al 2Fe 1O  4              (C)  []         0.3087
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1982
  Al 2O  5Ti 1              (C)  []         0.0701
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2270
  Ca 1O  3Si 1              (C)[WOLLAST     0.0037
  Fe 1                      (C)[]           0.0058
  Fe 2O  4Ti 1              (C)  [ULVIT     0.0153
  O  2Si 1                  (C)  [QUART     0.1712
*
     3 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1122.0941
 Gas products amount        (mol)       5.54E-0014
 Products heat capacity     (J/K)          80.0044
 Products entropy           (J/K)         139.5418
 Products enthalpy          (KJ)         -888.1435
 Mass  of the system        (Kg)            0.0696
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1540
  Al 2Fe 1O  4              (C)  []         0.2304
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1962
  Al 2O  5Ti 1              (C)  []         0.0817
```

```
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1116
  Fe 1                      (C)[]           0.0374
  Mg 1O  3Si 1              (C)             0.0524
  O  2Si 1                  (C)  [CRIST     0.1361
*
```

4 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1236.7251
 Gas products amount        (mol)       5.17E-0011
 Products heat capacity     (J/K)          79.3388
 Products entropy           (J/K)         144.7986
 Products enthalpy          (KJ)         -864.9225
 Mass  of the system        (Kg)            0.0685
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2944
  Al 2Fe 1O  4              (C)  []         0.1285
  Al 2Mg 1O  4              (C)  []         0.0361
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1942
  Al 2O  5Ti 1              (C)  []         0.0808
  Fe 1                      (C)[]           0.0690
  Mg 1O  3Si 1              (C)             0.0776
  O  2Si 1                  (C)  [CRIST     0.1194
*
```

5 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1349.7054
 Gas products amount        (mol)       5.84E-0011
 Products heat capacity     (J/K)          79.7261
 Products entropy           (J/K)         149.1576
 Products enthalpy          (KJ)         -842.4509
 Mass  of the system        (Kg)            0.0674
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2913
  Al 2Fe 1O  4              (C)  []         0.0265
  Al 2Mg 1O  4              (C)  []         0.1446
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1922
  Al 2O  5Si 1              (C)  [KIANI     0.0012
  Al 2O  5Ti 1              (C)  []         0.0800
  Fe 1                      (C)[]           0.1007
  O  2Si 1                  (C)  [CRIST     0.1636
*
```

6 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1428.8624
 Gas products amount        (mol)       2.14E-0011
 Products heat capacity     (J/K)          79.6006
 Products entropy           (J/K)         150.8251
 Products enthalpy          (KJ)         -820.6084
 Mass  of the system        (Kg)            0.0664
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2882
  Al 2Mg 1O  4              (C)  []         0.1431
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1902
  Al 2O  5Si 1              (C)  [KIANI     0.0572
  Al 2O  5Ti 1              (C)  []         0.0792
  Fe 1                      (C)[]           0.0959
  Fe 1Si 1                  (C)[]           0.0182
  O  2Si 1                  (C)  [CRIST     0.1281
*
```

7 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1493.0000
 Gas products amount        (mol)       1.75E-0011
 Products heat capacity     (J/K)          79.3262
 Products entropy           (J/K)         151.6232
 Products enthalpy          (KJ)         -799.3720
 Mass  of the system        (Kg)            0.0654
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2852
  Al 2Mg 1O  4              (C)  []         0.1415
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1881
```

```
 Al 2O  5Si 1              (C)  [KIANI     0.0885
 Al 2O  5Ti 1              (C)  []         0.0783
 Fe 1                      (C)[]           0.0783
 Fe 1Si 1                  (C)[]           0.0429
 O  2Si 1                  (C)  [CRIST     0.0971
*
```

8 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1553.0242
Gas products amount        (mol)       1.35E-0010
Products heat capacity     (J/K)          78.8530
Products entropy           (J/K)         152.0409
Products enthalpy          (KJ)         -778.9239
Mass  of the system        (Kg)            0.0644
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2821
 Al 2Mg 1O  4              (C)  []         0.1400
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1861
 Al 2O  5Si 1              (C)  [ANDAL     0.1199
 Al 2O  5Ti 1              (C)  []         0.0775
 Fe 1                      (C)[]           0.0608
 Fe 1Si 1                  (C)[]           0.0675
 O  2Si 1                  (C)  [CRIST     0.0661
*
```

9 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1611.2911
Gas products amount        (mol)       4.41E-0011
Products heat capacity     (J/K)          78.2415
Products entropy           (J/K)         152.5276
Products enthalpy          (KJ)         -758.8673
Mass  of the system        (Kg)            0.0634
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2790
 Al 2Mg 1O  4              (C)  []         0.1385
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1841
 Al 2O  3                  (C)[]           0.0951
 Al 2O  5Ti 1              (C)  []         0.0766
 Fe 1                      (C)[]           0.0433
 Fe 1Si 1                  (C)[]           0.0921
 O  2Si 1                  (C)  [CRIST     0.0912
*
```

10 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1665.0000
Gas products amount        (mol)       6.14E-0011
Products heat capacity     (J/K)          77.8263
Products entropy           (J/K)         152.5487
Products enthalpy          (KJ)         -740.0018
Mass  of the system        (Kg)            0.0625
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2760
 Al 2Mg 1O  4              (C)  []         0.1370
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1821
 Al 2O  3                  (C)[]           0.1149
 Al 2O  5Ti 1              (C)  []         0.0758
 Fe 1                      (C)[]           0.0257
 Fe 1Si 1                  (C)[]           0.1167
 O  2Si 1                  (C)  [CRIST     0.0719
*
```

11 wt% Al

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1692.8386     1692.5524     1693.1248
Gas products amount        (mol)       1.85E-0010    1.91E-0010    1.80E-0010
Products heat capacity     (J/K)          77.4076       77.4200       77.3958
Products entropy           (J/K)         152.1409      149.9762      154.2072
Products enthalpy          (KJ)         -720.9080     -724.5726     -717.4101
Phase transition enthalpy  (KJ)            7.1625
Mass  of the system        (Kg)            0.0616
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2729        0.2729        0.2729
```

```
 Al 2Mg 1O  4              (C)  []         0.1354        0.1354        0.1354
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.1800        0.1800        0.1800
 Al 2O  3                  (C)[]           0.1346        0.1346        0.1346
 Al 2O  5Ti 1              (C)  []         0.0749        0.0749        0.0749
 Fe 1                      (C)[]           0.0082        0.0082        0.0082
 Fe 1Si 1                  (L)[]           0.0723        0.0000        0.1414
 Fe 1Si 1                  (C)[]           0.0690        0.1414        0.0000
 O  2Si 1                  (C)  [CRIST     0.0525        0.0525        0.0525
*
```

12 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1693.1248
Gas products amount        (mol)       4.70E-0010
Products heat capacity     (J/K)          76.3711
Products entropy           (J/K)         151.9906
Products enthalpy          (KJ)         -702.4620
Mass  of the system        (Kg)            0.0607
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2698
 Al 2Mg 1O  4              (C)  []         0.1339
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.1780
 Al 2O  3                  (C)[]           0.1649
 Al 2O  5Ti 1              (C)  []         0.0551
 Fe 1Si 1                  (L)[]           0.1520
 O  2Si 1                  (C)  [CRIST     0.0394
 Si 3Ti 5                  (C)[]           0.0068
*
```

13 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1710.0000
Gas products amount        (mol)       1.80E-0009
Products heat capacity     (J/K)          74.4499
Products entropy           (J/K)         150.5586
Products enthalpy          (KJ)         -685.3804
Mass  of the system        (Kg)            0.0599
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2668
 Al 2Mg 1O  4              (C)  []         0.1324
 Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0953
 Al 2O  3                  (C)[]           0.2047
 Al 2O  5Ti 1              (C)  []         0.0186
 Fe 1Si 1                  (L)[]           0.1502
 O  2Si 1                  (C)  [CRIST     0.1125
 Si 3Ti 5                  (C)[]           0.0195
*
```

14 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1750.4331
Gas products amount        (mol)       5.26E-0010
Products heat capacity     (J/K)          73.7400
Products entropy           (J/K)         150.0848
Products enthalpy          (KJ)         -667.7233
Mass  of the system        (Kg)            0.0591
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2637
 Al 2Mg 1O  4              (C)  []         0.1309
 Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0942
 Al 2O  3                  (C)[]           0.2343
 Fe 1Si 1                  (L)[]           0.1485
 O  2Si 1                  (C)  [CRIST     0.0981
 Si 1                      (L)[]           0.0044
 Si 3Ti 5                  (C)[]           0.0258
*
```

15 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1778.5436
Gas products amount        (mol)       3.47E-0010
Products heat capacity     (J/K)          72.9228
Products entropy           (J/K)         149.4192
Products enthalpy          (KJ)         -650.8463
```

```
 Mass  of the system        (Kg)            0.0583
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2606
  Al 2Mg 1O  4              (C)  []         0.1294
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0931
  Al 2O  3                  (C)[]           0.2536
  Fe 1Si 1                  (L)[]           0.1468
  O  2Si 1                  (C)  [CRIST     0.0775
  Si 1                      (L)[]           0.0135
  Si 3Ti 5                  (C)[]           0.0255
*
     16 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1780.9761     1780.5735     1781.3788
 Gas products amount        (mol)       1.38E-0009    2.34E-0010    1.81E-0009
 Products heat capacity     (J/K)          71.8406       71.9443       71.8021
 Products entropy           (J/K)         148.6352      147.7086      148.9794
 Products enthalpy          (KJ)         -634.6464     -636.2964     -634.0337
 Phase transition enthalpy  (KJ)            2.2627
 Mass  of the system        (Kg)            0.0575
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2576        0.2576        0.2576
  Al 2Mg 1O  4              (C)  []         0.1278        0.1278        0.1278
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0921        0.0921        0.0921
  Al 2O  3                  (C)[]           0.2439        0.2728        0.2332
  Al 2O  5Ti 1              (C)  []         0.0516        0.0000        0.0707
  Fe 1Si 1                  (L)[]           0.1451        0.1451        0.1451
  O  2Si 1                  (C)  [CRIST     0.0399        0.0570        0.0336
  Si 1                      (L)[]           0.0352        0.0225        0.0400
  Si 3Ti 5                  (C)[]           0.0068        0.0252        0.0000
*
     17 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1793.0741
 Gas products amount        (mol)       1.43E-0009
 Products heat capacity     (J/K)          70.9216
 Products entropy           (J/K)         147.6660
 Products enthalpy          (KJ)         -619.2434
 Mass  of the system        (Kg)            0.0567
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2545
  Al 2Mg 1O  4              (C)  []         0.1263
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0910
  Al 2O  3                  (C)[]           0.2529
  Al 2O  5Ti 1              (C)  []         0.0699
  Fe 1Si 1                  (L)[]           0.1433
  O  2Si 1                  (C)  [CRIST     0.0133
  Si 1                      (L)[]           0.0488
*
     18 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1804.9796
 Gas products amount        (mol)       4.89E-0010
 Products heat capacity     (J/K)          70.5428
 Products entropy           (J/K)         147.2053
 Products enthalpy          (KJ)         -603.1189
 Mass  of the system        (Kg)            0.0560
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2514
  Al 2Mg 1O  4              (C)  []         0.1248
  Al 2O  3                  (C)[]           0.3049
  Al 2O  5Ti 1              (C)  []         0.0691
  Fe 1Si 1                  (L)[]           0.1416
  Na 2O  3Si 1              (L)[]           0.0386
  O  2Si 1                  (C)  [CRIST     0.0120
  Si 1                      (L)[]           0.0576
*
     19 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1825.7175     1825.4157     1826.0193
 Gas products amount        (mol)       1.64E-0009    1.77E-0009    7.02E-0010
```

```
 Products heat capacity     (J/K)          69.8645       69.8111       70.2371
 Products entropy           (J/K)         146.4083      145.8409      150.3717
 Products enthalpy          (KJ)         -588.2425     -589.2786     -581.0054
 Phase transition enthalpy  (KJ)            8.2732
 Mass  of the system        (Kg)            0.0552
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2173        0.2484        0.0000
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.0311        0.0000        0.2484
  Al 2Mg 1O  4              (C)  []         0.1233        0.1233        0.1233
  Al 2O  3                  (C)[]           0.3386        0.3386        0.3386
  Al 2O  5Ti 1              (C)  []         0.0426        0.0426        0.0426
  Fe 1Si 1                  (L)[]           0.1399        0.1399        0.1399
  Na 2O  3Si 1              (L)[]           0.0381        0.0381        0.0381
  Si 1                      (L)[]           0.0601        0.0601        0.0601
  Si 3Ti 5                  (C)[]           0.0091        0.0091        0.0091
*
```

20 wt% Al

```
 Volume of gas products   (litres)      6.54E-0007        0.0000    1.19E-0006
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1825.7360     1825.4095     1826.0626
 Gas products amount        (mol)       5.60E-0009    3.04E-0009    7.71E-0009
 Products heat capacity     (J/K)          69.0761       68.8674       69.2482
 Products entropy           (J/K)         145.6381      143.4201      147.4677
 Products enthalpy          (KJ)         -573.5660     -577.6162     -570.2252
 Phase transition enthalpy  (KJ)            7.3910
 Mass  of the system        (Kg)            0.0545
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0102        0.0102        0.0102
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1015        0.2245        0.0000
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.1230        0.0000        0.2245
  Al 2Mg 1O  4              (C)  []         0.1217        0.1217        0.1217
  Al 2O  3                  (C)[]           0.3851        0.3851        0.3851
  Fe 1Si 1                  (L)[]           0.1382        0.1382        0.1382
  Na 2O  3Si 1              (L)[]           0.0377        0.0377        0.0377
  Si 1                      (L)[]           0.0586        0.0586        0.0586
  Si 3Ti 5                  (C)[]           0.0240        0.0240        0.0240
*
```

21 wt% Al

```
 Volume of gas products   (litres)      7.98E-0007
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1839.2567
 Gas products amount        (mol)       5.12E-0009
 Products heat capacity     (J/K)          67.9493
 Products entropy           (J/K)         144.9471
 Products enthalpy          (KJ)         -558.8632
 Mass  of the system        (Kg)            0.0538
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0419
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.1573
  Al 2Mg 1O  4              (C)  []         0.1202
  Al 2O  3                  (C)[]           0.4157
  Fe 1Si 1                  (L)[]           0.1364
  Na 2O  3Si 1              (L)[]           0.0372
  Si 1                      (L)[]           0.0676
  Si 3Ti 5                  (C)[]           0.0237
*
```

22 wt% Al

```
 Volume of gas products   (litres)      3.26E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1863.1887
 Gas products amount        (mol)       2.06E-0008
 Products heat capacity     (J/K)          66.6766
 Products entropy           (J/K)         143.9651
 Products enthalpy          (KJ)         -544.8898
 Mass  of the system        (Kg)            0.0532
  Al 4Ca 1O  7              (C)  []         0.1045
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.1273
  Al 2Mg 1O  4              (C)  []         0.1187
  Al 2O  3                  (C)[]           0.3780
  Fe 1Si 1                  (L)[]           0.1347
  Na 2O  3Si 1              (L)[]           0.0367
  Si 1                      (L)[]           0.0766
  Si 3Ti 5                  (C)[]           0.0234
*
```

```
    23 wt% Al
 Volume of gas products   (litres)          1.5686    2.23E-0004        5.0993
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1873.0535     1872.7195     1873.3874
 Gas products amount        (mol)           0.0099    1.40E-0006        0.0321
 Products heat capacity     (J/K)          65.4025       65.4077       65.3907
 Products entropy           (J/K)         142.8047      141.8644      144.9216
 Products enthalpy          (KJ)         -531.6958     -533.4569     -527.7311
 Phase transition enthalpy  (KJ)            5.7259
 Mass  of the system        (Kg)            0.0525
1 Mg 1                      (G)         1.88E-0005    2.69E-0009    6.11E-0005
1 Na 1                      (G)             0.0041    5.89E-0007        0.0135
1 Na 2                      (G)         5.42E-0005    7.71E-0009    1.76E-0004
1 O  1Si 1                  (G)         2.51E-0004    3.55E-0008    8.17E-0004
  Al 4Ca 1O  7              (C)  []         0.1320        0.1495        0.0926
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.0948        0.0761        0.1370
  Al 2Mg 1O  4              (C)  []         0.1171        0.1172        0.1168
  Al 2O  3                  (C)[]           0.3861        0.3792        0.4018
  Fe 1Si 1                  (L)[]           0.1330        0.1330        0.1330
  Na 2O  3Si 1              (L)[]           0.0251        0.0363        0.0000
  Si 1                      (L)[]           0.0843        0.0857        0.0812
  Si 3Ti 5                  (C)[]           0.0231        0.0231        0.0231
*
    24 wt% Al
 Volume of gas products   (litres)          4.0381    4.96E-0005        4.9699
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1872.6013     1872.2967     1872.9060
 Gas products amount        (mol)           0.0254    3.13E-0007        0.0313
 Products heat capacity     (J/K)          64.1070       64.1203       64.1039
 Products entropy           (J/K)         141.8880      139.4681      142.4464
 Products enthalpy          (KJ)         -518.4169     -522.9491     -517.3710
 Phase transition enthalpy  (KJ)            5.5781
 Mass  of the system        (Kg)            0.0519
1 Mg 1                      (G)         4.87E-0005    6.14E-0010    6.00E-0005
1 Na 1                      (G)             0.0108    1.32E-0007        0.0133
1 Na 2                      (G)         1.42E-0004    1.79E-0009    1.74E-0004
1 O  1Si 1                  (G)         6.52E-0004    8.21E-0009    8.02E-0004
  Al 4Ca 1O  7              (C)  []         0.1489        0.1945        0.1384
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.0737        0.0249        0.0850
  Al 2Mg 1O  4              (C)  []         0.1154        0.1157        0.1153
  Al 2O  3                  (C)[]           0.3985        0.3804        0.4027
  Fe 1Si 1                  (L)[]           0.1312        0.1312        0.1312
  Na 2O  3Si 1              (L)[]           0.0067        0.0358        0.0000
  Si 1                      (L)[]           0.0911        0.0947        0.0903
  Si 3Ti 5                  (C)[]           0.0228        0.0228        0.0228
*
    25 wt% Al
 Volume of gas products   (litres)          4.9573
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1897.1157
 Gas products amount        (mol)           0.0308
 Products heat capacity     (J/K)          62.9746
 Products entropy           (J/K)         140.9009
 Products enthalpy          (KJ)         -505.6192
 Mass  of the system        (Kg)            0.0513
1 Mg 1                      (G)         7.74E-0005        0.0053  (atm)
1 Na 1                      (G)             0.0131        0.9508  (atm)
1 Na 2                      (G)         1.60E-0004        0.0058  (atm)
1 O  1Si 1                  (G)             0.0010        0.0381  (atm)
  Al 4Ca 1O  7              (C)  []         0.1844
  Al 2Ca 1O  8Si 2          (L)[AMORTHI     0.0327
  Al 2Mg 1O  4              (C)  []         0.1137
  Al 2O  3                  (C)[]           0.4036
  Fe 1Si 1                  (L)[]           0.1295
  Si 1                      (L)[]           0.0993
  Si 3Ti 5                  (C)[]           0.0225
*
    26 wt% Al
 Volume of gas products   (litres)          5.2049
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1912.4437
```

```
 Gas products amount        (mol)           0.0321
 Products heat capacity     (J/K)          61.9999
 Products entropy           (J/K)         139.5882
 Products enthalpy          (KJ)         -493.2073
 Mass  of the system        (Kg)            0.0507
1 Mg 1                      (G)             0.0015        0.0975  (atm)
1 Na 1                      (G)             0.0130        0.8911  (atm)
1 Na 2                      (G)         1.42E-0004        0.0049  (atm)
1 Al 2O  1                  (G)         1.12E-0004        0.0025  (atm)
1 O  1Si 1                  (G)         7.84E-0005        0.0028  (atm)
  Al 2Ca 1                  (L)[]           0.0046
  Al 4Ca 1O  7              (C)  []         0.1995
  Al 2Mg 1O  4              (C)  []         0.1038
  Al 2O  3                  (C)[]           0.4223
  Fe 1Si 1                  (L)[]           0.1278
  Si 1                      (L)[]           0.1051
  Si 3Ti 5                  (C)[]           0.0222
*
```

27 wt% Al

```
 Volume of gas products   (litres)          5.0745
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1912.4437
 Gas products amount        (mol)           0.0313
 Products heat capacity     (J/K)          61.3931
 Products entropy           (J/K)         138.1897
 Products enthalpy          (KJ)         -480.2055
 Mass  of the system        (Kg)            0.0501
1 Mg 1                      (G)             0.0015        0.0975  (atm)
1 Na 1                      (G)             0.0128        0.8911  (atm)
1 Na 2                      (G)         1.40E-0004        0.0049  (atm)
1 Al 2O  1                  (G)         1.11E-0004        0.0025  (atm)
1 O  1Si 1                  (G)         7.73E-0005        0.0028  (atm)
  Al 2Ca 1                  (L)[]           0.0222
  Al 4Ca 1O  7              (C)  []         0.1479
  Al 2Mg 1O  4              (C)  []         0.1024
  Al 2O  3                  (C)[]           0.4613
  Fe 1Si 1                  (L)[]           0.1261
  Si 1                      (L)[]           0.1036
  Si 3Ti 5                  (C)[]           0.0219
*
```

28 wt% Al

```
 Volume of gas products   (litres)          4.8503
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1898.2405
 Gas products amount        (mol)           0.0301
 Products heat capacity     (J/K)          60.7310
 Products entropy           (J/K)         136.3246
 Products enthalpy          (KJ)         -468.4567
 Mass  of the system        (Kg)            0.0495
1 Mg 1                      (G)             0.0013        0.0877  (atm)
1 Na 1                      (G)             0.0126        0.9017  (atm)
1 Na 2                      (G)         1.45E-0004        0.0052  (atm)
1 Al 2O  1                  (G)         8.90E-0005        0.0021  (atm)
1 O  1Si 1                  (G)         6.32E-0005        0.0024  (atm)
  Al 2Ca 1                  (L)[]           0.0399
  Al 4Ca 1O  7              (C)  []         0.0959
  Al 2Mg 1O  4              (C)  []         0.1020
  Al 2O  3                  (C)[]           0.4998
  Fe 1Si 1                  (L)[]           0.1243
  Si 1                      (L)[]           0.1022
  Si 3Ti 5                  (C)[]           0.0216
*
```

29 wt% Al

```
 Volume of gas products   (litres)          4.6403
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1883.8618
 Gas products amount        (mol)           0.0291
 Products heat capacity     (J/K)          60.0804
 Products entropy           (J/K)         134.4977
 Products enthalpy          (KJ)         -456.9767
 Mass  of the system        (Kg)            0.0489
```

```
1 Mg 1                      (G)             0.0011        0.0787  (atm)
1 Na 1                      (G)             0.0124        0.9112  (atm)
1 Na 2                      (G)          1.50E-0004       0.0055  (atm)
1 Al 2O  1                  (G)          7.11E-0005       0.0017  (atm)
  Al 2Ca 1                  (L)[]           0.0577
  Al 4Ca 1O  7              (C)  []         0.0440
  Al 2Mg 1O  4              (C)  []         0.1014
  Al 2O  3                  (C)[]           0.5383
  Fe 1Si 1                  (L)[]           0.1226
  Si 1                      (L)[]           0.1008
  Si 3Ti 5                  (C)[]           0.0213
*
```

30 wt% Al

```
 Volume of gas products   (litres)          4.6891
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1873.7828
 Gas products amount        (mol)           0.0295
 Products heat capacity     (J/K)          59.4080
 Products entropy           (J/K)         133.0583
 Products enthalpy          (KJ)         -445.0648
 Mass  of the system        (Kg)            0.0484
1 Mg 1                      (G)             0.0017        0.1142  (atm)
1 Na 1                      (G)             0.0123        0.8745  (atm)
1 Na 2                      (G)          1.46E-0004       0.0052  (atm)
1 Al 2O  1                  (G)          1.56E-0004       0.0037  (atm)
  Al 2Ca 1                  (L)[]           0.0698
  Al 4Ca 1                  (L)[]           0.0043
  Al 2Mg 1O  4              (C)  []         0.0966
  Al 2O  3                  (C)[]           0.5736
  Fe 1Si 1                  (L)[]           0.1209
  Si 1                      (L)[]           0.0994
  Si 3Ti 5                  (C)[]           0.0210
*
```

31%

```
 Volume of gas products   (litres)          4.3796
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1844.5720
 Gas products amount        (mol)           0.0280
 Products heat capacity     (J/K)          58.5030
 Products entropy           (J/K)         131.0372
 Products enthalpy          (KJ)         -434.3237
 Mass  of the system        (Kg)            0.0478
1 Mg 1                      (G)             0.0013        0.0927  (atm)
1 Na 1                      (G)             0.0121        0.8971  (atm)
1 Na 2                      (G)          1.60E-0004       0.0059  (atm)
1 Al 2O  1                  (G)          1.02E-0004       0.0025  (atm)
  Al 2Ca 1                  (L)[]           0.0434
  Al 4Ca 1                  (L)[]           0.0443
  Al 2Mg 1O  4              (C)  []         0.0973
  Al 2O  3                  (C)[]           0.5635
  Fe 1Si 1                  (L)[]           0.1192
  Si 1                      (L)[]           0.0980
  Si 3Ti 5                  (C)[]           0.0207
*
```

32 wt% Al

```
 Volume of gas products   (litres)          4.1726
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1827.4189
 Gas products amount        (mol)           0.0269
 Products heat capacity     (J/K)          57.6780
 Products entropy           (J/K)         129.4801
 Products enthalpy          (KJ)         -423.0287
 Mass  of the system        (Kg)            0.0473
1 Mg 1                      (G)             0.0011        0.0818  (atm)
1 Na 1                      (G)             0.0119        0.9085  (atm)
1 Na 2                      (G)          1.67E-0004       0.0064  (atm)
1 Al 2O  1                  (G)          7.92E-0005       0.0020  (atm)
  Al 2Ca 1                  (L)[]           0.0173
  Al 4Ca 1                  (L)[]           0.0837
  Al 2Mg 1O  4              (C)  []         0.0969
  Al 2O  3                  (C)[]           0.5544
```

```
  Fe 1Si 1                  (L)[]           0.1174
  Si 1                      (L)[]           0.1966
  Si 3Ti 5                  (C)[]           0.0204
*
     33 wt% Al
 Volume of gas products   (litres)          4.0536
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0264
 Products heat capacity     (J/K)          56.8842
 Products entropy           (J/K)         128.0117
 Products enthalpy          (KJ)         -411.8321
 Mass  of the system        (Kg)            0.0468
1 Mg 1                      (G)             0.0012        0.0878  (atm)
1 Na 1                      (G)             0.0117        0.9020  (atm)
1 Na 2                      (G)         1.72E-0004        0.0066  (atm)
1 Al 2O  1                  (G)         9.27E-0005        0.0023  (atm)
  Al 1                      (L)[]           0.0049
  Al 4Ca 1                  (L)[]           0.1093
  Al 2Mg 1O  4              (C)  []         0.0949
  Al 2O  3                  (C)[]           0.5468
  Fe 1Si 1                  (L)[]           0.1157
  Si 1                      (L)[]           0.0952
  Si 3Ti 5                  (C)[]           0.0201
*
     34 wt% Al
 Volume of gas products   (litres)          3.8144
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1782.7022
 Gas products amount        (mol)           0.0252
 Products heat capacity     (J/K)          56.1157
 Products entropy           (J/K)         126.1905
 Products enthalpy          (KJ)         -401.4801
 Mass  of the system        (Kg)            0.0463
1 Mg 1                      (G)         9.47E-0004        0.0715  (atm)
1 Na 1                      (G)             0.0115        0.9186  (atm)
1 Na 2                      (G)         1.86E-0004        0.0074  (atm)
1 Al 2O  1                  (G)         6.16E-0005        0.0016  (atm)
  Al 1                      (L)[]           0.0199
  Al 4Ca 1                  (L)[]           0.1077
  Al 2Mg 1O  4              (C)  []         0.0949
  Al 2O  3                  (C)[]           0.5373
  Fe 1Si 1                  (L)[]           0.1140
  Si 1                      (L)[]           0.0937
  Si 3Ti 5                  (C)[]           0.0198
*
     35 wt% Al
 Volume of gas products   (litres)          3.6107
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1758.0728
 Gas products amount        (mol)           0.0242
 Products heat capacity     (J/K)          55.3776
 Products entropy           (J/K)         124.4980
 Products enthalpy          (KJ)         -391.1668
 Mass  of the system        (Kg)            0.0458
1 Mg 1                      (G)         7.58E-0004        0.0590  (atm)
1 Na 1                      (G)             0.0113        0.9310  (atm)
1 Na 2                      (G)         2.00E-0004        0.0082  (atm)
  Al 1                      (L)[]           0.0349
  Al 4Ca 1                  (L)[]           0.1060
  Al 2Mg 1O  4              (C)  []         0.0945
  Al 2O  3                  (C)[]           0.5282
  Fe 1Si 1                  (L)[]           0.1122
  Si 1                      (L)[]           0.0923
  Si 3Ti 5                  (C)[]           0.0195
*
     36 wt% Al
 Volume of gas products   (litres)          3.4249
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1733.3948
 Gas products amount        (mol)           0.0233
```

```
 Products heat capacity     (J/K)          54.6572
 Products entropy           (J/K)         122.8397
 Products enthalpy          (KJ)         -381.0563
 Mass  of the system        (Kg)            0.0453
1 Mg 1                      (G)         6.05E-0004        0.0483  (atm)
1 Na 1                      (G)             0.0111        0.9413  (atm)
1 Na 2                      (G)         2.15E-0004        0.0091  (atm)
  Al 1                      (L)[]           0.0499
  Al 4Ca 1                  (L)[]           0.1044
  Al 2Mg 1O  4              (C)  []         0.0939
  Al 2O  3                  (C)[]           0.5193
  Fe 1Si 1                  (L)[]           0.1105
  Si 1                      (L)[]           0.0909
  Si 3Ti 5                  (C)[]           0.0192
*
     37 wt% Al
 Volume of gas products   (litres)          3.2580
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0225
 Products heat capacity     (J/K)          53.9598
 Products entropy           (J/K)         121.2556
 Products enthalpy          (KJ)         -371.0692
 Mass  of the system        (Kg)            0.0448
1 Mg 1                      (G)         4.86E-0004        0.0398  (atm)
1 Na 1                      (G)             0.0109        0.9493  (atm)
1 Na 2                      (G)         2.29E-0004        0.0099  (atm)
  Al 1                      (L)[]           0.0648
  Al 4Ca 1                  (L)[]           0.1028
  Al 2Mg 1O  4              (C)  []         0.0930
  Al 2O  3                  (C)[]           0.5105
  Fe 1Si 1                  (L)[]           0.1088
  Si 1                      (L)[]           0.0895
  Si 3Ti 5                  (C)[]           0.0189
*
     38 wt% Al
 Volume of gas products   (litres)          3.1255
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1694.3492
 Gas products amount        (mol)           0.0218
 Products heat capacity     (J/K)          53.3131
 Products entropy           (J/K)         119.9523
 Products enthalpy          (KJ)         -360.8546
 Mass  of the system        (Kg)            0.0443
1 Mg 1                      (G)         4.16E-0004        0.0349  (atm)
1 Na 1                      (G)             0.0108        0.9539  (atm)
1 Na 2                      (G)         2.38E-0004        0.0105  (atm)
  Al 1                      (L)[]           0.0797
  Al 4Ca 1                  (L)[]           0.1011
  Al 2Mg 1O  4              (C)  []         0.0919
  Al 2O  3                  (C)[]           0.5021
  Fe 1Si 1                  (L)[]           0.1071
  Si 1                      (L)[]           0.0881
  Si 3Ti 5                  (C)[]           0.0186
*
     39 wt% Al
 Volume of gas products   (litres)          3.0387        3.0377        3.0398
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1692.6736     1692.3208     1693.0264
 Gas products amount        (mol)           0.0212        0.0212        0.0212
 Products heat capacity     (J/K)          52.7481       52.7544       52.7418
 Products entropy           (J/K)         118.0050      116.8794      119.1341
 Products enthalpy          (KJ)         -351.9800     -353.8855     -350.0685
 Phase transition enthalpy  (KJ)           3.8170
 Mass  of the system        (Kg)            0.0439
1 Mg 1                      (G)         4.03E-0004    4.02E-0004    4.05E-0004
1 Na 1                      (G)             0.0106        0.0106        0.0106
1 Na 2                      (G)         2.35E-0004    2.36E-0004    2.35E-0004
  Al 1                      (L)[]           0.0945        0.0945        0.0945
  Al 4Ca 1                  (L)[]           0.0995        0.0995        0.0995
  Al 2Mg 1O  4              (C)  []         0.0905        0.0905        0.0905
```

```
  Al 2O  3                  (C)[]           0.4940        0.4940        0.4940
  Fe 1Si 1                  (L)[]           0.0526        0.0000        0.1053
  Fe 1Si 1                  (C)[]           0.0528        0.1053        0.0000
  Si 1                      (L)[]           0.0866        0.0866        0.0866
  Si 3Ti 5                  (C)[]           0.0183        0.0183        0.0183
*
```

40 wt% Al

```
 Volume of gas products   (litres)          2.9541
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1691.1568
 Gas products amount        (mol)           0.0206
 Products heat capacity     (J/K)          52.1940
 Products entropy           (J/K)         116.1417
 Products enthalpy          (KJ)         -343.2097
 Mass  of the system        (Kg)            0.0434
1 Mg 1                      (G)         3.91E-0004        0.0339  (atm)
1 Na 1                      (G)             0.0104        0.9547  (atm)
1 Na 2                      (G)         2.33E-0004        0.0107  (atm)
  Al 1                      (L)[]           0.1094
  Al 4Ca 1                  (L)[]           0.0979
  Al 2Mg 1O  4              (C)  []         0.0890
  Al 2O  3                  (C)[]           0.4858
  Fe 1Si 1                  (C)[]           0.1036
  Si 1                      (L)[]           0.0852
  Si 3Ti 5                  (C)[]           0.0180
*
```

41 wt% Al

```
 Volume of gas products   (litres)          2.8722        2.8709        2.8724
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6730     1689.3868     1689.9591
 Gas products amount        (mol)           0.0200        0.0200        0.0200
 Products heat capacity     (J/K)          51.6766       51.8897       51.6450
 Products entropy           (J/K)         114.9238      111.5873      115.4175
 Products enthalpy          (KJ)         -333.5861     -339.2247     -332.7517
 Phase transition enthalpy  (KJ)            6.4730
 Mass  of the system        (Kg)            0.0430
1 Mg 1                      (G)         3.80E-0004    3.79E-0004    3.81E-0004
1 Na 1                      (G)             0.0102        0.0102        0.0102
1 Na 2                      (G)         2.30E-0004    2.30E-0004    2.30E-0004
  Al 1                      (L)[]           0.1242        0.1242        0.1242
  Al 4Ca 1                  (L)[]           0.0962        0.0962        0.0962
  Al 2Mg 1O  4              (C)  []         0.0876        0.0876        0.0876
  Al 2O  3                  (C)[]           0.4777        0.4777        0.4777
  Fe 1Si 1                  (C)[]           0.1019        0.1019        0.1019
  Si 1                      (C)[]           0.0108        0.0838    1.28E-0005
  Si 1                      (L)[]           0.0730        0.0000        0.0838
  Si 3Ti 5                  (C)[]           0.0177        0.0177        0.0177
*
```

42 wt% Al

```
 Volume of gas products   (litres)          2.7951        2.7940        2.7955
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6713     1689.3832     1689.9593
 Gas products amount        (mol)           0.0195        0.0195        0.0195
 Products heat capacity     (J/K)          51.1972       51.3509       51.1348
 Products entropy           (J/K)         113.4286      111.0171      114.4067
 Products enthalpy          (KJ)         -324.6630     -328.7384     -323.0101
 Phase transition enthalpy  (KJ)            5.7283
 Mass  of the system        (Kg)            0.0426
1 Mg 1                      (G)         3.73E-0004    3.72E-0004    3.74E-0004
1 Na 1                      (G)             0.0101        0.0101        0.0101
1 Na 2                      (G)         2.26E-0004    2.26E-0004    2.26E-0004
  Al 1                      (L)[]           0.1391        0.1391        0.1391
  Al 4Ca 1                  (L)[]           0.0946        0.0946        0.0946
  Al 2Mg 1O  4              (C)  []         0.0861        0.0861        0.0861
  Al 2O  3                  (C)[]           0.4696        0.4696        0.4696
  Fe 1Si 1                  (C)[]           0.1002        0.1002        0.1002
  Si 1                      (C)[]           0.0291        0.0824        0.0075
  Si 1                      (L)[]           0.0533        0.0000        0.0749
  Si 3Ti 5                  (C)[]           0.0174        0.0174        0.0174
*
```

43 wt% Al

```
 Volume of gas products   (litres)          2.7195        2.7189        2.7204
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6733     1689.3873     1689.9594
 Gas products amount        (mol)           0.0190        0.0190        0.0190
 Products heat capacity     (J/K)          50.7270       50.8230       50.5913
 Products entropy           (J/K)         111.9633      110.4591      114.0870
 Products enthalpy          (KJ)         -315.9175     -318.4597     -312.3285
 Phase transition enthalpy  (KJ)            6.1312
 Mass  of the system        (Kg)            0.0422
1 Mg 1                      (G)         3.67E-0004    3.66E-0004    3.68E-0004
1 Na 1                      (G)            0.0099        0.0099        0.0099
1 Na 2                      (G)         2.22E-0004    2.22E-0004    2.22E-0004
  Al 1                      (L)[]           0.1539        0.1539        0.1539
  Al 4Ca 1                  (L)[]           0.0930        0.0930        0.0930
  Al 2Mg 1O  4              (C)  []         0.0846        0.0846        0.0846
  Al 2O  3                  (C)[]           0.4615        0.4615        0.4615
  Fe 1Si 1                  (C)[]           0.0984        0.0984        0.0984
  Si 1                      (C)[]           0.0474        0.0810    1.24E-0005
  Si 1                      (L)[]           0.0336        0.0000        0.0810
  Si 3Ti 5                  (C)[]           0.0171        0.0171        0.0171
*
```

44 wt% Al

```
 Volume of gas products   (litres)          2.6452        2.6450        2.6464
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6735     1689.3875     1689.9596
 Gas products amount        (mol)           0.0185        0.0185        0.0185
 Products heat capacity     (J/K)          50.2660       50.3053       50.0799
 Products entropy           (J/K)         110.5262      109.9113      113.4410
 Products enthalpy          (KJ)         -307.3423     -308.3815     -302.4163
 Phase transition enthalpy  (KJ)            5.9653
 Mass  of the system        (Kg)            0.0417
1 Mg 1                      (G)         3.60E-0004    3.59E-0004    3.61E-0004
1 Na 1                      (G)            0.0097        0.0097        0.0097
1 Na 2                      (G)         2.18E-0004    2.19E-0004    2.18E-0004
  Al 1                      (L)[]           0.1688        0.1688        0.1688
  Al 4Ca 1                  (L)[]           0.0914        0.0914        0.0914
  Al 2Mg 1O  4              (C)  []         0.0831        0.0831        0.0831
  Al 2O  3                  (C)[]           0.4534        0.4534        0.4534
  Fe 1Si 1                  (C)[]           0.0967        0.0967        0.0967
  Si 1                      (C)[]           0.0657        0.0795    1.21E-0005
  Si 1                      (L)[]           0.0139        0.0000        0.0795
  Si 3Ti 5                  (C)[]           0.0168        0.0168        0.0168
*
```

45 wt% Al

```
 Volume of gas products   (litres)          2.5701
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1688.3637
 Gas products amount        (mol)           0.0180
 Products heat capacity     (J/K)          49.7928
 Products entropy           (J/K)         109.3434
 Products enthalpy          (KJ)         -298.5518
 Mass  of the system        (Kg)            0.0413
1 Mg 1                      (G)         3.50E-0004        0.0331  (atm)
1 Na 1                      (G)            0.0095        0.9554  (atm)
1 Na 2                      (G)         2.15E-0004        0.0108  (atm)
  Al 1                      (L)[]           0.1836
  Al 4Ca 1                  (L)[]           0.0897
  Al 2Mg 1O  4              (C)  []         0.0817
  Al 2O  3                  (C)[]           0.4453
  Fe 1Si 1                  (C)[]           0.0950
  Si 1                      (C)[]           0.0781
  Si 3Ti 5                  (C)[]           0.0165
*
```

46 wt% Al

```
 Volume of gas products   (litres)          2.4462
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1665.0000
 Gas products amount        (mol)           0.0173
 Products heat capacity     (J/K)          49.1850
 Products entropy           (J/K)         108.1155
 Products enthalpy          (KJ)         -290.0315
```

```
1 Mg 1                      (G)         4.68E-0004        0.0270  (atm)
1 Na 1                      (G)             0.0166        0.9608  (atm)
1 Na 2                      (G)         2.04E-0004        0.0118  (atm)
  Al 1                      (L)[]           0.3012
  Al 4Ca 1                  (L)[]           0.2044
  Al 2Mg 1O  4              (C)  []         0.0232
  Al 2O  3                  (C)[]           0.1754
  Fe 1Si 1                  (C)[]           0.0455
  Si 1                      (C)[]           0.1118
  Si 3Ti 5                  (C)[]           0.0020
*
```

47 wt% Al

```
 Volume of gas products   (litres)          2.2919
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1622.4521
 Gas products amount        (mol)           0.0167
 Products heat capacity     (J/K)          48.5045
 Products entropy           (J/K)         106.3275
 Products enthalpy          (KJ)         -282.6131
 Mass  of the system        (Kg)            0.0406
1 Mg 1                      (G)         1.83E-0004        0.0183  (atm)
1 Na 1                      (G)             0.0091        0.9676  (atm)
1 Na 2                      (G)         2.61E-0004        0.0138  (atm)
  Al 1                      (L)[]           0.2134
  Al 4Ca 1                  (L)[]           0.0865
  Al 2Mg 1O  4              (C)  []         0.0796
  Al 2O  3                  (C)[]           0.4282
  Fe 1Si 1                  (C)[]           0.0915
  Si 1                      (C)[]           0.0753
  Si 3Ti 5                  (C)[]           0.0159
*
```

48 wt% Al

```
 Volume of gas products   (litres)          2.1740
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1593.2849
 Gas products amount        (mol)           0.0161
 Products heat capacity     (J/K)          47.9028
 Products entropy           (J/K)         104.9594
 Products enthalpy          (KJ)         -274.6648
 Mass  of the system        (Kg)            0.0402
1 Mg 1                      (G)         1.35E-0004        0.0138  (atm)
1 Na 1                      (G)             0.0089        0.9706  (atm)
1 Na 2                      (G)         2.84E-0004        0.0154  (atm)
  Al 1                      (L)[]           0.2283
  Al 4Ca 1                  (L)[]           0.0848
  Al 2Mg 1O  4              (C)  []         0.0783
  Al 2O  3                  (C)[]           0.4199
  Fe 1Si 1                  (C)[]           0.0898
  Si 1                      (C)[]           0.0739
  Si 3Ti 5                  (C)[]           0.0156
*
```

49 wt% Al

```
 Volume of gas products   (litres)          2.0448
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1553.4490
 Gas products amount        (mol)           0.0155
 Products heat capacity     (J/K)          47.2701
 Products entropy           (J/K)         103.2793
 Products enthalpy          (KJ)         -267.3650
 Mass  of the system        (Kg)            0.0398
1 Mg 1                      (G)         8.80E-0005        0.0093  (atm)
1 Na 1                      (G)             0.0087        0.9727  (atm)
1 Na 2                      (G)         3.23E-0004        0.0180  (atm)
  Al 1                      (L)[]           0.2432
  Al 4Ca 1                  (L)[]           0.0832
  Al 2Mg 1O  4              (C)  []         0.0771
  Al 2O  3                  (C)[]           0.4116
  Fe 1Si 1                  (C)[]           0.0881
  Si 1                      (C)[]           0.0724
  Si 3Ti 5                  (C)[]           0.0153
*
```

```
     50 wt% Al
 Volume of gas products   (litres)          1.9490
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1530.0000
 Gas products amount        (mol)           0.0150
 Products heat capacity     (J/K)          46.7254
 Products entropy           (J/K)         102.1140
 Products enthalpy          (KJ)         -259.4186
 Mass  of the system        (Kg)            0.0394
1 Mg 1                      (G)         6.72E-0005        0.0073  (atm)
1 Na 1                      (G)             0.0085        0.9730  (atm)
1 Na 2                      (G)         3.45E-0004        0.0197  (atm)
  Al 1                      (L)[]           0.2580
  Al 4Ca 1                  (L)[]           0.0816
  Al 2Mg 1O  4              (C)  []         0.0757
  Al 2O  3                  (C)[]           0.4034
  Fe 1Si 1                  (C)[]           0.0863
  Si 1                      (C)[]           0.0710
  Si 3Ti 5                  (C)[]           0.0150
*
     51 wt% Al
 Volume of gas products   (litres)          1.8367
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1493.0000
 Gas products amount        (mol)           0.0145
 Products heat capacity     (J/K)          46.1387
 Products entropy           (J/K)         100.5417
 Products enthalpy          (KJ)         -252.2420
 Mass  of the system        (Kg)            0.0391
1 Mg 1                      (G)         4.37E-0005        0.0048  (atm)
1 Na 1                      (G)             0.0083        0.9723  (atm)
1 Na 2                      (G)         3.90E-0004        0.0228  (atm)
  Al 1                      (L)[]           0.2729
  Al 4Ca 1                  (L)[]           0.0799
  Al 2Mg 1O  4              (C)  []         0.0743
  Al 2O  3                  (C)[]           0.3952
  Fe 1Si 1                  (C)[]           0.0846
  Si 1                      (C)[]           0.0696
  Si 3Ti 5                  (C)[]           0.0147
*
     52 wt% Al
 Volume of gas products   (litres)          1.7397
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)           0.0140
 Products heat capacity     (J/K)          45.5963
 Products entropy           (J/K)          99.1947
 Products enthalpy          (KJ)         -244.8668
 Mass  of the system        (Kg)            0.0387
1 Na 1                      (G)             0.0081        0.9707  (atm)
1 Na 2                      (G)         4.30E-0004        0.0258  (atm)
  Al 1                      (L)[]           0.2877
  Al 4Ca 1                  (L)[]           0.0783
  Al 2Mg 1O  4              (C)  []         0.0729
  Al 2O  3                  (C)[]           0.3871
  Fe 1Si 1                  (C)[]           0.0829
  Si 1                      (C)[]           0.0682
  Si 3Ti 5                  (C)[]           0.0144
*
     53 wt% Al
 Volume of gas products   (litres)          1.6656
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1446.9852
 Gas products amount        (mol)           0.0136
 Products heat capacity     (J/K)          45.1232
 Products entropy           (J/K)          98.2957
 Products enthalpy          (KJ)         -236.9863
 Mass  of the system        (Kg)            0.0384
1 Na 1                      (G)             0.0079        0.9695  (atm)
1 Na 2                      (G)         4.49E-0004        0.0276  (atm)
  Al 1                      (L)[]           0.3026
```

```
  Al 4Ca 1                  (L)[]           0.0767
  Al 2Mg 1O  4              (C)  []         0.0714
  Al 2O  3                  (C)[]           0.3790
  Fe 1Si 1                  (C)[]           0.0812
  Si 1                      (C)[]           0.0668
  Si 3Ti 5                  (C)[]           0.0141
*
     54 wt% Al
 Volume of gas products   (litres)          1.5804
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1420.8010
 Gas products amount        (mol)           0.0131
 Products heat capacity     (J/K)          44.6227
 Products entropy           (J/K)          97.0889
 Products enthalpy          (KJ)         -229.7030
 Mass  of the system        (Kg)            0.0380
1 Na 1                      (G)             0.0077        0.9671  (atm)
1 Na 2                      (G)         4.89E-0004        0.0309  (atm)
  Al 1                      (L)[]           0.3174
  Al 4Ca 1                  (L)[]           0.0750
  Al 2Mg 1O  4              (C)  []         0.0699
  Al 2O  3                  (C)[]           0.3709
  Fe 1Si 1                  (C)[]           0.0794
  Si 1                      (C)[]           0.0653
  Si 3Ti 5                  (C)[]           0.0138
*
     55 wt% Al
 Volume of gas products   (litres)          1.4976
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1394.4478
 Gas products amount        (mol)           0.0127
 Products heat capacity     (J/K)          44.1342
 Products entropy           (J/K)          95.8843
 Products enthalpy          (KJ)         -222.5497
 Mass  of the system        (Kg)            0.0377
1 Na 1                      (G)             0.0074        0.9639  (atm)
1 Na 2                      (G)         5.35E-0004        0.0346  (atm)
  Al 1                      (L)[]           0.3323
  Al 4Ca 1                  (L)[]           0.0734
  Al 2Mg 1O  4              (C)  []         0.0684
  Al 2O  3                  (C)[]           0.3628
  Fe 1Si 1                  (C)[]           0.0777
  Si 1                      (C)[]           0.0639
  Si 3Ti 5                  (C)[]           0.0135
*
     56 wt% Al
 Volume of gas products   (litres)          1.4172
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1367.9479
 Gas products amount        (mol)           0.0122
 Products heat capacity     (J/K)          43.6579
 Products entropy           (J/K)          94.6820
 Products enthalpy          (KJ)         -215.5267
 Mass  of the system        (Kg)            0.0374
1 Na 1                      (G)             0.0072        0.9600  (atm)
1 Na 2                      (G)         5.86E-0004        0.0390  (atm)
  Al 1                      (L)[]           0.3471
  Al 4Ca 1                  (L)[]           0.0718
  Al 2Mg 1O  4              (C)  []         0.0669
  Al 2O  3                  (C)[]           0.3547
  Fe 1Si 1                  (C)[]           0.0760
  Si 1                      (C)[]           0.0625
  Si 3Ti 5                  (C)[]           0.0132
*
     57 wt% Al
 Volume of gas products   (litres)      5.18E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1341.2900
 Gas products amount        (mol)       4.55E-0007
 Products heat capacity     (J/K)          43.3379
 Products entropy           (J/K)          92.5681
```

```
 Products enthalpy          (KJ)         -209.8721
 Mass  of the system        (Kg)            0.0370
  Al 1                      (L)[]           0.3649
  Al 4Ca 1                  (L)[]           0.0701
  Al 2Mg 1O  4              (C)  []         0.0654
  Al 1Na 1O  2              (C)  []         0.0272
  Al 2O  3                  (C)[]           0.3241
  Fe 1Si 1                  (C)[]           0.0743
  Si 1                      (C)[]           0.0611
  Si 3Ti 5                  (C)[]           0.0129
*
```

58 wt% Al

```
 Volume of gas products   (litres)      8.64E-0007
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1306.4281
 Gas products amount        (mol)       7.80E-0009
 Products heat capacity     (J/K)          42.8508
 Products entropy           (J/K)          91.1342
 Products enthalpy          (KJ)         -203.4054
 Mass  of the system        (Kg)            0.0367
  Al 1                      (L)[]           0.3797
  Al 4Ca 1                  (L)[]           0.0685
  Al 2Mg 1O  4              (C)  []         0.0639
  Al 1Na 1O  2              (C)  []         0.0266
  Al 2O  3                  (C)[]           0.3165
  Fe 1Si 1                  (C)[]           0.0725
  Si 1                      (C)[]           0.0597
  Si 3Ti 5                  (C)[]           0.0126
*
```

59 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1287.5113
 Gas products amount        (mol)       7.72E-0010
 Products heat capacity     (J/K)          42.4307
 Products entropy           (J/K)          90.2253
 Products enthalpy          (KJ)         -196.3663
 Mass  of the system        (Kg)            0.0364
  Al 1                      (L)[]           0.3945
  Al 4Ca 1                  (L)[]           0.0669
  Al 2Mg 1O  4              (C)  []         0.0624
  Al 1Na 1O  2              (C)  []         0.0259
  Al 2O  3                  (C)[]           0.3090
  Fe 1Si 1                  (C)[]           0.0708
  Si 1                      (C)[]           0.0582
  Si 3Ti 5                  (C)[]           0.0123
*
```

60 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)       5.81E-0010
 Products heat capacity     (J/K)          42.0254
 Products entropy           (J/K)          89.3698
 Products enthalpy          (KJ)         -189.3876
 Mass  of the system        (Kg)            0.0361
  Al 1                      (L)[]           0.4092
  Al 4Ca 1                  (L)[]           0.0653
  Al 2Mg 1O  4              (C)  []         0.0609
  Al 1Na 1O  2              (C)  []         0.0253
  Al 2O  3                  (C)[]           0.3015
  Fe 1Si 1                  (C)[]           0.0691
  Si 1                      (C)[]           0.0568
  Si 3Ti 5                  (C)[]           0.0120
*
```

61 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)       2.26E-0009
 Products heat capacity     (J/K)          41.5586
```

```
 Products entropy           (J/K)          87.7673
 Products enthalpy          (KJ)         -183.4571
 Mass  of the system        (Kg)            0.0358
  Al 1                      (L)[]           0.4240
  Al 4Ca 1                  (L)[]           0.0636
  Al 2Mg 1O  4              (C)  []         0.0594
  Al 1Na 1O  2              (C)  []         0.0247
  Al 2O  3                  (C)[]           0.2939
  Fe 1Si 1                  (C)[]           0.0673
  Si 1                      (C)[]           0.0554
  Si 3Ti 5                  (C)[]           0.0117
*
```

62 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)       5.63E-0010
 Products heat capacity     (J/K)          41.0822
 Products entropy           (J/K)          85.8095
 Products enthalpy          (KJ)         -178.0998
 Mass  of the system        (Kg)            0.0355
  Al 1                      (L)[]           0.4387
  Al 4Ca 1                  (L)[]           0.0620
  Al 2Mg 1O  4              (C)  []         0.0578
  Al 1Na 1O  2              (C)  []         0.0240
  Al 2O  3                  (C)[]           0.2865
  Fe 1Si 1                  (C)[]           0.0656
  Si 1                      (C)[]           0.0540
  Si 3Ti 5                  (C)[]           0.0114
*
```

63 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)       4.17E-0010
 Products heat capacity     (J/K)          40.7577
 Products entropy           (J/K)          85.5671
 Products enthalpy          (KJ)         -170.6632
 Mass  of the system        (Kg)            0.0352
  Al 1                      (L)[]           0.4535
  Al 4Ca 1                  (L)[]           0.0604
  Al 2Mg 1O  4              (C)  []         0.0563
  Al 1Na 1O  2              (C)  []         0.0234
  Al 2O  3                  (C)[]           0.2788
  Fe 1Si 1                  (C)[]           0.0639
  Si 1                      (C)[]           0.0526
  Si 3Ti 5                  (C)[]           0.0111
*
```

64 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1149.6816
 Gas products amount        (mol)       1.19E-0010
 Products heat capacity     (J/K)          40.3873
 Products entropy           (J/K)          83.6203
 Products enthalpy          (KJ)         -165.4044
 Mass  of the system        (Kg)            0.0349
  Al 1                      (L)[]           0.4897
  Al 2Ca 1                  (C)[]           0.0373
  Al 2Mg 1O  4              (C)  []         0.0548
  Al 1Na 1O  2              (C)  []         0.0228
  Al 2O  3                  (C)[]           0.2713
  Fe 1Si 1                  (C)[]           0.0622
  Si 1                      (C)[]           0.0511
  Si 3Ti 5                  (C)[]           0.0108
*
```

65 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1128.6500
 Gas products amount        (mol)       1.32E-0010
```

```
 Products heat capacity     (J/K)          39.9384
 Products entropy           (J/K)          82.3728
 Products enthalpy          (KJ)         -159.4309
 Mass  of the system        (Kg)            0.0346
  Al 1                      (L)[]           0.4908
  Al 2Ca 1                  (C)[]           0.0363
  Al 2Mg 1O  4              (C)  []         0.0533
  Al 1Na 1O  2              (C)  []         0.0221
  Al 2O  3                  (C)[]           0.2638
  Al 3Ti 1                  (C)  []         0.0209
  Fe 1Si 1                  (C)[]           0.0604
  Si 1                      (C)[]           0.0524
*
     66 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1107.2203
 Gas products amount        (mol)       2.56E-0011
 Products heat capacity     (J/K)          39.5829
 Products entropy           (J/K)          81.4352
 Products enthalpy          (KJ)         -153.2036
 Mass  of the system        (Kg)            0.0344
  Al 1                      (L)[]           0.5053
  Al 2Ca 1                  (C)[]           0.0352
  Al 2Mg 1O  4              (C)  []         0.0517
  Al 1Na 1O  2              (C)  []         0.0215
  Al 2O  3                  (C)[]           0.2562
  Al 3Ti 1                  (C)  []         0.0203
  Fe 1Si 1                  (C)[]           0.0587
  Si 1                      (C)[]           0.0510
*
     67 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1085.3948
 Gas products amount        (mol)       1.42E-0010
 Products heat capacity     (J/K)          39.2348
 Products entropy           (J/K)          80.4842
 Products enthalpy          (KJ)         -147.0948
 Mass  of the system        (Kg)            0.0341
  Al 1                      (L)[]           0.5199
  Al 2Ca 1                  (C)[]           0.0342
  Al 2Mg 1O  4              (C)  []         0.0502
  Al 1Na 1O  2              (C)  []         0.0209
  Al 2O  3                  (C)[]           0.2487
  Al 3Ti 1                  (C)  []         0.0197
  Fe 1Si 1                  (C)[]           0.0570
  Si 1                      (C)[]           0.0495
*
     68 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1053.2599
 Gas products amount        (mol)       4.64E-0011
 Products heat capacity     (J/K)          38.6956
 Products entropy           (J/K)          77.6745
 Products enthalpy          (KJ)         -143.0402
 Mass  of the system        (Kg)            0.0338
  Al 1                      (L)[]           0.4811
  Al 2Ca 1                  (C)[]           0.0332
  Al 3Fe 1                  (C)  []         0.0901
  Al 2Mg 1O  4              (C)  []         0.0487
  Al 1Na 1O  2              (C)  []         0.0202
  Al 2O  3                  (C)[]           0.2412
  Al 3Ti 1                  (C)  []         0.0191
  Si 1                      (C)[]           0.0664
*
     69 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1042.0000
```

```
 Gas products amount        (mol)       2.16E-0010
 Products heat capacity     (J/K)          38.3915
 Products entropy           (J/K)          77.1688
 Products enthalpy          (KJ)         -136.6475
 Mass  of the system        (Kg)            0.0336
  Al 1                      (L)[]           0.4973
  Al 2Ca 1                  (C)[]           0.0321
  Al 3Fe 1                  (C)  []         0.0873
  Al 2Mg 1O  4              (C)  []         0.0472
  Al 1Na 1O  2              (C)  []         0.0196
  Al 2O  3                  (C)[]           0.2336
  Al 3Ti 1                  (C)  []         0.0185
  Si 1                      (C)[]           0.0644
*
     70 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1023.0000
 Gas products amount        (mol)       2.03E-0009
 Products heat capacity     (J/K)          38.0710
 Products entropy           (J/K)          76.3789
 Products enthalpy          (KJ)         -130.6478
 Mass  of the system        (Kg)            0.0333
  Al 1                      (L)[]           0.5136
  Al 2Ca 1                  (C)[]           0.0311
  Al 3Fe 1                  (C)  []         0.0844
  Al 2Mg 1O  4              (C)  []         0.0457
  Al 1Na 1O  2              (C)  []         0.0190
  Al 2O  3                  (C)[]           0.2261
  Al 3Ti 1                  (C)  []         0.0179
  Si 1                      (C)[]           0.0623
*
     71 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       4.41E-0012
 Products heat capacity     (J/K)          37.6878
 Products entropy           (J/K)          74.6753
 Products enthalpy          (KJ)         -125.6467
 Mass  of the system        (Kg)            0.0330
  Al 1                      (L)[]           0.5298
  Al 2Ca 1                  (C)[]           0.0301
  Al 3Fe 1                  (C)  []         0.0816
  Al 2Mg 1O  4              (C)  []         0.0441
  Al 1Na 1O  2              (C)  []         0.0183
  Al 2O  3                  (C)[]           0.2186
  Al 3Ti 1                  (C)  []         0.0173
  Si 1                      (C)[]           0.0602
*
     72 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       3.79E-0012
 Products heat capacity     (J/K)          37.3671
 Products entropy           (J/K)          73.6383
 Products enthalpy          (KJ)         -120.0495
 Mass  of the system        (Kg)            0.0328
  Al 1                      (L)[]           0.5460
  Al 2Ca 1                  (C)[]           0.0290
  Al 3Fe 1                  (C)  []         0.0788
  Al 2Mg 1O  4              (C)  []         0.0426
  Al 1Na 1O  2              (C)  []         0.0177
  Al 2O  3                  (C)[]           0.2110
  Al 3Ti 1                  (C)  []         0.0167
  Si 1                      (C)[]           0.0581
*
     73 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

Temperature	(K)	933.3198		
Gas products amount	(mol)	4.99E-0010		
Products heat capacity	(J/K)	37.2296		
Products entropy	(J/K)	71.8298		
Products enthalpy	(KJ)	-115.2475		
Mass of the system	(Kg)	0.0325		
Al 1	(C)[]	0.0647		
Al 1	(L)[]	0.4975		
Al 2Ca 1	(C)[]	0.0280		
Al 3Fe 1	(C) []	0.0760		
Al 2Mg 1O 4	(C) []	0.0411		
Al 1Na 1O 2	(C) []	0.0171		
Al 2O 3	(C)[]	0.2035		
Al 3Ti 1	(C) []	0.0161		
Si 1	(C)[]	0.0561		

*

74 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9020	932.4632	933.3408
Gas products amount	(mol)	2.55E-0011	5.16E-0011	1.77E-0011
Products heat capacity	(J/K)	37.2765	38.2830	36.9752
Products entropy	(J/K)	70.2225	64.6994	71.8759
Products enthalpy	(KJ)	-110.3475	-115.5039	-108.8038
Phase transition enthalpy	(KJ)	6.7001		
Mass of the system	(Kg)	0.0323		
Al 1	(C)[]	0.1777	0.5784	0.0577
Al 1	(L)[]	0.4007	0.0000	0.5207
Al 2Ca 1	(C)[]	0.0269	0.0269	0.0269
Al 3Fe 1	(C) []	0.0732	0.0732	0.0732
Al 2Mg 1O 4	(C) []	0.0396	0.0396	0.0396
Al 1Na 1O 2	(C) []	0.0164	0.0164	0.0164
Al 2O 3	(C)[]	0.1960	0.1960	0.1960
Al 3Ti 1	(C) []	0.0155	0.0155	0.0155
Si 1	(C)[]	0.0540	0.0540	0.0540

*

75 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9176	932.4739	933.3612
Gas products amount	(mol)	4.51E-0011	1.29E-0011	7.26E-0011
Products heat capacity	(J/K)	37.2803	38.0810	36.5965
Products entropy	(J/K)	68.8674	64.4829	72.6123
Products enthalpy	(KJ)	-105.3067	-109.4000	-101.8104
Phase transition enthalpy	(KJ)	7.5896		
Mass of the system	(Kg)	0.0320		
Al 1	(C)[]	0.2739	0.5946	5.21E-0006
Al 1	(L)[]	0.3207	0.0000	0.5946
Al 2Ca 1	(C)[]	0.0259	0.0259	0.0259
Al 3Fe 1	(C) []	0.0704	0.0704	0.0704
Al 2Mg 1O 4	(C) []	0.0380	0.0380	0.0380
Al 1Na 1O 2	(C) []	0.0158	0.0158	0.0158
Al 2O 3	(C)[]	0.1884	0.1884	0.1884
Al 3Ti 1	(C) []	0.0149	0.0149	0.0149
Si 1	(C)[]	0.0519	0.0519	0.0519

*

76 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9278	932.4745	933.3811
Gas products amount	(mol)	2.68E-0010	4.24E-0010	5.54E-0011
Products heat capacity	(J/K)	37.2864	37.8819	36.4696
Products entropy	(J/K)	67.5337	64.2694	72.0116
Products enthalpy	(KJ)	-100.3435	-103.3910	-96.1628
Phase transition enthalpy	(KJ)	7.2281		
Mass of the system	(Kg)	0.0318		
Al 1	(C)[]	0.3704	0.6108	0.0405
Al 1	(L)[]	0.2405	0.0000	0.5704
Al 2Ca 1	(C)[]	0.0249	0.0249	0.0249
Al 3Fe 1	(C) []	0.0675	0.0675	0.0675
Al 2Mg 1O 4	(C) []	0.0365	0.0365	0.0365

```
 Al 1Na 1O  2              (C)  []         0.0152        0.0152        0.0152
 Al 2O  3                  (C)[]           0.1809        0.1809        0.1809
 Al 3Ti 1                  (C)  []         0.0143        0.0143        0.0143
 Si 1                      (C)[]           0.0498        0.0498        0.0498
*
    77 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           932.9407      932.4810      933.4003
Gas products amount        (mol)       8.44E-0011    1.09E-0010    1.43E-0011
Products heat capacity     (J/K)          37.2912       37.6856       36.1430
Products entropy           (J/K)          66.2186       64.0590       72.5044
Products enthalpy          (KJ)          -95.4511      -97.4674      -89.5827
Phase transition enthalpy  (KJ)            7.8847
Mass  of the system        (Kg)            0.0316
 Al 1                      (C)[]           0.4667        0.6271    4.79E-0006
 Al 1                      (L)[]           0.1604        0.0000        0.6271
 Al 2Ca 1                  (C)[]           0.0238        0.0238        0.0238
 Al 3Fe 1                  (C)  []         0.0647        0.0647        0.0647
 Al 2Mg 1O  4              (C)  []         0.0350        0.0350        0.0350
 Al 1Na 1O  2              (C)  []         0.0145        0.0145        0.0145
 Al 2O  3                  (C)[]           0.1733        0.1733        0.1733
 Al 3Ti 1                  (C)  []         0.0137        0.0137        0.0137
 Si 1                      (C)[]           0.0478        0.0478        0.0478
*
    78 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           932.9494      932.4799      933.4188
Gas products amount        (mol)       3.11E-0011    1.46E-0011    1.33E-0010
Products heat capacity     (J/K)          37.2969       37.4923       36.0925
Products entropy           (J/K)          64.9234       63.8516       71.5295
Products enthalpy          (KJ)          -90.6317      -91.6323      -84.4643
Phase transition enthalpy  (KJ)            7.1681
Mass  of the system        (Kg)            0.0313
 Al 1                      (C)[]           0.5632        0.6433        0.0693
 Al 1                      (L)[]           0.0801        0.0000        0.5740
 Al 2Ca 1                  (C)[]           0.0228        0.0228        0.0228
 Al 3Fe 1                  (C)  []         0.0619        0.0619        0.0619
 Al 2Mg 1O  4              (C)  []         0.0335        0.0335        0.0335
 Al 1Na 1O  2              (C)  []         0.0139        0.0139        0.0139
 Al 2O  3                  (C)[]           0.1658        0.1658        0.1658
 Al 3Ti 1                  (C)  []         0.0131        0.0131        0.0131
 Si 1                      (C)[]           0.0457        0.0457        0.0457
*
    79 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           929.2579
Gas products amount        (mol)       2.66E-0011
Products heat capacity     (J/K)          37.4804
Products entropy           (J/K)          63.9447
Products enthalpy          (KJ)          -85.8733
Mass  of the system        (Kg)            0.0313
 Al 1                      (C)[]           0.6616
 Al 2Ca 1                  (C)[]           0.0216
 Al 3Fe 1                  (C)  []         0.0587
 Al 2Mg 1O  4              (C)  []         0.0318
 Al 1Na 1O  2              (C)  []         0.0132
 Al 2O  3                  (C)[]           0.1573
 Al 3Ti 1                  (C)  []         0.0125
 Si 1                      (C)[]           0.0433
*
    80 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           903.0000
Gas products amount        (mol)       4.39E-0012
Products heat capacity     (J/K)          36.5488
Products entropy           (J/K)          62.2627
Products enthalpy          (KJ)          -81.3005
```

```
 Mass  of the system        (Kg)            0.0309
  Al 1                      (C)[]           0.6757
  Al 2Ca 1                  (C)[]           0.0207
  Al 3Fe 1                  (C)  []         0.0563
  Al 2Mg 1O  4              (C)  []         0.0304
  Al 1Na 1O  2              (C)  []         0.0126
  Al 2O  3                  (C)[]           0.1507
  Al 3Ti 1                  (C)  []         0.0119
  Si 1                      (C)[]           0.0415
*
```

81 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           870.0000
 Gas products amount        (mol)       1.18E-0010
 Products heat capacity     (J/K)          35.7429
 Products entropy           (J/K)          60.7283
 Products enthalpy          (KJ)          -76.8997
 Mass  of the system        (Kg)            0.0307
  Al 1                      (C)[]           0.6919
  Al 2Ca 1                  (C)[]           0.0197
  Al 3Fe 1                  (C)  []         0.0535
  Al 2Mg 1O  4              (C)  []         0.0289
  Al 1Na 1O  2              (C)  []         0.0120
  Al 2O  3                  (C)[]           0.1432
  Al 3Ti 1                  (C)  []         0.0113
  Si 1                      (C)[]           0.0395
*
```

82 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           870.0000
 Gas products amount        (mol)       6.40E-0011
 Products heat capacity     (J/K)          35.5505
 Products entropy           (J/K)          60.5455
 Products enthalpy          (KJ)          -71.3798
 Mass  of the system        (Kg)            0.0304
  Al 1                      (C)[]           0.7081
  Al 2Ca 1                  (C)[]           0.0187
  Al 3Fe 1                  (C)  []         0.0507
  Al 2Mg 1O  4              (C)  []         0.0274
  Al 1Na 1O  2              (C)  []         0.0114
  Al 2O  3                  (C)[]           0.1356
  Al 3Ti 1                  (C)  []         0.0107
  Si 1                      (C)[]           0.0374
*
```

83 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       3.53E-0014
 Products heat capacity     (J/K)          34.1125
 Products entropy           (J/K)          57.4532
 Products enthalpy          (KJ)          -68.3729
 Mass  of the system        (Kg)            0.0302
  Al 1                      (C)[]           0.7243
  Al 2Ca 1                  (C)[]           0.0176
  Al 3Fe 1                  (C)  []         0.0478
  Al 2Mg 1O  4              (C)  []         0.0259
  Al 1Na 1O  2              (C)  []         0.0107
  Al 2O  3                  (C)[]           0.1281
  Al 3Ti 1                  (C)  []         0.0101
  Si 1                      (C)[]           0.0353
*
```

84 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       6.84E-0011
 Products heat capacity     (J/K)          33.9172
 Products entropy           (J/K)          57.2914
```

```
 Products enthalpy          (KJ)          -62.9934
 Mass  of the system        (Kg)            0.0300
  Al 1                      (C)[]           0.7406
  Al 2Ca 1                  (C)[]           0.0166
  Al 3Fe 1                  (C)  []         0.0450
  Al 2Mg 1O  4              (C)  []         0.0243
  Al 1Na 1O  2              (C)  []         0.0101
  Al 2O  3                  (C)[]           0.1206
  Al 3Ti 1                  (C)  []         0.0095
  Si 1                      (C)[]           0.0332
*
     85 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           785.0000
 Gas products amount        (mol)       2.63E-0011
 Products heat capacity     (J/K)          33.4678
 Products entropy           (J/K)          56.4962
 Products enthalpy          (KJ)          -58.1966
 Mass  of the system        (Kg)            0.0298
  Al 1                      (C)[]           0.7568
  Al 2Ca 1                  (C)[]           0.0155
  Al 3Fe 1                  (C)  []         0.0422
  Al 2Mg 1O  4              (C)  []         0.0228
  Al 1Na 1O  2              (C)  []         0.0095
  Al 2O  3                  (C)[]           0.1131
  Al 3Ti 1                  (C)  []         0.0089
  Si 1                      (C)[]           0.0311
*
     86 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       4.18E-0012
 Products heat capacity     (J/K)          32.5374
 Products entropy           (J/K)          54.3529
 Products enthalpy          (KJ)          -54.4689
 Mass  of the system        (Kg)            0.0296
  Al 1                      (C)[]           0.7730
  Al 2Ca 1                  (C)[]           0.0145
  Al 3Fe 1                  (C)  []         0.0394
  Al 2Mg 1O  4              (C)  []         0.0213
  Al 1Na 1O  2              (C)  []         0.0089
  Al 2O  3                  (C)[]           0.1055
  Al 3Ti 1                  (C)  []         0.0084
  Si 1                      (C)[]           0.0291
*
     87 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           716.0000
 Gas products amount        (mol)       1.55E-0011
 Products heat capacity     (J/K)          31.9617
 Products entropy           (J/K)          53.1565
 Products enthalpy          (KJ)          -50.0709
 Mass  of the system        (Kg)            0.0294
  Al 1                      (C)[]           0.7892
  Al 2Ca 1                  (C)[]           0.0135
  Al 3Fe 1                  (C)  []         0.0366
  Al 2Mg 1O  4              (C)  []         0.0198
  Al 1Na 1O  2              (C)  []         0.0082
  Al 2O  3                  (C)[]           0.0980
  Al 3Ti 1                  (C)  []         0.0078
  Si 1                      (C)[]           0.0270
*
     88 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       8.82E-0012
 Products heat capacity     (J/K)          30.9921
```

```
 Products entropy           (J/K)          50.7098
 Products enthalpy          (KJ)          -46.5654
 Mass  of the system        (Kg)            0.0292
  Al 1                      (C)[]           0.8054
  Al 2Ca 1                  (C)[]           0.0124
  Al 3Fe 1                  (C)  []         0.0338
  Al 2Mg 1O  4              (C)  []         0.0183
  Al 1Na 1O  2              (C)  []         0.0076
  Al 2O  3                  (C)[]           0.0904
  Al 3Ti 1                  (C)  []         0.0072
  Si 1                      (C)[]           0.0249
*
     89 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       1.27E-0011
 Products heat capacity     (J/K)          30.8032
 Products entropy           (J/K)          50.5975
 Products enthalpy          (KJ)          -41.5236
 Mass  of the system        (Kg)            0.0290
  Al 1                      (C)[]           0.8216
  Al 2Ca 1                  (C)[]           0.0114
  Al 3Fe 1                  (C)  []         0.0310
  Al 2Mg 1O  4              (C)  []         0.0167
  Al 1Na 1O  2              (C)  []         0.0070
  Al 2O  3                  (C)[]           0.0829
  Al 3Ti 1                  (C)  []         0.0066
  Si 1                      (C)[]           0.0228
*
     90 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           619.4637
 Gas products amount        (mol)       4.27E-0012
 Products heat capacity     (J/K)          29.9623
 Products entropy           (J/K)          48.3384
 Products enthalpy          (KJ)          -37.9268
 Mass  of the system        (Kg)            0.0288
  Al 1                      (C)[]           0.8379
  Al 2Ca 1                  (C)[]           0.0104
  Al 3Fe 1                  (C)  []         0.0281
  Al 2Mg 1O  4              (C)  []         0.0152
  Al 1Na 1O  2              (C)  []         0.0063
  Al 2O  3                  (C)[]           0.0754
  Al 3Ti 1                  (C)  []         0.0060
  Si 1                      (C)[]           0.0208
*
     91 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       3.89E-0011
 Products heat capacity     (J/K)          28.9772
 Products entropy           (J/K)          45.2781
 Products enthalpy          (KJ)          -34.7559
 Mass  of the system        (Kg)            0.0286
  Al 1                      (C)[]           0.8541
  Al 2Ca 1                  (C)[]           0.0093
  Al 3Fe 1                  (C)  []         0.0253
  Al 2Mg 1O  4              (C)  []         0.0137
  Al 1Na 1O  2              (C)  []         0.0057
  Al 2O  3                  (C)[]           0.0678
  Al 3Ti 1                  (C)  []         0.0054
  Si 1                      (C)[]           0.0187
*
     92 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       5.22E-0012
```

```
 Products heat capacity     (J/K)          28.8002
 Products entropy           (J/K)          45.2010
 Products enthalpy          (KJ)          -29.8933
 Mass  of the system        (Kg)            0.0284
  Al 1                      (C)[]           0.8703
  Al 2Ca 1                  (C)[]           0.0083
  Al 3Fe 1                  (C)  []         0.0225
  Al 2Mg 1O  4              (C)  []         0.0122
  Al 1Na 1O  2              (C)  []         0.0051
  Al 2O  3                  (C)[]           0.0603
  Al 3Ti 1                  (C)  []         0.0048
  Si 1                      (C)[]           0.0166
*
```

93 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       1.07E-0010
 Products heat capacity     (J/K)          27.8699
 Products entropy           (J/K)          41.9252
 Products enthalpy          (KJ)          -26.7884
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8865
  Al 2Ca 1                  (C)[]           0.0073
  Al 3Fe 1                  (C)  []         0.0197
  Al 2Mg 1O  4              (C)  []         0.0107
  Al 1Na 1O  2              (C)  []         0.0044
  Al 2O  3                  (C)[]           0.0528
  Al 3Ti 1                  (C)  []         0.0042
  Si 1                      (C)[]           0.0145
*
```

94 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       8.60E-0014
 Products heat capacity     (J/K)          27.3075
 Products entropy           (J/K)          39.9907
 Products enthalpy          (KJ)          -22.9498
 Mass  of the system        (Kg)            0.0280
  Al 1                      (C)[]           0.9027
  Al 2Ca 1                  (C)[]           0.0062
  Al 3Fe 1                  (C)  []         0.0169
  Al 2Mg 1O  4              (C)  []         0.0091
  Al 1Na 1O  2              (C)  []         0.0038
  Al 2O  3                  (C)[]           0.0452
  Al 3Ti 1                  (C)  []         0.0036
  Si 1                      (C)[]           0.0125
*
```

95 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       2.37E-0013
 Products heat capacity     (J/K)          27.1502
 Products entropy           (J/K)          39.9462
 Products enthalpy          (KJ)          -18.2596
 Mass  of the system        (Kg)            0.0279
  Al 1                      (C)[]           0.9189
  Al 2Ca 1                  (C)[]           0.0052
  Al 3Fe 1                  (C)  []         0.0141
  Al 2Mg 1O  4              (C)  []         0.0076
  Al 1Na 1O  2              (C)  []         0.0032
  Al 2O  3                  (C)[]           0.0377
  Al 3Ti 1                  (C)  []         0.0030
  Si 1                      (C)[]           0.0104
*
```

96 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
```

```
 Gas products amount        (mol)       2.55E-0013
 Products heat capacity     (J/K)          26.9951
 Products entropy           (J/K)          39.9026
 Products enthalpy          (KJ)          -13.6332
 Mass  of the system        (Kg)            0.0277
  Al 1                      (C)[]           0.9351
  Al 2Ca 1                  (C)[]           0.0041
  Al 3Fe 1                  (C)  []         0.0113
  Al 2Mg 1O  4              (C)  []         0.0061
  Al 1Na 1O  2              (C)  []         0.0025
  Al 2O  3                  (C)[]           0.0301
  Al 3Ti 1                  (C)  []         0.0024
  Si 1                      (C)[]           0.0083
*
     97 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       6.09E-0014
 Products heat capacity     (J/K)          25.9271
 Products entropy           (J/K)          34.9678
 Products enthalpy          (KJ)          -11.1503
 Mass  of the system        (Kg)            0.0275
  Al 1                      (C)[]           0.9496
  Al 4Ca 1                  (C)[]           0.0049
  Al 3Fe 1                  (C)  []         0.0084
  Al 2Mg 1O  4              (C)  []         0.0046
  Al 1Na 1O  2              (C)  []         0.0019
  Al 2O  3                  (C)[]           0.0226
  Al 3Ti 1                  (C)  []         0.0018
  Si 1                      (C)[]           0.0062
*
     98 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          25.7941
 Products entropy           (J/K)          34.9529
 Products enthalpy          (KJ)           -6.6288
 Mass  of the system        (Kg)            0.0273
  Al 1                      (C)[]           0.9664
  Al 4Ca 1                  (C)[]           0.0033
  Al 3Fe 1                  (C)  []         0.0056
  Al 2Mg 1O  4              (C)  []         0.0030
  Al 1Na 1O  2              (C)  []         0.0013
  Al 2O  3                  (C)[]           0.0151
  Al 3Ti 1                  (C)  []         0.0012
  Si 1                      (C)[]           0.0042
*
     99 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           370.9277
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          25.4624
 Products entropy           (J/K)          33.7878
 Products enthalpy          (KJ)           -2.5990
 Mass  of the system        (Kg)            0.0272
  Al 1                      (C)[]           0.9832
  Al 4Ca 1                  (C)[]           0.0016
  Al 3Fe 1                  (C)  []         0.0028
  Al 2Mg 1O  4              (C)  []         0.0015
  Al 1Na 1O  2              (C)  []     6.34E-0004
  Al 2O  3                  (C)[]           0.0075
  Al 3Ti 1                  (C)  []     5.98E-0004
  Si 1                      (C)[]           0.0021
*
     100 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)           336.8270
 Gas products amount        (mol)       1.25E-0012
 Products heat capacity     (J/K)          24.9186
 Products entropy           (J/K)          31.3558
 Products enthalpy          (KJ)            0.9453
 Mass  of the system        (Kg)            0.0270
  Al 1                      (C)[]           1.0000
*
```

Mg/(JSC-Mars-1A)

```
     Content of Magnesium - 0 wt% Mg
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           695.4633
 Gas products amount        (mol)       4.39E-0013
 Products heat capacity     (J/K)          78.7794
 Products entropy           (J/K)         106.0598
 Products enthalpy          (KJ)         -962.7387
 Mass  of the system        (Kg)            0.0732
  Al 3Ca 1Na 1O 16Si 5      (C)  [LABRA     0.0176
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1938
  Al 2O  5Si 1              (C)  [KIANI     0.2159
  Al 2O  5Ti 1              (C)  []         0.0842
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2316
  Fe 2O  3                  (C)[]           0.1643
  O  2Si 1                  (C)[]           0.0927
*
     1 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           836.1459
 Gas products amount        (mol)       4.92E-0014
 Products heat capacity     (J/K)          84.0741
 Products entropy           (J/K)         120.1319
 Products enthalpy          (KJ)         -934.3076
 Mass  of the system        (Kg)            0.0718
  Al 2Fe 1O  4              (C)  []         0.0375
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2003
  Al 2O  5Si 1              (C)  [KIANI     0.1840
  Al 2O  5Ti 1              (C)  []         0.0834
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2363
  Fe 3O  4                  (C)[]           0.1406
  Mg 2O  6Si 2              (C)[KLINOEN     0.0381
  O  2Si 1                  (C)[]           0.0800
*
     2 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          79.0975
 Products entropy           (J/K)         130.7919
 Products enthalpy          (KJ)         -906.9891
 Mass  of the system        (Kg)            0.0704
  Al 2Fe 1O  4              (C)  []         0.2396
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1982
  Al 2O  5Ti 1              (C)  []         0.0751
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2339
  Fe 3O  4                  (C)[]           0.0429
  Fe 2O  4Ti 1              (C)  [ULVIT     0.0092
  Mg 2O  6Si 2              (C)[KLINOEN     0.0794
  O  2Si 1                  (C)[]       4.54E-0005
  O  2Si 1                  (C)  [QUART     0.1217
*
     3 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1106.6443
 Gas products amount        (mol)       1.03E-0011
 Products heat capacity     (J/K)          79.5505
 Products entropy           (J/K)         137.7137
 Products enthalpy          (KJ)         -880.5943
 Mass  of the system        (Kg)            0.0691
  Al 2Fe 1O  4              (C)  []         0.2553
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1962
  Al 2O  5Ti 1              (C)  []         0.0553
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2315
```

```
  Fe 1                        (C)[]           0.0132
  Fe 2O  4Ti 1                (C)  [ULVIT     0.0325
  Mg 2O  6Si 2                (C)[KLINOEN     0.1207
  O  2Si 1                    (C)  [CRIST     0.0953
*
```

4 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)       7.08E-0012
 Products heat capacity     (J/K)          78.6043
 Products entropy           (J/K)         143.0470
 Products enthalpy          (KJ)         -855.3434
 Mass  of the system        (Kg)            0.0678
  Al 2Fe 1O  4              (C)  []         0.2277
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1942
  Al 2O  5Ti 1              (C)  []         0.0808
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2291
  Fe 1                      (C)[]           0.0368
  Fe 1O  1                  (C)[]       5.10E-0004
  Mg 1O  3Si 1              (C)             0.1621
  O  2Si 1                  (C)  [CRIST     0.0688
*
```

5 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1337.8246
 Gas products amount        (mol)       3.60E-0014
 Products heat capacity     (J/K)          78.1237
 Products entropy           (J/K)         147.0673
 Products enthalpy          (KJ)         -830.9954
 Mass  of the system        (Kg)            0.0665
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1173
  Al 2Fe 1O  4              (C)  []         0.1520
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1922
  Al 2O  5Ti 1              (C)  []         0.0800
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1355
  Fe 1                      (C)[]           0.0603
  Mg 1O  3Si 1              (C)             0.2457
  O  2Si 1                  (C)  [CRIST     0.0170
*
```

6 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1448.7460
 Gas products amount        (mol)       1.02E-0010
 Products heat capacity     (J/K)          77.6069
 Products entropy           (J/K)         150.4462
 Products enthalpy          (KJ)         -807.4609
 Mass  of the system        (Kg)            0.0653
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1550
  Al 2Fe 1O  4              (C)  []         0.0752
  Al 2Mg 1O  4              (C)  []         0.0417
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1902
  Al 2O  5Ti 1              (C)  []         0.0792
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1037
  Fe 1                      (C)[]           0.0839
  Mg 1O  3Si 1              (C)             0.2712
*
```

7 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1556.1246
 Gas products amount        (mol)       1.56E-0011
 Products heat capacity     (J/K)          77.1519
 Products entropy           (J/K)         153.1364
 Products enthalpy          (KJ)         -784.8668
 Mass  of the system        (Kg)            0.0642
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1513
  Al 2Mg 1O  4              (C)  []         0.1032
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1881
```

```
  Al 2O  5Ti 1              (C)  []         0.0783
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1042
  Fe 1                      (C)[]           0.1066
  Fe 1Si 1                  (C)[]       4.11E-0004
  Mg 1O  3Si 1              (C)             0.2679
*
     8 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1628.4508
 Gas products amount        (mol)       5.58E-0011
 Products heat capacity     (J/K)          76.3952
 Products entropy           (J/K)         153.8151
 Products enthalpy          (KJ)         -762.8707
 Mass  of the system        (Kg)            0.0631
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0574
  Al 2Mg 1O  4              (C)  []         0.1493
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1861
  Al 2O  5Ti 1              (C)  []         0.0775
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1749
  Fe 1                      (C)[]           0.0931
  Fe 1Si 1                  (C)[]           0.0190
  Mg 1O  3Si 1              (C)             0.2428
*
     9 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1665.0000
 Gas products amount        (mol)       1.25E-0009
 Products heat capacity     (J/K)          77.9448
 Products entropy           (J/K)         154.2916
 Products enthalpy          (KJ)         -741.7326
 Mass  of the system        (Kg)            0.0620
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2651
  Al 2Mg 1O  4              (C)  []         0.0411
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1841
  Al 2O  5Ti 1              (C)  []         0.0766
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0109
  Fe 1                      (C)[]           0.0796
  Fe 1Si 1                  (C)[]           0.0375
  Mg 2O  4Si 1              (C)             0.3051
*
     10 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1672.8429     1672.6739     1673.0119
 Gas products amount        (mol)       4.11E-0011    2.55E-0011    9.61E-0011
 Products heat capacity     (J/K)          79.8903       79.6163       80.8551
 Products entropy           (J/K)         154.7273      154.4177      155.8171
 Products enthalpy          (KJ)         -721.2755     -721.7934     -719.4525
 Phase transition enthalpy  (KJ)            2.3408
 Mass  of the system        (Kg)            0.0610
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0904        0.1161        0.0000
  Al 2Mg 1O  4              (C)  []         0.1285        0.1153        0.1747
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.1821        0.1821        0.1821
  Al 2O  5Ti 1              (C)  []         0.0758        0.0758        0.0758
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1444        0.1244        0.2148
  Fe 1                      (C)[]           0.0661        0.0661        0.0661
  Fe 1Si 1                  (C)[]           0.0561        0.0561        0.0561
  Mg 1O  3Si 1              (C)             0.0332        0.0146        0.0984
  Mg 2O  4Si 1              (C)             0.2235        0.2494        0.1320
*
     11 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1692.7334     1692.3126     1693.1543
 Gas products amount        (mol)       5.75E-0010    9.36E-0010    1.93E-0010
 Products heat capacity     (J/K)          79.4558       80.6750       78.1679
 Products entropy           (J/K)         154.2956      153.1447      155.5113
 Products enthalpy          (KJ)         -701.5085     -703.5229     -699.3807
 Phase transition enthalpy  (KJ)            4.1423
```

```
 Mass  of the system        (Kg)            0.0600
  Al 2Mg 1O  4              (C)  []         0.1728        0.1728        0.1728
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.0474        0.0000        0.0975
  Al 2Na 2O 16Si 6          (C)  [LOW A     0.0925        0.1800       -0.0000
  Al 2O  5Ti 1              (C)  []         0.0750        0.0750        0.0750
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2124        0.2124        0.2124
  Fe 1                      (C)[]           0.0526        0.0526        0.0526
  Fe 1Si 1                  (L)[]           0.0363        0.0000        0.0747
  Fe 1Si 1                  (C)[]           0.0384        0.0747        0.0000
  Mg 1O  3Si 1              (C)             0.1396        0.0055        0.2812
  Mg 2O  4Si 1              (C)             0.1331        0.2270        0.0338
*
```

12 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1719.5978
 Gas products amount        (mol)       9.28E-0011
 Products heat capacity     (J/K)          77.4982
 Products entropy           (J/K)         154.4008
 Products enthalpy          (KJ)         -682.3828
 Mass  of the system        (Kg)            0.0590
  Al 2Mg 1O  4              (C)  []         0.1708
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0964
  Al 2O  5Ti 1              (C)  []         0.0741
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2100
  Fe 1                      (C)[]           0.0391
  Fe 1Si 1                  (L)[]           0.0932
  Mg 1O  3Si 1              (C)             0.1853
  Mg 2O  4Si 1              (C)             0.1310
*
```

13 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1759.8519
 Gas products amount        (mol)       1.27E-0010
 Products heat capacity     (J/K)          77.2739
 Products entropy           (J/K)         154.5727
 Products enthalpy          (KJ)         -664.1431
 Mass  of the system        (Kg)            0.0580
  Al 2Mg 1O  4              (C)  []         0.1689
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0953
  Al 2O  5Ti 1              (C)  []         0.0733
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2077
  Fe 1                      (C)[]           0.0256
  Fe 1Si 1                  (L)[]           0.1118
  Mg 1O  3Si 1              (C)             0.0893
  Mg 2O  4Si 1              (C)             0.2282
*
```

14 wt% Mg

```
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1796.1668     1795.9154     1796.4183
 Gas products amount        (mol)       8.73E-0010    6.78E-0010    1.13E-0009
 Products heat capacity     (J/K)          77.3089       77.0819       77.6142
 Products entropy           (J/K)         155.0007      154.6038      155.5344
 Products enthalpy          (KJ)         -645.9290     -646.6482     -644.9620
 Phase transition enthalpy  (KJ)            1.6861
 Mass  of the system        (Kg)            0.0571
  Al 2Mg 1O  4              (C)  []         0.1889        0.1701        0.2142
  Al 1Na 1O  4Si 1          (C)  [NEFEL     0.0504        0.0879        0.0000
  Al 2O  5Ti 1              (C)  []         0.0724        0.0724        0.0724
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2053        0.2053        0.2053
  Fe 1                      (C)[]           0.0121        0.0121        0.0121
  Fe 1Si 1                  (L)[]           0.1303        0.1303        0.1303
  Mg 2O  4Si 1              (C)             0.3098        0.3191        0.2973
  Na 2O  3Si 1              (L)[]           0.0188        0.0027        0.0405
  O  2Si 1                  (C)  [CRIST     0.0119       -0.0000        0.0279
*
```

15 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)          1833.5981
 Gas products amount        (mol)       1.42E-0009
 Products heat capacity     (J/K)          76.8078
 Products entropy           (J/K)         155.1710
 Products enthalpy          (KJ)         -628.5352
 Mass  of the system        (Kg)            0.0562
  Al 2Mg 1O  4              (C)  []         0.2139
  Al 2O  5Ti 1              (C)  []         0.0687
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2029
  Fe 1Si 1                  (L)[]           0.1468
  Mg 2O  4Si 1              (C)             0.3259
  Mg 2O  6Si 2              (L)[KLINOEN 8.14E-0004
  Na 2O  3Si 1              (L)[]           0.0400
  Si 3Ti 5                  (C)[]           0.0010
*
```

16 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1887.6950
 Gas products amount        (mol)       1.24E-0009
 Products heat capacity     (J/K)          75.4959
 Products entropy           (J/K)         154.5582
 Products enthalpy          (KJ)         -611.7207
 Mass  of the system        (Kg)            0.0554
  Al 2Mg 1O  4              (C)  []         0.2509
  Al 2O  5Ti 1              (C)  []         0.0174
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1731
  Ca 1O  3Ti 1              (C)  []         0.0172
  Fe 1Si 1                  (L)[]           0.1451
  Mg 2O  4Si 1              (C)             0.3460
  Na 2O  3Si 1              (L)[]           0.0395
  Si 3Ti 5                  (C)[]           0.0108
*
```

17 wt% Mg

```
 Volume of gas products   (litres)          3.9805
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1880.6924
 Gas products amount        (mol)           0.0250
 Products heat capacity     (J/K)          73.9112
 Products entropy           (J/K)         153.6121
 Products enthalpy          (KJ)         -595.7254
 Mass  of the system        (Kg)            0.0546
1 Mg 1                      (G)         2.37E-0004        0.0213  (atm)
1 Na 1                      (G)             0.0101        0.9594  (atm)
1 Na 2                      (G)         1.30E-0004        0.0062  (atm)
1 O  1Si 1                  (G)         2.64E-0004        0.0131  (atm)
  Al 2Mg 1O  4              (C)  []         0.2614
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1676
  Ca 1O  3Ti 1              (C)  []         0.0192
  Fe 1Si 1                  (L)[]           0.1433
  Mg 2O  4Si 1              (C)             0.3701
  Na 2O  3Si 1              (L)[]           0.0119
  Si 3Ti 5                  (C)[]           0.0158
*
```

18 wt% Mg

```
 Volume of gas products   (litres)          6.1427
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1919.6209
 Gas products amount        (mol)           0.0377
 Products heat capacity     (J/K)          71.9985
 Products entropy           (J/K)         152.7648
 Products enthalpy          (KJ)         -579.6222
 Mass  of the system        (Kg)            0.0538
1 Mg 1                      (G)             0.0015        0.0892  (atm)
1 Na 1                      (G)             0.0144        0.8914  (atm)
1 Na 2                      (G)         1.55E-0004        0.0048  (atm)
1 O  1Si 1                  (G)         4.52E-0004        0.0146  (atm)
  Al 2Mg 1O  4              (C)  []         0.2582
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1122
  Ca 2O  4Si 1              (C)  [BETA]     0.0304
  Ca 1O  3Ti 1              (C)  []         0.0044
```

```
  Fe 1Si 1                  (L)[]           0.1416
  Mg 2O  4Si 1              (C)             0.4141
  Si 3Ti 5                  (C)[]           0.0225
*
     19 wt% Mg
 Volume of gas products   (litres)          7.4584
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1953.7035
 Gas products amount        (mol)           0.0450
 Products heat capacity     (J/K)          69.7124
 Products entropy           (J/K)         151.5718
 Products enthalpy          (KJ)         -564.2773
 Mass  of the system        (Kg)            0.0530
1 Mg 1                      (G)             0.0048        0.2340  (atm)
1 Na 1                      (G)             0.0143        0.7293  (atm)
1 Na 2                      (G)         1.15E-0004        0.0029  (atm)
1 O  1Si 1                  (G)             0.0013        0.0336  (atm)
  Al 2Mg 1O  4              (C)  []         0.2551
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0334
  Ca 2O  4Si 1              (C)  [BETA]     0.0636
  Fe 1Si 1                  (L)[]           0.1399
  Mg 2O  4Si 1              (C)             0.4599
  Si 1                      (L)[]           0.0034
  Si 3Ti 5                  (C)[]           0.0243
*
     20 wt% Mg
 Volume of gas products   (litres)          8.3401
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1970.8120
 Gas products amount        (mol)           0.0499
 Products heat capacity     (J/K)          68.0928
 Products entropy           (J/K)         150.4302
 Products enthalpy          (KJ)         -549.1595
 Mass  of the system        (Kg)            0.0522
1 Mg 1                      (G)             0.0074        0.3197  (atm)
1 Na 1                      (G)             0.0141        0.6413  (atm)
1 Na 2                      (G)         9.59E-0005        0.0022  (atm)
1 O  1Si 1                  (G)             0.0015        0.0366  (atm)
  Al 2Mg 1O  4              (C)  []         0.2519
  Ca 2O  4Si 1              (C)  [BETA]     0.0759
  Fe 1Si 1                  (L)[]           0.1382
  Mg 1O  1                  (C)[]           0.0201
  Mg 2O  4Si 1              (C)             0.4578
  Si 1                      (L)[]           0.0089
  Si 3Ti 5                  (C)[]           0.0240
*
     21 wt% Mg
 Volume of gas products   (litres)          8.3731
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1977.2967
 Gas products amount        (mol)           0.0499
 Products heat capacity     (J/K)          66.9956
 Products entropy           (J/K)         149.0200
 Products enthalpy          (KJ)         -535.0303
 Mass  of the system        (Kg)            0.0515
1 Mg 1                      (G)             0.0079        0.3345  (atm)
1 Na 1                      (G)             0.0139        0.6240  (atm)
1 Na 2                      (G)         9.06E-0005        0.0020  (atm)
1 O  1Si 1                  (G)             0.0017        0.0392  (atm)
  Al 2Mg 1O  4              (C)  []         0.2488
  Ca 2O  4Si 1              (C)  [BETA]     0.0750
  Fe 1Si 1                  (L)[]           0.1364
  Mg 1O  1                  (C)[]           0.0597
  Mg 2O  4Si 1              (C)             0.4173
  Si 1                      (L)[]           0.0156
  Si 3Ti 5                  (C)[]           0.0237
*
     22 wt% Mg
 Volume of gas products   (litres)          8.8498
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1992.7740
```

```
 Gas products amount        (mol)           0.0524
 Products heat capacity     (J/K)          65.9690
 Products entropy           (J/K)         148.2361
 Products enthalpy          (KJ)         -520.1250
 Mass  of the system        (Kg)            0.0508
1 Mg 1                      (G)             0.0093        0.3723  (atm)
1 Na 1                      (G)             0.0138        0.5797  (atm)
1 Na 2                      (G)          8.02E-0005       0.0017  (atm)
1 O  1Si 1                  (G)             0.0021        0.0460  (atm)
  Al 2Mg 1O  4              (C)  []         0.2456
  Ca 2O  4Si 1              (C)  [BETA]     0.0740
  Fe 1Si 1                  (L)[]           0.1347
  Mg 1O  1                  (C)[]           0.0961
  Mg 2O  4Si 1              (C)             0.3792
  Si 1                      (L)[]           0.0217
  Si 3Ti 5                  (C)[]           0.0234
*
```

23 wt% Mg

```
 Volume of gas products   (litres)          8.6170        8.6141        8.6385
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1993.0370     1992.7740     1993.2999
 Gas products amount        (mol)           0.0510        0.0510        0.0511
 Products heat capacity     (J/K)          65.2337       64.8970       67.6723
 Products entropy           (J/K)         146.9247      146.5096      149.9311
 Products enthalpy          (KJ)         -506.7187     -507.5461     -500.7273
 Phase transition enthalpy  (KJ)            6.8188
 Mass  of the system        (Kg)            0.0501
1 Mg 1                      (G)             0.0092        0.0092        0.0093
1 Na 1                      (G)             0.0136        0.0136        0.0136
1 Na 2                      (G)          7.91E-0005    7.92E-0005    7.88E-0005
1 O  1Si 1                  (G)             0.0021        0.0021        0.0021
  Al 2Mg 1O  4              (C)  []         0.2425        0.2425        0.2425
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0223        0.0000        0.1837
  Ca 2O  4Si 1              (C)  [BETA]     0.0642        0.0731        0.0000
  Fe 1Si 1                  (L)[]           0.1330        0.1330        0.1330
  Mg 1O  1                  (C)[]           0.1457        0.1374        0.2057
  Mg 2O  4Si 1              (C)             0.3155        0.3372        0.1582
  Si 1                      (L)[]           0.0288        0.0288        0.0288
  Si 3Ti 5                  (C)[]           0.0231        0.0231        0.0231
*
```

24 wt% Mg

```
 Volume of gas products   (litres)          8.3736        8.3621        8.4002
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1992.6560     1992.2751     1993.0370
 Gas products amount        (mol)           0.0496        0.0495        0.0497
 Products heat capacity     (J/K)          64.6696       63.8517       66.5550
 Products entropy           (J/K)         145.8120      144.7989      148.1471
 Products enthalpy          (KJ)         -493.3491     -495.3680     -488.6955
 Phase transition enthalpy  (KJ)            6.6725
 Mass  of the system        (Kg)            0.0494
1 Mg 1                      (G)             0.0091        0.0090        0.0091
1 Na 1                      (G)             0.0134        0.0134        0.0134
1 Na 2                      (G)          7.83E-0005    7.84E-0005    7.80E-0005
1 O  1Si 1                  (G)             0.0020        0.0020        0.0020
  Al 2Mg 1O  4              (C)  []         0.2393        0.2393        0.2393
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0549        0.0000        0.1814
  Ca 2O  4Si 1              (C)  [BETA]     0.0503        0.0721        0.0000
  Fe 1Si 1                  (L)[]           0.1312        0.1312        0.1312
  Mg 1O  1                  (C)[]           0.1992        0.1789        0.2461
  Mg 2O  4Si 1              (C)             0.2417        0.2951        0.1185
  Si 1                      (L)[]           0.0360        0.0360        0.0359
  Si 3Ti 5                  (C)[]           0.0228        0.0228        0.0228
*
```

25 wt% Mg

```
 Volume of gas products   (litres)          8.1635        8.1550        8.1729
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1992.7477     1992.5288     1992.9665
 Gas products amount        (mol)           0.0483        0.0483        0.0484
 Products heat capacity     (J/K)          64.0943       62.8378       65.4686
 Products entropy           (J/K)         144.7294      143.1833      146.4205
 Products enthalpy          (KJ)         -480.3388     -483.4201     -476.9687
```

```
 Phase transition enthalpy  (KJ)            6.4514
 Mass  of the system        (Kg)            0.0487
1 Mg 1                      (G)             0.0090        0.0089        0.0090
1 Na 1                      (G)             0.0132        0.0132        0.0132
1 Na 2                      (G)          7.71E-0005    7.72E-0005    7.70E-0005
1 O  1Si 1                  (G)             0.0020        0.0020        0.0020
  Al 2Mg 1O  4              (C)  []         0.2362        0.2362        0.2362
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0855        0.0000        0.1790
  Ca 2O  4Si 1              (C)  [BETA]     0.0372        0.0712        0.0000
  Fe 1Si 1                  (L)[]           0.1295        0.1295        0.1295
  Mg 1O  1                  (C)[]           0.2518        0.2201        0.2866
  Mg 2O  4Si 1              (C)             0.1699        0.2532        0.0789
  Si 1                      (L)[]           0.0431        0.0431        0.0431
  Si 3Ti 5                  (C)[]           0.0225        0.0225        0.0225
*
     26 wt% Mg
 Volume of gas products   (litres)          7.9745        7.9509        7.9872
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1993.1614     1992.7476     1993.5752
 Gas products amount        (mol)           0.0472        0.0471        0.0473
 Products heat capacity     (J/K)          63.5181       61.8505       64.4129
 Products entropy           (J/K)         143.6753      141.6077      144.7848
 Products enthalpy          (KJ)         -467.6735     -471.7941     -465.4623
 Phase transition enthalpy  (KJ)            6.3318
 Mass  of the system        (Kg)            0.0481
1 Mg 1                      (G)             0.0089        0.0089        0.0089
1 Na 1                      (G)             0.0130        0.0130        0.0130
1 Na 2                      (G)          7.57E-0005    7.60E-0005    7.56E-0005
1 O  1Si 1                  (G)             0.0020        0.0020        0.0020
  Al 2Mg 1O  4              (C)  []         0.2330        0.2330        0.2330
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1149        0.0000        0.1766
  Ca 2O  4Si 1              (C)  [BETA]     0.0245        0.0702        0.0000
  Fe 1Si 1                  (L)[]           0.1278        0.1278        0.1278
  Mg 1O  1                  (C)[]           0.3039        0.2613        0.3268
  Mg 2O  4Si 1              (C)             0.0994        0.2113        0.0394
  Si 1                      (L)[]           0.0502        0.0502        0.0502
  Si 3Ti 5                  (C)[]           0.0222        0.0222        0.0222
*
     27 wt% Mg
 Volume of gas products   (litres)          7.7536        7.7248        7.7589
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1992.7914     1992.4213     1993.1614
 Gas products amount        (mol)           0.0459        0.0457        0.0459
 Products heat capacity     (J/K)          62.9940       60.8865       63.3761
 Products entropy           (J/K)         142.6478      140.0376      143.1210
 Products enthalpy          (KJ)         -455.3346     -460.5365     -454.3914
 Phase transition enthalpy  (KJ)            6.1451
 Mass  of the system        (Kg)            0.0474
1 Mg 1                      (G)             0.0088        0.0087        0.0088
1 Na 1                      (G)             0.0129        0.0129        0.0129
1 Na 2                      (G)          7.49E-0005    7.52E-0005    7.48E-0005
1 O  1Si 1                  (G)             0.0020        0.0019        0.0020
  Al 2Mg 1O  4              (C)  []         0.2299        0.2299        0.2299
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1472        0.0000        0.1738
  Ca 2O  4Si 1              (C)  [BETA]     0.0108        0.0693    1.41E-0004
  Fe 1Si 1                  (L)[]           0.1261        0.1261        0.1261
  Mg 1O  1                  (C)[]           0.3573        0.3027        0.3672
  Mg 2O  4Si 1              (C)             0.0260        0.1692        0.0000
  Si 1                      (L)[]           0.0573        0.0574        0.0573
  Si 3Ti 5                  (C)[]           0.0219        0.0219        0.0219
*
     28 wt% Mg
 Volume of gas products   (litres)          7.9763
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2000.9723
 Gas products amount        (mol)           0.0470
 Products heat capacity     (J/K)          61.8592
 Products entropy           (J/K)         141.3956
 Products enthalpy          (KJ)         -443.8185
 Mass  of the system        (Kg)            0.0468
1 Mg 1                      (G)             0.0097        0.3985  (atm)
```

```
1 Na 1                      (G)             0.0127        0.5503  (atm)
1 Na 2                      (G)          6.89E-0005       0.0015  (atm)
1 O  1Si 1                  (G)             0.0022        0.0494  (atm)
  Al 2Mg 1O  4              (C)  []         0.2267
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1335
  Ca 2O  4Si 1              (C)  [BETA]     0.0152
  Fe 1Si 1                  (L)[]           0.1243
  Mg 1O  1                  (C)[]           0.3901
  Si 1                      (L)[]           0.0638
  Si 3Ti 5                  (C)[]           0.0216
*
```

29 wt% Mg

```
 Volume of gas products   (litres)          8.9757
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2018.3094
 Gas products amount        (mol)           0.0524
 Products heat capacity     (J/K)          60.5116
 Products entropy           (J/K)         140.3996
 Products enthalpy          (KJ)         -432.0017
 Mass  of the system        (Kg)            0.0462
1 Mg 1                      (G)             0.0127        0.4606  (atm)
1 Na 1                      (G)             0.0125        0.4807  (atm)
1 Na 2                      (G)          5.70E-0005       0.0011  (atm)
1 O  1Si 1                  (G)             0.0029        0.0572  (atm)
  Al 2Mg 1O  4              (C)  []         0.2236
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0986
  Ca 2O  4Si 1              (C)  [BETA]     0.0282
  Fe 1Si 1                  (L)[]           0.1226
  Mg 1O  1                  (C)[]           0.4088
  Si 1                      (L)[]           0.0559
  Si 2Ti 1                  (L)[]           0.0342
*
```

30 wt% Mg

```
 Volume of gas products   (litres)          9.7388
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2028.9253
 Gas products amount        (mol)           0.0566
 Products heat capacity     (J/K)          59.0821
 Products entropy           (J/K)         139.4457
 Products enthalpy          (KJ)         -420.6760
 Mass  of the system        (Kg)            0.0457
1 Mg 1                      (G)             0.0151        0.5023  (atm)
1 Na 1                      (G)             0.0124        0.4338  (atm)
1 Na 2                      (G)          4.95E-0005    8.68E-0004  (atm)
1 O  1Si 1                  (G)             0.0034        0.0625  (atm)
  Al 2Mg 1O  4              (C)  []         0.2204
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0621
  Ca 2O  4Si 1              (C)  [BETA]     0.0417
  Fe 1Si 1                  (L)[]           0.1209
  Mg 1O  1                  (C)[]           0.4285
  Si 1                      (L)[]           0.0743
  Si 3Ti 5                  (C)[]           0.0210
*
```

31 wt% Mg

```
 Volume of gas products   (litres)         10.7008
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2038.8456
 Gas products amount        (mol)           0.0619
 Products heat capacity     (J/K)          57.7373
 Products entropy           (J/K)         138.4599
 Products enthalpy          (KJ)         -409.6081
1 Mg 1                      (G)             0.0337        0.5446  (atm)
1 Na 1                      (G)             0.0239        0.3864  (atm)
1 O  1Si 1                  (G)             0.0042        0.0678  (atm)
  Al 2Mg 1O  4              (C)  []         0.0689
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0057
  Ca 2O  4Si 1              (C)  [BETA]     0.0143
  Fe 1Si 1                  (L)[]           0.0640
  Mg 1O  1                  (C)[]           0.5001
  Si 1                      (L)[]           0.1275
  Si 3Ti 5                  (C)[]           0.0029
```

```
*
     32 wt% Mg
 Volume of gas products   (litres)         12.2074
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2038.8456
 Gas products amount        (mol)           0.0706
 Products heat capacity     (J/K)          56.5073
 Products entropy           (J/K)         137.5148
 Products enthalpy          (KJ)         -398.6423
 Mass  of the system        (Kg)            0.0445
1 Mg 1                      (G)             0.0234        0.6083  (atm)
1 Na 1                      (G)             0.0120        0.3299  (atm)
1 O  1Si 1                  (G)             0.0042        0.0607  (atm)
  Al 2Mg 1O  4              (C)   []        0.2141
  Ca 2O  4Si 1              (C)   [BETA]    0.0645
  Fe 1Si 1                  (L)[]           0.1174
  Mg 1O  1                  (C)[]           0.4604
  Si 1                      (L)[]           0.0710
  Si 2Ti 1                  (L)[]           0.0328
*
     33 wt% Mg
 Volume of gas products   (litres)         15.1524
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1978.9253
 Gas products amount        (mol)           0.0903
 Products heat capacity     (J/K)          55.3098
 Products entropy           (J/K)         136.7805
 Products enthalpy          (KJ)         -387.6441
 Mass  of the system        (Kg)            0.0440
1 Ca 1                      (G)          6.27E-0005    7.62E-0004  (atm)
1 Mg 1                      (G)             0.0364        0.7290  (atm)
1 Na 1                      (G)             0.0119        0.2512  (atm)
1 O  1Si 1                  (G)             0.0017        0.0185  (atm)
  Al 2Mg 1O  4              (C)   []        0.2109
  Ca 2O  4Si 1              (C)   [BETA]    0.0635
  Fe 1Si 1                  (L)[]           0.1157
  Mg 1O  1                  (C)[]           0.4560
  Si 1                      (L)[]           0.0838
  Si 3Ti 5                  (C)[]           0.0201
*
     34 wt% Mg
 Volume of gas products   (litres)         18.0884
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1901.5147
 Gas products amount        (mol)           0.1122
 Products heat capacity     (J/K)          54.0804
 Products entropy           (J/K)         135.6977
 Products enthalpy          (KJ)         -377.2990
 Mass  of the system        (Kg)            0.0435
1 Ca 1                      (G)          1.36E-0004        0.0013  (atm)
1 Mg 1                      (G)             0.0500        0.7972  (atm)
1 Na 1                      (G)             0.0117        0.1968  (atm)
1 O  1Si 1                  (G)          4.75E-0004        0.0042  (atm)
  Al 2Mg 1O  4              (C)   []        0.2078
  Ca 2O  4Si 1              (C)   [BETA]    0.0624
  Fe 1Si 1                  (L)[]           0.1140
  Mg 1O  1                  (C)[]           0.4505
  Si 1                      (L)[]           0.0833
  Si 3Ti 5                  (C)[]           0.0198
*
     35 wt% Mg
 Volume of gas products   (litres)         19.9775
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1845.3518
 Gas products amount        (mol)           0.1277
 Products heat capacity     (J/K)          53.0075
 Products entropy           (J/K)         134.6380
 Products enthalpy          (KJ)         -366.9843
 Mass  of the system        (Kg)            0.0430
1 Ca 1                      (G)          2.24E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0598        0.8280  (atm)
```

```
1 Na 1                      (G)             0.0115        0.1683  (atm)
1 O  1Si 1                  (G)          1.77E-0004       0.0013  (atm)
  Al 2Ca 1                  (L)[]           0.0033
  Al 2Mg 1O  4              (C)  []         0.1996
  Ca 2O  4Si 1              (C)  [BETA]     0.0582
  Fe 1Si 1                  (L)[]           0.1123
  Mg 1O  1                  (C)[]           0.4527
  Si 1                      (L)[]           0.0827
  Si 3Ti 5                  (C)[]           0.0195
*
```

36 wt% Mg

```
 Volume of gas products   (litres)         20.2722
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1846.5590
 Gas products amount        (mol)           0.1295
 Products heat capacity     (J/K)          52.2719
 Products entropy           (J/K)         133.8489
 Products enthalpy          (KJ)         -356.4042
 Mass  of the system        (Kg)            0.0425
1 Ca 1                      (G)          2.32E-0004       0.0019  (atm)
1 Mg 1                      (G)             0.0619        0.8347  (atm)
1 Na 1                      (G)             0.0113        0.1615  (atm)
1 O  1Si 1                  (G)          1.84E-0004       0.0014  (atm)
  Al 2Ca 1                  (L)[]           0.0129
  Al 2Mg 1O  4              (C)  []         0.1820
  Ca 2O  4Si 1              (C)  [BETA]     0.0485
  Fe 1Si 1                  (L)[]           0.1105
  Mg 1O  1                  (C)[]           0.4704
  Si 1                      (L)[]           0.0829
  Si 3Ti 5                  (C)[]           0.0192
*
```

37 wt% Mg

```
 Volume of gas products   (litres)         18.9102
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1845.3589
 Gas products amount        (mol)           0.1209
 Products heat capacity     (J/K)          51.6033
 Products entropy           (J/K)         131.9259
 Products enthalpy          (KJ)         -348.1970
 Mass  of the system        (Kg)            0.0420
1 Ca 1                      (G)          2.17E-0004       0.0019  (atm)
1 Mg 1                      (G)             0.0579        0.8279  (atm)
1 Na 1                      (G)             0.0111        0.1684  (atm)
1 O  1Si 1                  (G)          1.71E-0004       0.0013  (atm)
  Al 2Ca 1                  (L)[]           0.0271
  Al 2Mg 1O  4              (C)  []         0.1574
  Ca 2O  4Si 1              (C)  [BETA]     0.0346
  Fe 1Si 1                  (L)[]           0.1088
  Mg 1O  1                  (C)[]           0.5000
  Si 1                      (L)[]           0.0837
  Si 3Ti 5                  (C)[]           0.0189
*
```

38 wt% Mg

```
 Volume of gas products   (litres)         19.4378
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1846.9099
 Gas products amount        (mol)           0.1241
 Products heat capacity     (J/K)          50.8575
 Products entropy           (J/K)         131.2844
 Products enthalpy          (KJ)         -337.4737
 Mass  of the system        (Kg)            0.0415
1 Ca 1                      (G)          2.29E-0004       0.0019  (atm)
1 Mg 1                      (G)             0.0609        0.8367  (atm)
1 Na 1                      (G)             0.0110        0.1595  (atm)
1 O  1Si 1                  (G)          1.82E-0004       0.0014  (atm)
  Al 2Ca 1                  (L)[]           0.0363
  Al 2Mg 1O  4              (C)  []         0.1405
  Ca 2O  4Si 1              (C)  [BETA]     0.0252
  Fe 1Si 1                  (L)[]           0.1063
  Mg 1O  1                  (C)[]           0.5166
  Si 1                      (L)[]           0.0842
```

```
  Si 3Ti 5                  (C)[]           0.0186
*
     39 wt% Mg
 Volume of gas products   (litres)         18.7944
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1846.7400
 Gas products amount        (mol)           0.1200
 Products heat capacity     (J/K)          50.2350
 Products entropy           (J/K)         129.9680
 Products enthalpy          (KJ)         -329.0915
 Mass  of the system        (Kg)            0.0410
1 Ca 1                      (G)         2.23E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0594        0.8358  (atm)
1 Na 1                      (G)             0.0108        0.1605  (atm)
1 O  1Si 1                  (G)         1.77E-0004        0.0014  (atm)
  Al 2Ca 1                  (L)[]           0.0482
  Al 2Mg 1O  4              (C)  []         0.1192
  Ca 2O  4Si 1              (C)  [BETA]     0.0133
  Fe 1Si 1                  (L)[]           0.1053
  Mg 1O  1                  (C)[]           0.5407
  Si 1                      (L)[]           0.0844
  Si 3Ti 5                  (C)[]           0.0183
*
     40 wt% Mg
 Volume of gas products   (litres)         18.5195
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1847.1007
 Gas products amount        (mol)           0.1182
 Products heat capacity     (J/K)          49.5802
 Products entropy           (J/K)         128.8686
 Products enthalpy          (KJ)         -320.1403
 Mass  of the system        (Kg)            0.0406
1 Ca 1                      (G)         2.23E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0594        0.8378  (atm)
1 Na 1                      (G)             0.0106        0.1584  (atm)
1 O  1Si 1                  (G)         1.77E-0004        0.0014  (atm)
  Al 2Ca 1                  (L)[]           0.0594
  Al 2Mg 1O  4              (C)  []         0.0991
  Ca 2O  4Si 1              (C)  [BETA]     0.0021
  Fe 1Si 1                  (L)[]           0.1036
  Mg 1O  1                  (C)[]           0.5626
  Si 1                      (L)[]           0.0848
  Si 3Ti 5                  (C)[]           0.0180
*
     41 wt% Mg
 Volume of gas products   (litres)         20.5362
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1772.0711
 Gas products amount        (mol)           0.1367
 Products heat capacity     (J/K)          48.5625
 Products entropy           (J/K)         127.8451
 Products enthalpy          (KJ)         -311.2058
 Mass  of the system        (Kg)            0.0401
1 Mg 1                      (G)             0.0717        0.8658  (atm)
1 Na 1                      (G)             0.0104        0.1333  (atm)
  Al 2Ca 1                  (L)[]           0.0611
  Al 2Mg 1O  4              (C)  []         0.0933
  Fe 1Si 1                  (L)[]           0.1019
  Mg 1O  1                  (C)[]           0.5600
  Si 1                      (L)[]           0.0838
  Si 3Ti 5                  (C)[]           0.0177
*
     42 wt% Mg
 Volume of gas products   (litres)         20.7568
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1729.4452
 Gas products amount        (mol)           0.1415
 Products heat capacity     (J/K)          47.8917
 Products entropy           (J/K)         126.4849
 Products enthalpy          (KJ)         -302.8708
 Mass  of the system        (Kg)            0.0397
```

```
1 Mg 1                      (G)             0.0758        0.8743  (atm)
1 Na 1                      (G)             0.0103        0.1251  (atm)
  Al 2Ca 1                  (L)[]           0.0601
  Al 2Mg 1O  4              (C)  []         0.0917
  Fe 1Si 1                  (L)[]           0.1002
  Mg 1O  1                  (C)[]           0.5506
  Mg 2Si 1                  (L)             0.0183
  Si 1                      (L)[]           0.0757
  Si 3Ti 5                  (C)[]           0.0174
*
```

43 wt% Mg

```
 Volume of gas products   (litres)         20.1002
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1729.3415
 Gas products amount        (mol)           0.1371
 Products heat capacity     (J/K)          47.4963
 Products entropy           (J/K)         125.4250
 Products enthalpy          (KJ)         -294.2228
 Mass  of the system        (Kg)            0.0393
1 Mg 1                      (G)             0.0742        0.8738  (atm)
1 Na 1                      (G)             0.0101        0.1256  (atm)
  Al 2Ca 1                  (L)[]           0.0591
  Al 2Mg 1O  4              (C)  []         0.0901
  Fe 1Si 1                  (L)[]           0.0984
  Mg 1O  1                  (C)[]           0.5411
  Mg 2Si 1                  (L)             0.0457
  Si 1                      (L)[]           0.0642
  Si 3Ti 5                  (C)[]           0.0171
*
```

44 wt% Mg

```
 Volume of gas products   (litres)         18.9728
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1728.6950
 Gas products amount        (mol)           0.1294
 Products heat capacity     (J/K)          47.1485
 Products entropy           (J/K)         124.0590
 Products enthalpy          (KJ)         -286.3247
 Mass  of the system        (Kg)            0.0388
1 Mg 1                      (G)             0.0705        0.8701  (atm)
1 Na 1                      (G)             0.0099        0.1293  (atm)
  Al 2Ca 1                  (L)[]           0.0580
  Al 2Mg 1O  4              (C)  []         0.0885
  Fe 1Si 1                  (L)[]           0.0967
  Mg 1O  1                  (C)[]           0.5316
  Mg 2Si 1                  (L)             0.0763
  Si 1                      (L)[]           0.0516
  Si 3Ti 5                  (C)[]           0.0168
*
```

45 wt% Mg

```
 Volume of gas products   (litres)         18.7181
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1729.0213
 Gas products amount        (mol)           0.1277
 Products heat capacity     (J/K)          46.7392
 Products entropy           (J/K)         123.2972
 Products enthalpy          (KJ)         -277.6013
 Mass  of the system        (Kg)            0.0384
1 Mg 1                      (G)             0.0704        0.8720  (atm)
1 Na 1                      (G)             0.0097        0.1274  (atm)
  Al 2Ca 1                  (L)[]           0.0570
  Al 2Mg 1O  4              (C)  []         0.0869
  Fe 1Si 1                  (L)[]           0.0950
  Mg 1O  1                  (C)[]           0.5221
  Mg 2Si 1                  (L)             0.1012
  Si 1                      (L)[]           0.0411
  Si 3Ti 5                  (C)[]           0.0165
*
```

46 wt% Mg

```
 Volume of gas products   (litres)         17.8735
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1728.6655
```

```
 Gas products amount        (mol)           0.1219
 Products heat capacity     (J/K)          46.3870
 Products entropy           (J/K)         122.1479
 Products enthalpy          (KJ)         -269.7566
 Mass  of the system        (Kg)            0.0380
1 Mg 1                      (G)             0.0678        0.8698  (atm)
1 Na 1                      (G)             0.0096        0.1295  (atm)
  Al 2Ca 1                  (L)[]           0.0560
  Al 2Mg 1O  4              (C)  []         0.0853
  Fe 1Si 1                  (L)[]           0.0933
  Mg 1O  1                  (C)[]           0.5126
  Mg 2Si 1                  (L)             0.1302
  Si 1                      (L)[]           0.0290
  Si 3Ti 5                  (C)[]           0.0162
*
```

47 wt% Mg

```
 Volume of gas products   (litres)         17.2631
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1728.5015
 Gas products amount        (mol)           0.1178
 Products heat capacity     (J/K)          46.0241
 Products entropy           (J/K)         121.1678
 Products enthalpy          (KJ)         -261.8219
 Mass  of the system        (Kg)            0.0376
1 Mg 1                      (G)             0.0661        0.8691  (atm)
1 Na 1                      (G)             0.0094        0.1303  (atm)
  Al 2Ca 1                  (L)[]           0.0549
  Al 2Mg 1O  4              (C)  []         0.0838
  Fe 1Si 1                  (L)[]           0.0915
  Mg 1O  1                  (C)[]           0.5031
  Mg 2Si 1                  (L)             0.1577
  Si 1                      (L)[]           0.0175
  Si 3Ti 5                  (C)[]           0.0159
*
```

48 wt% Mg

```
 Volume of gas products   (litres)         16.4944
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1728.1899
 Gas products amount        (mol)           0.1126
 Products heat capacity     (J/K)          45.6829
 Products entropy           (J/K)         120.0929
 Products enthalpy          (KJ)         -254.2497
 Mass  of the system        (Kg)            0.0372
1 Mg 1                      (G)             0.0637        0.8670  (atm)
1 Na 1                      (G)             0.0092        0.1324  (atm)
  Al 2Ca 1                  (L)[]           0.0539
  Al 2Mg 1O  4              (C)  []         0.0822
  Fe 1Si 1                  (L)[]           0.0898
  Mg 1O  1                  (C)[]           0.4936
  Mg 2Si 1                  (L)             0.1863
  Si 1                      (L)[]           0.0056
  Si 3Ti 5                  (C)[]           0.0156
*
```

49 wt% Mg

```
 Volume of gas products   (litres)         17.7808       17.7763       17.7855
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1692.3096     1691.8732     1692.7460
 Gas products amount        (mol)           0.1239        0.1239        0.1239
 Products heat capacity     (J/K)          45.0497       45.0531       45.0460
 Products entropy           (J/K)         118.8020      118.1009      119.5479
 Products enthalpy          (KJ)         -247.1926     -248.3795     -245.9298
 Phase transition enthalpy  (KJ)           2.4497
 Mass  of the system        (Kg)            0.0369
1 Mg 1                      (G)             0.0721        0.0721        0.0721
1 Na 1                      (G)             0.0090        0.0090        0.0090
  Al 2Ca 1                  (L)[]           0.0529        0.0529        0.0529
  Al 2Mg 1O  4              (C)  []         0.0806        0.0806        0.0806
  Fe 1Si 1                  (L)[]           0.0388        0.0000        0.0800
  Fe 1Si 1                  (C)[]           0.0493        0.0881        0.0081
  Mg 1O  1                  (C)[]           0.4841        0.4841        0.4841
  Mg 2Si 1                  (L)             0.1978        0.1978        0.1978
```

```
  Si 3Ti 5                  (C)[]           0.0153        0.0153        0.0153
*
     50 wt% Mg
 Volume of gas products   (litres)         19.5287
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1624.6262
 Gas products amount        (mol)           0.1418
 Products heat capacity     (J/K)          44.1580
 Products entropy           (J/K)         117.4972
 Products enthalpy          (KJ)         -240.1472
 Mass  of the system        (Kg)            0.0365
1 Mg 1                      (G)             0.0850        0.9005  (atm)
1 Na 1                      (G)             0.0088        0.0990  (atm)
  Al 2Ca 1                  (L)[]           0.0450
  Al 4Ca 1                  (L)[]           0.0107
  Al 2Mg 1O  4              (C)  []         0.0687
  Fe 1Si 1                  (C)[]           0.0863
  Mg 1O  1                  (C)[]           0.4863
  Mg 2Si 1                  (L)             0.1940
  Si 3Ti 5                  (C)[]           0.0150
*
     51 wt% Mg
 Volume of gas products   (litres)         19.4437
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1625.0047
 Gas products amount        (mol)           0.1411
 Products heat capacity     (J/K)          43.6033
 Products entropy           (J/K)         116.8834
 Products enthalpy          (KJ)         -232.0538
 Mass  of the system        (Kg)            0.0361
1 Mg 1                      (G)             0.0857        0.9030  (atm)
1 Na 1                      (G)             0.0087        0.0965  (atm)
  Al 2Ca 1                  (L)[]           0.0214
  Al 4Ca 1                  (L)[]           0.0462
  Al 2Mg 1O  4              (C)  []         0.0330
  Fe 1Si 1                  (C)[]           0.0846
  Mg 1O  1                  (C)[]           0.5155
  Mg 2Si 1                  (L)             0.1901
  Si 3Ti 5                  (C)[]           0.0147
*
     52 wt% Mg
 Volume of gas products   (litres)         18.1140
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1606.5995
 Gas products amount        (mol)           0.1330
 Products heat capacity     (J/K)          43.1397
 Products entropy           (J/K)         114.8004
 Products enthalpy          (KJ)         -226.7126
 Mass  of the system        (Kg)            0.0358
1 Mg 1                      (G)             0.0813        0.9002  (atm)
1 Na 1                      (G)             0.0085        0.0993  (atm)
  Al 2Ca 1                  (L)[]           0.0309
  Al 4Ca 1                  (L)[]           0.0295
  Al 3Ti 1                  (C)  []         0.0286
  Fe 1Si 1                  (C)[]           0.0828
  Mg 1O  1                  (C)[]           0.5419
  Mg 2Si 1                  (L)             0.1963
*
     53 wt% Mg
 Volume of gas products   (litres)         20.8907
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)           0.1684
 Products heat capacity     (J/K)          41.9296
 Products entropy           (J/K)         114.0997
 Products enthalpy          (KJ)         -218.5666
 Mass  of the system        (Kg)            0.0354
1 Mg 1                      (G)             0.1067        0.9236  (atm)
1 Na 1                      (G)             0.0083        0.0760  (atm)
1 Mg 2                      (G)          6.57E-0005    2.84E-0004  (atm)
  Al 4Ca 1                  (L)[]           0.0767
```

```
  Al 3Ti 1                  (C)  []     3.58E-0004
  Fe 1Si 1                  (C)[]           0.0812
  Mg 1O  1                  (C)[]           0.5303
  Mg 2Si 1                  (L)             0.1824
  Si 3Ti 5                  (C)[]           0.0139
*
```

54 wt% Mg

```
 Volume of gas products   (litres)         20.4817
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1419.7670
 Gas products amount        (mol)           0.1701
 Products heat capacity     (J/K)          41.5555
 Products entropy           (J/K)         112.1738
 Products enthalpy          (KJ)         -212.4935
 Mass  of the system        (Kg)            0.0351
1 Mg 1                      (G)             0.1092        0.9267  (atm)
1 Na 1                      (G)             0.0081        0.0728  (atm)
1 Mg 2                      (G)          7.29E-0005    3.09E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0477
  Al 3Fe 1                  (C)  []         0.0466
  Fe 1Si 1                  (C)[]           0.0508
  Mg 1O  1                  (C)[]           0.5191
  Mg 2Si 1                  (L)             0.2046
  Si 3Ti 5                  (C)[]           0.0138
*
```

55 wt% Mg

```
 Volume of gas products   (litres)         22.8415       22.8370       22.8471
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1375.0800     1374.7761     1375.3839
 Gas products amount        (mol)           0.1959        0.1959        0.1959
 Products heat capacity     (J/K)          40.6645       40.5643       40.7856
 Products entropy           (J/K)         110.7047      108.7769      113.0322
 Products enthalpy          (KJ)         -205.6094     -208.2619     -202.4069
 Phase transition enthalpy  (KJ)           5.8550
 Mass  of the system        (Kg)            0.0348
1 Mg 1                      (G)             0.1285        0.1285        0.1285
1 Na 1                      (G)             0.0079        0.0079        0.0079
1 Mg 2                      (G)          9.43E-0005    9.43E-0005    9.43E-0005
  Al 2Ca 1                  (L)[]           0.0466        0.0466        0.0466
  Al 3Fe 1                  (C)  []         0.0456        0.0456        0.0456
  Fe 1Si 1                  (C)[]           0.0497        0.0497        0.0497
  Mg 1O  1                  (C)[]           0.5078        0.5078        0.5078
  Mg 2Si 1                  (L)             0.0907        0.0000        0.2001
  Mg 2Si 1                  (C)             0.1095        0.2001        0.0000
  Si 3Ti 5                  (C)[]           0.0135        0.0135        0.0135
*
```

56 wt% Mg

```
 Volume of gas products   (litres)         23.0052
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1360.6468
 Gas products amount        (mol)           0.1994
 Products heat capacity     (J/K)          40.1929
 Products entropy           (J/K)         108.5816
 Products enthalpy          (KJ)         -199.7278
 Mass  of the system        (Kg)            0.0344
1 Mg 1                      (G)             0.1325        0.9412  (atm)
1 Na 1                      (G)             0.0078        0.0583  (atm)
1 Mg 2                      (G)          1.00E-0004    3.56E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0456
  Al 3Fe 1                  (C)  []         0.0446
  Fe 1Si 1                  (C)[]           0.0486
  Mg 1                      (L)[]           0.0154
  Mg 1O  1                  (C)[]           0.4965
  Mg 2Si 1                  (C)             0.1957
  Si 3Ti 5                  (C)[]           0.0132
*
```

57 wt% Mg

```
 Volume of gas products   (litres)         21.3704
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1360.3673
 Gas products amount        (mol)           0.1853
```

```
 Products heat capacity     (J/K)          40.1092
 Products entropy           (J/K)         107.1410
 Products enthalpy          (KJ)         -193.0472
 Mass  of the system        (Kg)            0.0341
1 Mg 1                      (G)             0.1240        0.9388  (atm)
1 Na 1                      (G)             0.0076        0.0607  (atm)
1 Mg 2                      (G)         9.35E-0005    3.54E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0446
  Al 3Fe 1                  (C)  []         0.0436
  Fe 1Si 1                  (C)[]           0.0475
  Mg 1                      (L)[]           0.0433
  Mg 1O  1                  (C)[]           0.4852
  Mg 2Si 1                  (C)             0.1912
  Si 3Ti 5                  (C)[]           0.0129
*
```

58 wt% Mg

```
 Volume of gas products   (litres)         19.3861
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1359.9267
 Gas products amount        (mol)           0.1681
 Products heat capacity     (J/K)          40.0709
 Products entropy           (J/K)         105.4136
 Products enthalpy          (KJ)         -186.9180
 Mass  of the system        (Kg)            0.0338
1 Mg 1                      (G)             0.1131        0.9347  (atm)
1 Na 1                      (G)             0.0074        0.0647  (atm)
1 Mg 2                      (G)         8.50E-0005    3.51E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0435
  Al 3Fe 1                  (C)  []         0.0426
  Fe 1Si 1                  (C)[]           0.0464
  Mg 1                      (L)[]           0.0736
  Mg 1O  1                  (C)[]           0.4739
  Mg 2Si 1                  (C)             0.1868
  Si 3Ti 5                  (C)[]           0.0126
*
```

59 wt% Mg

```
 Volume of gas products   (litres)         17.7378
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1359.3989
 Gas products amount        (mol)           0.1539
 Products heat capacity     (J/K)          39.9983
 Products entropy           (J/K)         103.9596
 Products enthalpy          (KJ)         -180.5740
 Mass  of the system        (Kg)            0.0335
1 Mg 1                      (G)             0.1040        0.9311  (atm)
1 Na 1                      (G)             0.0072        0.0684  (atm)
1 Mg 2                      (G)         7.80E-0005    3.49E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0425
  Al 3Fe 1                  (C)  []         0.0415
  Fe 1Si 1                  (C)[]           0.0453
  Mg 1                      (L)[]           0.1020
  Mg 1O  1                  (C)[]           0.4626
  Mg 2Si 1                  (C)             0.1823
  Si 3Ti 5                  (C)[]           0.0123
*
```

60 wt% Mg

```
 Volume of gas products   (litres)         16.2218
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1358.9390
 Gas products amount        (mol)           0.1408
 Products heat capacity     (J/K)          39.9152
 Products entropy           (J/K)         102.6153
 Products enthalpy          (KJ)         -174.2302
 Mass  of the system        (Kg)            0.0332
1 Mg 1                      (G)             0.0956        0.9272  (atm)
1 Na 1                      (G)             0.0070        0.0722  (atm)
1 Mg 2                      (G)         7.15E-0005    3.47E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0415
  Al 3Fe 1                  (C)  []         0.0405
  Fe 1Si 1                  (C)[]           0.0442
  Mg 1                      (L)[]           0.1297
```

```
  Mg 1O  1                  (C)[]           0.4514
  Mg 2Si 1                  (C)             0.1779
  Si 3Ti 5                  (C)[]           0.0120
*
     61 wt% Mg
 Volume of gas products   (litres)         14.4812
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1358.1418
 Gas products amount        (mol)           0.1258
 Products heat capacity     (J/K)          39.8623
 Products entropy           (J/K)         101.0812
 Products enthalpy          (KJ)         -168.2934
 Mass  of the system        (Kg)            0.0329
1 Mg 1                      (G)             0.0857        0.9213  (atm)
1 Na 1                      (G)             0.0069        0.0781  (atm)
1 Mg 2                      (G)          6.37E-0005    3.43E-0004  (atm)
1 Na 2                      (G)          4.76E-0005    2.71E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0404
  Al 3Fe 1                  (C)  []         0.0395
  Fe 1Si 1                  (C)[]           0.0431
  Mg 1                      (L)[]           0.1591
  Mg 1O  1                  (C)[]           0.4401
  Mg 2Si 1                  (C)             0.1734
  Si 3Ti 5                  (C)[]           0.0117
*
     62 wt% Mg
 Volume of gas products   (litres)         12.3058
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1356.7009
 Gas products amount        (mol)           0.1070
 Products heat capacity     (J/K)          39.8629
 Products entropy           (J/K)          99.1760
 Products enthalpy          (KJ)         -163.0016
 Mass  of the system        (Kg)            0.0326
1 Mg 1                      (G)             0.0727        0.9107  (atm)
1 Na 1                      (G)             0.0067        0.0886  (atm)
1 Mg 2                      (G)          5.35E-0005    3.35E-0004  (atm)
1 Na 2                      (G)          5.29E-0005    3.50E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0394
  Al 3Fe 1                  (C)  []         0.0385
  Fe 1Si 1                  (C)[]           0.0420
  Mg 1                      (L)[]           0.1914
  Mg 1O  1                  (C)[]           0.4288
  Mg 2Si 1                  (C)             0.1690
  Si 3Ti 5                  (C)[]           0.0114
*
     63 wt% Mg
 Volume of gas products   (litres)         10.4846
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1355.2458
 Gas products amount        (mol)           0.0912
 Products heat capacity     (J/K)          39.8270
 Products entropy           (J/K)          97.5578
 Products enthalpy          (KJ)         -157.4597
 Mass  of the system        (Kg)            0.0323
1 Mg 1                      (G)             0.0618        0.8991  (atm)
1 Na 1                      (G)             0.0065        0.1001  (atm)
1 Mg 2                      (G)          4.51E-0005    3.28E-0004  (atm)
1 Na 2                      (G)          5.86E-0005    4.51E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0384
  Al 3Fe 1                  (C)  []         0.0375
  Fe 1Si 1                  (C)[]           0.0409
  Mg 1                      (L)[]           0.2217
  Mg 1O  1                  (C)[]           0.4175
  Mg 2Si 1                  (C)             0.1645
  Si 3Ti 5                  (C)[]           0.0111
*
     64 wt% Mg
 Volume of gas products   (litres)          8.9200
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1353.4493
```

```
 Gas products amount        (mol)           0.0777
 Products heat capacity     (J/K)          39.7647
 Products entropy           (J/K)          96.1395
 Products enthalpy          (KJ)         -151.7785
 Mass  of the system        (Kg)            0.0320
1 Mg 1                      (G)             0.0523        0.8859  (atm)
1 Na 1                      (G)             0.0063        0.1132  (atm)
1 Na 2                      (G)          6.50E-0005    5.82E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0373
  Al 3Fe 1                  (C)  []         0.0365
  Fe 1Si 1                  (C)[]           0.0398
  Mg 1                      (L)[]           0.2506
  Mg 1O  1                  (C)[]           0.4062
  Mg 2Si 1                  (C)             0.1601
  Si 3Ti 5                  (C)[]           0.0108
*
```

65 wt% Mg

```
 Volume of gas products   (litres)          7.9377
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1352.1911
 Gas products amount        (mol)           0.0692
 Products heat capacity     (J/K)          39.6262
 Products entropy           (J/K)          94.6414
 Products enthalpy          (KJ)         -146.3386
 Mass  of the system        (Kg)            0.0317
1 Mg 1                      (G)             0.0465        0.8766  (atm)
1 Na 1                      (G)             0.0061        0.1224  (atm)
1 Na 2                      (G)          6.87E-0005    6.84E-0004  (atm)
  Al 2Ca 1                  (C)[]           0.0363
  Al 3Fe 1                  (C)  []         0.0355
  Fe 1Si 1                  (C)[]           0.0387
  Mg 1                      (L)[]           0.2757
  Mg 1O  1                  (C)[]           0.3949
  Mg 2Si 1                  (C)             0.1557
  Si 3Ti 5                  (C)[]           0.0105
*
```

66 wt% Mg

```
 Volume of gas products   (litres)          6.3914
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1348.9880
 Gas products amount        (mol)           0.0559
 Products heat capacity     (J/K)          39.5675
 Products entropy           (J/K)          93.2186
 Products enthalpy          (KJ)         -140.9204
 Mass  of the system        (Kg)            0.0314
1 Mg 1                      (G)             0.0368        0.8531  (atm)
1 Na 1                      (G)             0.0059        0.1456  (atm)
1 Na 2                      (G)          8.04E-0005    9.85E-0004  (atm)
  Al 2Ca 1                  (C)[]           0.0352
  Al 3Fe 1                  (C)  []         0.0345
  Fe 1Si 1                  (C)[]           0.0376
  Mg 1                      (L)[]           0.3048
  Mg 1O  1                  (C)[]           0.3836
  Mg 2Si 1                  (C)             0.1512
  Si 3Ti 5                  (C)[]           0.0102
*
```

67 wt% Mg

```
 Volume of gas products   (litres)          5.1343
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1345.0034
 Gas products amount        (mol)           0.0450
 Products heat capacity     (J/K)          39.4780
 Products entropy           (J/K)          92.0091
 Products enthalpy          (KJ)         -135.3407
 Mass  of the system        (Kg)            0.0312
1 Mg 1                      (G)             0.0289        0.8248  (atm)
1 Na 1                      (G)             0.0058        0.1735  (atm)
1 Na 2                      (G)          9.46E-0005        0.0014  (atm)
  Al 2Ca 1                  (C)[]           0.0342
  Al 3Fe 1                  (C)  []         0.0334
  Fe 1Si 1                  (C)[]           0.0365
```

```
  Mg 1                      (L)[]           0.3320
  Mg 1O  1                  (C)[]           0.3724
  Mg 2Si 1                  (C)             0.1468
  Si 3Ti 5                  (C)[]           0.0099
*
     68 wt% Mg
 Volume of gas products   (litres)          3.9649
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1339.0207
 Gas products amount        (mol)           0.0349
 Products heat capacity     (J/K)          39.3781
 Products entropy           (J/K)          90.8114
 Products enthalpy          (KJ)         -129.8603
 Mass  of the system        (Kg)            0.0309
1 Mg 1                      (G)             0.0215        0.7834  (atm)
1 Na 1                      (G)             0.0056        0.2141  (atm)
1 Na 2                      (G)         1.16E-0004        0.0022  (atm)
  Al 2Ca 1                  (C)[]           0.0332
  Al 3Fe 1                  (C)  []         0.0324
  Fe 1Si 1                  (C)[]           0.0354
  Mg 1                      (L)[]           0.3588
  Mg 1O  1                  (C)[]           0.3611
  Mg 2Si 1                  (C)             0.1423
  Si 3Ti 5                  (C)[]           0.0096
*
     69 wt% Mg
 Volume of gas products   (litres)          2.3256
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1318.3153
 Gas products amount        (mol)           0.0208
 Products heat capacity     (J/K)          39.3047
 Products entropy           (J/K)          88.7845
 Products enthalpy          (KJ)         -125.5886
 Mass  of the system        (Kg)            0.0307
1 Mg 1                      (G)             0.0108        0.6538  (atm)
1 Na 1                      (G)             0.0053        0.3398  (atm)
1 Na 2                      (G)         1.96E-0004        0.0063  (atm)
  Al 2Ca 1                  (C)[]           0.0321
  Al 3Fe 1                  (C)  []         0.0314
  Fe 1Si 1                  (C)[]           0.0343
  Mg 1                      (L)[]           0.3889
  Mg 1O  1                  (C)[]           0.3498
  Mg 2Si 1                  (C)             0.1379
  Si 3Ti 5                  (C)[]           0.0093
*
     70 wt% Mg
 Volume of gas products   (litres)          1.7209
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1301.0631
 Gas products amount        (mol)           0.0156
 Products heat capacity     (J/K)          39.1248
 Products entropy           (J/K)          87.7107
 Products enthalpy          (KJ)         -120.1532
 Mass  of the system        (Kg)            0.0304
1 Mg 1                      (G)             0.0070        0.5598  (atm)
1 Na 1                      (G)             0.0051        0.4291  (atm)
1 Na 2                      (G)         2.59E-0004        0.0110  (atm)
  Al 2Ca 1                  (C)[]           0.0311
  Al 3Fe 1                  (C)  []         0.0304
  Fe 1Si 1                  (C)[]           0.0332
  Mg 1                      (L)[]           0.4121
  Mg 1O  1                  (C)[]           0.3385
  Mg 2Si 1                  (C)             0.1334
  Si 3Ti 5                  (C)[]           0.0090
*
     71 wt% Mg
 Volume of gas products   (litres)          1.2028
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)           0.0112
 Products heat capacity     (J/K)          38.9098
```

```
 Products entropy           (J/K)          86.2846
 Products enthalpy          (KJ)         -115.2550
 Mass  of the system        (Kg)           0.0301
1 Mg 1                      (G)            0.0038        0.4182  (atm)
1 Na 1                      (G)            0.0048        0.5596  (atm)
1 Na 2                      (G)         3.76E-0004       0.0221  (atm)
  Al 2Ca 1                  (C)[]          0.0301
  Al 3Fe 1                  (C)  []        0.0294
  Fe 1Si 1                  (C)[]          0.0321
  Mg 1                      (L)[]          0.4347
  Mg 1O  1                  (C)[]          0.3272
  Mg 2Si 1                  (C)            0.1290
  Si 3Ti 5                  (C)[]          0.0087
*
```

72 wt% Mg

```
 Volume of gas products   (litres)          1.0514
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1258.0000
 Gas products amount        (mol)           0.0099
 Products heat capacity     (J/K)          38.7003
 Products entropy           (J/K)          85.7454
 Products enthalpy          (KJ)         -109.3192
 Mass  of the system        (Kg)           0.0299
1 Mg 1                      (G)            0.0030        0.3720  (atm)
1 Na 1                      (G)            0.0046        0.6007  (atm)
1 Na 2                      (G)         4.13E-0004       0.0272  (atm)
  Al 2Ca 1                  (C)[]          0.0290
  Al 3Fe 1                  (C)  []        0.0284
  Fe 1Si 1                  (C)[]          0.0309
  Mg 1                      (L)[]          0.4548
  Mg 1O  1                  (C)[]          0.3159
  Mg 2Si 1                  (C)            0.1245
  Si 3Ti 5                  (C)[]          0.0084
*
```

73 wt% Mg

```
 Volume of gas products   (litres)          0.7359
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1200.0100
 Gas products amount        (mol)           0.0072
 Products heat capacity     (J/K)          38.2989
 Products entropy           (J/K)          83.2792
 Products enthalpy          (KJ)         -105.8509
 Mass  of the system        (Kg)           0.0297
1 Mg 1                      (G)            0.0012        0.2042  (atm)
1 Na 1                      (G)            0.0041        0.7375  (atm)
1 Na 2                      (G)         6.53E-0004       0.0582  (atm)
  Al 2Ca 1                  (C)[]          0.0280
  Al 1Fe 1                  (C)  []        0.0442
  Al 3Fe 1                  (C)  []        0.0030
  Mg 1                      (L)[]          0.4587
  Mg 1O  1                  (C)[]          0.3047
  Mg 2Si 1                  (C)            0.1473
  Si 3Ti 5                  (C)[]          0.0081
*
```

74 wt% Mg

```
 Volume of gas products   (litres)          0.6506
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)           0.0065
 Products heat capacity     (J/K)          38.0800
 Products entropy           (J/K)          82.5523
 Products enthalpy          (KJ)         -100.3158
 Mass  of the system        (Kg)           0.0294
1 Mg 1                      (G)         8.80E-0004       0.1638  (atm)
1 Na 1                      (G)            0.0039        0.7651  (atm)
1 Na 2                      (G)         7.23E-0004       0.0711  (atm)
  Al 2Ca 1                  (C)[]          0.0270
  Al 1Fe 1                  (C)  []        0.0425
  Al 3Fe 1                  (C)  []        0.0029
  Mg 1                      (L)[]          0.4790
  Mg 1O  1                  (C)[]          0.2934
```

```
 Mg 2Si 1                  (C)             0.1419
 Si 3Ti 5                  (C)[]           0.0078
*
    75 wt% Mg
Volume of gas products   (litres)      1.34E-0006
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1136.7132
Gas products amount        (mol)       1.39E-0008
Products heat capacity     (J/K)          37.8731
Products entropy           (J/K)          80.5326
Products enthalpy          (KJ)          -96.3520
Mass  of the system        (Kg)            0.0292
 Al 2Ca 1                  (C)[]           0.0259
 Al 1Fe 1                  (C)  []         0.0409
 Al 3Fe 1                  (C)  []         0.0028
 Mg 1                      (L)[]           0.4999
 Mg 1O  1                  (C)[]           0.2821
 Mg 2Si 1                  (C)             0.1364
 Na 1                      (L)[]           0.0044
 Si 3Ti 5                  (C)[]           0.0075
*
    76 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1098.7006
Gas products amount        (mol)       3.17E-0009
Products heat capacity     (J/K)          37.6195
Products entropy           (J/K)          79.2464
Products enthalpy          (KJ)          -91.5929
Mass  of the system        (Kg)            0.0289
 Al 2Ca 1                  (C)[]           0.0249
 Al 1Fe 1                  (C)  []         0.0393
 Al 3Fe 1                  (C)  []         0.0027
 Mg 1                      (L)[]           0.5199
 Mg 1O  1                  (C)[]           0.2708
 Mg 2Si 1                  (C)             0.1310
 Na 1                      (L)[]           0.0043
 Si 3Ti 5                  (C)[]           0.0072
*
    77 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1042.0000
Gas products amount        (mol)       9.55E-0010
Products heat capacity     (J/K)          37.3323
Products entropy           (J/K)          77.2655
Products enthalpy          (KJ)          -87.6148
Mass  of the system        (Kg)            0.0287
 Al 2Ca 1                  (C)[]           0.0238
 Al 1Fe 1                  (C)  []         0.0376
 Al 3Fe 1                  (C)  []         0.0026
 Mg 1                      (L)[]           0.5399
 Mg 1O  1                  (C)[]           0.2595
 Mg 2Si 1                  (C)             0.1255
 Na 1                      (L)[]           0.0041
 Si 3Ti 5                  (C)[]           0.0069
*
    78 wt% Mg
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1042.0000
Gas products amount        (mol)       3.53E-0010
Products heat capacity     (J/K)          37.1778
Products entropy           (J/K)          77.2744
Products enthalpy          (KJ)          -81.6029
Mass  of the system        (Kg)            0.0285
 Al 2Ca 1                  (C)[]           0.0228
 Al 1Fe 1                  (C)  []         0.0360
 Al 3Fe 1                  (C)  []         0.0025
 Mg 1                      (L)[]           0.5599
 Mg 1O  1                  (C)[]           0.2482
```

```
  Mg 2Si 1                  (C)             0.1201
  Na 1                      (L)[]           0.0039
  Si 3Ti 5                  (C)[]           0.0066
*
     79 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       2.48E-0010
 Products heat capacity     (J/K)          36.8968
 Products entropy           (J/K)          75.0156
 Products enthalpy          (KJ)          -77.9753
 Mass  of the system        (Kg)            0.0283
  Al 2Ca 1                  (C)[]           0.0218
  Al 1Fe 1                  (C)  []         0.0344
  Al 3Fe 1                  (C)  []         0.0024
  Mg 1                      (L)[]           0.5799
  Mg 1O  1                  (C)[]           0.2370
  Mg 2Si 1                  (C)             0.1146
  Na 1                      (L)[]           0.0037
  Si 3Ti 5                  (C)[]           0.0063
*
     80 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       2.01E-0010
 Products heat capacity     (J/K)          36.7029
 Products entropy           (J/K)          74.0840
 Products enthalpy          (KJ)          -73.0563
 Mass  of the system        (Kg)            0.0281
  Al 2Ca 1                  (C)[]           0.0207
  Al 1Fe 1                  (C)  []         0.0327
  Al 3Fe 1                  (C)  []         0.0023
  Mg 1                      (L)[]           0.5999
  Mg 1O  1                  (C)[]           0.2257
  Mg 2Si 1                  (C)             0.1091
  Na 1                      (L)[]           0.0035
  Si 3Ti 5                  (C)[]           0.0060
*
     81 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           922.9241      922.8283      923.0200
 Gas products amount        (mol)       1.47E-0009    3.63E-0011    1.82E-0009
 Products heat capacity     (J/K)          36.2024       34.9737       36.5021
 Products entropy           (J/K)          71.7066       66.9745       72.8606
 Products enthalpy          (KJ)          -69.5410      -73.9087      -68.4759
 Phase transition enthalpy  (KJ)            5.4328
 Mass  of the system        (Kg)            0.0278
  Al 2Ca 1                  (C)[]           0.0197        0.0197        0.0197
  Al 1Fe 1                  (C)  []         0.0311        0.0311        0.0311
  Al 3Fe 1                  (C)  []         0.0021        0.0021        0.0021
  Mg 1                      (C)[]           0.1093        0.5573        0.0000
  Mg 1                      (L)[]           0.5107        0.0626        0.6199
  Mg 1O  1                  (C)[]           0.2144        0.2144        0.2144
  Mg 2Si 1                  (C)             0.1037        0.1037        0.1037
  Na 1                      (L)[]           0.0034        0.0034        0.0034
  Si 3Ti 5                  (C)[]           0.0057        0.0057        0.0057
*
     82 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           922.9352      922.8543      923.0161
 Gas products amount        (mol)       4.28E-0010    9.13E-0010    8.24E-0011
 Products heat capacity     (J/K)          35.6464       34.6290       36.3703
 Products entropy           (J/K)          70.0980       66.1806       72.8855
 Products enthalpy          (KJ)          -65.3796      -68.9954      -62.8068
 Phase transition enthalpy  (KJ)            6.1886
 Mass  of the system        (Kg)            0.0276
  Al 2Ca 1                  (C)[]           0.0187        0.0187        0.0187
```

```
 Al 1Fe 1                  (C)  []         0.0294        0.0294        0.0294
 Al 3Fe 1                  (C)  []         0.0020        0.0020        0.0020
 Mg 1                      (C)[]           0.2660        0.6399        0.0000
 Mg 1                      (L)[]           0.3739    3.38E-0006        0.6399
 Mg 1O  1                  (C)[]           0.2031        0.2031        0.2031
 Mg 2Si 1                  (C)             0.0982        0.0982        0.0982
 Na 1                      (L)[]           0.0032        0.0032        0.0032
 Si 3Ti 5                  (C)[]           0.0054        0.0054        0.0054
*
```

83 wt% Mg

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           922.9556      922.8776      923.0337
Gas products amount        (mol)       2.12E-0009    2.86E-0009    3.06E-0010
Products heat capacity     (J/K)          35.0990       34.6391       36.2405
Products entropy           (J/K)          68.5143       66.7431       72.9109
Products enthalpy          (KJ)          -61.2821      -62.9169      -57.2241
Phase transition enthalpy  (KJ)            5.6928
Mass  of the system        (Kg)            0.0274
 Al 2Ca 1                  (C)[]           0.0176        0.0176        0.0176
 Al 1Fe 1                  (C)  []         0.0278        0.0278        0.0278
 Al 3Fe 1                  (C)  []         0.0019        0.0019        0.0019
 Mg 1                      (C)[]           0.4228        0.5931        0.0000
 Mg 1                      (L)[]           0.2372        0.0668        0.6599
 Mg 1O  1                  (C)[]           0.1918        0.1918        0.1918
 Mg 2Si 1                  (C)             0.0928        0.0928        0.0928
 Na 1                      (L)[]           0.0030        0.0030        0.0030
 Si 3Ti 5                  (C)[]           0.0051        0.0051        0.0051
*
```

84 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           922.8982
Gas products amount        (mol)       2.91E-0010
Products heat capacity     (J/K)          34.4731
Products entropy           (J/K)          66.6205
Products enthalpy          (KJ)          -57.5553
Mass  of the system        (Kg)            0.0272
 Al 2Ca 1                  (C)[]           0.0166
 Al 1Fe 1                  (C)  []         0.0262
 Al 3Fe 1                  (C)  []         0.0018
 Mg 1                      (C)[]           0.6119
 Mg 1                      (L)[]           0.0680
 Mg 1O  1                  (C)[]           0.1805
 Mg 2Si 1                  (C)             0.0873
 Na 1                      (L)[]           0.0028
 Si 3Ti 5                  (C)[]           0.0048
*
```

85 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           903.0000
Gas products amount        (mol)       9.34E-0010
Products heat capacity     (J/K)          33.9058
Products entropy           (J/K)          65.0413
Products enthalpy          (KJ)          -53.5628
Mass  of the system        (Kg)            0.0270
 Al 2Ca 1                  (C)[]           0.0155
 Al 1Fe 1                  (C)  []         0.0195
 Al 3Ti 1                  (C)  []         0.0042
 Fe 2Ti 1                  (C)  []         0.0059
 Mg 1                      (C)[]           0.6979
 Mg 1O  1                  (C)[]           0.1693
 Mg 2Si 1                  (C)             0.0851
 Na 1                      (L)[]           0.0027
*
```

86 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           870.0000
Gas products amount        (mol)       9.00E-0011
```

```
 Products heat capacity     (J/K)          33.4116
 Products entropy           (J/K)          63.6754
 Products enthalpy          (KJ)          -49.5107
 Mass  of the system        (Kg)            0.0268
  Al 2Ca 1                  (C)[]           0.0145
  Al 1Fe 1                  (C)  []         0.0229
  Al 3Fe 1                  (C)  []         0.0016
  Mg 1                      (C)[]           0.7199
  Mg 1O  1                  (C)[]           0.1580
  Mg 2Si 1                  (C)             0.0764
  Na 1                      (L)[]           0.0025
  Si 3Ti 5                  (C)[]           0.0042
*
     87 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.5000
 Gas products amount        (mol)       1.18E-0009
 Products heat capacity     (J/K)          33.0216
 Products entropy           (J/K)          62.7310
 Products enthalpy          (KJ)          -45.0915
 Mass  of the system        (Kg)            0.0266
  Al 2Ca 1                  (C)[]           0.0135
  Al 1Fe 1                  (C)  []         0.0213
  Al 3Fe 1                  (C)  []         0.0015
  Mg 1                      (C)[]           0.7400
  Mg 1O  1                  (C)[]           0.1467
  Mg 2Si 1                  (C)             0.0709
  Na 1                      (L)[]           0.0023
  Si 3Ti 5                  (C)[]           0.0039
*
     88 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       1.26E-0010
 Products heat capacity     (J/K)          32.3447
 Products entropy           (J/K)          60.7025
 Products enthalpy          (KJ)          -41.6119
 Mass  of the system        (Kg)            0.0264
  Al 2Ca 1                  (C)[]           0.0124
  Al 1Fe 1                  (C)  []         0.0196
  Al 3Fe 1                  (C)  []         0.0014
  Mg 1                      (C)[]           0.7600
  Mg 1O  1                  (C)[]           0.1354
  Mg 2Si 1                  (C)             0.0655
  Na 1                      (L)[]           0.0021
  Si 3Ti 5                  (C)[]           0.0036
*
     89 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       5.90E-0011
 Products heat capacity     (J/K)          31.5395
 Products entropy           (J/K)          58.1206
 Products enthalpy          (KJ)          -38.5298
 Mass  of the system        (Kg)            0.0262
  Al 2Ca 1                  (C)[]           0.0114
  Al 1Fe 1                  (C)  []         0.0180
  Al 3Fe 1                  (C)  []         0.0012
  Mg 1                      (C)[]           0.7800
  Mg 1O  1                  (C)[]           0.1241
  Mg 2Si 1                  (C)             0.0600
  Na 1                      (L)[]           0.0020
  Si 3Ti 5                  (C)[]           0.0033
*
     90 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
```

```
 Gas products amount        (mol)       6.22E-0012
 Products heat capacity     (J/K)          31.3757
 Products entropy           (J/K)          58.0362
 Products enthalpy          (KJ)          -33.5964
 Mass  of the system        (Kg)            0.0260
  Al 2Ca 1                  (C)[]           0.0104
  Al 1Fe 1                  (C)  []         0.0164
  Al 3Fe 1                  (C)  []         0.0011
  Mg 1                      (C)[]           0.8000
  Mg 1O  1                  (C)[]           0.1128
  Mg 2Si 1                  (C)             0.0546
  Na 1                      (L)[]           0.0018
  Si 3Ti 5                  (C)[]           0.0030
*
```

91 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       2.44E-0012
 Products heat capacity     (J/K)          30.3994
 Products entropy           (J/K)          54.6617
 Products enthalpy          (KJ)          -31.0449
 Mass  of the system        (Kg)            0.0259
  Al 2Ca 1                  (C)[]           0.0093
  Al 1Fe 1                  (C)  []         0.0147
  Al 3Fe 1                  (C)  []         0.0010
  Mg 1                      (C)[]           0.8200
  Mg 1O  1                  (C)[]           0.1016
  Mg 2Si 1                  (C)             0.0491
  Na 1                      (L)[]           0.0016
  Si 3Ti 5                  (C)[]           0.0027
*
```

92 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       4.43E-0013
 Products heat capacity     (J/K)          30.2380
 Products entropy           (J/K)          54.5965
 Products enthalpy          (KJ)          -26.2368
 Mass  of the system        (Kg)            0.0257
  Al 2Ca 1                  (C)[]           0.0083
  Al 1Fe 1                  (C)  []         0.0131
  Al 3Fe 1                  (C)  []     9.06E-0004
  Mg 1                      (C)[]           0.8400
  Mg 1O  1                  (C)[]           0.0903
  Mg 2Si 1                  (C)             0.0437
  Na 1                      (L)[]           0.0014
  Si 3Ti 5                  (C)[]           0.0024
*
```

93 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           580.0000
 Gas products amount        (mol)       1.09E-0010
 Products heat capacity     (J/K)          29.1395
 Products entropy           (J/K)          50.4846
 Products enthalpy          (KJ)          -24.0171
 Mass  of the system        (Kg)            0.0255
  Al 2Ca 1                  (C)[]           0.0073
  Al 1Fe 1                  (C)  []         0.0114
  Al 3Fe 1                  (C)  []     7.94E-0004
  Mg 1                      (C)[]           0.8600
  Mg 1O  1                  (C)[]           0.0790
  Mg 2Si 1                  (C)             0.0382
  Na 1                      (L)[]           0.0012
  Si 3Ti 5                  (C)[]           0.0021
*
```

94 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)           560.0000
 Gas products amount        (mol)       8.19E-0011
 Products heat capacity     (J/K)          28.7589
 Products entropy           (J/K)          49.4301
 Products enthalpy          (KJ)          -19.9094
 Mass  of the system        (Kg)            0.0253
  Al 2Ca 1                  (C)[]           0.0062
  Al 1Fe 1                  (C)  []         0.0098
  Al 3Fe 1                  (C)  []     6.75E-0004
  Mg 1                      (C)[]           0.8800
  Mg 1O  1                  (C)[]           0.0677
  Mg 2Si 1                  (C)             0.0327
  Na 1                      (L)[]           0.0011
  Si 3Ti 5                  (C)[]           0.0018
*
     95 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       2.21E-0012
 Products heat capacity     (J/K)          27.9265
 Products entropy           (J/K)          46.1923
 Products enthalpy          (KJ)          -16.9779
 Mass  of the system        (Kg)            0.0251
  Al 2Ca 1                  (C)[]           0.0052
  Al 1Fe 1                  (C)  []         0.0082
  Al 3Fe 1                  (C)  []     5.66E-0004
  Mg 1                      (C)[]           0.9000
  Mg 1O  1                  (C)[]           0.0564
  Mg 2Si 1                  (C)             0.0273
  Na 1                      (L)[]       8.87E-0004
  Si 3Ti 5                  (C)[]           0.0015
*
     96 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       8.91E-0014
 Products heat capacity     (J/K)          27.3993
 Products entropy           (J/K)          44.2903
 Products enthalpy          (KJ)          -13.3204
 Mass  of the system        (Kg)            0.0250
  Al 2Ca 1                  (C)[]           0.0041
  Al 1Fe 1                  (C)  []         0.0065
  Al 3Fe 1                  (C)  []     4.49E-0004
  Mg 1                      (C)[]           0.9200
  Mg 1O  1                  (C)[]           0.0451
  Mg 2Si 1                  (C)             0.0218
  Na 1                      (L)[]       7.09E-0004
  Si 3Ti 5                  (C)[]           0.0012
*
     97 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       3.31E-0014
 Products heat capacity     (J/K)          27.2546
 Products entropy           (J/K)          44.2827
 Products enthalpy          (KJ)           -8.8054
 Mass  of the system        (Kg)            0.0248
  Al 2Ca 1                  (C)[]           0.0031
  Al 1Fe 1                  (C)  []         0.0051
  Al 3Ti 1                  (C)  []     2.15E-0004
  Mg 1                      (C)[]           0.9399
  Mg 1O  1                  (C)[]           0.0339
  Mg 2Si 1                  (C)             0.0164
  Na 1                      (L)[]       5.32E-0004
  Si 3Ti 5                  (C)[]       7.93E-0004
*
     98 wt% Mg
 Volume of gas products   (litres)          0.0000
```

```
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       7.82E-0013
 Products heat capacity     (J/K)          26.2007
 Products entropy           (J/K)          39.3370
 Products enthalpy          (KJ)           -6.4626
 Mass  of the system        (Kg)            0.0246
  Al 2Ca 1                  (C)[]           0.0021
  Al 1Fe 1                  (C)  []         0.0033
  Al 3Fe 1                  (C)  []     2.28E-0004
  Mg 1                      (C)[]           0.9600
  Mg 1O  1                  (C)[]           0.0226
  Mg 2Si 1                  (C)             0.0109
  Na 1                      (L)[]       3.55E-0004
  Si 3Ti 5                  (C)[]       5.99E-0004
*
```

99 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           379.0141
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          25.9680
 Products entropy           (J/K)          38.7449
 Products enthalpy          (KJ)           -2.2936
 Mass  of the system        (Kg)            0.0245
  Al 2Ca 1                  (C)[]           0.0010
  Al 1Fe 1                  (C)  []         0.0016
  Al 3Fe 1                  (C)  []     1.12E-0004
  Mg 1                      (C)[]           0.9800
  Mg 1O  1                  (C)[]           0.0113
  Mg 2Si 1                  (C)             0.0055
  Na 1                      (L)[]       1.77E-0004
  Si 3Ti 5                  (C)[]       2.99E-0004
*
```

100 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          25.3585
 Products entropy           (J/K)          35.7450
 Products enthalpy          (KJ)            0.9638
 Mass  of the system        (Kg)            0.0243
  Mg 1                      (C)[]           1.0000
*
```

Al/(Mojave Mars)

```
     Content of Aluminum - 0 wt% Al
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           812.7265
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          75.7239
 Products entropy           (J/K)         112.2711
 Products enthalpy          (KJ)         -901.6645
 Mass  of the system        (Kg)            0.0672
  Al 3Ca 1Na 1O 16Si 5      (C)  [LABRA     0.1942
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2313
  Al 2O  5Si 1              (C)  [KIANI     0.0939
  Al 2O  5Ti 1              (C)  []         0.0251
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3307
  Fe 2O  3                  (C)[]           0.1100
  O  2Si 1                  (C)[]           0.0148
*
     1 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           962.4406
 Gas products amount        (mol)       3.24E-0014
 Products heat capacity     (J/K)          75.7031
 Products entropy           (J/K)         124.1719
 Products enthalpy          (KJ)         -879.7369
 Mass  of the system        (Kg)            0.0662
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0359
  Al 2Fe 1O  4              (C)  []         0.1713
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3222
  Al 2O  5Ti 1              (C)  []         0.0249
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3274
  Ca 1O  3Si 1              (C)[WOLLAST     0.0263
  Fe 3O  4                  (C)[]           0.0292
  O  2Si 1                  (C)[]           0.0628
*
     2 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1089.7059
 Gas products amount        (mol)       1.22E-0011
 Products heat capacity     (J/K)          76.6881
 Products entropy           (J/K)         131.9159
 Products enthalpy          (KJ)         -857.8853
 Mass  of the system        (Kg)            0.0653
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1048
  Al 2Fe 1O  4              (C)  []         0.1588
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3190
  Al 2O  5Ti 1              (C)  []         0.0246
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3187
  Fe 1                      (C)[]           0.0244
  Mg 2O  6Si 2              (C)[KLINOEN     0.0025
  O  2Si 1                  (C)  [CRIST     0.0472
*
     3 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1200.0100
 Gas products amount        (mol)       5.85E-0012
 Products heat capacity     (J/K)          76.0550
 Products entropy           (J/K)         137.1655
 Products enthalpy          (KJ)         -837.1122
 Mass  of the system        (Kg)            0.0643
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3142
  Al 2Fe 1O  4              (C)  []         0.0586
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3157
  Al 2O  5Ti 1              (C)  []         0.0244
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1517
```

```
  Fe 1                        (C)[]           0.0558
  Mg 1O  3Si 1                (C)             0.0784
  O  2Si 1                    (C)  [CRIST     0.0012
*
```

4 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1288.5544
 Gas products amount        (mol)       9.97E-0011
 Products heat capacity     (J/K)          76.0746
 Products entropy           (J/K)         140.4319
 Products enthalpy          (KJ)         -816.9035
 Mass  of the system        (Kg)            0.0634
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3701
  Al 2Mg 1O  4              (C)  []         0.0444
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3125
  Al 2O  5Ti 1              (C)  []         0.0241
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1040
  Fe 1                      (C)[]           0.0672
  Fe 1Si 1                  (C)[]           0.0100
  Mg 1O  3Si 1              (C)             0.0676
*
```

5 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1349.7788
 Gas products amount        (mol)       1.20E-0011
 Products heat capacity     (J/K)          75.8439
 Products entropy           (J/K)         141.7242
 Products enthalpy          (KJ)         -797.2112
 Mass  of the system        (Kg)            0.0625
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3529
  Al 2Mg 1O  4              (C)  []         0.0783
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3092
  Al 2O  5Ti 1              (C)  []         0.0239
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1134
  Fe 1                      (C)[]           0.0503
  Fe 1Si 1                  (C)[]           0.0342
  Mg 1O  3Si 1              (C)             0.0378
*
```

6 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1398.7255
 Gas products amount        (mol)       1.37E-0010
 Products heat capacity     (J/K)          75.0907
 Products entropy           (J/K)         141.3479
 Products enthalpy          (KJ)         -777.8635
 Mass  of the system        (Kg)            0.0615
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4110
  Al 2Mg 1O  4              (C)  []         0.0866
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2662
  Al 2O  5Ti 1              (C)  []         0.0237
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0672
  Fe 1                      (C)[]           0.0342
  Fe 1Si 1                  (C)[]           0.0582
  Mg 1O  3Si 1              (C)             0.0530
*
```

7 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1457.0552
 Gas products amount        (mol)       1.77E-0010
 Products heat capacity     (J/K)          75.0893
 Products entropy           (J/K)         142.6529
 Products enthalpy          (KJ)         -761.6210
 Mass  of the system        (Kg)            0.0609
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3978
  Al 2Mg 1O  4              (C)  []         0.1173
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2627
  Al 2O  5Ti 1              (C)  []         0.0235
```

```
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0723
  Fe 1                      (C)[]           0.0173
  Fe 1Si 1                  (C)[]           0.0822
  Mg 1O  3Si 1              (C)             0.0270
*
     8 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1516.3473
 Gas products amount        (mol)       4.32E-0011
 Products heat capacity     (J/K)          74.9111
 Products entropy           (J/K)         143.5025
 Products enthalpy          (KJ)         -743.3875
 Mass  of the system        (Kg)            0.0601
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3796
  Al 2Mg 1O  4              (C)  []         0.1515
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2598
  Al 2O  5Ti 1              (C)  []         0.0232
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0752
  Ca 1O  3Si 1              (C)[WOLLAST     0.0038
  Fe 1                      (C)[]       3.72E-0004
  Fe 1Si 1                  (C)[]           0.1064
*
     9 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1554.9121
 Gas products amount        (mol)       2.52E-0009
 Products heat capacity     (J/K)          74.5254
 Products entropy           (J/K)         143.3631
 Products enthalpy          (KJ)         -725.4953
 Mass  of the system        (Kg)            0.0593
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4222
  Al 2Mg 1O  4              (C)  []         0.1726
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2570
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0288
  Ca 1O  3Si 1              (C)[WOLLAST     0.0028
  Fe 1Si 1                  (C)[]           0.1058
  Si 1                      (C)[]           0.0026
  Si 3Ti 5                  (C)[]           0.0082
*
     10 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1589.7840
 Gas products amount        (mol)       2.17E-0010
 Products heat capacity     (J/K)          73.8058
 Products entropy           (J/K)         142.7780
 Products enthalpy          (KJ)         -708.3692
 Mass  of the system        (Kg)            0.0585
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4237
  Al 2Mg 1O  4              (C)  []         0.1965
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.0232
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2113
  Ca 1O  3Si 1              (C)[WOLLAST     0.0214
  Fe 1Si 1                  (C)[]           0.1046
  Si 1                      (C)[]           0.0112
  Si 3Ti 5                  (C)[]           0.0081
*
     11 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1624.4066
 Gas products amount        (mol)       9.22E-0011
 Products heat capacity     (J/K)          73.2779
 Products entropy           (J/K)         142.2533
 Products enthalpy          (KJ)         -691.5189
 Mass  of the system        (Kg)            0.0578
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4695
  Al 2Mg 1O  4              (C)  []         0.1944
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.0578
```

```
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1446
 Al 2O  3                  (C)[]           0.0025
 Fe 1Si 1                  (C)[]           0.1035
 Si 1                      (C)[]           0.0197
 Si 3Ti 5                  (C)[]           0.0080
*
    12 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1665.0000
Gas products amount        (mol)       3.26E-0010
Products heat capacity     (J/K)          72.6466
Products entropy           (J/K)         141.8584
Products enthalpy          (KJ)         -674.7363
Mass  of the system        (Kg)            0.0570
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4643
 Al 2Mg 1O  4              (C)  []         0.1922
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.0794
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.1020
 Al 2O  3                  (C)[]           0.0237
 Fe 1Si 1                  (C)[]           0.1023
 Si 1                      (C)[]           0.0283
 Si 3Ti 5                  (C)[]           0.0079
*
    13 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1690.0189     1689.7253     1690.3124
Gas products amount        (mol)       5.56E-0010    5.90E-0010    4.12E-0010
Products heat capacity     (J/K)          71.9073       71.9336       71.7966
Products entropy           (J/K)         140.7775      140.3519      142.5703
Products enthalpy          (KJ)         -659.0694     -659.7886     -656.0397
Phase transition enthalpy  (KJ)            3.7490
Mass  of the system        (Kg)            0.0563
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4590        0.4590        0.4590
 Al 2Mg 1O  4              (C)  []         0.1900        0.1900        0.1900
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1009        0.1009        0.1009
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.0594        0.0594        0.0594
 Al 2O  3                  (C)[]           0.0449        0.0449        0.0449
 Fe 1Si 1                  (C)[]           0.1012        0.1012        0.1012
 Si 1                      (C)[]           0.0298        0.0368        0.0000
 Si 1                      (L)[]           0.0071        0.0000        0.0368
 Si 3Ti 5                  (C)[]           0.0078        0.0078        0.0078
*
    14 wt% Al
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1689.8515     1689.3906     1690.3124
Gas products amount        (mol)       2.03E-0010    1.14E-0010    2.47E-0010
Products heat capacity     (J/K)          70.7739       70.8843       70.7191
Products entropy           (J/K)         140.3283      138.5185      141.2265
Products enthalpy          (KJ)         -643.4530     -646.5114     -641.9349
Phase transition enthalpy  (KJ)            4.5765
Mass  of the system        (Kg)            0.0556
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4537        0.4537        0.4537
 Al 2Mg 1O  4              (C)  []         0.1878        0.1878        0.1878
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1224        0.1224        0.1224
 Al 2Na 2O 16Si 6          (C)  [LOW A     0.0169        0.0169        0.0169
 Al 2O  3                  (C)[]           0.0661        0.0661        0.0661
 Fe 1Si 1                  (C)[]           0.1000        0.1000        0.1000
 Si 1                      (C)[]           0.0151        0.0454        0.0000
 Si 1                      (L)[]           0.0303        0.0000        0.0454
 Si 3Ti 5                  (C)[]           0.0077        0.0077        0.0077
*
    15 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1690.0461
Gas products amount        (mol)       2.99E-0009
Products heat capacity     (J/K)          69.5647
Products entropy           (J/K)         139.6924
```

```
 Products enthalpy          (KJ)         -628.3256
 Mass  of the system        (Kg)            0.0549
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0179
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.4121
  Al 2Mg 1O  4              (C)  []         0.1856
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1300
  Al 2O  3                  (C)[]           0.0939
  Fe 1Si 1                  (C)[]           0.0988
  Si 1                      (L)[]           0.0539
  Si 3Ti 5                  (C)[]           0.0076
*
     16 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1692.4976     1692.1758     1692.8195
 Gas products amount        (mol)       1.01E-0009    5.01E-0010    1.90E-0009
 Products heat capacity     (J/K)          68.3869       68.3918       68.3786
 Products entropy           (J/K)         139.1047      138.1543      140.7392
 Products enthalpy          (KJ)         -613.3539     -614.9628     -610.5870
 Phase transition enthalpy  (KJ)            4.3758
 Mass  of the system        (Kg)            0.0543
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0476        0.0476        0.0476
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.3466        0.3466        0.3466
  Al 2Mg 1O  4              (C)  []         0.1834        0.1834        0.1834
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1285        0.1285        0.1285
  Al 2O  3                  (C)[]           0.1262        0.1262        0.1262
  Fe 1Si 1                  (L)[]           0.0359        0.0000        0.0977
  Fe 1Si 1                  (C)[]           0.0618        0.0977    1.63E-0005
  Si 1                      (L)[]           0.0625        0.0625        0.0625
  Si 3Ti 5                  (C)[]           0.0076        0.0076        0.0076
*
     17 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1692.8233     1692.6453     1693.0013
 Gas products amount        (mol)       2.93E-0010    3.48E-0010    2.75E-0010
 Products heat capacity     (J/K)          67.2213       67.2328       67.2175
 Products entropy           (J/K)         138.4703      136.5855      139.0984
 Products enthalpy          (KJ)         -598.8386     -602.0292     -597.7753
 Phase transition enthalpy  (KJ)            4.2540
 Mass  of the system        (Kg)            0.0536
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0773        0.0773        0.0773
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2811        0.2811        0.2811
  Al 2Mg 1O  4              (C)  []         0.1813        0.1813        0.1813
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1270        0.1270        0.1270
  Al 2O  3                  (C)[]           0.1584        0.1584        0.1584
  Fe 1Si 1                  (L)[]           0.0724        0.0000        0.0965
  Fe 1Si 1                  (C)[]           0.0241        0.0965        0.0000
  Si 1                      (L)[]           0.0710        0.0710        0.0710
  Si 3Ti 5                  (C)[]           0.0075        0.0075        0.0075
*
     18 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1699.3884
 Gas products amount        (mol)       2.57E-0010
 Products heat capacity     (J/K)          66.1235
 Products entropy           (J/K)         137.7380
 Products enthalpy          (KJ)         -584.8582
 Mass  of the system        (Kg)            0.0530
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1070
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2156
  Al 2Mg 1O  4              (C)  []         0.1791
  Al 1Na 1O  4Si 1          (C)  [KARNE     0.1255
  Al 2O  3                  (C)[]           0.1906
  Fe 1Si 1                  (L)[]           0.0953
  Si 1                      (L)[]           0.0796
  Si 3Ti 5                  (C)[]           0.0074
*
     19 wt% Al
 Volume of gas products   (litres)      7.33E-0007
```

```
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)       5.05E-0009
 Products heat capacity     (J/K)          65.7313
 Products entropy           (J/K)         137.0187
 Products enthalpy          (KJ)         -570.8717
 Mass  of the system        (Kg)            0.0524
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0968
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.2310
  Al 2Mg 1O  4              (C)  []         0.1769
  Al 2O  3                  (C)[]           0.2525
  Fe 1Si 1                  (L)[]           0.0942
  Na 2O  3Si 1              (L)[]           0.0532
  Si 1                      (L)[]           0.0881
  Si 3Ti 5                  (C)[]           0.0073
*
     20 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1736.0352
 Gas products amount        (mol)       4.95E-0010
 Products heat capacity     (J/K)          64.7959
 Products entropy           (J/K)         136.4390
 Products enthalpy          (KJ)         -557.3055
 Mass  of the system        (Kg)            0.0518
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1269
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.1645
  Al 2Mg 1O  4              (C)  []         0.1747
  Al 2O  3                  (C)[]           0.2844
  Fe 1Si 1                  (L)[]           0.0930
  Na 2O  3Si 1              (L)[]           0.0526
  Si 1                      (L)[]           0.0967
  Si 3Ti 5                  (C)[]           0.0072
*
     21 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1761.6437
 Gas products amount        (mol)       9.14E-0010
 Products heat capacity     (J/K)          63.8697
 Products entropy           (J/K)         135.8347
 Products enthalpy          (KJ)         -544.0899
 Mass  of the system        (Kg)            0.0512
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1571
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0980
  Al 2Mg 1O  4              (C)  []         0.1725
  Al 2O  3                  (C)[]           0.3163
  Fe 1Si 1                  (L)[]           0.0919
  Na 2O  3Si 1              (L)[]           0.0519
  Si 1                      (L)[]           0.1052
  Si 3Ti 5                  (C)[]           0.0071
*
     22 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1787.5221
 Gas products amount        (mol)       1.72E-0009
 Products heat capacity     (J/K)          62.9564
 Products entropy           (J/K)         135.2320
 Products enthalpy          (KJ)         -531.1662
 Mass  of the system        (Kg)            0.0506
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1873
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0315
  Al 2Mg 1O  4              (C)  []         0.1703
  Al 2O  3                  (C)[]           0.3482
  Fe 1Si 1                  (L)[]           0.0907
  Na 2O  3Si 1              (L)[]           0.0513
  Si 1                      (L)[]           0.1138
  Si 3Ti 5                  (C)[]           0.0070
*
     23 wt% Al
```

```
 Volume of gas products   (litres)          1.9226
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1786.8699
 Gas products amount        (mol)           0.0127
 Products heat capacity     (J/K)          61.8328
 Products entropy           (J/K)         134.5587
 Products enthalpy          (KJ)         -518.5418
 Mass  of the system        (Kg)            0.0501
1 Na 1                      (G)             0.0057        0.9808  (atm)
1 Na 2                      (G)         9.76E-0005        0.0084  (atm)
1 O  1Si 1                  (G)         9.62E-0005        0.0086  (atm)
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.2002
  Al 2Mg 1O  4              (C)  []         0.1681
  Al 2O  3                  (C)[]           0.3737
  Fe 1Si 1                  (L)[]           0.0895
  Na 2O  3Si 1              (L)[]           0.0352
  Si 1                      (L)[]           0.1205
  Si 3Ti 5                  (C)[]           0.0069
*
```

24 wt% Al

```
 Volume of gas products   (litres)          5.4078
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1762.5293
 Gas products amount        (mol)           0.0362
 Products heat capacity     (J/K)          60.5329
 Products entropy           (J/K)         133.8216
 Products enthalpy          (KJ)         -506.2060
 Mass  of the system        (Kg)            0.0495
1 Na 1                      (G)             0.0165        0.9832  (atm)
1 Na 2                      (G)         3.04E-0004        0.0090  (atm)
1 O  1Si 1                  (G)         1.90E-0004        0.0059  (atm)
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1976
  Al 2Mg 1O  4              (C)  []         0.1658
  Al 2O  3                  (C)[]           0.3934
  Fe 1Si 1                  (L)[]           0.0884
  Na 2O  3Si 1              (L)[]           0.0053
  Si 1                      (L)[]           0.1257
  Si 3Ti 5                  (C)[]           0.0068
*
```

25 wt% Al

```
 Volume of gas products   (litres)          5.8822
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1757.7789
 Gas products amount        (mol)           0.0395
 Products heat capacity     (J/K)          59.3371
 Products entropy           (J/K)         133.0816
 Products enthalpy          (KJ)         -494.1116
 Mass  of the system        (Kg)            0.0490
1 Mg 1                      (G)         3.92E-0005        0.0020  (atm)
1 Na 1                      (G)             0.0182        0.9839  (atm)
1 Na 2                      (G)         3.41E-0004        0.0092  (atm)
1 O  1Si 1                  (G)         1.75E-0004        0.0049  (atm)
  Al 4Ca 1O  7              (C)  []         0.1567
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.1124
  Al 2Mg 1O  4              (C)  []         0.1636
  Al 2O  3                  (C)[]           0.3210
  Fe 1Si 1                  (L)[]           0.0872
  Si 1                      (L)[]           0.1337
  Si 3Ti 5                  (C)[]           0.0067
*
```

26 wt% Al

```
 Volume of gas products   (litres)          5.7376
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1756.8718
 Gas products amount        (mol)           0.0385
 Products heat capacity     (J/K)          58.1812
 Products entropy           (J/K)         132.3476
 Products enthalpy          (KJ)         -482.2817
 Mass  of the system        (Kg)            0.0484
1 Mg 1                      (G)         3.83E-0005        0.0020  (atm)
1 Na 1                      (G)             0.0180        0.9839  (atm)
```

```
1 Na 2                      (G)         3.37E-0004        0.0092  (atm)
1 O  1Si 1                  (G)         1.70E-0004        0.0049  (atm)
  Al 4Ca 1O  7              (C)  []         0.3473
  Al 2Ca 2O  7Si 1          (C)  [GEHLE     0.0092
  Al 2Mg 1O  4              (C)  []         0.1614
  Al 2O  3                  (C)[]           0.2285
  Fe 1Si 1                  (L)[]           0.0860
  Si 1                      (L)[]           0.1423
  Si 3Ti 5                  (C)[]           0.0067
*
```

27 wt% Al

```
 Volume of gas products   (litres)          5.6771
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1746.7572
 Gas products amount        (mol)           0.0383
 Products heat capacity     (J/K)          57.5503
 Products entropy           (J/K)         130.9146
 Products enthalpy          (KJ)         -470.7103
 Mass  of the system        (Kg)            0.0479
1 Mg 1                      (G)         4.93E-0004        0.0254  (atm)
1 Na 1                      (G)             0.0177        0.9648  (atm)
1 Na 2                      (G)         3.36E-0004        0.0091  (atm)
  Al 2Ca 1                  (L)[]           0.0156
  Al 4Ca 1O  7              (C)  []         0.3169
  Al 2Mg 1O  4              (C)  []         0.1565
  Al 2O  3                  (C)[]           0.2596
  Fe 1Si 1                  (L)[]           0.0849
  Si 1                      (L)[]           0.1414
  Si 3Ti 5                  (C)[]           0.0066
*
```

28 wt% Al

```
 Volume of gas products   (litres)          5.5043
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1739.0231
 Gas products amount        (mol)           0.0373
 Products heat capacity     (J/K)          57.0175
 Products entropy           (J/K)         129.4363
 Products enthalpy          (KJ)         -459.3749
 Mass  of the system        (Kg)            0.0474
1 Mg 1                      (G)         4.53E-0004        0.0237  (atm)
1 Na 1                      (G)             0.0175        0.9663  (atm)
1 Na 2                      (G)         3.40E-0004        0.0094  (atm)
  Al 2Ca 1                  (L)[]           0.0333
  Al 4Ca 1O  7              (C)  []         0.2630
  Al 2Mg 1O  4              (C)  []         0.1546
  Al 2O  3                  (C)[]           0.3012
  Fe 1Si 1                  (L)[]           0.0837
  Si 1                      (L)[]           0.1395
  Si 3Ti 5                  (C)[]           0.0065
*
```

29 wt% Al

```
 Volume of gas products   (litres)          5.3371
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1731.3030
 Gas products amount        (mol)           0.0364
 Products heat capacity     (J/K)          56.4949
 Products entropy           (J/K)         127.9880
 Products enthalpy          (KJ)         -448.2724
 Mass  of the system        (Kg)            0.0469
1 Mg 1                      (G)         4.16E-0004        0.0221  (atm)
1 Na 1                      (G)             0.0172        0.9677  (atm)
1 Na 2                      (G)         3.44E-0004        0.0096  (atm)
  Al 2Ca 1                  (L)[]           0.0510
  Al 4Ca 1O  7              (C)  []         0.2090
  Al 2Mg 1O  4              (C)  []         0.1526
  Al 2O  3                  (C)[]           0.3428
  Fe 1Si 1                  (L)[]           0.0826
  Si 1                      (L)[]           0.1375
  Si 3Ti 5                  (C)[]           0.0064
*
```

30 wt% Al

```
 Volume of gas products   (litres)          5.1750
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1723.5969
 Gas products amount        (mol)           0.0354
 Products heat capacity     (J/K)          55.9822
 Products entropy           (J/K)         126.5689
 Products enthalpy          (KJ)         -437.3978
 Mass  of the system        (Kg)            0.0464
1 Mg 1                      (G)         3.81E-0004        0.0206  (atm)
1 Na 1                      (G)             0.0170        0.9690  (atm)
1 Na 2                      (G)         3.48E-0004        0.0099  (atm)
  Al 2Ca 1                  (L)[]           0.0687
  Al 4Ca 1O  7              (C)  []         0.1551
  Al 2Mg 1O  4              (C)  []         0.1506
  Al 2O  3                  (C)[]           0.3845
  Fe 1Si 1                  (L)[]           0.0814
  Si 1                      (L)[]           0.1356
  Si 3Ti 5                  (C)[]           0.0063
*
```

31 wt% Al

```
 Volume of gas products   (litres)          4.9941
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0344
 Products heat capacity     (J/K)          55.4505
 Products entropy           (J/K)         124.9815
 Products enthalpy          (KJ)         -427.0827
 Mass  of the system        (Kg)            0.0460
1 Mg 1                      (G)         3.30E-0004        0.0181  (atm)
1 Na 1                      (G)             0.0167        0.9711  (atm)
1 Na 2                      (G)         3.58E-0004        0.0104  (atm)
  Al 2Ca 1                  (L)[]           0.0865
  Al 4Ca 1O  7              (C)  []         0.1011
  Al 2Mg 1O  4              (C)  []         0.1488
  Al 2O  3                  (C)[]           0.4261
  Fe 1Si 1                  (L)[]           0.0802
  Si 1                      (L)[]           0.1337
  Si 3Ti 5                  (C)[]           0.0062
*
```

32 wt% Al

```
 Volume of gas products   (litres)          4.8719
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.0336
 Products heat capacity     (J/K)          54.9945
 Products entropy           (J/K)         123.8730
 Products enthalpy          (KJ)         -416.2083
 Mass  of the system        (Kg)            0.0455
1 Mg 1                      (G)         3.25E-0004        0.0181  (atm)
1 Na 1                      (G)             0.0165        0.9711  (atm)
1 Na 2                      (G)         3.53E-0004        0.0104  (atm)
  Al 2Ca 1                  (L)[]           0.1042
  Al 4Ca 1O  7              (C)  []         0.0473
  Al 2Mg 1O  4              (C)  []         0.1466
  Al 2O  3                  (C)[]           0.4678
  Fe 1Si 1                  (L)[]           0.0791
  Si 1                      (L)[]           0.1317
  Si 3Ti 5                  (C)[]           0.0061
*
```

33 wt% Al

```
 Volume of gas products   (litres)          4.7564
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1694.5234
 Gas products amount        (mol)           0.0331
 Products heat capacity     (J/K)          54.4421
 Products entropy           (J/K)         122.3659
 Products enthalpy          (KJ)         -406.2296
 Mass  of the system        (Kg)            0.0451
1 Mg 1                      (G)         5.02E-0004        0.0281  (atm)
1 Na 1                      (G)             0.0162        0.9607  (atm)
1 Na 2                      (G)         3.61E-0004        0.0107  (atm)
```

```
  Al 2Ca 1                  (L)[]           0.1166
  Al 4Ca 1                  (L)[]           0.0046
  Al 2Mg 1O  4              (C)  []         0.1434
  Al 2O  3                  (C)[]           0.5046
  Fe 1Si 1                  (L)[]           0.0779
  Si 1                      (L)[]           0.1298
  Si 3Ti 5                  (C)[]           0.0060
*
     34 wt% Al
 Volume of gas products   (litres)          4.7739
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1725.8723
 Gas products amount        (mol)           0.0326
 Products heat capacity     (J/K)          54.5820
 Products entropy           (J/K)         123.5710
 Products enthalpy          (KJ)         -398.9960
 Mass  of the system        (Kg)            0.0452
1 Mg 1                      (G)         6.45E-0004        0.0367  (atm)
1 Na 1                      (G)             0.0158        0.9529  (atm)
1 Na 2                      (G)         3.16E-0004        0.0095  (atm)
  Al 2Ca 1                  (L)[]           0.0953
  Al 4Ca 1                  (L)[]           0.0329
  Al 2Mg 1O  4              (C)  []         0.1386
  Al 2O  3                  (C)[]           0.4997
  Fe 1Si 1                  (L)[]           0.0889
  Si 1                      (L)[]           0.1219
  Si 3Ti 5                  (C)[]           0.0059
*
     35 wt% Al
 Volume of gas products   (litres)          4.5177
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1692.9454
 Gas products amount        (mol)           0.0315
 Products heat capacity     (J/K)          53.2160
 Products entropy           (J/K)         119.2871
 Products enthalpy          (KJ)         -386.5815
 Mass  of the system        (Kg)            0.0442
1 Mg 1                      (G)         4.80E-0004        0.0277  (atm)
1 Na 1                      (G)             0.0157        0.9610  (atm)
1 Na 2                      (G)         3.52E-0004        0.0107  (atm)
  Al 2Ca 1                  (L)[]           0.0611
  Al 4Ca 1                  (L)[]           0.0863
  Al 2Mg 1O  4              (C)  []         0.1391
  Al 2O  3                  (C)[]           0.4895
  Fe 1Si 1                  (L)[]           0.0075
  Fe 1Si 1                  (C)[]           0.0681
  Si 1                      (L)[]           0.1259
  Si 3Ti 5                  (C)[]           0.0058
*
     36 wt% Al
 Volume of gas products   (litres)          4.3964
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1690.7684
 Gas products amount        (mol)           0.0307
 Products heat capacity     (J/K)          52.6088
 Products entropy           (J/K)         118.3336
 Products enthalpy          (KJ)         -376.1267
 Mass  of the system        (Kg)            0.0437
1 Mg 1                      (G)         4.63E-0004        0.0272  (atm)
1 Na 1                      (G)             0.0155        0.9615  (atm)
1 Na 2                      (G)         3.49E-0004        0.0108  (atm)
  Al 2Ca 1                  (L)[]           0.0333
  Al 4Ca 1                  (L)[]           0.1272
  Al 2Mg 1O  4              (C)  []         0.1371
  Al 2O  3                  (C)[]           0.4819
  Fe 1Si 1                  (C)[]           0.0744
  Si 1                      (L)[]           0.1240
  Si 3Ti 5                  (C)[]           0.0058
*
     37 wt% Al
 Volume of gas products   (litres)          4.2829        4.2809        4.2830
```

Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.6645	1689.3837	1689.9453
Gas products amount	(mol)	0.0299	0.0299	0.0299
Products heat capacity	(J/K)	52.0815	52.3795	52.0555
Products entropy	(J/K)	116.6347	111.9871	117.0394
Products enthalpy	(KJ)	-367.1603	-375.0147	-366.4763
Phase transition enthalpy	(KJ)	8.5384		
Mass of the system	(Kg)	0.0433		
1 Mg 1	(G)	4.53E-0004	4.50E-0004	4.53E-0004
1 Na 1	(G)	0.0153	0.0153	0.0153
1 Na 2	(G)	3.45E-0004	3.46E-0004	3.45E-0004
Al 2Ca 1	(L)[]	0.0056	0.0056	0.0056
Al 4Ca 1	(L)[]	0.1681	0.1681	0.1681
Al 2Mg 1O 4	(C) []	0.1349	0.1349	0.1349
Al 2O 3	(C)[]	0.4744	0.4744	0.4744
Fe 1Si 1	(C)[]	0.0733	0.0733	0.0733
Si 1	(C)[]	0.0210	0.1220	0.0122
Si 1	(L)[]	0.1011	0.0000	0.1099
Si 3Ti 5	(C)[]	0.0057	0.0057	0.0057

*

38 wt% Al

Volume of gas products	(litres)	4.2039	4.2023	4.2046
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.6664	1689.3874	1689.9454
Gas products amount	(mol)	0.0293	0.0293	0.0293
Products heat capacity	(J/K)	51.6034	51.8429	51.4917
Products entropy	(J/K)	115.1942	111.4635	116.9328
Products enthalpy	(KJ)	-357.8922	-364.1972	-354.9540
Phase transition enthalpy	(KJ)	9.2432		
Mass of the system	(Kg)	0.0429		
1 Mg 1	(G)	5.57E-0004	5.55E-0004	5.58E-0004
1 Na 1	(G)	0.0150	0.0150	0.0150
1 Na 2	(G)	3.37E-0004	3.38E-0004	3.37E-0004
Al 1	(L)[]	0.0127	0.0127	0.0126
Al 4Ca 1	(L)[]	0.1740	0.1740	0.1740
Al 2Mg 1O 4	(C) []	0.1321	0.1321	0.1321
Al 2O 3	(C)[]	0.4675	0.4675	0.4675
Fe 1Si 1	(C)[]	0.0721	0.0721	0.0721
Si 1	(C)[]	0.0382	0.1201	4.03E-0006
Si 1	(L)[]	0.0819	0.0000	0.1201
Si 3Ti 5	(C)[]	0.0056	0.0056	0.0056

*

39 wt% Al

Volume of gas products	(litres)	4.0967	4.0956	4.0977
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.6666	1689.3876	1689.9455
Gas products amount	(mol)	0.0286	0.0286	0.0286
Products heat capacity	(J/K)	51.1500	51.3325	50.9902
Products entropy	(J/K)	113.7673	110.9256	116.2561
Products enthalpy	(KJ)	-348.8000	-353.6024	-344.5939
Phase transition enthalpy	(KJ)	9.0085		
Mass of the system	(Kg)	0.0425		
1 Mg 1	(G)	5.48E-0004	5.47E-0004	5.49E-0004
1 Na 1	(G)	0.0148	0.0148	0.0148
1 Na 2	(G)	3.32E-0004	3.32E-0004	3.32E-0004
Al 1	(L)[]	0.0286	0.0286	0.0286
Al 4Ca 1	(L)[]	0.1712	0.1712	0.1712
Al 2Mg 1O 4	(C) []	0.1300	0.1300	0.1300
Al 2O 3	(C)[]	0.4599	0.4599	0.4600
Fe 1Si 1	(C)[]	0.0709	0.0709	0.0709
Si 1	(C)[]	0.0552	0.1182	3.97E-0006
Si 1	(L)[]	0.0630	0.0000	0.1182
Si 3Ti 5	(C)[]	0.0055	0.0055	0.0055

*

40 wt% Al

Volume of gas products	(litres)	3.9916	3.9908	3.9929
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.6667	1689.3878	1689.9457
Gas products amount	(mol)	0.0279	0.0279	0.0279
Products heat capacity	(J/K)	50.7051	50.8315	50.4980
Products entropy	(J/K)	112.3664	110.3974	115.5919

```
 Products enthalpy          (KJ)         -339.8766     -343.2042     -334.4254
 Phase transition enthalpy  (KJ)            8.7787
 Mass  of the system        (Kg)            0.0421
1 Mg 1                      (G)          5.38E-0004    5.37E-0004    5.40E-0004
1 Na 1                      (G)             0.0145        0.0145        0.0145
1 Na 2                      (G)          3.27E-0004    3.27E-0004    3.26E-0004
  Al 1                      (L)[]           0.0445        0.0445        0.0445
  Al 4Ca 1                  (L)[]           0.1684        0.1684        0.1684
  Al 2Mg 1O  4              (C)  []         0.1279        0.1279        0.1279
  Al 2O  3                  (C)[]           0.4524        0.4524        0.4524
  Fe 1Si 1                  (C)[]           0.0698        0.0698        0.0698
  Si 1                      (C)[]           0.0722        0.1162    3.90E-0006
  Si 1                      (L)[]           0.0441        0.0000        0.1162
  Si 3Ti 5                  (C)[]           0.0054        0.0054        0.0054
*
```

41 wt% Al

```
 Volume of gas products   (litres)          3.8884        3.8880        3.8900
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6669     1689.3879     1689.9459
 Gas products amount        (mol)           0.0271        0.0271        0.0271
 Products heat capacity     (J/K)          50.2684       50.3399       50.0149
 Products entropy           (J/K)         110.9922      109.8792      114.9403
 Products enthalpy          (KJ)         -331.1189     -333.0000     -324.4468
 Phase transition enthalpy  (KJ)            8.5532
 Mass  of the system        (Kg)            0.0417
1 Mg 1                      (G)          5.29E-0004    5.29E-0004    5.32E-0004
1 Na 1                      (G)             0.0143        0.0143        0.0143
1 Na 2                      (G)          3.21E-0004    3.21E-0004    3.21E-0004
  Al 1                      (L)[]           0.0604        0.0604        0.0604
  Al 4Ca 1                  (L)[]           0.1656        0.1656        0.1656
  Al 2Mg 1O  4              (C)  []         0.1257        0.1258        0.1257
  Al 2O  3                  (C)[]           0.4449        0.4449        0.4449
  Fe 1Si 1                  (C)[]           0.0686        0.0686        0.0686
  Si 1                      (C)[]           0.0892        0.1143        0.0000
  Si 1                      (L)[]           0.0251        0.0000        0.1143
  Si 3Ti 5                  (C)[]           0.0053        0.0053        0.0053
*
```

42 wt% Al

```
 Volume of gas products   (litres)          3.7831
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1688.2960
 Gas products amount        (mol)           0.0264
 Products heat capacity     (J/K)          49.8516
 Products entropy           (J/K)         109.3368
 Products enthalpy          (KJ)         -323.0365
 Mass  of the system        (Kg)            0.0413
1 Mg 1                      (G)          5.15E-0004        0.0331  (atm)
1 Na 1                      (G)             0.0140        0.9554  (atm)
1 Na 2                      (G)          3.17E-0004        0.0108  (atm)
  Al 1                      (L)[]           0.0764
  Al 4Ca 1                  (L)[]           0.1628
  Al 2Mg 1O  4              (C)  []         0.1237
  Al 2O  3                  (C)[]           0.4373
  Fe 1Si 1                  (C)[]           0.0674
  Si 1                      (C)[]           0.1124
  Si 3Ti 5                  (C)[]           0.0052
*
```

43 wt% Al

```
 Volume of gas products   (litres)          3.6063
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1665.0000
 Gas products amount        (mol)           0.0255
 Products heat capacity     (J/K)          49.2640
 Products entropy           (J/K)         108.1302
 Products enthalpy          (KJ)         -314.3862
 Mass  of the system        (Kg)            0.0410
1 Mg 1                      (G)          4.09E-0004        0.0270  (atm)
1 Na 1                      (G)             0.0138        0.9607  (atm)
1 Na 2                      (G)          3.38E-0004        0.0118  (atm)
  Al 1                      (L)[]           0.0924
  Al 4Ca 1                  (L)[]           0.1600
```

```
  Al 2Mg 1O  4              (C)  []         0.1221
  Al 2O  3                  (C)[]           0.4292
  Fe 1Si 1                  (C)[]           0.0663
  Si 1                      (C)[]           0.1104
  Si 3Ti 5                  (C)[]           0.0051
*
```

44 wt% Al

```
 Volume of gas products   (litres)          3.4443
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1643.2172
 Gas products amount        (mol)           0.0247
 Products heat capacity     (J/K)          48.6976
 Products entropy           (J/K)         106.9879
 Products enthalpy          (KJ)         -305.8056
 Mass  of the system        (Kg)            0.0406
1 Mg 1                      (G)         3.28E-0004        0.0222  (atm)
1 Na 1                      (G)             0.0135        0.9647  (atm)
1 Na 2                      (G)         3.58E-0004        0.0128  (atm)
  Al 1                      (L)[]           0.1083
  Al 4Ca 1                  (L)[]           0.1572
  Al 2Mg 1O  4              (C)  []         0.1204
  Al 2O  3                  (C)[]           0.4213
  Fe 1Si 1                  (C)[]           0.0651
  Si 1                      (C)[]           0.1085
  Si 3Ti 5                  (C)[]           0.0050
*
```

45 wt% Al

```
 Volume of gas products   (litres)          3.2738
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1615.2518
 Gas products amount        (mol)           0.0239
 Products heat capacity     (J/K)          48.1155
 Products entropy           (J/K)         105.6751
 Products enthalpy          (KJ)         -297.6735
 Mass  of the system        (Kg)            0.0402
1 Mg 1                      (G)         2.47E-0004        0.0171  (atm)
1 Na 1                      (G)             0.0132        0.9685  (atm)
1 Na 2                      (G)         3.88E-0004        0.0142  (atm)
  Al 1                      (L)[]           0.1243
  Al 4Ca 1                  (L)[]           0.1544
  Al 2Mg 1O  4              (C)  []         0.1187
  Al 2O  3                  (C)[]           0.4133
  Fe 1Si 1                  (C)[]           0.0640
  Si 1                      (C)[]           0.1066
  Si 3Ti 5                  (C)[]           0.0049
*
```

46 wt% Al

```
 Volume of gas products   (litres)          3.1131
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1587.4779
 Gas products amount        (mol)           0.0231
 Products heat capacity     (J/K)          47.5485
 Products entropy           (J/K)         104.3829
 Products enthalpy          (KJ)         -289.6653
 Mass  of the system        (Kg)            0.0399
1 Mg 1                      (G)         1.84E-0004        0.0131  (atm)
1 Na 1                      (G)             0.0129        0.9710  (atm)
1 Na 2                      (G)         4.21E-0004        0.0158  (atm)
  Al 1                      (L)[]           0.1403
  Al 4Ca 1                  (L)[]           0.1516
  Al 2Mg 1O  4              (C)  []         0.1168
  Al 2O  3                  (C)[]           0.4055
  Fe 1Si 1                  (C)[]           0.0628
  Si 1                      (C)[]           0.1046
  Si 3Ti 5                  (C)[]           0.0049
*
```

47 wt% Al

```
 Volume of gas products   (litres)          2.9361
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1549.2548
 Gas products amount        (mol)           0.0224
```

```
 Products heat capacity     (J/K)          46.9486
 Products entropy           (J/K)         102.7851
 Products enthalpy          (KJ)         -282.2839
 Mass  of the system        (Kg)            0.0395
1 Mg 1                      (G)         1.22E-0004        0.0089  (atm)
1 Na 1                      (G)             0.0126        0.9728  (atm)
1 Na 2                      (G)         4.76E-0004        0.0183  (atm)
  Al 1                      (L)[]           0.1563
  Al 4Ca 1                  (L)[]           0.1488
  Al 2Mg 1O  4              (C)  []         0.1150
  Al 2O  3                  (C)[]           0.3977
  Fe 1Si 1                  (C)[]           0.6616
  Si 1                      (C)[]           0.1027
  Si 3Ti 5                  (C)[]           0.0048
*
```

48 wt% Al

```
 Volume of gas products   (litres)          2.8116
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1530.0000
 Gas products amount        (mol)           0.0217
 Products heat capacity     (J/K)          46.4480
 Products entropy           (J/K)         101.7796
 Products enthalpy          (KJ)         -274.1310
 Mass  of the system        (Kg)            0.0392
1 Mg 1                      (G)         9.76E-0005        0.0073  (atm)
1 Na 1                      (G)             0.0124        0.9730  (atm)
1 Na 2                      (G)         5.02E-0004        0.0197  (atm)
  Al 1                      (L)[]           0.1722
  Al 4Ca 1                  (L)[]           0.1459
  Al 2Mg 1O  4              (C)  []         0.1130
  Al 2O  3                  (C)[]           0.3900
  Fe 1Si 1                  (C)[]           0.0605
  Si 1                      (C)[]           0.1007
  Si 3Ti 5                  (C)[]           0.0047
*
```

49 wt% Al

```
 Volume of gas products   (litres)          2.6530
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1493.0000
 Gas products amount        (mol)           0.0210
 Products heat capacity     (J/K)          45.8840
 Products entropy           (J/K)         100.2384
 Products enthalpy          (KJ)         -266.9347
 Mass  of the system        (Kg)            0.0388
1 Mg 1                      (G)         6.35E-0005        0.0048  (atm)
1 Na 1                      (G)             0.0121        0.9723  (atm)
1 Na 2                      (G)         5.67E-0004        0.0228  (atm)
  Al 1                      (L)[]           0.1881
  Al 4Ca 1                  (L)[]           0.1431
  Al 2Mg 1O  4              (C)  []         0.1110
  Al 2O  3                  (C)[]           0.3823
  Fe 1Si 1                  (C)[]           0.0593
  Si 1                      (C)[]           0.0988
  Si 3Ti 5                  (C)[]           0.0046
*
```

50 wt% Al

```
 Volume of gas products   (litres)          2.5162
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1463.0000
 Gas products amount        (mol)           0.0203
 Products heat capacity     (J/K)          45.3639
 Products entropy           (J/K)          98.9209
 Products enthalpy          (KJ)         -259.5340
 Mass  of the system        (Kg)            0.0385
1 Mg 1                      (G)         4.40E-0005        0.0034  (atm)
1 Na 1                      (G)             0.0118        0.9707  (atm)
1 Na 2                      (G)         6.25E-0004        0.0258  (atm)
  Al 1                      (L)[]           0.2041
  Al 4Ca 1                  (L)[]           0.1403
  Al 2Mg 1O  4              (C)  []         0.1089
  Al 2O  3                  (C)[]           0.3747
```

```
  Fe 1Si 1                  (C)[]           0.0581
  Si 1                      (C)[]           0.0969
  Si 3Ti 5                  (C)[]           0.0045
*
     51 wt% Al
 Volume of gas products   (litres)          2.4156
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1448.5215
 Gas products amount        (mol)           0.0197
 Products heat capacity     (J/K)          44.9200
 Products entropy           (J/K)          98.0967
 Products enthalpy          (KJ)         -251.5513
 Mass  of the system        (Kg)            0.0382
1 Na 1                      (G)             0.0115        0.9697  (atm)
1 Na 2                      (G)         6.50E-0004        0.0274  (atm)
  Al 1                      (L)[]           0.2200
  Al 4Ca 1                  (L)[]           0.1375
  Al 2Mg 1O  4              (C)  []         0.1068
  Al 2O  3                  (C)[]           0.3672
  Fe 1Si 1                  (C)[]           0.0570
  Si 1                      (C)[]           0.0949
  Si 3Ti 5                  (C)[]           0.0044
*
     52 wt% Al
 Volume of gas products   (litres)          2.3001
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1424.8887
 Gas products amount        (mol)           0.0190
 Products heat capacity     (J/K)          44.4499
 Products entropy           (J/K)          96.9966
 Products enthalpy          (KJ)         -244.1127
 Mass  of the system        (Kg)            0.0379
1 Na 1                      (G)             0.0112        0.9675  (atm)
1 Na 2                      (G)         7.01E-0004        0.0303  (atm)
  Al 1                      (L)[]           0.2359
  Al 4Ca 1                  (L)[]           0.1347
  Al 2Mg 1O  4              (C)  []         0.1047
  Al 2O  3                  (C)[]           0.3597
  Fe 1Si 1                  (C)[]           0.0558
  Si 1                      (C)[]           0.0930
  Si 3Ti 5                  (C)[]           0.0043
*
     53 wt% Al
 Volume of gas products   (litres)          2.1878
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1401.0718
 Gas products amount        (mol)           0.0184
 Products heat capacity     (J/K)          43.9906
 Products entropy           (J/K)          95.8982
 Products enthalpy          (KJ)         -236.8037
 Mass  of the system        (Kg)            0.0375
1 Na 1                      (G)             0.0109        0.9648  (atm)
1 Na 2                      (G)         7.58E-0004        0.0336  (atm)
  Al 1                      (L)[]           0.2518
  Al 4Ca 1                  (L)[]           0.1319
  Al 2Mg 1O  4              (C)  []         0.1025
  Al 2O  3                  (C)[]           0.3521
  Fe 1Si 1                  (C)[]           0.0546
  Si 1                      (C)[]           0.0911
  Si 3Ti 5                  (C)[]           0.0042
*
     54 wt% Al
 Volume of gas products   (litres)          2.0530
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1363.4218
 Gas products amount        (mol)           0.0178
 Products heat capacity     (J/K)          43.4906
 Products entropy           (J/K)          94.3644
 Products enthalpy          (KJ)         -230.2165
 Mass  of the system        (Kg)            0.0372
1 Na 1                      (G)             0.0105        0.9592  (atm)
```

```
1 Na 2                      (G)         8.73E-0004        0.0398  (atm)
  Al 1                      (L)[]           0.2678
  Al 4Ca 1                  (L)[]           0.1291
  Al 2Mg 1O  4              (C)  []         0.1004
  Al 2O  3                  (C)[]           0.3446
  Fe 1Si 1                  (C)[]           0.0535
  Si 1                      (C)[]           0.0891
  Si 3Ti 5                  (C)[]           0.0041
*
     55 wt% Al
 Volume of gas products   (litres)      8.87E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1359.6817
 Gas products amount        (mol)       7.69E-0007
 Products heat capacity     (J/K)          43.3406
 Products entropy           (J/K)          92.5911
 Products enthalpy          (KJ)         -224.0791
 Mass  of the system        (Kg)            0.0369
  Al 1                      (L)[]           0.2880
  Al 4Ca 1                  (L)[]           0.1263
  Al 2Mg 1O  4              (C)  []         0.0983
  Al 1Na 1O  2              (C)  []         0.0397
  Al 2O  3                  (C)[]           0.3041
  Fe 1Si 1                  (C)[]           0.0523
  Si 1                      (C)[]           0.0872
  Si 3Ti 5                  (C)[]           0.0040
*
     56 wt% Al
 Volume of gas products   (litres)      1.85E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1336.0263
 Gas products amount        (mol)       1.63E-0007
 Products heat capacity     (J/K)          42.9050
 Products entropy           (J/K)          91.5597
 Products enthalpy          (KJ)         -217.0566
 Mass  of the system        (Kg)            0.0366
  Al 1                      (L)[]           0.3039
  Al 4Ca 1                  (L)[]           0.1235
  Al 2Mg 1O  4              (C)  []         0.0961
  Al 1Na 1O  2              (C)  []         0.0388
  Al 2O  3                  (C)[]           0.2973
  Fe 1Si 1                  (C)[]           0.0512
  Si 1                      (C)[]           0.0852
  Si 3Ti 5                  (C)[]           0.0040
*
     57 wt% Al
 Volume of gas products   (litres)           0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1297.7987
 Gas products amount        (mol)       7.43E-0010
 Products heat capacity     (J/K)          42.4287
 Products entropy           (J/K)          90.0588
 Products enthalpy          (KJ)         -210.7644
 Mass  of the system        (Kg)            0.0363
  Al 1                      (L)[]           0.3197
  Al 4Ca 1                  (L)[]           0.1207
  Al 2Mg 1O  4              (C)  []         0.0939
  Al 1Na 1O  2              (C)  []         0.0380
  Al 2O  3                  (C)[]           0.2906
  Fe 1Si 1                  (C)[]           0.0500
  Si 1                      (C)[]           0.0833
  Si 3Ti 5                  (C)[]           0.0039
*
     58 wt% Al
 Volume of gas products   (litres)           0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)       4.37E-0010
 Products heat capacity     (J/K)          42.0016
 Products entropy           (J/K)          88.8951
 Products enthalpy          (KJ)         -204.1300
```

```
 Mass  of the system        (Kg)            0.0360
  Al 1                      (L)[]           0.3355
  Al 4Ca 1                  (L)[]           0.1179
  Al 2Mg 1O  4              (C)  []         0.0917
  Al 1Na 1O  2              (C)  []         0.0371
  Al 2O  3                  (C)[]           0.2838
  Fe 1Si 1                  (C)[]           0.0488
  Si 1                      (C)[]           0.0814
  Si 3Ti 5                  (C)[]           0.0038
*
```

59 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1258.0000
 Gas products amount        (mol)       1.32E-0010
 Products heat capacity     (J/K)          41.6382
 Products entropy           (J/K)          88.2576
 Products enthalpy          (KJ)         -196.9420
 Mass  of the system        (Kg)            0.0358
  Al 1                      (L)[]           0.3513
  Al 4Ca 1                  (L)[]           0.1151
  Al 2Mg 1O  4              (C)  []         0.0895
  Al 1Na 1O  2              (C)  []         0.0362
  Al 2O  3                  (C)[]           0.2771
  Fe 1Si 1                  (C)[]           0.0477
  Si 1                      (C)[]           0.0794
  Si 3Ti 5                  (C)[]           0.0037
*
```

60 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)       2.20E-0010
 Products heat capacity     (J/K)          41.2308
 Products entropy           (J/K)          87.0934
 Products enthalpy          (KJ)         -190.5274
 Mass  of the system        (Kg)            0.0355
  Al 1                      (L)[]           0.3672
  Al 4Ca 1                  (L)[]           0.1123
  Al 2Mg 1O  4              (C)  []         0.0874
  Al 1Na 1O  2              (C)  []         0.0353
  Al 2O  3                  (C)[]           0.2703
  Fe 1Si 1                  (C)[]           0.0465
  Si 1                      (C)[]           0.0775
  Si 3Ti 5                  (C)[]           0.0036
*
```

61 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)       6.35E-0010
 Products heat capacity     (J/K)          40.7695
 Products entropy           (J/K)          85.1737
 Products enthalpy          (KJ)         -185.1074
 Mass  of the system        (Kg)            0.0352
  Al 1                      (L)[]           0.3830
  Al 4Ca 1                  (L)[]           0.1095
  Al 2Mg 1O  4              (C)  []         0.0852
  Al 1Na 1O  2              (C)  []         0.0344
  Al 2O  3                  (C)[]           0.2636
  Fe 1Si 1                  (C)[]           0.0453
  Si 1                      (C)[]           0.0756
  Si 3Ti 5                  (C)[]           0.0035
*
```

62 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1166.3977
 Gas products amount        (mol)       1.31E-0010
 Products heat capacity     (J/K)          40.6178
 Products entropy           (J/K)          84.8076
```

```
 Products enthalpy          (KJ)         -180.3069
 Mass  of the system        (Kg)            0.0351
  Al 1                      (L)[]           0.3973
  Al 4Ca 1                  (L)[]           0.1062
  Al 2Mg 1O  4              (C)  []         0.0963
  Al 1Na 1O  2              (C)  []         0.0334
  Al 2O  3                  (C)[]           0.2460
  Fe 1Si 1                  (C)[]           0.0440
  Si 1                      (C)[]           0.0733
  Si 3Ti 5                  (C)[]           0.0034
*
```

63 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1146.0930
 Gas products amount        (mol)       6.39E-0010
 Products heat capacity     (J/K)          40.1032
 Products entropy           (J/K)          82.3298
 Products enthalpy          (KJ)         -173.3201
 Mass  of the system        (Kg)            0.0347
  Al 1                      (L)[]           0.4483
  Al 2Ca 1                  (C)[]           0.0660
  Al 2Mg 1O  4              (C)  []         0.0808
  Al 1Na 1O  2              (C)  []         0.0327
  Al 2O  3                  (C)[]           0.2500
  Al 3Ti 1                  (C)  []         0.0066
  Fe 1Si 1                  (C)[]           0.0430
  Si 1                      (C)[]           0.0725
*
```

64 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1125.1903
 Gas products amount        (mol)       4.65E-0011
 Products heat capacity     (J/K)          39.7554
 Products entropy           (J/K)          81.4472
 Products enthalpy          (KJ)         -166.9560
 Mass  of the system        (Kg)            0.0344
  Al 1                      (L)[]           0.4632
  Al 2Ca 1                  (C)[]           0.0642
  Al 2Mg 1O  4              (C)  []         0.0786
  Al 1Na 1O  2              (C)  []         0.0318
  Al 2O  3                  (C)[]           0.2433
  Al 3Ti 1                  (C)  []         0.0064
  Fe 1Si 1                  (C)[]           0.0419
  Si 1                      (C)[]           0.0706
*
```

65 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1103.9079
 Gas products amount        (mol)       9.14E-0011
 Products heat capacity     (J/K)          39.4139
 Products entropy           (J/K)          80.5508
 Products enthalpy          (KJ)         -160.6987
 Mass  of the system        (Kg)            0.0341
  Al 1                      (L)[]           0.4781
  Al 2Ca 1                  (C)[]           0.0624
  Al 2Mg 1O  4              (C)  []         0.0764
  Al 1Na 1O  2              (C)  []         0.0309
  Al 2O  3                  (C)[]           0.2365
  Al 3Ti 1                  (C)  []         0.0063
  Fe 1Si 1                  (C)[]           0.0407
  Si 1                      (C)[]           0.0686
*
```

66 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1082.2762
 Gas products amount        (mol)       8.49E-0010
 Products heat capacity     (J/K)          39.0797
```

```
 Products entropy           (J/K)          79.6426
 Products enthalpy          (KJ)         -154.5555
 Mass  of the system        (Kg)            0.0339
  Al 1                      (L)[]           0.4930
  Al 2Ca 1                  (C)[]           0.0606
  Al 2Mg 1O  4              (C)  []         0.0742
  Al 1Na 1O  2              (C)  []         0.0300
  Al 2O  3                  (C)[]           0.2297
  Al 3Ti 1                  (C)  []         0.0061
  Fe 1Si 1                  (C)[]           0.0395
  Si 1                      (C)[]           0.0667
*
     67 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1060.2441
 Gas products amount        (mol)       9.08E-0011
 Products heat capacity     (J/K)          38.7509
 Products entropy           (J/K)          78.7155
 Products enthalpy          (KJ)         -148.5126
 Mass  of the system        (Kg)            0.0336
  Al 1                      (L)[]           0.5080
  Al 2Ca 1                  (C)[]           0.0588
  Al 2Mg 1O  4              (C)  []         0.0721
  Al 1Na 1O  2              (C)  []         0.0291
  Al 2O  3                  (C)[]           0.2230
  Al 3Ti 1                  (C)  []         0.0059
  Fe 1Si 1                  (C)[]           0.0384
  Si 1                      (C)[]           0.0647
*
     68 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1042.0000
 Gas products amount        (mol)       1.85E-0009
 Products heat capacity     (J/K)          38.3220
 Products entropy           (J/K)          76.9456
 Products enthalpy          (KJ)         -143.4524
 Mass  of the system        (Kg)            0.0334
  Al 1                      (L)[]           0.4870
  Al 2Ca 1                  (C)[]           0.0571
  Al 3Fe 1                  (C)  []         0.0606
  Al 2Mg 1O  4              (C)  []         0.0699
  Al 1Na 1O  2              (C)  []         0.0282
  Al 2O  3                  (C)[]           0.2163
  Al 3Ti 1                  (C)  []         0.0057
  Si 1                      (C)[]           0.0752
*
     69 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1023.0000
 Gas products amount        (mol)       2.31E-0012
 Products heat capacity     (J/K)          38.0140
 Products entropy           (J/K)          76.1686
 Products enthalpy          (KJ)         -137.4310
 Mass  of the system        (Kg)            0.0331
  Al 1                      (L)[]           0.5030
  Al 2Ca 1                  (C)[]           0.0553
  Al 3Fe 1                  (C)  []         0.0587
  Al 2Mg 1O  4              (C)  []         0.0677
  Al 1Na 1O  2              (C)  []         0.0274
  Al 2O  3                  (C)[]           0.2095
  Al 3Ti 1                  (C)  []         0.0055
  Si 1                      (C)[]           0.0728
*
     70 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       8.31E-0012
```

```
 Products heat capacity     (J/K)          37.6431
 Products entropy           (J/K)          74.4782
 Products enthalpy          (KJ)         -132.4038
 Mass  of the system        (Kg)            0.0329
  Al 1                      (L)[]           0.5191
  Al 2Ca 1                  (C)[]           0.5535
  Al 3Fe 1                  (C)  []         0.0568
  Al 2Mg 1O  4              (C)  []         0.0655
  Al 1Na 1O  2              (C)  []         0.0265
  Al 2O  3                  (C)[]           0.2027
  Al 3Ti 1                  (C)  []         0.0054
  Si 1                      (C)[]           0.0705
*
     71 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       3.83E-0013
 Products heat capacity     (J/K)          37.3337
 Products entropy           (J/K)          73.4527
 Products enthalpy          (KJ)         -126.7761
 Mass  of the system        (Kg)            0.0327
  Al 1                      (L)[]           0.5351
  Al 2Ca 1                  (C)[]           0.0517
  Al 3Fe 1                  (C)  []         0.0550
  Al 2Mg 1O  4              (C)  []         0.0633
  Al 1Na 1O  2              (C)  []         0.0256
  Al 2O  3                  (C)[]           0.1960
  Al 3Ti 1                  (C)  []         0.0052
  Si 1                      (C)[]           0.0681
*
     72 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           903.0000
 Gas products amount        (mol)       9.05E-0013
 Products heat capacity     (J/K)          55.0248
 Products entropy           (J/K)          87.0839
 Products enthalpy          (KJ)         -353.7484
 Mass  of the system        (Kg)            0.0466
  Al 1                      (C)[]           0.3831
  Al 2Ca 1                  (C)[]           0.0347
  Al 3Fe 1                  (C)  []         0.0369
  Al 2Mg 1O  4              (C)  []         0.0425
  Al 1Na 1O  2              (C)  []         0.0172
  Al 2O  3                  (C)[]           0.4364
  Al 3Ti 1                  (C)  []         0.0035
  Si 1                      (C)[]           0.0457
*
     73 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           932.8868      932.4548      933.3188
 Gas products amount        (mol)       4.89E-0011    5.47E-0012    5.96E-0011
 Products heat capacity     (J/K)          37.2453       38.2374       37.0004
 Products entropy           (J/K)          70.1600       64.7121       71.5051
 Products enthalpy          (KJ)         -116.9037     -121.9899     -115.6479
 Phase transition enthalpy  (KJ)            6.3420
 Mass  of the system        (Kg)            0.0322
  Al 1                      (C)[]           0.1707        0.5671        0.0729
  Al 1                      (L)[]           0.3964        0.0000        0.4943
  Al 2Ca 1                  (C)[]           0.0481        0.0481        0.0481
  Al 3Fe 1                  (C)  []         0.0512        0.0512        0.0512
  Al 2Mg 1O  4              (C)  []         0.0590        0.0590        0.0590
  Al 1Na 1O  2              (C)  []         0.0238        0.0238        0.0238
  Al 2O  3                  (C)[]           0.1825        0.1825        0.1825
  Al 3Ti 1                  (C)  []         0.0048        0.0048        0.0048
  Si 1                      (C)[]           0.0634        0.0634        0.0634
*
     74 wt% Al
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
```

Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.8998	932.4619	933.3378
Gas products amount	(mol)	3.07E-0011	4.78E-0012	4.59E-0011
Products heat capacity	(J/K)	37.2509	38.0660	36.7740
Products entropy	(J/K)	69.0048	64.5318	71.6217
Products enthalpy	(KJ)	-112.1393	-116.3153	-109.6962
Phase transition enthalpy	(KJ)	6.6191		
Mass of the system	(Kg)	0.0320		
Al 1	(C)[]	0.2537	0.5812	0.0620
Al 1	(L)[]	0.3275	0.0000	0.5192
Al 2Ca 1	(C)[]	0.0463	0.0463	0.0463
Al 3Fe 1	(C) []	0.0492	0.0492	0.0492
Al 2Mg 1O 4	(C) []	0.0567	0.0567	0.0567
Al 1Na 1O 2	(C) []	0.0229	0.0229	0.0229
Al 2O 3	(C)[]	0.1764	0.1764	0.1764
Al 3Ti 1	(C) []	0.0062	0.0062	0.0062
Si 1	(C)[]	0.0610	0.0610	0.0610

*

75 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9168	932.4736	933.3600
Gas products amount	(mol)	8.25E-0011	8.12E-0011	8.44E-0011
Products heat capacity	(J/K)	37.2563	37.8561	36.3746
Products entropy	(J/K)	67.5826	64.2982	72.4107
Products enthalpy	(KJ)	-106.7201	-109.7864	-102.2125
Phase transition enthalpy	(KJ)	7.5739		
Mass of the system	(Kg)	0.0317		
Al 1	(C)[]	0.3566	0.5992	1.56E-0006
Al 1	(L)[]	0.2426	0.0000	0.5992
Al 2Ca 1	(C)[]	0.0446	0.0446	0.0446
Al 3Fe 1	(C) []	0.0474	0.0474	0.0474
Al 2Mg 1O 4	(C) []	0.0546	0.0546	0.0546
Al 1Na 1O 2	(C) []	0.0221	0.0221	0.0221
Al 2O 3	(C)[]	0.1689	0.1689	0.1689
Al 3Ti 1	(C) []	0.0045	0.0045	0.0045
Si 1	(C)[]	0.0587	0.0587	0.0587

*

76 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9271	932.4745	933.3797
Gas products amount	(mol)	5.75E-0011	6.05E-0011	5.01E-0011
Products heat capacity	(J/K)	37.2631	37.6690	36.2509
Products entropy	(J/K)	66.3196	64.0949	71.8676
Products enthalpy	(KJ)	-101.7326	-103.8097	-96.5530
Phase transition enthalpy	(KJ)	7.2566		
Mass of the system	(Kg)	0.0315		
Al 1	(C)[]	0.4498	0.6152	0.0372
Al 1	(L)[]	0.1654	0.0000	0.5780
Al 2Ca 1	(C)[]	0.0428	0.0428	0.0428
Al 3Fe 1	(C) []	0.0455	0.0455	0.0455
Al 2Mg 1O 4	(C) []	0.0524	0.0524	0.0524
Al 1Na 1O 2	(C) []	0.0212	0.0212	0.0212
Al 2O 3	(C)[]	0.1622	0.1622	0.1622
Al 3Ti 1	(C) []	0.0043	0.0043	0.0043
Si 1	(C)[]	0.0564	0.0564	0.0564

*

77 wt% Al

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	932.9386	932.4783	933.3989
Gas products amount	(mol)	2.20E-0010	2.57E-0010	9.13E-0012
Products heat capacity	(J/K)	37.2695	37.4849	36.0381
Products entropy	(J/K)	65.0755	63.8950	71.8240
Products enthalpy	(KJ)	-96.8179	-97.9200	-90.5175
Phase transition enthalpy	(KJ)	7.4025		
Mass of the system	(Kg)	0.0313		
Al 1	(C)[]	0.5429	0.6313	0.0375
Al 1	(L)[]	0.0884	0.0000	0.5938
Al 2Ca 1	(C)[]	0.0410	0.0410	0.0410

```
 Al 3Fe 1                  (C)  []         0.0436        0.0436        0.0436
 Al 2Mg 1O  4              (C)  []         0.0502        0.0502        0.0502
 Al 1Na 1O  2              (C)  []         0.0203        0.0203        0.0203
 Al 2O  3                  (C)[]           0.1554        0.1554        0.1554
 Al 3Ti 1                  (C)  []         0.0041        0.0041        0.0041
 Si 1                      (C)[]           0.0540        0.0540        0.0540
*
```

78 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           929.1122
Gas products amount        (mol)       9.46E-0010
Products heat capacity     (J/K)          37.2393
Products entropy           (J/K)          63.5626
Products enthalpy          (KJ)          -92.2351
Mass  of the system        (Kg)            0.0311
 Al 1                      (C)[]           0.6473
 Al 2Ca 1                  (C)[]           0.0392
 Al 3Fe 1                  (C)  []         0.0417
 Al 2Mg 1O  4              (C)  []         0.0480
 Al 1Na 1O  2              (C)  []         0.0194
 Al 2O  3                  (C)[]           0.1487
 Al 3Ti 1                  (C)  []         0.0039
 Si 1                      (C)[]           0.0517
*
```

79 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           903.0000
Gas products amount        (mol)       6.02E-0012
Products heat capacity     (J/K)          36.5676
Products entropy           (J/K)          62.3192
Products enthalpy          (KJ)          -87.4673
Mass  of the system        (Kg)            0.0309
 Al 1                      (C)[]           0.6633
 Al 2Ca 1                  (C)[]           0.0375
 Al 3Fe 1                  (C)  []         0.0398
 Al 2Mg 1O  4              (C)  []         0.0459
 Al 1Na 1O  2              (C)  []         0.0185
 Al 2O  3                  (C)[]           0.1419
 Al 3Ti 1                  (C)  []         0.0038
 Si 1                      (C)[]           0.0493
*
```

80 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           870.0000
Gas products amount        (mol)       3.02E-0011
Products heat capacity     (J/K)          35.7786
Products entropy           (J/K)          60.7896
Products enthalpy          (KJ)          -83.0000
Mass  of the system        (Kg)            0.0307
 Al 1                      (C)[]           0.6794
 Al 2Ca 1                  (C)[]           0.0357
 Al 3Fe 1                  (C)  []         0.0379
 Al 2Mg 1O  4              (C)  []         0.0437
 Al 1Na 1O  2              (C)  []         0.0177
 Al 2O  3                  (C)[]           0.1352
 Al 3Ti 1                  (C)  []         0.0036
 Si 1                      (C)[]           0.0470
*
```

81 wt% Al

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           870.0000
Gas products amount        (mol)       7.20E-0011
Products heat capacity     (J/K)          35.5940
Products entropy           (J/K)          60.6127
Products enthalpy          (KJ)          -77.4141
Mass  of the system        (Kg)            0.0304
 Al 1                      (C)[]           0.6954
```

```
 Al 2Ca 1                  (C)[]           0.0339
 Al 3Fe 1                  (C)  []         0.0360
 Al 2Mg 1O  4              (C)  []         0.0415
 Al 1Na 1O  2              (C)  []         0.0168
 Al 2O  3                  (C)[]           0.1284
 Al 3Ti 1                  (C)  []         0.0034
 Si 1                      (C)[]           0.0446
*
    82 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           848.5000
Gas products amount        (mol)       6.24E-0012
Products heat capacity     (J/K)          35.0221
Products entropy           (J/K)          59.5566
Products enthalpy          (KJ)          -72.6576
Mass  of the system        (Kg)            0.0302
 Al 1                      (C)[]           0.7114
 Al 2Ca 1                  (C)[]           0.0321
 Al 3Fe 1                  (C)  []         0.0341
 Al 2Mg 1O  4              (C)  []         0.0393
 Al 1Na 1O  2              (C)  []         0.0159
 Al 2O  3                  (C)[]           0.1216
 Al 3Ti 1                  (C)  []         0.0032
 Si 1                      (C)[]           0.0423
*
    83 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           800.0000
Gas products amount        (mol)       1.16E-0010
Products heat capacity     (J/K)          33.9905
Products entropy           (J/K)          57.3638
Products enthalpy          (KJ)          -68.8855
Mass  of the system        (Kg)            0.0300
 Al 1                      (C)[]           0.7275
 Al 2Ca 1                  (C)[]           0.0303
 Al 3Fe 1                  (C)  []         0.0322
 Al 2Mg 1O  4              (C)  []         0.0371
 Al 1Na 1O  2              (C)  []         0.0150
 Al 2O  3                  (C)[]           0.1149
 Al 3Ti 1                  (C)  []         0.0030
 Si 1                      (C)[]           0.0399
*
    84 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           848.5000
Gas products amount        (mol)       4.51E-0011
Products heat capacity     (J/K)          35.0081
Products entropy           (J/K)          59.6290
Products enthalpy          (KJ)          -69.1617
Mass  of the system        (Kg)            0.0303
 Al 1                      (C)[]           0.7088
 Al 2Ca 1                  (C)[]           0.0281
 Al 3Fe 1                  (C)  []         0.0298
 Al 2Mg 1O  4              (C)  []         0.0344
 Al 1Na 1O  2              (C)  []         0.0139
 Al 2O  3                  (C)[]           0.1198
 Al 3Ti 1                  (C)  []         0.0282
 Si 1                      (C)[]           0.0370
*
    85 wt% Al
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           740.0000
Gas products amount        (mol)       9.56E-0011
Products heat capacity     (J/K)          32.6366
Products entropy           (J/K)          54.4031
Products enthalpy          (KJ)          -60.2185
Mass  of the system        (Kg)            0.0296
```

```
 Al 1                      (C)[]          0.7595
 Al 2Ca 1                  (C)[]          0.0268
 Al 3Fe 1                  (C)  []        0.0284
 Al 2Mg 1O  4              (C)  []        0.0328
 Al 1Na 1O  2              (C)  []        0.0132
 Al 2O  3                  (C)[]          0.1014
 Al 3Ti 1                  (C)  []        0.0027
 Si 1                      (C)[]          0.0352
*
```

86 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          740.0000
Gas products amount        (mol)      3.29E-0011
Products heat capacity     (J/K)         32.4495
Products entropy           (J/K)         54.2718
Products enthalpy          (KJ)         -54.9655
Mass  of the system        (Kg)          0.0295
 Al 1                      (C)[]          0.7756
 Al 2Ca 1                  (C)[]          0.0250
 Al 3Fe 1                  (C)  []        0.0265
 Al 2Mg 1O  4              (C)  []        0.0306
 Al 1Na 1O  2              (C)  []        0.0124
 Al 2O  3                  (C)[]          0.0946
 Al 3Ti 1                  (C)  []        0.0025
 Si 1                      (C)[]          0.0329
*
```

87 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          716.0000
Gas products amount        (mol)      2.61E-0013
Products heat capacity     (J/K)         31.8829
Products entropy           (J/K)         53.0849
Products enthalpy          (KJ)         -50.5521
Mass  of the system        (Kg)          0.0293
 Al 1                      (C)[]          0.7916
 Al 2Ca 1                  (C)[]          0.0232
 Al 3Fe 1                  (C)  []        0.0246
 Al 2Mg 1O  4              (C)  []        0.0284
 Al 1Na 1O  2              (C)  []        0.0115
 Al 2O  3                  (C)[]          0.0879
 Al 3Ti 1                  (C)  []        0.0023
 Si 1                      (C)[]          0.0305
*
```

88 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          665.0000
Gas products amount        (mol)      9.68E-0013
Products heat capacity     (J/K)         30.9235
Products entropy           (J/K)         50.6501
Products enthalpy          (KJ)         -47.0250
Mass  of the system        (Kg)          0.0291
 Al 1                      (C)[]          0.8076
 Al 2Ca 1                  (C)[]          0.0214
 Al 3Fe 1                  (C)  []        0.0227
 Al 2Mg 1O  4              (C)  []        0.0262
 Al 1Na 1O  2              (C)  []        0.0106
 Al 2O  3                  (C)[]          0.0811
 Al 3Ti 1                  (C)  []        0.0021
 Si 1                      (C)[]          0.0282
*
```

89 wt% Al

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          665.0000
Gas products amount        (mol)      1.48E-0012
Products heat capacity     (J/K)         30.7414
Products entropy           (J/K)         50.5433
Products enthalpy          (KJ)         -41.9613
```

```
 Mass  of the system        (Kg)            0.0289
  Al 1                      (C)[]           0.8237
  Al 2Ca 1                  (C)[]           0.0196
  Al 3Fe 1                  (C)  []         0.0208
  Al 2Mg 1O  4              (C)  []         0.0240
  Al 1Na 1O  2              (C)  []         0.0097
  Al 2O  3                  (C)[]           0.0743
  Al 3Ti 1                  (C)  []         0.0020
  Si 1                      (C)[]           0.0258
*
     90 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           580.0000
 Gas products amount        (mol)       3.27E-0012
 Products heat capacity     (J/K)          29.3712
 Products entropy           (J/K)          46.3430
 Products enthalpy          (KJ)          -39.5074
 Mass  of the system        (Kg)            0.0287
  Al 1                      (C)[]           0.8397
  Al 2Ca 1                  (C)[]           0.0178
  Al 3Fe 1                  (C)  []         0.0190
  Al 2Mg 1O  4              (C)  []         0.0218
  Al 1Na 1O  2              (C)  []         0.0088
  Al 2O  3                  (C)[]           0.0676
  Al 3Ti 1                  (C)  []         0.0018
  Si 1                      (C)[]           0.0235
*
     91 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       2.92E-0011
 Products heat capacity     (J/K)          28.9326
 Products entropy           (J/K)          45.2431
 Products enthalpy          (KJ)          -35.1341
 Mass  of the system        (Kg)            0.0285
  Al 1                      (C)[]           0.8557
  Al 2Ca 1                  (C)[]           0.0160
  Al 3Fe 1                  (C)  []         0.0171
  Al 2Mg 1O  4              (C)  []         0.0197
  Al 1Na 1O  2              (C)  []         0.0079
  Al 2O  3                  (C)[]           0.0608
  Al 3Ti 1                  (C)  []         0.0016
  Si 1                      (C)[]           0.0211
*
     92 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          28.7613
 Products entropy           (J/K)          45.1702
 Products enthalpy          (KJ)          -30.2404
 Mass  of the system        (Kg)            0.0283
  Al 1                      (C)[]           0.8718
  Al 2Ca 1                  (C)[]           0.0143
  Al 3Fe 1                  (C)  []         0.0152
  Al 2Mg 1O  4              (C)  []         0.0175
  Al 1Na 1O  2              (C)  []         0.0071
  Al 2O  3                  (C)[]           0.0541
  Al 3Ti 1                  (C)  []         0.0014
  Si 1                      (C)[]           0.0188
*
     93 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       1.60E-0013
 Products heat capacity     (J/K)          27.8386
 Products entropy           (J/K)          41.9023
```

```
 Products enthalpy          (KJ)          -27.1006
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8878
  Al 2Ca 1                  (C)[]           0.0125
  Al 3Fe 1                  (C)  []         0.0133
  Al 2Mg 1O  4              (C)  []         0.0153
  Al 1Na 1O  2              (C)  []         0.0062
  Al 2O  3                  (C)[]           0.0473
  Al 3Ti 1                  (C)  []         0.0013
  Si 1                      (C)[]           0.0164
*
     94 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       2.51E-0012
 Products heat capacity     (J/K)          27.2818
 Products entropy           (J/K)          39.9731
 Products enthalpy          (KJ)          -23.2259
 Mass  of the system        (Kg)            0.0280
  Al 1                      (C)[]           0.9038
  Al 2Ca 1                  (C)[]           0.0107
  Al 3Fe 1                  (C)  []         0.0114
  Al 2Mg 1O  4              (C)  []         0.0131
  Al 1Na 1O  2              (C)  []         0.0053
  Al 2O  3                  (C)[]           0.0405
  Al 3Ti 1                  (C)  []         0.0011
  Si 1                      (C)[]           0.0141
*
     95 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          27.1292
 Products entropy           (J/K)          39.9318
 Products enthalpy          (KJ)          -18.4960
 Mass  of the system        (Kg)            0.0278
  Al 1                      (C)[]           0.9198
  Al 2Ca 1                  (C)[]           0.0089
  Al 3Fe 1                  (C)  []         0.0095
  Al 2Mg 1O  4              (C)  []         0.0109
  Al 1Na 1O  2              (C)  []         0.0044
  Al 2O  3                  (C)[]           0.0338
  Al 3Ti 1                  (C)  []     8.94E-0004
  Si 1                      (C)[]           0.0117
*
     96 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           433.0000
 Gas products amount        (mol)       5.28E-0013
 Products heat capacity     (J/K)          26.5838
 Products entropy           (J/K)          37.8668
 Products enthalpy          (KJ)          -14.7378
 Mass  of the system        (Kg)            0.0276
  Al 1                      (C)[]           0.9359
  Al 2Ca 1                  (C)[]           0.0071
  Al 3Fe 1                  (C)  []         0.0076
  Al 2Mg 1O  4              (C)  []         0.0087
  Al 1Na 1O  2              (C)  []         0.0035
  Al 2O  3                  (C)[]           0.0270
  Al 3Ti 1                  (C)  []     7.18E-0004
  Si 1                      (C)[]           0.0094
*
     97 wt% Al
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       6.62E-0011
 Products heat capacity     (J/K)          25.9148
```

```
 Products entropy           (J/K)          34.9590
 Products enthalpy          (KJ)          -11.2999
 Mass  of the system        (Kg)            0.0275
  Al 1                      (C)[]           0.9488
  Al 4Ca 1                  (C)[]           0.0084
  Al 3Fe 1                  (C)  []         0.0057
  Al 2Mg 1O  4              (C)  []         0.0066
  Al 1Na 1O  2              (C)  []         0.0026
  Al 2O  3                  (C)[]           0.0203
  Al 3Ti 1                  (C)  []     5.35E-0004
  Si 1                      (C)[]           0.0070
*
```

98 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       6.68E-0011
 Products heat capacity     (J/K)          25.7859
 Products entropy           (J/K)          34.9469
 Products enthalpy          (KJ)           -6.7292
 Mass  of the system        (Kg)            0.0273
  Al 1                      (C)[]           0.9659
  Al 4Ca 1                  (C)[]           0.0056
  Al 3Fe 1                  (C)  []         0.0038
  Al 2Mg 1O  4              (C)  []         0.0044
  Al 1Na 1O  2              (C)  []         0.0018
  Al 2O  3                  (C)[]           0.0135
  Al 3Ti 1                  (C)  []     3.59E-0004
  Si 1                      (C)[]           0.0047
*
```

99 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           363.6499
 Gas products amount        (mol)       2.88E-0011
 Products heat capacity     (J/K)          25.3703
 Products entropy           (J/K)          33.2814
 Products enthalpy          (KJ)           -2.8375
 Mass  of the system        (Kg)            0.0271
  Al 1                      (C)[]           0.9829
  Al 4Ca 1                  (C)[]           0.0028
  Al 3Fe 1                  (C)  []         0.0019
  Al 2Mg 1O  4              (C)  []         0.0022
  Al 1Na 1O  2              (C)  []     8.82E-0004
  Al 2O  3                  (C)[]           0.0068
  Al 3Ti 1                  (C)  []     1.80E-0004
  Si 1                      (C)[]           0.0023
*
```

100 wt% Al

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       1.25E-0012
 Products heat capacity     (J/K)          24.9186
 Products entropy           (J/K)          31.3558
 Products enthalpy          (KJ)            0.9453
 Mass  of the system        (Kg)            0.0270
  Al 1                      (C)[]           1.0000
*
```

Mg/(Mojave Mars)

```
     Content of Magnesium - 0 wt% Mg
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           812.7256
 Gas products amount        (mol)       1.82E-0011
 Products heat capacity     (J/K)          75.7239
 Products entropy           (J/K)         112.2710
 Products enthalpy          (KJ)         -901.6645
 Mass  of the system        (Kg)            0.0672
  Al 3Ca 1Na 1O 16Si 5      (C)  [LABRA     0.1942
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.2313
  Al 2O  5Si 1              (C)  [KIANI     0.0939
  Al 2O  5Ti 1              (C)  []         0.0251
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3307
  Fe 2O  3                  (C)[]           0.1100
  O  2Si 1                  (C)[]           0.0148
*
     1 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       1.33E-0012
 Products heat capacity     (J/K)          75.9948
 Products entropy           (J/K)         123.2997
 Products enthalpy          (KJ)         -877.0909
 Mass  of the system        (Kg)            0.0660
  Al 2Fe 1O  4              (C)  []         0.0960
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3222
  Al 2O  5Si 1              (C)  [KIANI     0.0611
  Al 2O  5Ti 1              (C)  []         0.0249
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.4044
  Fe 3O  4                  (C)[]           0.0627
  Mg 2O  6Si 2              (C)[KLINOEN     0.0056
  O  2Si 1                  (C)[]           0.0129
  O  2Si 1                  (C)  [QUART     0.0103
*
     2 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1077.3179
 Gas products amount        (mol)       1.80E-0012
 Products heat capacity     (J/K)          76.2783
 Products entropy           (J/K)         130.6401
 Products enthalpy          (KJ)         -853.4894
 Mass  of the system        (Kg)            0.0649
  Al 2Fe 1O  4              (C)  []         0.1763
  Al 2Na 2O 16Si 6          (C)  [HIGH      0.3190
  Al 2O  5Ti 1              (C)  []         0.0075
  Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.4003
  Fe 1                      (C)[]           0.0082
  Fe 2O  4Ti 1              (C)  [ULVIT     0.0211
  Mg 2O  6Si 2              (C)[KLINOEN     0.0473
  O  2Si 1                  (C)  [CRIST     0.0177
  O  2Si 1                  (C)  [QUART     0.0026
*
     3 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1194.4645
 Gas products amount        (mol)       5.46E-0013
 Products heat capacity     (J/K)          75.8639
 Products entropy           (J/K)         135.9008
 Products enthalpy          (KJ)         -830.6310
 Mass  of the system        (Kg)            0.0638
  Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0077
  Al 2Fe 1O  4              (C)  []         0.1340
  Al 2Mg 1O  4              (C)  []         0.0160
```

```
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.3157
 Al 2O  5Ti 1              (C)  []         0.0244
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3902
 Fe 1                      (C)[]           0.0316
 Mg 1O  3Si 1              (C)             0.0804
*
```

4 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1301.6489
Gas products amount        (mol)       9.11E-0013
Products heat capacity     (J/K)          75.7272
Products entropy           (J/K)         140.0068
Products enthalpy          (KJ)         -808.5369
Mass  of the system        (Kg)            0.0628
 Al 2Ca 1O  8Si 2          (C)[AMORTHI     0.0076
 Al 2Fe 1O  4              (C)  []         0.0589
 Al 2Mg 1O  4              (C)  []         0.0761
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.3125
 Al 2O  5Ti 1              (C)  []         0.0241
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3862
 Fe 1                      (C)[]           0.0550
 Mg 1O  3Si 1              (C)             0.0796
*
```

5 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1399.9850
Gas products amount        (mol)       6.28E-0011
Products heat capacity     (J/K)          75.3871
Products entropy           (J/K)         143.0560
Products enthalpy          (KJ)         -787.1491
Mass  of the system        (Kg)            0.0618
 Al 2Mg 1O  4              (C)  []         0.1269
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.3092
 Al 2O  5Ti 1              (C)  []         0.0239
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3881
 Fe 1                      (C)[]           0.0705
 Fe 1Si 1                  (C)[]           0.0039
 Mg 1O  3Si 1              (C)             0.0655
 Mg 2O  4Si 1              (C)             0.0121
*
```

6 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1463.0000
Gas products amount        (mol)       3.92E-0011
Products heat capacity     (J/K)          75.0823
Products entropy           (J/K)         144.2477
Products enthalpy          (KJ)         -766.2850
Mass  of the system        (Kg)            0.0608
 Al 2Mg 1O  4              (C)  []         0.1256
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.3060
 Al 2O  5Ti 1              (C)  []         0.0236
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.3601
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0173
 Fe 1                      (C)[]           0.0577
 Fe 1Si 1                  (C)[]           0.0221
 Mg 2O  4Si 1              (C)             0.0878
*
```

7 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1520.7495
Gas products amount        (mol)       9.23E-0013
Products heat capacity     (J/K)          74.5240
Products entropy           (J/K)         145.0309
Products enthalpy          (KJ)         -746.1740
Mass  of the system        (Kg)            0.0598
 Al 2Mg 1O  4              (C)  []         0.1242
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.3027
```

```
 Al 2O  5Ti 1              (C)  []         0.0234
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.2615
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0856
 Fe 1                      (C)[]           0.0448
 Fe 1Si 1                  (C)[]           0.0402
 Mg 2O  4Si 1              (C)             0.1177
*
```

8 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1574.8186
Gas products amount        (mol)       1.58E-0010
Products heat capacity     (J/K)          74.0866
Products entropy           (J/K)         145.5454
Products enthalpy          (KJ)         -726.9022
Mass  of the system        (Kg)            0.0589
 Al 2Mg 1O  4              (C)  []         0.1229
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.2994
 Al 2O  5Ti 1              (C)  []         0.0231
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.1629
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1539
 Fe 1                      (C)[]           0.0320
 Fe 1Si 1                  (C)[]           0.0583
 Mg 2O  4Si 1              (C)             0.1475
*
```

9 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1630.1514
Gas products amount        (mol)       8.23E-0011
Products heat capacity     (J/K)          73.8227
Products entropy           (J/K)         146.0539
Products enthalpy          (KJ)         -708.0671
Mass  of the system        (Kg)            0.0580
 Al 2Mg 1O  4              (C)  []         0.1215
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.2962
 Al 2O  5Ti 1              (C)  []         0.0229
 Ca 1Mg 1O  6Si 2          (C)[DIOPSID     0.0642
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.2222
 Fe 1                      (C)[]           0.0192
 Fe 1Si 1                  (C)[]           0.0765
 Mg 2O  4Si 1              (C)             0.1774
*
```

10 wt% Mg

```
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1687.5000
Gas products amount        (mol)       1.73E-0010
Products heat capacity     (J/K)          73.6753
Products entropy           (J/K)         146.5410
Products enthalpy          (KJ)         -689.6333
Mass  of the system        (Kg)            0.0571
 Al 2Mg 1O  4              (C)  []         0.1243
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.2778
 Al 2O  5Ti 1              (C)  []         0.0226
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.2656
 Fe 1                      (C)[]           0.0063
 Fe 1Si 1                  (C)[]           0.0946
 Mg 2O  4Si 1              (C)             0.2052
 Na 2O  3Si 1              (L)[]           0.0035
*
```

11 wt% Mg

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1687.8515     1687.5000     1688.2031
Gas products amount        (mol)       4.85E-0010    5.71E-0010    3.21E-0010
Products heat capacity     (J/K)          74.9944       72.6920       79.4243
Products entropy           (J/K)         146.4216      144.2735      150.5550
Products enthalpy          (KJ)         -671.4179     -675.1259     -664.2830
Phase transition enthalpy  (KJ)           10.8429
 Al 2Mg 1O  4              (C)  []         0.0545        0.0562        0.0511
```

```
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.0209        0.0000        0.0612
 Al 2Na 2O 16Si 6          (C)  [LOW A 1.66E-0004        0.0000    4.86E-0004
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.0171        0.0260        0.0000
 Al 2O  5Ti 1              (C)  []         0.0028        0.0028        0.0028
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0323        0.0000        0.0945
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0622        0.0945        0.0000
 Fe 1Si 1                  (C)[]           0.0690        0.0690        0.0690
 Mg 2O  4Si 1              (C)             0.0906        0.0897        0.0923
 Na 2O  3Si 1              (L)[]           0.0033        0.0051        0.0000
 Si 3Ti 5                  (C)[]       8.20E-0004    8.20E-0004    8.20E-0004
*
```

12 wt% Mg

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1688.2581     1687.9637     1688.5525
Gas products amount        (mol)       9.48E-0010    7.69E-0010    9.85E-0010
Products heat capacity     (J/K)          75.9719       71.8143       76.8260
Products entropy           (J/K)         146.1979      142.3034      146.9980
Products enthalpy          (KJ)         -654.7905     -661.5045     -653.4112
Phase transition enthalpy  (KJ)            8.0933
Mass  of the system        (Kg)            0.0555
 Al 2Mg 1O  4              (C)  []         0.1387        0.1578        0.1348
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1287        0.0000        0.1552
 Al 2Na 2O 16Si 6          (C)  [HIGH      0.0344        0.2018        0.0000
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.2331        0.0000        0.2810
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.0913        0.2597        0.0567
 Fe 1Si 1                  (C)[]           0.1018        0.1018        0.1018
 Mg 2O  4Si 1              (C)             0.2565        0.2471        0.2584
 Na 2O  3Si 1              (L)[]           0.0034        0.0197        0.0000
 Si 1                      (C)[]           0.0043        0.0043        0.0043
 Si 3Ti 5                  (C)[]           0.0079        0.0079        0.0079
*
```

13 wt% Mg

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1692.8465     1692.6206     1693.0724
Gas products amount        (mol)       3.28E-0010    1.85E-0010    3.72E-0010
Products heat capacity     (J/K)          73.7849       73.7973       73.7812
Products entropy           (J/K)         145.8673      143.8142      146.4893
Products enthalpy          (KJ)         -638.0527     -641.5283     -636.9998
Phase transition enthalpy  (KJ)            4.5286
Mass  of the system        (Kg)            0.0547
 Al 2Mg 1O  4              (C)  []         0.1333        0.1333        0.1333
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.1534        0.1534        0.1534
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1765        0.1765        0.1765
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1292        0.1292        0.1292
 Fe 1Si 1                  (L)[]           0.0772        0.0000        0.1006
 Fe 1Si 1                  (C)[]           0.0234        0.1006        0.0000
 Mg 2O  4Si 1              (C)             0.2884        0.2884        0.2884
 Si 1                      (L)[]           0.0108        0.0108        0.0108
 Si 3Ti 5                  (C)[]           0.0078        0.0078        0.0078
*
```

14 wt% Mg

```
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)          1696.9996     1696.9107     1697.0884
Gas products amount        (mol)       5.69E-0010    4.01E-0010    6.44E-0010
Products heat capacity     (J/K)          73.4344       70.8582       74.5908
Products entropy           (J/K)         145.5544      143.0664      146.6712
Products enthalpy          (KJ)         -621.7981     -626.0200     -619.9028
Phase transition enthalpy  (KJ)            6.1172
Mass  of the system        (Kg)            0.0539
 Al 2Mg 1O  4              (C)  []         0.1842        0.1318        0.2077
 Al 1Na 1O  4Si 1          (C)  [KARNE     0.0470        0.1516        0.0000
 Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1917        0.0721        0.2454
 Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1153        0.2017        0.0765
 Fe 1Si 1                  (L)[]           0.0995        0.0995        0.0995
 Mg 2O  4Si 1              (C)             0.2924        0.3183        0.2808
 Na 2O  3Si 1              (L)[]           0.0450        0.0000        0.0651
 Si 1                      (L)[]           0.0173        0.0173        0.0173
 Si 3Ti 5                  (C)[]           0.0077        0.0077        0.0077
```

```
*
     15 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1748.1172
 Gas products amount        (mol)       5.85E-0010
 Products heat capacity     (J/K)          71.9653
 Products entropy           (J/K)         145.2156
 Products enthalpy          (KJ)         -605.9912
 Mass  of the system        (Kg)            0.0531
  Al 2Mg 1O  4              (C)  []         0.2053
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.1390
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1505
  Fe 1Si 1                  (L)[]           0.0983
  Mg 2O  4Si 1              (C)             0.3111
  Na 2O  3Si 1              (L)[]           0.0644
  Si 1                      (L)[]           0.0238
  Si 3Ti 5                  (C)[]           0.0076
*
     16 wt% Mg
 Volume of gas products   (litres)          2.8352        0.0000        8.3039
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1763.1072     1762.8202     1763.3943
 Gas products amount        (mol)           0.0190    1.57E-0009        0.0555
 Products heat capacity     (J/K)          69.8753       69.2480       71.0854
 Products entropy           (J/K)         144.5287      142.2269      148.9685
 Products enthalpy          (KJ)         -590.6202     -595.1549     -581.8734
 Phase transition enthalpy  (KJ)           13.2815
 Mass  of the system        (Kg)            0.0524
1 Mg 1                      (G)         1.69E-0004    3.69E-0012    4.95E-0004
1 Na 1                      (G)             0.0080    4.98E-0010        0.0235
1 Na 2                      (G)         1.45E-0004    9.75E-0012    4.25E-0004
1 O  1Si 1                  (G)         9.15E-0005    4.67E-0011    2.68E-0004
  Al 2Mg 1O  4              (C)  []         0.2029        0.2029        0.2029
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0916        0.0325        0.2056
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1478        0.2244        0.0000
  Ca 2O  4Si 1              (C)  [BETA]     0.0187        0.0000        0.0547
  Fe 1Si 1                  (L)[]           0.0972        0.0972        0.0972
  Mg 2O  4Si 1              (C)             0.3563        0.3415        0.3848
  Na 2O  3Si 1              (L)[]           0.0419        0.0636        0.0000
  Si 1                      (L)[]           0.0277        0.0303        0.0226
  Si 3Ti 5                  (C)[]           0.0075        0.0075        0.0075
*
     17 wt% Mg
 Volume of gas products   (litres)          6.1045        3.5004        8.0948
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1763.1185     1762.7002     1763.5367
 Gas products amount        (mol)           0.0408        0.0234        0.0541
 Products heat capacity     (J/K)          67.8081       67.3716       68.1418
 Products entropy           (J/K)         143.7177      141.4984      145.4140
 Products enthalpy          (KJ)         -575.6657     -580.4493     -572.0096
 Phase transition enthalpy  (KJ)            8.4397
 Mass  of the system        (Kg)            0.0517
1 Mg 1                      (G)         3.60E-0004    1.90E-0004    4.90E-0004
1 Na 1                      (G)             0.0176        0.0101        0.0233
1 Na 2                      (G)         3.17E-0004    1.83E-0004    4.19E-0004
1 O  1Si 1                  (G)         2.02E-0004    1.20E-0004    2.65E-0004
  Al 2Mg 1O  4              (C)  []         0.2005        0.2005        0.2005
  Ca 1Mg 1O  6Si 2          (L)[DIOPSID     0.0550        0.0000        0.0971
  Ca 1Mg 1O  4Si 1          (C)  [MONTI     0.1061        0.2450        0.0000
  Ca 2O  4Si 1              (C)  [BETA]     0.0545        0.0000        0.0962
  Fe 1Si 1                  (L)[]           0.0960        0.0960        0.0960
  Mg 2O  4Si 1              (C)             0.4154        0.3714        0.4491
  Na 2O  3Si 1              (L)[]           0.0154        0.0356        0.0000
  Si 1                      (L)[]           0.0311        0.0336        0.0292
  Si 3Ti 5                  (C)[]           0.0074        0.0074        0.0074
*
     18 wt% Mg
 Volume of gas products   (litres)          8.3070
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1771.0261
```

```
 Gas products amount        (mol)           0.0553
 Products heat capacity     (J/K)          65.5023
 Products entropy           (J/K)         142.7473
 Products enthalpy          (KJ)         -560.9858
 Mass  of the system        (Kg)            0.0510
1 Mg 1                      (G)             0.0017        0.0659  (atm)
1 Na 1                      (G)             0.0230        0.9228  (atm)
1 Na 2                      (G)          3.88E-0004       0.0078  (atm)
1 O  1Si 1                  (G)          1.69E-0004       0.0035  (atm)
  Al 2Mg 1O  4              (C)  []         0.1980
  Ca 2O  4Si 1              (C)  [BETA]     0.1332
  Fe 1Si 1                  (L)[]           0.0948
  Mg 2O  4Si 1              (C)             0.5061
  Si 1                      (L)[]           0.0352
  Si 3Ti 5                  (C)[]           0.0073
*
```

19 wt% Mg

```
 Volume of gas products   (litres)          8.3202
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1790.4120
 Gas products amount        (mol)           0.0548
 Products heat capacity     (J/K)          64.6059
 Products entropy           (J/K)         141.9770
 Products enthalpy          (KJ)         -546.6092
 Mass  of the system        (Kg)            0.0503
1 Mg 1                      (G)             0.0021        0.0794  (atm)
1 Na 1                      (G)             0.0228        0.9089  (atm)
1 Na 2                      (G)          3.56E-0004       0.0071  (atm)
1 O  1Si 1                  (G)          2.17E-0004       0.0045  (atm)
  Al 2Mg 1O  4              (C)  []         0.1956
  Ca 2O  4Si 1              (C)  [BETA]     0.1316
  Fe 1Si 1                  (L)[]           0.0937
  Mg 1O  1                  (C)[]           0.0392
  Mg 2O  4Si 1              (C)             0.4657
  Si 1                      (L)[]           0.0415
  Si 3Ti 5                  (C)[]           0.0072
*
```

20 wt% Mg

```
 Volume of gas products   (litres)          8.2682
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1803.8100
 Gas products amount        (mol)           0.0541
 Products heat capacity     (J/K)          63.6954
 Products entropy           (J/K)         140.9741
 Products enthalpy          (KJ)         -533.0481
 Mass  of the system        (Kg)            0.0497
1 Mg 1                      (G)             0.0024        0.0890  (atm)
1 Na 1                      (G)             0.0225        0.8989  (atm)
1 Na 2                      (G)          3.35E-0004       0.0067  (atm)
1 O  1Si 1                  (G)          2.57E-0004       0.0054  (atm)
  Al 2Mg 1O  4              (C)  []         0.1932
  Ca 2O  4Si 1              (C)  [BETA]     0.1300
  Fe 1Si 1                  (L)[]           0.0925
  Mg 1O  1                  (C)[]           0.0788
  Mg 2O  4Si 1              (C)             0.4249
  Si 1                      (L)[]           0.0480
  Si 3Ti 5                  (C)[]           0.0072
*
```

21 wt% Mg

```
 Volume of gas products   (litres)          8.2225
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1816.9142
 Gas products amount        (mol)           0.0534
 Products heat capacity     (J/K)          62.8035
 Products entropy           (J/K)         139.9869
 Products enthalpy          (KJ)         -519.8468
 Mass  of the system        (Kg)            0.0490
1 Mg 1                      (G)             0.0026        0.0992  (atm)
1 Na 1                      (G)             0.0222        0.8882  (atm)
1 Na 2                      (G)          3.15E-0004       0.0063  (atm)
1 O  1Si 1                  (G)          3.03E-0004       0.0063  (atm)
```

```
  Al 2Mg 1O  4              (C)  []         0.1908
  Ca 2O  4Si 1              (C)  [BETA]     0.1283
  Fe 1Si 1                  (L)[]           0.0914
  Mg 1O  1                  (C)[]           0.1183
  Mg 2O  4Si 1              (C)             0.3842
  Si 1                      (L)[]           0.0544
  Si 3Ti 5                  (C)[]           0.0071
*
```

22 wt% Mg

```
 Volume of gas products   (litres)          8.2420
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1833.7613
 Gas products amount        (mol)           0.0530
 Products heat capacity     (J/K)          61.9501
 Products entropy           (J/K)         139.1850
 Products enthalpy          (KJ)         -506.6796
 Mass  of the system        (Kg)            0.0484
1 Mg 1                      (G)             0.0030        0.1139  (atm)
1 Na 1                      (G)             0.0220        0.8725  (atm)
1 Na 2                      (G)         2.92E-0004        0.0058  (atm)
1 O  1Si 1                  (G)         3.75E-0004        0.0078  (atm)
  Al 2Mg 1O  4              (C)  []         0.1884
  Ca 2O  4Si 1              (C)  [BETA]     0.1267
  Fe 1Si 1                  (L)[]           0.0902
  Mg 1O  1                  (C)[]           0.1574
  Mg 2O  4Si 1              (C)             0.3439
  Si 1                      (L)[]           0.0608
  Si 3Ti 5                  (C)[]           0.0070
*
```

23 wt% Mg

```
 Volume of gas products   (litres)          8.2553
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1848.7796
 Gas products amount        (mol)           0.0527
 Products heat capacity     (J/K)          61.1052
 Products entropy           (J/K)         138.3364
 Products enthalpy          (KJ)         -493.9551
 Mass  of the system        (Kg)            0.0478
1 Mg 1                      (G)             0.0034        0.1285  (atm)
1 Na 1                      (G)             0.0217        0.8567  (atm)
1 Na 2                      (G)         2.71E-0004        0.0054  (atm)
1 O  1Si 1                  (G)         4.52E-0004        0.0093  (atm)
  Al 2Mg 1O  4              (C)  []         0.1860
  Ca 2O  4Si 1              (C)  [BETA]     0.1251
  Fe 1Si 1                  (L)[]           0.0891
  Mg 1O  1                  (C)[]           0.1965
  Mg 2O  4Si 1              (C)             0.3035
  Si 1                      (L)[]           0.0671
  Si 3Ti 5                  (C)[]           0.0069
*
```

24 wt% Mg

```
 Volume of gas products   (litres)          8.2825
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1863.4779
 Gas products amount        (mol)           0.0524
 Products heat capacity     (J/K)          60.2763
 Products entropy           (J/K)         137.5045
 Products enthalpy          (KJ)         -481.5458
 Mass  of the system        (Kg)            0.0472
1 Mg 1                      (G)             0.0039        0.1443  (atm)
1 Na 1                      (G)             0.0214        0.8396  (atm)
1 Na 2                      (G)         2.52E-0004        0.0049  (atm)
1 O  1Si 1                  (G)         5.43E-0004        0.0111  (atm)
  Al 2Mg 1O  4              (C)  []         0.1835
  Ca 2O  4Si 1              (C)  [BETA]     0.1235
  Fe 1Si 1                  (L)[]           0.0879
  Mg 1O  1                  (C)[]           0.2354
  Mg 2O  4Si 1              (C)             0.2633
  Si 1                      (L)[]           0.0734
  Si 3Ti 5                  (C)[]           0.0068
*
```

```
     25 wt% Mg
 Volume of gas products   (litres)          8.3267
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1877.8362
 Gas products amount        (mol)           0.0523
 Products heat capacity     (J/K)          59.4628
 Products entropy           (J/K)         136.6910
 Products enthalpy          (KJ)         -469.4379
 Mass  of the system        (Kg)            0.0466
1 Mg 1                      (G)             0.0044        0.1613  (atm)
1 Na 1                      (G)             0.0212        0.8209  (atm)
1 Na 2                      (G)          2.34E-0004       0.0045  (atm)
1 O  1Si 1                  (G)          6.49E-0004       0.0131  (atm)
  Al 2Mg 1O  4              (C)  []         0.1811
  Ca 2O  4Si 1              (C)  [BETA]     0.1218
  Fe 1Si 1                  (L)[]           0.0867
  Mg 1O  1                  (C)[]           0.2742
  Mg 2O  4Si 1              (C)             0.2232
  Si 1                      (L)[]           0.0797
  Si 3Ti 5                  (C)[]           0.0067
*
     26 wt% Mg
 Volume of gas products   (litres)          8.3909
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1891.9283
 Gas products amount        (mol)           0.0523
 Products heat capacity     (J/K)          58.6640
 Products entropy           (J/K)         135.8991
 Products enthalpy          (KJ)         -457.6077
 Mass  of the system        (Kg)            0.0461
1 Mg 1                      (G)             0.0050        0.1797  (atm)
1 Na 1                      (G)             0.0209        0.8006  (atm)
1 Na 2                      (G)          2.17E-0004       0.0042  (atm)
1 O  1Si 1                  (G)          7.73E-0004       0.0154  (atm)
  Al 2Mg 1O  4              (C)  []         0.1787
  Ca 2O  4Si 1              (C)  [BETA]     0.1202
  Fe 1Si 1                  (L)[]           0.0856
  Mg 1O  1                  (C)[]           0.3129
  Mg 2O  4Si 1              (C)             0.1832
  Si 1                      (L)[]           0.0859
  Si 3Ti 5                  (C)[]           0.0066
*
     27 wt% Mg
 Volume of gas products   (litres)          8.4743
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1905.6623
 Gas products amount        (mol)           0.0524
 Products heat capacity     (J/K)          57.8795
 Products entropy           (J/K)         135.1257
 Products enthalpy          (KJ)         -446.0527
 Mass  of the system        (Kg)            0.0455
1 Mg 1                      (G)             0.0056        0.1993  (atm)
1 Na 1                      (G)             0.0206        0.7787  (atm)
1 Na 2                      (G)          2.01E-0004       0.0038  (atm)
1 O  1Si 1                  (G)          9.16E-0004       0.0180  (atm)
  Al 2Mg 1O  4              (C)  []         0.1763
  Ca 2O  4Si 1              (C)  [BETA]     0.1186
  Fe 1Si 1                  (L)[]           0.0844
  Mg 1O  1                  (C)[]           0.3513
  Mg 2O  4Si 1              (C)             0.1434
  Si 1                      (L)[]           0.0921
  Si 3Ti 5                  (C)[]           0.0065
*
     28 wt% Mg
 Volume of gas products   (litres)          8.5811
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1918.9578
 Gas products amount        (mol)           0.0527
 Products heat capacity     (J/K)          57.1083
 Products entropy           (J/K)         134.3719
 Products enthalpy          (KJ)         -434.7622
```

```
 Mass  of the system        (Kg)            0.0450
1 Mg 1                      (G)             0.0063        0.2203  (atm)
1 Na 1                      (G)             0.0204        0.7552  (atm)
1 Na 2                      (G)         1.86E-0004        0.0034  (atm)
1 O  1Si 1                  (G)             0.0011        0.0209  (atm)
  Al 2Mg 1O  4              (C)  []         0.1739
  Ca 2O  4Si 1              (C)  [BETA]     0.1170
  Fe 1Si 1                  (L)[]           0.0833
  Mg 1O  1                  (C)[]           0.3895
  Mg 2O  4Si 1              (C)             0.1037
  Si 1                      (L)[]           0.0983
  Si 3Ti 5                  (C)[]           0.0064
*
```

29 wt% Mg

```
 Volume of gas products   (litres)          8.6492
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1929.7381
 Gas products amount        (mol)           0.0529
 Products heat capacity     (J/K)          56.3426
 Products entropy           (J/K)         133.5367
 Products enthalpy          (KJ)         -423.9163
 Mass  of the system        (Kg)            0.0444
1 Mg 1                      (G)             0.0069        0.2384  (atm)
1 Na 1                      (G)             0.0201        0.7347  (atm)
1 Na 2                      (G)         1.74E-0004        0.0032  (atm)
1 O  1Si 1                  (G)             0.0012        0.0236  (atm)
  Al 2Mg 1O  4              (C)  []         0.1715
  Ca 2O  4Si 1              (C)  [BETA]     0.1153
  Fe 1Si 1                  (L)[]           0.0821
  Mg 1O  1                  (C)[]           0.4280
  Mg 2O  4Si 1              (C)             0.0638
  Si 1                      (L)[]           0.1045
  Si 3Ti 5                  (C)[]           0.0064
*
```

30 wt% Mg

```
 Volume of gas products   (litres)          8.7745
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1941.5373
 Gas products amount        (mol)           0.0533
 Products heat capacity     (J/K)          55.5951
 Products entropy           (J/K)         132.7856
 Products enthalpy          (KJ)         -413.1895
 Mass  of the system        (Kg)            0.0439
1 Mg 1                      (G)             0.0077        0.2597  (atm)
1 Na 1                      (G)             0.0198        0.7105  (atm)
1 Na 2                      (G)         1.61E-0004        0.0029  (atm)
1 O  1Si 1                  (G)             0.0014        0.0268  (atm)
  Al 2Mg 1O  4              (C)  []         0.1691
  Ca 2O  4Si 1              (C)  [BETA]     0.1137
  Fe 1Si 1                  (L)[]           0.0810
  Mg 1O  1                  (C)[]           0.4660
  Mg 2O  4Si 1              (C)             0.0243
  Si 1                      (L)[]           0.1106
  Si 3Ti 5                  (C)[]           0.0063
*
```

31 wt% Mg

```
 Volume of gas products   (litres)         10.2307
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1941.5373
 Gas products amount        (mol)           0.0621
 Products heat capacity     (J/K)          54.7824
 Products entropy           (J/K)         132.6472
 Products enthalpy          (KJ)         -401.5102
 Mass  of the system        (Kg)            0.0434
1 Mg 1                      (G)             0.0134        0.3850  (atm)
1 Na 1                      (G)             0.0196        0.5946  (atm)
1 Na 2                      (G)         1.33E-0004        0.0020  (atm)
1 O  1Si 1                  (G)             0.0011        0.0181  (atm)
  Al 2Mg 1O  4              (C)  []         0.1666
  Ca 2O  4Si 1              (C)  [BETA]     0.1121
  Fe 1Si 1                  (L)[]           0.0798
```

```
  Mg 1O  1                  (C)[]           0.4871
  Si 1                      (L)[]           0.1140
  Si 3Ti 5                  (C)[]           0.0062
*
```

32 wt% Mg

```
 Volume of gas products   (litres)         13.2314
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1851.2609
 Gas products amount        (mol)           0.0843
 Products heat capacity     (J/K)          53.5699
 Products entropy           (J/K)         131.3737
 Products enthalpy          (KJ)         -391.9594
 Mass  of the system        (Kg)            0.0429
1 Ca 1                      (G)         6.76E-0005    8.59E-0004  (atm)
1 Mg 1                      (G)             0.0271        0.5681  (atm)
1 Na 1                      (G)             0.0193        0.4274  (atm)
1 Na 2                      (G)         1.19E-0004        0.0013  (atm)
1 O  1Si 1                  (G)         1.91E-0004        0.0022  (atm)
  Al 2Mg 1O  4              (C)   []        0.1642
  Ca 2O  4Si 1              (C)   [BETA]    0.1103
  Fe 1Si 1                  (L)[]           0.0787
  Mg 1O  1                  (C)[]           0.4810
  Si 1                      (L)[]           0.1129
  Si 3Ti 5                  (C)[]           0.0061
*
```

33 wt% Mg

```
 Volume of gas products   (litres)         14.2478
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1803.7568
 Gas products amount        (mol)           0.0932
 Products heat capacity     (J/K)          52.6310
 Products entropy           (J/K)         129.9519
 Products enthalpy          (KJ)         -382.6251
 Mass  of the system        (Kg)            0.0425
1 Ca 1                      (G)         1.16E-0004        0.0013  (atm)
1 Mg 1                      (G)             0.0330        0.6198  (atm)
1 Na 1                      (G)             0.0190        0.3767  (atm)
1 Na 2                      (G)         1.19E-0004        0.0012  (atm)
1 O  1Si 1                  (G)         7.42E-0005    7.67E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0064
  Al 2Mg 1O  4              (C)   []        0.1522
  Ca 2O  4Si 1              (C)   [BETA]    0.1028
  Fe 1Si 1                  (L)[]           0.0775
  Mg 1O  1                  (C)[]           0.4905
  Si 1                      (L)[]           0.1123
  Si 3Ti 5                  (C)[]           0.0060
*
```

34 wt% Mg

```
 Volume of gas products   (litres)         15.0572
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0981
 Products heat capacity     (J/K)          51.9399
 Products entropy           (J/K)         129.7080
 Products enthalpy          (KJ)         -371.3822
 Mass  of the system        (Kg)            0.0420
1 Ca 1                      (G)         1.30E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0368        0.6479  (atm)
1 Na 1                      (G)             0.0187        0.3487  (atm)
1 Na 2                      (G)         1.06E-0004    9.90E-0004  (atm)
1 O  1Si 1                  (G)         8.61E-0005    8.36E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0145
  Al 2Mg 1O  4              (C)   []        0.1374
  Ca 2O  4Si 1              (C)   [BETA]    0.0936
  Fe 1Si 1                  (L)[]           0.0763
  Mg 1O  1                  (C)[]           0.5045
  Si 1                      (L)[]           0.1119
  Si 3Ti 5                  (C)[]           0.0059
*
```

35 wt% Mg

```
 Volume of gas products   (litres)         14.6670
```

```
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0956
 Products heat capacity     (J/K)          51.2828
 Products entropy           (J/K)         128.5022
 Products enthalpy          (KJ)         -362.1332
 Mass  of the system        (Kg)            0.0415
1 Ca 1                      (G)         1.28E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0362        0.6479  (atm)
1 Na 1                      (G)             0.0184        0.3487  (atm)
1 Na 2                      (G)         1.05E-0004    9.90E-0004  (atm)
1 O  1Si 1                  (G)         8.48E-0005    8.36E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0260
  Al 2Mg 1O  4              (C)  []         0.1176
  Ca 2O  4Si 1              (C)  [BETA]     0.0815
  Fe 1Si 1                  (L)[]           0.0752
  Mg 1O  1                  (C)[]           0.5270
  Si 1                      (L)[]           0.1119
  Si 3Ti 5                  (C)[]           0.0058
*
```

36 wt% Mg

```
 Volume of gas products   (litres)         14.2767
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0930
 Products heat capacity     (J/K)          50.6400
 Products entropy           (J/K)         127.3163
 Products enthalpy          (KJ)         -353.0944
 Mass  of the system        (Kg)            0.0411
1 Ca 1                      (G)         1.26E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0356        0.6477  (atm)
1 Na 1                      (G)             0.0182        0.3489  (atm)
1 Na 2                      (G)         1.03E-0004    9.91E-0004  (atm)
1 O  1Si 1                  (G)         8.35E-0005    8.36E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0376
  Al 2Mg 1O  4              (C)  []         0.0977
  Ca 2O  4Si 1              (C)  [BETA]     0.0693
  Fe 1Si 1                  (L)[]           0.0740
  Mg 1O  1                  (C)[]           0.5496
  Si 1                      (L)[]           0.1120
  Si 3Ti 5                  (C)[]           0.0057
*
```

37 wt% Mg

```
 Volume of gas products   (litres)         13.9210
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1810.0000
 Gas products amount        (mol)           0.0907
 Products heat capacity     (J/K)          50.0101
 Products entropy           (J/K)         126.1743
 Products enthalpy          (KJ)         -344.2157
 Mass  of the system        (Kg)            0.0407
1 Ca 1                      (G)         1.24E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0351        0.6481  (atm)
1 Na 1                      (G)             0.0179        0.3485  (atm)
1 Na 2                      (G)         1.01E-0004    9.89E-0004  (atm)
1 O  1Si 1                  (G)         8.23E-0005    8.37E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0490
  Al 2Mg 1O  4              (C)  []         0.0780
  Ca 2O  4Si 1              (C)  [BETA]     0.0572
  Fe 1Si 1                  (L)[]           0.0729
  Mg 1O  1                  (C)[]           0.5719
  Si 1                      (L)[]           0.1120
  Si 3Ti 5                  (C)[]           0.0056
*
```

38 wt% Mg

```
 Volume of gas products   (litres)         14.1162
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1812.9810
 Gas products amount        (mol)           0.0918
 Products heat capacity     (J/K)          49.3843
 Products entropy           (J/K)         125.4989
```

```
 Products enthalpy          (KJ)         -334.7236
 Mass  of the system        (Kg)            0.0402
1 Ca 1                      (G)         1.30E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0367        0.6613  (atm)
1 Na 1                      (G)             0.0176        0.3353  (atm)
1 Na 2                      (G)         9.52E-0005    9.07E-0004  (atm)
1 O  1Si 1                  (G)         8.77E-0005    8.71E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0589
  Al 2Mg 1O  4              (C)  []         0.0606
  Ca 2O  4Si 1              (C)  [BETA]     0.0465
  Fe 1Si 1                  (L)[]           0.0717
  Mg 1O  1                  (C)[]           0.5903
  Si 1                      (L)[]           0.1118
  Si 3Ti 5                  (C)[]           0.0055
*
```

39 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           316.6491
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)       1.90E+0005
 Products entropy           (J/K)       1.81E+0005
 Products enthalpy          (KJ)       -3.16E+0006
 Mass  of the system        (Kg)          268.0174
  Mg 1O  3Ti 1              (C)  []     1.63E-0004
  O  7Ti 4                  (C)[]       6.67E-0004
  O  2Ti 1                  (C)[]           0.9990
*
```

40 wt% Mg

```
 Volume of gas products   (litres)         14.2999
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1817.2986
 Gas products amount        (mol)           0.0928
 Products heat capacity     (J/K)          48.1722
 Products entropy           (J/K)         124.0162
 Products enthalpy          (KJ)         -316.6395
 Mass  of the system        (Kg)            0.0394
1 Ca 1                      (G)         1.40E-0004        0.0015  (atm)
1 Mg 1                      (G)             0.0391        0.6821  (atm)
1 Na 1                      (G)             0.0170        0.3145  (atm)
1 Na 2                      (G)         8.54E-0005    7.88E-0004  (atm)
1 O  1Si 1                  (G)         9.60E-0005    9.25E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0792
  Al 2Mg 1O  4              (C)  []         0.0251
  Ca 2O  4Si 1              (C)  [BETA]     0.0246
  Fe 1Si 1                  (L)[]           0.0694
  Mg 1O  1                  (C)[]           0.6283
  Si 1                      (L)[]           0.1115
  Si 3Ti 5                  (C)[]           0.0054
*
```

41 wt% Mg

```
 Volume of gas products   (litres)         13.4171
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1814.9212
 Gas products amount        (mol)           0.0872
 Products heat capacity     (J/K)          47.6049
 Products entropy           (J/K)         122.5311
 Products enthalpy          (KJ)         -309.2674
 Mass  of the system        (Kg)            0.0390
1 Ca 1                      (G)         1.30E-0004        0.0014  (atm)
1 Mg 1                      (G)             0.0365        0.6708  (atm)
1 Na 1                      (G)             0.0167        0.3258  (atm)
1 Na 2                      (G)         8.75E-0005    8.51E-0004  (atm)
1 O  1Si 1                  (G)         8.82E-0005    8.95E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0923
  Al 2Mg 1O  4              (C)  []         0.0029
  Ca 2O  4Si 1              (C)  [BETA]     0.0110
  Fe 1Si 1                  (L)[]           0.0682
  Mg 1O  1                  (C)[]           0.6549
  Si 1                      (L)[]           0.1118
  Si 3Ti 5                  (C)[]           0.0053
```

```
*
     42 wt% Mg
 Volume of gas products   (litres)         15.4090
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1752.0813
 Gas products amount        (mol)           0.1037
 Products heat capacity     (J/K)          46.7202
 Products entropy           (J/K)         121.7564
 Products enthalpy          (KJ)         -300.7189
 Mass  of the system        (Kg)            0.0386
1 Ca 1                      (G)         2.10E-0004        0.0019  (atm)
1 Mg 1                      (G)             0.0477        0.7305  (atm)
1 Na 1                      (G)             0.0165        0.2665  (atm)
1 Na 2                      (G)         8.48E-0005    6.86E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0926
  Ca 1Mg 1O  2              (C)  []         0.0100
  Fe 1Si 1                  (L)[]           0.0671
  Mg 1O  1                  (C)[]           0.6488
  Si 1                      (L)[]           0.1118
  Si 3Ti 5                  (C)[]           0.0052
*
     43 wt% Mg
 Volume of gas products   (litres)         16.9132
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.1167
 Products heat capacity     (J/K)          46.0385
 Products entropy           (J/K)         121.3210
 Products enthalpy          (KJ)         -291.5861
 Mass  of the system        (Kg)            0.0382
1 Ca 1                      (G)         2.23E-0004        0.0018  (atm)
1 Mg 1                      (G)             0.0569        0.7668  (atm)
1 Na 1                      (G)             0.0162        0.2305  (atm)
1 Na 2                      (G)         8.22E-0005    5.85E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0910
  Ca 1Mg 1O  2              (C)  []         0.0098
  Fe 1Si 1                  (L)[]           0.0659
  Mg 1O  1                  (C)[]           0.6377
  Mg 2Si 1                  (L)             0.0114
  Si 1                      (L)[]           0.1057
  Si 3Ti 5                  (C)[]           0.0051
*
     44 wt% Mg
 Volume of gas products   (litres)         16.4656
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1710.0000
 Gas products amount        (mol)           0.1136
 Products heat capacity     (J/K)          45.6939
 Products entropy           (J/K)         120.4744
 Products enthalpy          (KJ)         -283.3252
 Mass  of the system        (Kg)            0.0378
1 Ca 1                      (G)         2.19E-0004        0.0018  (atm)
1 Mg 1                      (G)             0.0560        0.7670  (atm)
1 Na 1                      (G)             0.0159        0.2303  (atm)
1 Na 2                      (G)         8.07E-0005    5.84E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0894
  Ca 1Mg 1O  2              (C)  []         0.0097
  Fe 1Si 1                  (L)[]           0.0648
  Mg 1O  1                  (C)[]           0.6265
  Mg 2Si 1                  (L)             0.0388
  Si 1                      (L)[]           0.0937
  Si 3Ti 5                  (C)[]           0.0050
*
     45 wt% Mg
 Volume of gas products   (litres)         14.9094
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1706.8297
 Gas products amount        (mol)           0.1030
 Products heat capacity     (J/K)          45.4420
 Products entropy           (J/K)         118.8286
 Products enthalpy          (KJ)         -276.6183
```

```
 Mass  of the system        (Kg)            0.0375
1 Ca 1                      (G)         1.95E-0004        0.0018  (atm)
1 Mg 1                      (G)            0.0502        0.7505  (atm)
1 Na 1                      (G)            0.0156        0.2468  (atm)
1 Na 2                      (G)         8.57E-0005    6.78E-0004  (atm)
  Al 2Ca 1                  (L)[]          0.0878
  Ca 1Mg 1O  2              (C)  []        0.0095
  Fe 1Si 1                  (L)[]          0.0636
  Mg 1O  1                  (C)[]          0.6153
  Mg 2Si 1                  (L)            0.0738
  Si 1                      (L)[]          0.0790
  Si 3Ti 5                  (C)[]          0.0049
*
```

46 wt% Mg

```
 Volume of gas products   (litres)        14.2165
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1705.9670
 Gas products amount        (mol)          0.0983
 Products heat capacity     (J/K)         45.1309
 Products entropy           (J/K)        117.8198
 Products enthalpy          (KJ)        -269.0094
 Mass  of the system        (Kg)           0.0371
1 Ca 1                      (G)         1.86E-0004        0.0018  (atm)
1 Mg 1                      (G)            0.0480        0.7458  (atm)
1 Na 1                      (G)            0.0153        0.2515  (atm)
1 Na 2                      (G)         8.60E-0005    7.06E-0004  (atm)
  Al 2Ca 1                  (L)[]          0.0862
  Ca 1Mg 1O  2              (C)  []        0.0094
  Fe 1Si 1                  (L)[]          0.0625
  Mg 1O  1                  (C)[]          0.6041
  Mg 2Si 1                  (L)            0.1031
  Si 1                      (L)[]          0.0663
  Si 3Ti 5                  (C)[]          0.0048
*
```

47 wt% Mg

```
 Volume of gas products   (litres)        13.5960
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1705.1576
 Gas products amount        (mol)          0.0940
 Products heat capacity     (J/K)         44.8208
 Products entropy           (J/K)        116.8707
 Products enthalpy          (KJ)        -261.4762
 Mass  of the system        (Kg)           0.0367
1 Ca 1                      (G)         1.79E-0004        0.0017  (atm)
1 Mg 1                      (G)            0.0462        0.7418  (atm)
1 Na 1                      (G)            0.0150        0.2555  (atm)
1 Na 2                      (G)         8.60E-0005    7.31E-0004  (atm)
  Al 2Ca 1                  (L)[]          0.0846
  Ca 1Mg 1O  2              (C)  []        0.0092
  Fe 1Si 1                  (L)[]          0.0613
  Mg 1O  1                  (C)[]          0.5929
  Mg 2Si 1                  (L)            0.1320
  Si 1                      (L)[]          0.0538
  Si 3Ti 5                  (C)[]          0.0047
*
```

48 wt% Mg

```
 Volume of gas products   (litres)        12.9829
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1704.3441
 Gas products amount        (mol)          0.0898
 Products heat capacity     (J/K)         44.5175
 Products entropy           (J/K)        115.9365
 Products enthalpy          (KJ)        -254.0962
 Mass  of the system        (Kg)           0.0364
1 Ca 1                      (G)         1.71E-0004        0.0017  (atm)
1 Mg 1                      (G)            0.0443        0.7375  (atm)
1 Na 1                      (G)            0.0148        0.2599  (atm)
1 Na 2                      (G)         8.60E-0005    7.57E-0004  (atm)
  Al 2Ca 1                  (L)[]          0.0830
  Ca 1Mg 1O  2              (C)  []        0.0090
  Fe 1Si 1                  (L)[]          0.0601
```

```
  Mg 1O  1                  (C)[]           0.5817
  Mg 2Si 1                  (L)             0.1609
  Si 1                      (L)[]           0.0413
  Si 3Ti 5                  (C)[]           0.0047
*
```

49 wt% Mg

```
 Volume of gas products   (litres)         12.4287
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1703.5556
 Gas products amount        (mol)           0.0860
 Products heat capacity     (J/K)          44.2158
 Products entropy           (J/K)         115.0518
 Products enthalpy          (KJ)         -246.7998
 Mass  of the system        (Kg)            0.0360
1 Ca 1                      (G)         1.64E-0004        0.0017  (atm)
1 Mg 1                      (G)             0.0426        0.7337  (atm)
1 Na 1                      (G)             0.0145        0.2636  (atm)
1 Na 2                      (G)         8.58E-0005    7.81E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0814
  Ca 1Mg 1O  2              (C)  []         0.0089
  Fe 1Si 1                  (L)[]           0.0590
  Mg 1O  1                  (C)[]           0.5705
  Mg 2Si 1                  (L)             0.1894
  Si 1                      (L)[]           0.0289
  Si 3Ti 5                  (C)[]           0.0046
*
```

50 wt% Mg

```
 Volume of gas products   (litres)         11.8629
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1702.6641
 Gas products amount        (mol)           0.0822
 Products heat capacity     (J/K)          43.9215
 Products entropy           (J/K)         114.1661
 Products enthalpy          (KJ)         -239.6704
 Mass  of the system        (Kg)            0.0357
1 Ca 1                      (G)         1.57E-0004        0.0017  (atm)
1 Mg 1                      (G)             0.0408        0.7293  (atm)
1 Na 1                      (G)             0.0142        0.2680  (atm)
1 Na 2                      (G)         8.57E-0005    8.10E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0798
  Ca 1Mg 1O  2              (C)  []         0.0087
  Fe 1Si 1                  (L)[]           0.0578
  Mg 1O  1                  (C)[]           0.5593
  Mg 2Si 1                  (L)             0.2182
  Si 1                      (L)[]           0.0165
  Si 3Ti 5                  (C)[]           0.0045
*
```

51 wt% Mg

```
 Volume of gas products   (litres)         10.9591
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1700.0410
 Gas products amount        (mol)           0.0760
 Products heat capacity     (J/K)          43.6582
 Products entropy           (J/K)         113.0233
 Products enthalpy          (KJ)         -233.1376
 Mass  of the system        (Kg)            0.0354
1 Ca 1                      (G)         1.43E-0004        0.0017  (atm)
1 Mg 1                      (G)             0.0374        0.7161  (atm)
1 Na 1                      (G)             0.0139        0.2811  (atm)
1 Na 2                      (G)         8.89E-0005    8.99E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0782
  Ca 1Mg 1O  2              (C)  []         0.0086
  Fe 1Si 1                  (L)[]           0.0567
  Mg 1O  1                  (C)[]           0.5481
  Mg 2Si 1                  (L)             0.2494
  Si 1                      (L)[]           0.0031
  Si 3Ti 5                  (C)[]           0.0044
*
```

52 wt% Mg

```
 Volume of gas products   (litres)         13.5041
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)          1665.0000
 Gas products amount        (mol)           0.0957
 Products heat capacity     (J/K)          42.9986
 Products entropy           (J/K)         112.6321
 Products enthalpy          (KJ)         -225.4456
 Mass  of the system        (Kg)            0.0350
1 Ca 1                      (G)         1.79E-0004        0.0016  (atm)
1 Mg 1                      (G)             0.0518        0.7805  (atm)
1 Na 1                      (G)             0.0136        0.2171  (atm)
1 Na 2                      (G)         7.55E-0005    6.01E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0766
  Ca 1Mg 1O  2              (C)  []         0.0083
  Fe 1Si 1                  (C)[]           0.0555
  Mg 1O  1                  (C)[]           0.5370
  Mg 2Si 1                  (L)             0.2526
  Si 3Ti 5                  (C)[]           0.0043
*
```

53 wt% Mg

```
 Volume of gas products   (litres)         15.8969
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1530.0000
 Gas products amount        (mol)           0.1225
 Products heat capacity     (J/K)          41.9874
 Products entropy           (J/K)         111.2496
 Products enthalpy          (KJ)         -219.2078
 Mass  of the system        (Kg)            0.0347
1 Ca 1                      (G)         1.61E-0004        0.0011  (atm)
1 Mg 1                      (G)             0.0715        0.8339  (atm)
1 Na 1                      (G)             0.0133        0.1642  (atm)
1 Na 2                      (G)         9.11E-0005    5.61E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0750
  Ca 1Mg 1O  2              (C)  []         0.0082
  Fe 1Si 1                  (C)[]           0.0544
  Mg 1O  1                  (C)[]           0.5258
  Mg 2Si 1                  (L)             0.2473
  Si 3Ti 5                  (C)[]           0.0042
*
```

54 wt% Mg

```
 Volume of gas products   (litres)         18.1174
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1406.7952
 Gas products amount        (mol)           0.1519
 Products heat capacity     (J/K)          41.0289
 Products entropy           (J/K)         110.0874
 Products enthalpy          (KJ)         -212.3746
 Mass  of the system        (Kg)            0.0344
1 Mg 1                      (G)             0.0934        0.8708  (atm)
1 Na 1                      (G)             0.0130        0.1282  (atm)
1 Mg 2                      (G)         6.00E-0005    2.80E-0004  (atm)
1 Na 2                      (G)         1.17E-0004    5.78E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0734
  Ca 1Si 1                  (C)  []         0.0059
  Fe 1Si 1                  (C)[]           0.0532
  Mg 1O  1                  (C)[]           0.5213
  Mg 2Si 1                  (L)             0.2355
  Si 3Ti 5                  (C)[]           0.0041
*
```

55 wt% Mg

```
 Volume of gas products   (litres)         20.7236       20.7189       20.7304
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1375.1552     1374.7737     1375.5367
 Gas products amount        (mol)           0.1777        0.1777        0.1777
 Products heat capacity     (J/K)          40.1883       40.0868       40.3366
 Products entropy           (J/K)         108.5137      106.5601      111.3684
 Products enthalpy          (KJ)         -205.8951     -208.5832     -201.9673
 Phase transition enthalpy  (KJ)            6.6158
 Mass  of the system        (Kg)            0.0341
1 Mg 1                      (G)             0.1131        0.1131        0.1131
1 Na 1                      (G)             0.0127        0.0127        0.0127
1 Mg 2                      (G)         7.89E-0005    7.90E-0005    7.89E-0005
1 Na 2                      (G)         1.10E-0004    1.11E-0004    1.10E-0004
```

```
  Al 2Ca 1                  (L)[]           0.0718        0.0718        0.0718
  Ca 1Si 1                  (C)  []         0.0057        0.0057        0.0057
  Fe 1Si 1                  (C)[]           0.0520        0.0520        0.0520
  Mg 1O  1                  (C)[]           0.5099        0.5099        0.5099
  Mg 2Si 1                  (L)             0.0936        0.0000        0.2304
  Mg 2Si 1                  (C)             0.1368        0.2304        0.0000
  Si 3Ti 5                  (C)[]           0.0040        0.0040        0.0040
*
```

56 wt% Mg

```
 Volume of gas products   (litres)         21.5615
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1355.5149
 Gas products amount        (mol)           0.1876
 Products heat capacity     (J/K)          39.6495
 Products entropy           (J/K)         106.8463
 Products enthalpy          (KJ)         -199.6868
 Mass  of the system        (Kg)            0.0338
1 Mg 1                      (G)             0.1216        0.9015  (atm)
1 Na 1                      (G)             0.0124        0.0975  (atm)
1 Mg 2                      (G)          8.89E-0005    3.30E-0004  (atm)
1 Na 2                      (G)          1.09E-0004    4.28E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0703
  Ca 1Si 1                  (C)  []         0.0055
  Fe 1Si 1                  (C)[]           0.0509
  Mg 1                      (L)[]           0.0111
  Mg 1O  1                  (C)[]           0.4986
  Mg 2Si 1                  (C)             0.2253
  Si 3Ti 5                  (C)[]           0.0039
*
```

57 wt% Mg

```
 Volume of gas products   (litres)         19.7466
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1354.8248
 Gas products amount        (mol)           0.1719
 Products heat capacity     (J/K)          39.6109
 Products entropy           (J/K)         105.2555
 Products enthalpy          (KJ)         -193.3958
 Mass  of the system        (Kg)            0.0335
1 Mg 1                      (G)             0.1117        0.8959  (atm)
1 Na 1                      (G)             0.0122        0.1031  (atm)
1 Mg 2                      (G)          8.13E-0005    3.26E-0004  (atm)
1 Na 2                      (G)          1.13E-0004    4.79E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0687
  Ca 1Si 1                  (C)  []         0.0055
  Fe 1Si 1                  (C)[]           0.0497
  Mg 1                      (L)[]           0.0408
  Mg 1O  1                  (C)[]           0.4873
  Mg 2Si 1                  (C)             0.2201
  Si 3Ti 5                  (C)[]           0.0038
*
```

58 wt% Mg

```
 Volume of gas products   (litres)         17.9341
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1353.9367
 Gas products amount        (mol)           0.1562
 Products heat capacity     (J/K)          39.5779
 Products entropy           (J/K)         103.6663
 Products enthalpy          (KJ)         -187.2890
 Mass  of the system        (Kg)            0.0332
1 Mg 1                      (G)             0.1017        0.8892  (atm)
1 Na 1                      (G)             0.0119        0.1097  (atm)
1 Mg 2                      (G)          7.36E-0005    3.22E-0004  (atm)
1 Na 2                      (G)          1.18E-0004    5.45E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0671
  Ca 1Si 1                  (C)  []         0.0053
  Fe 1Si 1                  (C)[]           0.0486
  Mg 1                      (L)[]           0.0706
  Mg 1O  1                  (C)[]           0.4759
  Mg 2Si 1                  (C)             0.2150
  Si 3Ti 5                  (C)[]           0.0038
*
```

```
     59 wt% Mg
 Volume of gas products   (litres)         16.6069
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1353.2685
 Gas products amount        (mol)           0.1447
 Products heat capacity     (J/K)          39.4932
 Products entropy           (J/K)         102.4804
 Products enthalpy          (KJ)         -180.7780
 Mass  of the system        (Kg)            0.0329
1 Mg 1                      (G)             0.0945        0.8843  (atm)
1 Na 1                      (G)             0.0116        0.1146  (atm)
1 Mg 2                      (G)          6.81E-0005    3.19E-0004  (atm)
1 Na 2                      (G)          1.21E-0004    5.97E-0004  (atm)
  Al 2Ca 1                  (L)[]           0.0655
  Ca 1Si 1                  (C)  []         0.0052
  Fe 1Si 1                  (C)[]           0.0474
  Mg 1                      (L)[]           0.0975
  Mg 1O  1                  (C)[]           0.4646
  Mg 2Si 1                  (C)             0.2099
  Si 3Ti 5                  (C)[]           0.0037
*
     60 wt% Mg
 Volume of gas products   (litres)         15.5219
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1352.7109
 Gas products amount        (mol)           0.1353
 Products heat capacity     (J/K)          39.3590
 Products entropy           (J/K)         100.4619
 Products enthalpy          (KJ)         -175.5309
 Mass  of the system        (Kg)            0.0326
1 Mg 1                      (G)             0.0887        0.8804  (atm)
1 Na 1                      (G)             0.0113        0.1185  (atm)
1 Mg 2                      (G)          6.37E-0005    3.16E-0004  (atm)
1 Na 2                      (G)          1.22E-0004    6.39E-0004  (atm)
  Al 2Ca 1                  (C)[]           0.0639
  Ca 1Si 1                  (C)  []         0.0051
  Fe 1Si 1                  (C)[]           0.0463
  Mg 1                      (L)[]           0.1229
  Mg 1O  1                  (C)[]           0.4533
  Mg 2Si 1                  (C)             0.2048
  Si 3Ti 5                  (C)[]           0.0036
*
     61 wt% Mg
 Volume of gas products   (litres)         13.7043
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1351.2582
 Gas products amount        (mol)           0.1196
 Products heat capacity     (J/K)          39.3385
 Products entropy           (J/K)          98.8892
 Products enthalpy          (KJ)         -169.8178
 Mass  of the system        (Kg)            0.0324
1 Mg 1                      (G)             0.0781        0.8693  (atm)
1 Na 1                      (G)             0.0110        0.1294  (atm)
1 Mg 2                      (G)          5.56E-0005    3.09E-0004  (atm)
1 Na 2                      (G)          1.31E-0004    7.69E-0004  (atm)
  Al 2Ca 1                  (C)[]           0.0623
  Ca 1Si 1                  (C)  []         0.0050
  Fe 1Si 1                  (C)[]           0.0451
  Mg 1                      (L)[]           0.1533
  Mg 1O  1                  (C)[]           0.4419
  Mg 2Si 1                  (C)             0.1996
  Si 3Ti 5                  (C)[]           0.0035
*
     62 wt% Mg
 Volume of gas products   (litres)         12.6053
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1350.3116
 Gas products amount        (mol)           0.1101
 Products heat capacity     (J/K)          39.2395
 Products entropy           (J/K)          97.9193
 Products enthalpy          (KJ)         -163.4193
```

```
 Mass  of the system        (Kg)            0.0321
1 Mg 1                      (G)             0.0720        0.8629  (atm)
1 Na 1                      (G)             0.0107        0.1358  (atm)
1 Mg 2                      (G)         5.08E-0005    3.05E-0004  (atm)
1 Na 2                      (G)         1.34E-0004    8.50E-0004  (atm)
  Al 2Ca 1                  (C)[]           0.0607
  Ca 1Si 1                  (C)  []         0.0048
  Fe 1Si 1                  (C)[]           0.0440
  Mg 1                      (L)[]           0.1791
  Mg 1O  1                  (C)[]           0.4306
  Mg 2Si 1                  (C)             0.1945
  Si 3Ti 5                  (C)[]           0.0034
*
```

63 wt% Mg

```
 Volume of gas products   (litres)         11.1952
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1348.6926
 Gas products amount        (mol)           0.0979
 Products heat capacity     (J/K)          39.1789
 Products entropy           (J/K)          96.6752
 Products enthalpy          (KJ)         -157.5191
 Mass  of the system        (Kg)            0.0318
1 Mg 1                      (G)             0.0637        0.8513  (atm)
1 Na 1                      (G)             0.0104        0.1473  (atm)
1 Mg 2                      (G)         4.45E-0005    2.98E-0004  (atm)
1 Na 2                      (G)         1.43E-0004        0.0010  (atm)
  Al 2Ca 1                  (C)[]           0.0591
  Ca 1Si 1                  (C)  []         0.0047
  Fe 1Si 1                  (C)[]           0.0428
  Mg 1                      (L)[]           0.2072
  Mg 1O  1                  (C)[]           0.4193
  Mg 2Si 1                  (C)             0.1894
  Si 3Ti 5                  (C)[]           0.0033
*
```

64 wt% Mg

```
 Volume of gas products   (litres)          8.8612
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1344.2323
 Gas products amount        (mol)           0.0777
 Products heat capacity     (J/K)          39.2229
 Products entropy           (J/K)          94.5908
 Products enthalpy          (KJ)         -152.8728
 Mass  of the system        (Kg)            0.0316
1 Mg 1                      (G)             0.0491        0.8197  (atm)
1 Na 1                      (G)             0.0101        0.1783  (atm)
1 Na 2                      (G)         1.71E-0004        0.0015  (atm)
  Al 2Ca 1                  (C)[]           0.0575
  Ca 1Si 1                  (C)  []         0.0046
  Fe 1Si 1                  (C)[]           0.0416
  Mg 1                      (L)[]           0.2414
  Mg 1O  1                  (C)[]           0.4079
  Mg 2Si 1                  (C)             0.1843
  Si 3Ti 5                  (C)[]           0.0032
*
```

65 wt% Mg

```
 Volume of gas products   (litres)          1.8488
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1392.7267
 Gas products amount        (mol)           0.0157
 Products heat capacity     (J/K)          60.5858
 Products entropy           (J/K)         129.2958
 Products enthalpy          (KJ)         -424.3371
 Mass  of the system        (Kg)            0.0484
1 Mg 1                      (G)             0.0012        0.1567  (atm)
1 Na 1                      (G)             0.0061        0.8181  (atm)
1 Na 2                      (G)         3.74E-0004        0.0251  (atm)
  Al 1                      (L)[]           0.1208
  Al 4Ca 1                  (L)[]           0.0632
  Al 2Mg 1O  4              (C)  []         0.1070
  Fe 1Si 1                  (C)[]           0.0262
  Mg 1O  1                  (C)[]           0.5538
```

```
  Mg 2Si 1                  (L)             0.1192
  Si 3Ti 5                  (C)[]           0.0020
*
     66 wt% Mg
 Volume of gas products   (litres)          5.6574
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1332.5845
 Gas products amount        (mol)           0.0501
 Products heat capacity     (J/K)          39.1466
 Products entropy           (J/K)          91.5337
 Products enthalpy          (KJ)         -142.4306
 Mass  of the system        (Kg)            0.0310
1 Mg 1                      (G)             0.0291        0.7413  (atm)
1 Na 1                      (G)             0.0095        0.2551  (atm)
1 Na 2                      (G)         2.43E-0004        0.0033  (atm)
  Al 2Ca 1                  (C)[]           0.0543
  Ca 1Si 1                  (C)  []         0.0044
  Fe 1Si 1                  (C)[]           0.0393
  Mg 1                      (L)[]           0.3009
  Mg 1O  1                  (C)[]           0.3853
  Mg 2Si 1                  (C)             0.1740
  Si 3Ti 5                  (C)[]           0.0030
*
     67 wt% Mg
 Volume of gas products   (litres)          5.4290
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1332.5243
 Gas products amount        (mol)           0.0481
 Products heat capacity     (J/K)          38.9680
 Products entropy           (J/K)          91.3065
 Products enthalpy          (KJ)         -135.6452
 Mass  of the system        (Kg)            0.0308
1 Mg 1                      (G)             0.0281        0.7405  (atm)
1 Na 1                      (G)             0.0092        0.2559  (atm)
1 Na 2                      (G)         2.37E-0004        0.0033  (atm)
  Al 2Ca 1                  (C)[]           0.0527
  Ca 1Si 1                  (C)  []         0.0042
  Fe 1Si 1                  (C)[]           0.0382
  Mg 1                      (L)[]           0.3216
  Mg 1O  1                  (C)[]           0.3739
  Mg 2Si 1                  (C)             0.1689
  Si 3Ti 5                  (C)[]           0.0030
*
     68 wt% Mg
 Volume of gas products   (litres)          3.4383
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1311.4791
 Gas products amount        (mol)           0.0309
 Products heat capacity     (J/K)          38.9513
 Products entropy           (J/K)          88.9993
 Products enthalpy          (KJ)         -131.7245
 Mass  of the system        (Kg)            0.0305
1 Mg 1                      (G)             0.0151        0.6153  (atm)
1 Na 1                      (G)             0.0088        0.3764  (atm)
1 Na 2                      (G)         3.71E-0004        0.0080  (atm)
  Al 2Ca 1                  (C)[]           0.0511
  Ca 1Si 1                  (C)  []         0.0041
  Fe 1Si 1                  (C)[]           0.0370
  Mg 1                      (L)[]           0.3543
  Mg 1O  1                  (C)[]           0.3626
  Mg 2Si 1                  (C)             0.1638
  Si 3Ti 5                  (C)[]           0.0029
*
     69 wt% Mg
 Volume of gas products   (litres)          2.6790
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1295.9584
 Gas products amount        (mol)           0.0244
 Products heat capacity     (J/K)          38.8086
 Products entropy           (J/K)          87.8707
 Products enthalpy          (KJ)         -126.3351
```

```
 Mass  of the system        (Kg)            0.0303
1 Mg 1                      (G)             0.0104        0.5341  (atm)
1 Na 1                      (G)             0.0084        0.4531  (atm)
1 Na 2                      (G)         4.65E-0004        0.0126  (atm)
  Al 2Ca 1                  (C)[]           0.0495
  Ca 1Si 1                  (C)  []         0.0040
  Fe 1Si 1                  (C)[]           0.0359
  Mg 1                      (L)[]           0.3787
  Mg 1O  1                  (C)[]           0.3513
  Mg 2Si 1                  (C)             0.1587
  Si 3Ti 5                  (C)[]           0.0028
*
     70 wt% Mg
 Volume of gas products   (litres)          1.9957
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1270.0000
 Gas products amount        (mol)           0.0185
 Products heat capacity     (J/K)          38.6388
 Products entropy           (J/K)          86.4863
 Products enthalpy          (KJ)         -121.3608
 Mass  of the system        (Kg)            0.0301
1 Mg 1                      (G)             0.0063        0.4180  (atm)
1 Na 1                      (G)             0.0079        0.5598  (atm)
1 Na 2                      (G)         6.27E-0004        0.0221  (atm)
  Al 2Ca 1                  (C)[]           0.0479
  Ca 1Si 1                  (C)  []         0.0039
  Fe 1Si 1                  (C)[]           0.0347
  Mg 1                      (L)[]           0.4026
  Mg 1O  1                  (C)[]           0.3399
  Mg 2Si 1                  (C)             0.1535
  Si 3Ti 5                  (C)[]           0.0027
*
     71 wt% Mg
 Volume of gas products   (litres)          1.4728
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)           0.0141
 Products heat capacity     (J/K)          38.4243
 Products entropy           (J/K)          84.7941
 Products enthalpy          (KJ)         -116.8371
 Mass  of the system        (Kg)            0.0298
1 Mg 1                      (G)             0.0032        0.2807  (atm)
1 Na 1                      (G)             0.0074        0.6783  (atm)
1 Na 2                      (G)         8.91E-0004        0.0409  (atm)
  Al 2Ca 1                  (C)[]           0.0463
  Ca 1Si 1                  (C)  []         0.0037
  Fe 1Si 1                  (C)[]           0.0335
  Mg 1                      (L)[]           0.4253
  Mg 1O  1                  (C)[]           0.3286
  Mg 2Si 1                  (C)             0.1484
  Si 3Ti 5                  (C)[]           0.0026
*
     72 wt% Mg
 Volume of gas products   (litres)          1.2258
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1200.0100
 Gas products amount        (mol)           0.0120
 Products heat capacity     (J/K)          38.2059
 Products entropy           (J/K)          83.6288
 Products enthalpy          (KJ)         -111.7182
 Mass  of the system        (Kg)            0.0296
1 Mg 1                      (G)             0.0020        0.2043  (atm)
1 Na 1                      (G)             0.0069        0.7375  (atm)
1 Na 2                      (G)             0.0011        0.0582  (atm)
  Al 2Ca 1                  (C)[]           0.0447
  Ca 1Si 1                  (C)  []         0.0036
  Fe 1Si 1                  (C)[]           0.0324
  Mg 1                      (L)[]           0.4462
  Mg 1O  1                  (C)[]           0.3173
  Mg 2Si 1                  (C)             0.1433
  Si 3Ti 5                  (C)[]           0.0025
```

```
*
     73 wt% Mg
 Volume of gas products   (litres)          1.0853
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1180.0000
 Gas products amount        (mol)           0.0108
 Products heat capacity     (J/K)          38.0026
 Products entropy           (J/K)          82.8614
 Products enthalpy          (KJ)         -106.1958
 Mass  of the system        (Kg)            0.0294
1 Mg 1                      (G)             0.0015        0.1638  (atm)
1 Na 1                      (G)             0.0065        0.7650  (atm)
1 Na 2                      (G)             0.0012        0.0711  (atm)
  Al 2Ca 1                  (C)[]           0.0431
  Ca 1Si 1                  (C)  []         0.0035
  Fe 1Si 1                  (C)[]           0.0312
  Mg 1                      (L)[]           0.4665
  Mg 1O  1                  (C)[]           0.3060
  Mg 2Si 1                  (C)             0.1382
  Si 3Ti 5                  (C)[]           0.0024
*
     74 wt% Mg
 Volume of gas products   (litres)      6.19E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1141.8867
 Gas products amount        (mol)       6.39E-0008
 Products heat capacity     (J/K)          37.8627
 Products entropy           (J/K)          80.6245
 Products enthalpy          (KJ)         -102.4506
 Mass  of the system        (Kg)            0.0291
  Al 2Ca 1                  (C)[]           0.0415
  Ca 1Si 1                  (C)  []         0.0033
  Fe 1Si 1                  (C)[]           0.0301
  Mg 1                      (L)[]           0.4876
  Mg 1O  1                  (C)[]           0.2946
  Mg 2Si 1                  (C)             0.1331
  Na 1                      (L)[]           0.0074
  Si 3Ti 5                  (C)[]           0.0023
*
     75 wt% Mg
 Volume of gas products   (litres)      4.09E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1107.6184
 Gas products amount        (mol)       4.36E-0008
 Products heat capacity     (J/K)          37.6273
 Products entropy           (J/K)          79.4747
 Products enthalpy          (KJ)          -97.5062
 Mass  of the system        (Kg)            0.0289
  Al 2Ca 1                  (C)[]           0.0399
  Ca 1Si 1                  (C)  []         0.0032
  Fe 1Si 1                  (C)[]           0.0289
  Mg 1                      (L)[]           0.5073
  Mg 1O  1                  (C)[]           0.2833
  Mg 2Si 1                  (C)             0.1279
  Na 1                      (L)[]           0.0071
  Si 3Ti 5                  (C)[]           0.0022
*
     76 wt% Mg
 Volume of gas products   (litres)      5.62E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1126.5918
 Gas products amount        (mol)       5.88E-0008
 Products heat capacity     (J/K)          38.1882
 Products entropy           (J/K)          80.9297
 Products enthalpy          (KJ)         -101.1229
 Mass  of the system        (Kg)            0.0294
  Al 2Ca 1                  (C)[]           0.0374
  Ca 1Si 1                  (C)  []         0.0030
  Fe 1Si 1                  (C)[]           0.0271
  Mg 1                      (L)[]           0.5091
  Mg 1O  1                  (C)[]           0.2891
```

```
  Mg 2Si 1                  (C)             0.1065
  Na 1                      (L)[]           0.0067
  Si 3Ti 5                  (C)[]           0.0210
*
     77 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1042.0000
 Gas products amount        (mol)       9.38E-0010
 Products heat capacity     (J/K)          37.1834
 Products entropy           (J/K)          77.2053
 Products enthalpy          (KJ)          -87.7513
 Mass  of the system        (Kg)            0.0285
  Al 2Ca 1                  (C)[]           0.0367
  Ca 1Si 1                  (C)  []         0.0030
  Fe 1Si 1                  (C)[]           0.0266
  Mg 1                      (L)[]           0.5468
  Mg 1O  1                  (C)[]           0.2606
  Mg 2Si 1                  (C)             0.1177
  Na 1                      (L)[]           0.0066
  Si 3Ti 5                  (C)[]           0.0021
*
     79 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           980.0000
 Gas products amount        (mol)       2.77E-0010
 Products heat capacity     (J/K)          36.9116
 Products entropy           (J/K)          74.9490
 Products enthalpy          (KJ)          -84.0711
 Mass  of the system        (Kg)            0.0283
  Al 2Ca 1                  (C)[]           0.0351
  Ca 1Si 1                  (C)  []         0.0028
  Fe 1Si 1                  (C)[]           0.0254
  Mg 1                      (L)[]           0.5665
  Mg 1O  1                  (C)[]           0.2493
  Mg 2Si 1                  (C)             0.1126
  Na 1                      (L)[]           0.0063
  Si 3Ti 5                  (C)[]           0.0020
*
     80 wt% Mg
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           924.8726
 Gas products amount        (mol)       1.54E-0010
 Products heat capacity     (J/K)          36.5333
 Products entropy           (J/K)          72.8709
 Products enthalpy          (KJ)          -74.3861
 Mass  of the system        (Kg)            0.0279
  Al 2Ca 1                  (C)[]           0.0319
  Ca 1Si 1                  (C)  []         0.0026
  Fe 1Si 1                  (C)[]           0.0231
  Mg 1                      (L)[]           0.6059
  Mg 1O  1                  (C)[]           0.2266
  Mg 2Si 1                  (C)             0.1024
  Na 1                      (L)[]           0.0057
  Si 3Ti 5                  (C)[]           0.0018
*
     81 wt% Mg
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           922.9242      922.8283      923.0200
 Gas products amount        (mol)       7.07E-0010    2.59E-0011    1.04E-0009
 Products heat capacity     (J/K)          35.8986       34.8692       36.4027
 Products entropy           (J/K)          70.8837       66.9193       72.8252
 Products enthalpy          (KJ)          -70.5149      -74.1741      -68.7229
 Phase transition enthalpy  (KJ)           5.4512
 Mass  of the system        (Kg)            0.0277
  Al 2Ca 1                  (C)[]           0.0303        0.0303        0.0303
  Ca 1Si 1                  (C)  []         0.0024        0.0024        0.0024
  Fe 1Si 1                  (C)[]           0.0220        0.0220        0.0220
```

```
 Mg 1                      (C)[]          0.1850        0.5628        0.0000
 Mg 1                      (L)[]          0.4406        0.0627        0.6256
 Mg 1O  1                  (C)[]          0.2153        0.2153        0.2153
 Mg 2Si 1                  (C)            0.0972        0.0972        0.0972
 Na 1                      (L)[]          0.0054        0.0054        0.0054
 Si 3Ti 5                  (C)[]          0.0017        0.0017        0.0017
*
```

82 wt% Mg

```
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.9364      922.8542      923.0186
Gas products amount        (mol)       3.58E-0010    3.75E-0010    3.33E-0010
Products heat capacity     (J/K)          35.3645       34.7486       36.2778
Products entropy           (J/K)          69.3350       66.9630       72.8522
Products enthalpy          (KJ)         -66.3226      -68.5119      -63.0762
Phase transition enthalpy  (KJ)           5.4357
Mass  of the system        (Kg)           0.0275
 Al 2Ca 1                  (C)[]          0.0287        0.0287        0.0287
 Ca 1Si 1                  (C)  []        0.0023        0.0023        0.0023
 Fe 1Si 1                  (C)[]          0.0208        0.0208        0.0208
 Mg 1                      (C)[]          0.3377        0.5654        0.0000
 Mg 1                      (L)[]          0.3076        0.0799        0.6453
 Mg 1O  1                  (C)[]          0.2040        0.2040        0.2040
 Mg 2Si 1                  (C)            0.0921        0.0921        0.0921
 Na 1                      (L)[]          0.0051        0.0051        0.0051
 Si 3Ti 5                  (C)[]          0.0016        0.0016        0.0016
*
```

83 wt% Mg

```
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.9552      922.8773      923.0330
Gas products amount        (mol)       6.52E-0010    7.88E-0010    1.03E-0010
Products heat capacity     (J/K)          34.8375       34.5126       36.1544
Products entropy           (J/K)          67.8075       66.5564       72.8793
Products enthalpy          (KJ)         -62.1881      -63.3429      -57.5069
Phase transition enthalpy  (KJ)           5.8360
Mass  of the system        (Kg)           0.0273
 Al 2Ca 1                  (C)[]          0.0271        0.0271        0.0271
 Ca 1Si 1                  (C)  []        0.0022        0.0022        0.0022
 Fe 1Si 1                  (C)[]          0.0197        0.0197        0.0197
 Mg 1                      (C)[]          0.4905        0.6115        0.0000
 Mg 1                      (L)[]          0.1745        0.0535        0.6650
 Mg 1O  1                  (C)[]          0.1926        0.1926        0.1926
 Mg 2Si 1                  (C)            0.0870        0.0870        0.0870
 Na 1                      (L)[]          0.0049        0.0049        0.0049
 Si 3Ti 5                  (C)[]          0.0015        0.0015        0.0015
*
```

84 wt% Mg

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          919.6590
Gas products amount        (mol)       7.59E-0010
Products heat capacity     (J/K)          34.1751
Products entropy           (J/K)          65.7576
Products enthalpy          (KJ)         -58.6165
Mass  of the system        (Kg)           0.0271
 Al 2Ca 1                  (C)[]          0.0255
 Ca 1Si 1                  (C)  []        0.0021
 Fe 1Si 1                  (C)[]          0.0185
 Mg 1                      (C)[]          0.6847
 Mg 1O  1                  (C)[]          0.1813
 Mg 2Si 1                  (C)            0.0819
 Na 1                      (L)[]          0.0046
 Si 3Ti 5                  (C)[]          0.0014
*
```

85 wt% Mg

```
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          870.0000
Gas products amount        (mol)       1.29E-0010
Products heat capacity     (J/K)          33.5070
```

```
 Products entropy           (J/K)          63.7591
 Products enthalpy          (KJ)          -55.0230
 Mass  of the system        (Kg)            0.0269
  Al 2Ca 1                  (C)[]           0.0239
  Ca 1Si 1                  (C)  []         0.0019
  Fe 1Si 1                  (C)[]           0.0173
  Mg 1                      (C)[]           0.7044
  Mg 1O  1                  (C)[]           0.1700
  Mg 2Si 1                  (C)             0.0768
  Na 1                      (L)[]           0.0043
  Si 3Ti 5                  (C)[]           0.0013
*
```

86 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           870.0000
 Gas products amount        (mol)       1.14E-0010
 Products heat capacity     (J/K)          33.3462
 Products entropy           (J/K)          63.6449
 Products enthalpy          (KJ)          -49.8160
 Mass  of the system        (Kg)            0.0267
  Al 2Ca 1                  (C)[]           0.0223
  Ca 1Si 1                  (C)  []         0.0018
  Fe 1Si 1                  (C)[]           0.0162
  Mg 1                      (C)[]           0.7241
  Mg 1O  1                  (C)[]           0.1586
  Mg 2Si 1                  (C)             0.0716
  Na 1                      (L)[]           0.0040
  Si 3Ti 5                  (C)[]           0.0013
*
```

87 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       5.22E-0011
 Products heat capacity     (J/K)          32.4566
 Products entropy           (J/K)          60.7795
 Products enthalpy          (KJ)          -46.9794
 Mass  of the system        (Kg)            0.0265
  Al 2Ca 1                  (C)[]           0.0208
  Ca 1Si 1                  (C)  []         0.0017
  Fe 1Si 1                  (C)[]           0.0150
  Mg 1                      (C)[]           0.7438
  Mg 1O  1                  (C)[]           0.1473
  Mg 2Si 1                  (C)             0.0665
  Na 1                      (L)[]           0.0037
  Si 3Ti 5                  (C)[]           0.0012
*
```

88 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       2.94E-0009
 Products heat capacity     (J/K)          32.2959
 Products entropy           (J/K)          60.6819
 Products enthalpy          (KJ)          -41.9061
 Mass  of the system        (Kg)            0.0263
  Al 2Ca 1                  (C)[]           0.0192
  Ca 1Si 1                  (C)  []         0.0015
  Fe 1Si 1                  (C)[]           0.0139
  Mg 1                      (C)[]           0.7635
  Mg 1O  1                  (C)[]           0.1360
  Mg 2Si 1                  (C)             0.0614
  Na 1                      (L)[]           0.0034
  Si 3Ti 5                  (C)[]           0.0011
*
```

89 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           740.0000
 Gas products amount        (mol)       1.46E-0012
```

```
 Products heat capacity     (J/K)          31.4999
 Products entropy           (J/K)          58.1055
 Products enthalpy          (KJ)          -38.8137
 Mass  of the system        (Kg)            0.0261
  Al 2Ca 1                  (C)[]           0.0176
  Ca 1Si 1                  (C)  []         0.0014
  Fe 1Si 1                  (C)[]           0.0127
  Mg 1                      (C)[]           0.7832
  Mg 1O  1                  (C)[]           0.1246
  Mg 2Si 1                  (C)             0.0563
  Na 1                      (L)[]           0.0031
  Si 3Ti 5                  (C)[]       9.83E-0004
*
```

90 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           716.0000
 Gas products amount        (mol)       4.58E-0012
 Products heat capacity     (J/K)          31.0829
 Products entropy           (J/K)          56.9937
 Products enthalpy          (KJ)          -34.6164
 Mass  of the system        (Kg)            0.0260
  Al 2Ca 1                  (C)[]           0.0160
  Ca 1Si 1                  (C)  []         0.0013
  Fe 1Si 1                  (C)[]           0.0116
  Mg 1                      (C)[]           0.8029
  Mg 1O  1                  (C)[]           0.1133
  Mg 2Si 1                  (C)             0.0512
  Na 1                      (L)[]           0.0029
  Si 3Ti 5                  (C)[]       8.95E-0004
*
```

91 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       5.60E-0012
 Products heat capacity     (J/K)          30.3726
 Products entropy           (J/K)          54.6530
 Products enthalpy          (KJ)          -31.3000
 Mass  of the system        (Kg)            0.0258
  Al 2Ca 1                  (C)[]           0.0144
  Ca 1Si 1                  (C)  []         0.0012
  Fe 1Si 1                  (C)[]           0.0104
  Mg 1                      (C)[]           0.8226
  Mg 1O  1                  (C)[]           0.1020
  Mg 2Si 1                  (C)             0.0461
  Na 1                      (L)[]           0.0026
  Si 3Ti 5                  (C)[]       8.06E-0004
*
```

92 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           619.4136
 Gas products amount        (mol)       9.43E-0012
 Products heat capacity     (J/K)          29.7158
 Products entropy           (J/K)          52.4616
 Products enthalpy          (KJ)          -27.8421
 Mass  of the system        (Kg)            0.0256
  Al 2Ca 1                  (C)[]           0.0128
  Ca 1Si 1                  (C)  []         0.0010
  Fe 1Si 1                  (C)[]           0.0093
  Mg 1                      (C)[]           0.8423
  Mg 1O  1                  (C)[]           0.0907
  Mg 2Si 1                  (C)             0.0409
  Na 1                      (L)[]           0.0023
  Si 3Ti 5                  (C)[]       7.15E-0004
*
```

93 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
```

```
 Gas products amount        (mol)       2.68E-0011
 Products heat capacity     (J/K)          28.8982
 Products entropy           (J/K)          49.4562
 Products enthalpy          (KJ)          -24.8135
 Mass  of the system        (Kg)            0.0254
  Al 2Ca 1                  (C)[]           0.0112
  Ca 1Si 1                  (C)  []     9.00E-0004
  Fe 1Si 1                  (C)[]           0.0065
  Fe 2Ti 1                  (C)  []         0.0015
  Mg 1                      (C)[]           0.8608
  Mg 1O  1                  (C)[]           0.0793
  Mg 2Si 1                  (C)             0.0378
  Na 1                      (L)[]           0.0020
*
```

94 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           560.0000
 Gas products amount        (mol)       1.06E-0010
 Products heat capacity     (J/K)          28.7444
 Products entropy           (J/K)          49.4217
 Products enthalpy          (KJ)          -20.1009
 Mass  of the system        (Kg)            0.0253
  Al 2Ca 1                  (C)[]           0.0096
  Ca 1Si 1                  (C)  []     7.71E-0004
  Fe 1Si 1                  (C)[]           0.0056
  Fe 2Ti 1                  (C)  []         0.0013
  Mg 1                      (C)[]           0.8807
  Mg 1O  1                  (C)[]           0.0680
  Mg 2Si 1                  (C)             0.0324
  Na 1                      (L)[]           0.0017
*
```

95 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       2.97E-0011
 Products heat capacity     (J/K)          27.9168
 Products entropy           (J/K)          46.1867
 Products enthalpy          (KJ)          -17.1450
 Mass  of the system        (Kg)            0.0251
  Al 2Ca 1                  (C)[]           0.0080
  Ca 1Si 1                  (C)  []     6.43E-0004
  Fe 1Si 1                  (C)[]           0.0046
  Fe 2Ti 1                  (C)  []         0.0011
  Mg 1                      (C)[]           0.9006
  Mg 1O  1                  (C)[]           0.0567
  Mg 2Si 1                  (C)             0.0270
  Na 1                      (L)[]           0.0014
*
```

96 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           467.0000
 Gas products amount        (mol)       1.06E-0011
 Products heat capacity     (J/K)          27.3924
 Products entropy           (J/K)          44.2863
 Products enthalpy          (KJ)          -13.4571
 Mass  of the system        (Kg)            0.0249
  Al 2Ca 1                  (C)[]           0.0064
  Ca 1Si 1                  (C)  []     5.14E-0004
  Fe 1Si 1                  (C)[]           0.0037
  Fe 2Ti 1                  (C)  []     8.83E-0004
  Mg 1                      (C)[]           0.9205
  Mg 1O  1                  (C)[]           0.0453
  Mg 2Si 1                  (C)             0.0216
  Na 1                      (L)[]           0.0011
*
```

97 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)           433.0000
 Gas products amount        (mol)       3.68E-0014
 Products heat capacity     (J/K)          26.8581
 Products entropy           (J/K)          42.2347
 Products enthalpy          (KJ)           -9.8334
 Mass  of the system        (Kg)            0.0248
  Al 2Ca 1                  (C)[]           0.0048
  Ca 1Si 1                  (C)  []     3.85E-0004
  Fe 1Si 1                  (C)[]           0.0028
  Fe 2Ti 1                  (C)  []     6.63E-0004
  Mg 1                      (C)[]           0.9404
  Mg 1O  1                  (C)[]           0.0340
  Mg 2Si 1                  (C)             0.0162
  Na 1                      (L)[]       8.55E-0004
*
```

98 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       3.10E-0014
 Products heat capacity     (J/K)          26.1980
 Products entropy           (J/K)          39.3357
 Products enthalpy          (KJ)           -6.5349
 Mass  of the system        (Kg)            0.0246
  Al 2Ca 1                  (C)[]           0.0032
  Ca 1Si 1                  (C)  []     2.57E-0004
  Fe 1Si 1                  (C)[]           0.0018
  Fe 2Ti 1                  (C)  []     4.41E-0004
  Mg 1                      (C)[]           0.9602
  Mg 1O  1                  (C)[]           0.0227
  Mg 2Si 1                  (C)             0.0108
  Na 1                      (L)[]       5.71E-0004
*
```

99 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           379.0141
 Gas products amount        (mol)       5.37E-0011
 Products heat capacity     (J/K)          25.9667
 Products entropy           (J/K)          38.7443
 Products enthalpy          (KJ)           -2.3314
 Mass  of the system        (Kg)            0.0245
  Al 2Ca 1                  (C)[]           0.0016
  Ca 1Si 1                  (C)  []     1.28E-0004
  Fe 1Si 1                  (C)[]       9.26E-0004
  Fe 2Ti 1                  (C)  []     2.22E-0004
  Mg 1                      (C)[]           0.9801
  Mg 1O  1                  (C)[]           0.0113
  Mg 2Si 1                  (C)             0.0054
  Na 1                      (L)[]       2.86E-0004
*
```

100 wt% Mg

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       5.39E-0013
 Products heat capacity     (J/K)          25.3585
 Products entropy           (J/K)          35.7450
 Products enthalpy          (KJ)            0.9638
 Mass  of the system        (Kg)            0.0243
  Mg 1                      (C)[]           1.0000
*
```

Al/SiO_2

```
     Content of SiO2 - 0 wt% SiO2
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          24.9182
 Products entropy           (J/K)          31.3555
 Products enthalpy          (KJ)            0.9521
 Mass  of the system        (Kg)            0.0270
  Al 1                      (C)[]           1.0000
*
     1 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           370.9277
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          25.4473
 Products entropy           (J/K)          33.7383
 Products enthalpy          (KJ)           -3.2269
 Mass  of the system        (Kg)            0.0271
  Al 1                      (C)[]           0.9840
  Al 2O  3                  (C)[]           0.0113
  Si 1                      (C)[]           0.0047
*
     2 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       1.58E-0014
 Products heat capacity     (J/K)          25.7659
 Products entropy           (J/K)          34.8520
 Products enthalpy          (KJ)           -7.8828
 Mass  of the system        (Kg)            0.0273
  Al 1                      (C)[]           0.9680
  Al 2O  3                  (C)[]           0.0226
  Si 1                      (C)[]           0.0093
*
     3 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          25.8842
 Products entropy           (J/K)          34.8157
 Products enthalpy          (KJ)          -13.0318
 Mass  of the system        (Kg)            0.0274
  Al 1                      (C)[]           0.9520
  Al 2O  3                  (C)[]           0.0339
  Si 1                      (C)[]           0.0140
*
     4 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           433.0000
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          26.5523
 Products entropy           (J/K)          37.6624
 Products enthalpy          (KJ)          -17.0562
 Mass  of the system        (Kg)            0.0276
  Al 1                      (C)[]           0.9361
  Al 2O  3                  (C)[]           0.0453
  Si 1                      (C)[]           0.0187
*
     5 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
```

```
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          27.4949
 Products entropy           (J/K)          41.5361
 Products enthalpy          (KJ)          -20.5011
 Mass  of the system        (Kg)            0.0277
  Al 1                      (C)[]           0.9201
  Al 2O  3                  (C)[]           0.0566
  Si 1                      (C)[]           0.0234
*
```

6 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       2.11E-0014
 Products heat capacity     (J/K)          27.6470
 Products entropy           (J/K)          41.5337
 Products enthalpy          (KJ)          -25.8108
 Mass  of the system        (Kg)            0.0279
  Al 1                      (C)[]           0.9041
  Al 2O  3                  (C)[]           0.0679
  Si 1                      (C)[]           0.0280
*
```

7 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           543.0000
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          28.3478
 Products entropy           (J/K)          43.8464
 Products enthalpy          (KJ)          -29.9758
 Mass  of the system        (Kg)            0.0281
  Al 1                      (C)[]           0.8881
  Al 2O  3                  (C)[]           0.0792
  Si 1                      (C)[]           0.0327
*
```

8 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           589.4707
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          29.1248
 Products entropy           (J/K)          46.2230
 Products enthalpy          (KJ)          -34.0629
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8721
  Al 2O  3                  (C)[]           0.0905
  Si 1                      (C)[]           0.0374
*
```

7 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           543.0000
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          28.3478
 Products entropy           (J/K)          43.8464
 Products enthalpy          (KJ)          -29.9758
 Mass  of the system        (Kg)            0.0281
  Al 1                      (C)[]           0.8881
  Al 2O  3                  (C)[]           0.0792
  Si 1                      (C)[]           0.0327
*
```

8 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           570.7802
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          28.8750
 Products entropy           (J/K)          45.2886
 Products enthalpy          (KJ)          -34.6049
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8721
```

```
 Al 2O  3                  (C)[]          0.0905
 Si 1                      (C)[]          0.0374
*
    9 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          624.4318
Gas products amount        (mol)       1.50E-0014
Products heat capacity     (J/K)          29.7765
Products entropy           (J/K)          47.9490
Products enthalpy          (KJ)         -38.5110
Mass  of the system        (Kg)           0.0284
 Al 1                      (C)[]          0.8561
 Al 2O  3                  (C)[]          0.1018
 Si 1                      (C)[]          0.0421
*
    10 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          658.9059
Gas products amount        (mol)       3.73E-0012
Products heat capacity     (J/K)          30.4448
Products entropy           (J/K)          49.6063
Products enthalpy          (KJ)         -43.0100
Mass  of the system        (Kg)           0.0286
 Al 1                      (C)[]          0.8401
 Al 2O  3                  (C)[]          0.1131
 Si 1                      (C)[]          0.0467
*
    11 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          698.9899
Gas products amount        (mol)       1.50E-0014
Products heat capacity     (J/K)          31.2218
Products entropy           (J/K)          51.4767
Products enthalpy          (KJ)         -47.3689
Mass  of the system        (Kg)           0.0287
 Al 1                      (C)[]          0.8241
 Al 2O  3                  (C)[]          0.1244
 Si 1                      (C)[]          0.0514
*
    12 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          743.5277
Gas products amount        (mol)       1.02E-0010
Products heat capacity     (J/K)          32.1006
Products entropy           (J/K)          53.4930
Products enthalpy          (KJ)         -51.6114
Mass  of the system        (Kg)           0.0289
 Al 1                      (C)[]          0.8082
 Al 2O  3                  (C)[]          0.1358
 Si 1                      (C)[]          0.0561
*
    13 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          743.5277
Gas products amount        (mol)       1.16E-0011
Products heat capacity     (J/K)          32.2778
Products entropy           (J/K)          53.5604
Products enthalpy          (KJ)         -57.3283
Mass  of the system        (Kg)           0.0291
 Al 1                      (C)[]          0.7922
 Al 2O  3                  (C)[]          0.1471
 Si 1                      (C)[]          0.0608
*
    14 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
```

```
 Temperature                (K)          793.0141
 Gas products amount        (mol)       3.12E-0014
 Products heat capacity     (J/K)          33.2752
 Products entropy           (J/K)          55.7457
 Products enthalpy          (KJ)          -61.4863
 Mass  of the system        (Kg)            0.0292
  Al 1                      (C)[]           0.7762
  Al 2O  3                  (C)[]           0.1584
  Si 1                      (C)[]           0.0654
*
```

15 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          793.0141
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          33.4523
 Products entropy           (J/K)          55.8262
 Products enthalpy          (KJ)          -67.3313
 Mass  of the system        (Kg)            0.0294
  Al 1                      (C)[]           0.7602
  Al 2O  3                  (C)[]           0.1697
  Si 1                      (C)[]           0.0701
*
```

16 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          848.0000
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          34.5868
 Products entropy           (J/K)          58.1936
 Products enthalpy          (KJ)          -71.3726
 Mass  of the system        (Kg)            0.0296
  Al 1                      (C)[]           0.7442
  Al 2O  3                  (C)[]           0.1810
  Si 1                      (C)[]           0.0748
*
```

17 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          869.4083
 Gas products amount        (mol)       2.42E-0014
 Products heat capacity     (J/K)          35.1469
 Products entropy           (J/K)          59.1594
 Products enthalpy          (KJ)          -76.6016
 Mass  of the system        (Kg)            0.0298
  Al 1                      (C)[]           0.7282
  Al 2O  3                  (C)[]           0.1923
  Si 1                      (C)[]           0.0795
*
```

18 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          890.2017
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          35.7007
 Products entropy           (J/K)          60.0986
 Products enthalpy          (KJ)          -81.9104
 Mass  of the system        (Kg)            0.0300
  Al 1                      (C)[]           0.7122
  Al 2O  3                  (C)[]           0.2036
  Si 1                      (C)[]           0.0841
*
```

19 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          929.5861
 Gas products amount        (mol)       2.20E-0014
 Products heat capacity     (J/K)          36.6107
 Products entropy           (J/K)          61.7726
 Products enthalpy          (KJ)          -86.6016
 Mass  of the system        (Kg)            0.0301
```

```
 Al 1                        (C)[]          0.6962
 Al 2O  3                    (C)[]          0.2149
 Si 1                        (C)[]          0.0888
*
    20 wt% SiO2
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.1824      932.7282      933.6365
Gas products amount        (mol)       6.89E-0011    8.19E-0011    3.67E-0013
Products heat capacity     (J/K)          36.5802       36.8372       35.2247
Products entropy           (J/K)          63.4130       62.0108       70.8083
Products enthalpy          (KJ)          -91.3643      -92.6734      -84.4600
Phase transition enthalpy  (KJ)            8.2135
Mass  of the system        (Kg)            0.0303
 Al 1                      (C)[]          0.5718        0.6803        0.0000
 Al 1                      (L)[]          0.1084        0.0000        0.6803
 Al 2O  3                  (C)[]          0.2263        0.2263        0.2263
 Si 1                      (C)[]          0.0935        0.0935        0.0935
*
    21 wt% SiO2
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.3523      933.0641      933.6406
Gas products amount        (mol)       5.74E-0013    8.10E-0013    1.50E-0014
Products heat capacity     (J/K)          36.5392       37.0118       35.4212
Products entropy           (J/K)          64.7049       62.1400       70.7720
Products enthalpy          (KJ)          -96.5303      -98.9248      -90.8660
Phase transition enthalpy  (KJ)            8.0588
Mass  of the system        (Kg)            0.0305
 Al 1                      (C)[]          0.4669        0.6643        0.0000
 Al 1                      (L)[]          0.1974        0.0000        0.6643
 Al 2O  3                  (C)[]          0.2376        0.2376        0.2376
 Si 1                      (C)[]          0.0982        0.0982        0.0982
*
    22 wt% SiO2
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.4573      933.1320      933.7826
Gas products amount        (mol)       1.79E-0014    1.99E-0014    1.54E-0014
Products heat capacity     (J/K)          36.4917       37.1833       35.6204
Products entropy           (J/K)          66.0128       62.2602       70.7404
Products enthalpy          (KJ)         -101.7605     -105.2640      -97.3468
Phase transition enthalpy  (KJ)            7.9172
Mass  of the system        (Kg)            0.0307
 Al 1                      (C)[]          0.3614        0.6483        0.0000
 Al 1                      (L)[]          0.2869        0.0000        0.6483
 Al 2O  3                  (C)[]          0.2489        0.2489        0.2489
 Si 1                      (C)[]          0.1028        0.1028        0.1028
*
    23 wt% SiO2
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.3818      933.0525      933.7111
Gas products amount        (mol)       8.49E-0012    1.44E-0012    1.33E-0011
Products heat capacity     (J/K)          36.4409       37.3543       35.8217
Products entropy           (J/K)          67.3372       62.3759       70.7003
Products enthalpy          (KJ)         -107.0568     -111.6887     -103.9171
Phase transition enthalpy  (KJ)            7.7717
Mass  of the system        (Kg)            0.0309
 Al 1                      (C)[]          0.2554        0.6323        0.0000
 Al 1                      (L)[]          0.3768        0.0000        0.6323
 Al 2O  3                  (C)[]          0.2602        0.2602        0.2602
 Si 1                      (C)[]          0.1075        0.1075        0.1075
*
    24 wt% SiO2
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           932.8628      932.4454      933.2802
Gas products amount        (mol)       2.27E-0011    9.43E-0011    1.50E-0014
Products heat capacity     (J/K)          36.3841       37.5179       36.0258
Products entropy           (J/K)          68.6786       62.4720       70.6405
```

```
 Products enthalpy          (KJ)         -112.4210     -118.2156     -110.5895
 Phase transition enthalpy  (KJ)            7.6262
 Mass  of the system        (Kg)            0.0311
  Al 1                      (C)[]           0.1483        0.6163    3.99E-0004
  Al 1                      (L)[]           0.4680        0.0000        0.6159
  Al 2O  3                  (C)[]           0.2715        0.2715        0.2715
  Si 1                      (C)[]           0.1122        0.1122        0.1122
*
     25 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           937.4732
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          36.2407
 Products entropy           (J/K)          70.7697
 Products enthalpy          (KJ)         -117.1688
 Mass  of the system        (Kg)            0.0313
  Al 1                      (L)[]           0.6003
  Al 2O  3                  (C)[]           0.2828
  Si 1                      (C)[]           0.1169
*
     26 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           976.0870
 Gas products amount        (mol)       3.53E-0014
 Products heat capacity     (J/K)          36.5374
 Products entropy           (J/K)          72.2047
 Products enthalpy          (KJ)         -122.5826
 Mass  of the system        (Kg)            0.0315
  Al 1                      (L)[]           0.5843
  Al 2O  3                  (C)[]           0.2941
  Si 1                      (C)[]           0.1215
*
     27 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           991.1556
 Gas products amount        (mol)       4.75E-0013
 Products heat capacity     (J/K)          36.7877
 Products entropy           (J/K)          72.7381
 Products enthalpy          (KJ)         -128.9307
 Mass  of the system        (Kg)            0.0317
  Al 1                      (L)[]           0.5683
  Al 2O  3                  (C)[]           0.3054
  Si 1                      (C)[]           0.1262
*
     28 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1027.4014
 Gas products amount        (mol)       1.50E-0012
 Products heat capacity     (J/K)          37.0905
 Products entropy           (J/K)          74.0419
 Products enthalpy          (KJ)         -134.5774
 Mass  of the system        (Kg)            0.0319
  Al 1                      (L)[]           0.5524
  Al 2O  3                  (C)[]           0.3168
  Si 1                      (C)[]           0.1309
*
     29 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1063.5954
 Gas products amount        (mol)       4.76E-0014
 Products heat capacity     (J/K)          37.3990
 Products entropy           (J/K)          75.3162
 Products enthalpy          (KJ)         -140.2975
 Mass  of the system        (Kg)            0.0321
  Al 1                      (L)[]           0.5364
  Al 2O  3                  (C)[]           0.3281
```

```
  Si 1                      (C)[]           0.1356
*
     30 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1109.8141
 Gas products amount        (mol)       4.95E-0012
 Products heat capacity     (J/K)          37.7352
 Products entropy           (J/K)          76.9078
 Products enthalpy          (KJ)         -145.7137
 Mass  of the system        (Kg)            0.0323
  Al 1                      (L)[]           0.5204
  Al 2O  3                  (C)[]           0.3394
  Si 1                      (C)[]           0.1402
*
     31 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1135.8758
 Gas products amount        (mol)       2.94E-0011
 Products heat capacity     (J/K)          38.0343
 Products entropy           (J/K)          77.7892
 Products enthalpy          (KJ)         -151.9738
 Mass  of the system        (Kg)            0.0325
  Al 1                      (L)[]           0.5044
  Al 2O  3                  (C)[]           0.3507
  Si 1                      (C)[]           0.1449
*
     32 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1171.8663
 Gas products amount        (mol)       2.82E-0011
 Products heat capacity     (J/K)          38.3603
 Products entropy           (J/K)          78.9882
 Products enthalpy          (KJ)         -157.9174
 Mass  of the system        (Kg)            0.0328
  Al 1                      (L)[]           0.4884
  Al 2O  3                  (C)[]           0.3620
  Si 1                      (C)[]           0.1496
*
     33 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1200.0100
 Gas products amount        (mol)       2.42E-0012
 Products heat capacity     (J/K)          38.6761
 Products entropy           (J/K)          79.9174
 Products enthalpy          (KJ)         -164.2516
 Mass  of the system        (Kg)            0.0330
  Al 1                      (L)[]           0.4724
  Al 2O  3                  (C)[]           0.3733
  Si 1                      (C)[]           0.1543
*
     34 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1243.1147
 Gas products amount        (mol)       1.35E-0012
 Products heat capacity     (J/K)          39.0557
 Products entropy           (J/K)          81.3120
 Products enthalpy          (KJ)         -170.0865
 Mass  of the system        (Kg)            0.0332
  Al 1                      (L)[]           0.4564
  Al 2O  3                  (C)[]           0.3846
  Si 1                      (C)[]           0.1589
*
     35 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1279.4719
```

```
 Gas products amount        (mol)       1.20E-0011
 Products heat capacity     (J/K)          39.4266
 Products entropy           (J/K)          82.4751
 Products enthalpy          (KJ)         -176.2607
 Mass  of the system        (Kg)            0.0334
  Al 1                      (L)[]           0.4404
  Al 2O  3                  (C)[]           0.3960
  Si 1                      (C)[]           0.1636
*
```

36 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1315.1245
 Gas products amount        (mol)       9.35E-0014
 Products heat capacity     (J/K)          39.8062
 Products entropy           (J/K)          83.6039
 Products enthalpy          (KJ)         -182.5448
 Mass  of the system        (Kg)            0.0337
  Al 1                      (L)[]           0.4245
  Al 2O  3                  (C)[]           0.4073
  Si 1                      (C)[]           0.1683
*
```

37 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1350.6694
 Gas products amount        (mol)       5.33E-0011
 Products heat capacity     (J/K)          40.1965
 Products entropy           (J/K)          84.7188
 Products enthalpy          (KJ)         -188.9160
 Mass  of the system        (Kg)            0.0339
  Al 1                      (L)[]           0.4085
  Al 2O  3                  (C)[]           0.4186
  Si 1                      (C)[]           0.1730
*
```

38 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1386.2533
 Gas products amount        (mol)       4.28E-0012
 Products heat capacity     (J/K)          40.5981
 Products entropy           (J/K)          85.8257
 Products enthalpy          (KJ)         -195.3697
 Mass  of the system        (Kg)            0.0341
  Al 1                      (L)[]           0.3925
  Al 2O  3                  (C)[]           0.4299
  Si 1                      (C)[]           0.1776
*
```

39 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1421.6127
 Gas products amount        (mol)       1.73E-0011
 Products heat capacity     (J/K)          41.0103
 Products entropy           (J/K)          86.9182
 Products enthalpy          (KJ)         -201.9183
 Mass  of the system        (Kg)            0.0344
  Al 1                      (L)[]           0.3765
  Al 2O  3                  (C)[]           0.4412
  Si 1                      (C)[]           0.1823
*
```

40 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1456.8470
 Gas products amount        (mol)       8.63E-0011
 Products heat capacity     (J/K)          41.4337
 Products entropy           (J/K)          88.0007
 Products enthalpy          (KJ)         -208.5591
 Mass  of the system        (Kg)            0.0346
  Al 1                      (L)[]           0.3605
```

```
 Al 2O  3                  (C)[]          0.4525
 Si 1                      (C)[]          0.1870
*
    41 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1504.7847
Gas products amount        (mol)      2.09E-0011
Products heat capacity     (J/K)         41.9132
Products entropy           (J/K)         89.4331
Products enthalpy          (KJ)        -214.7575
Mass  of the system        (Kg)           0.0349
 Al 1                      (L)[]          0.3445
 Al 2O  3                  (C)[]          0.4638
 Si 1                      (C)[]          0.1916
*
    42 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1518.2132
Gas products amount        (mol)      5.99E-0011
Products heat capacity     (J/K)         42.2838
Products entropy           (J/K)         89.8982
Products enthalpy          (KJ)        -222.4952
Mass  of the system        (Kg)           0.0351
 Al 1                      (L)[]          0.3285
 Al 2O  3                  (C)[]          0.4751
 Si 1                      (C)[]          0.1963
*
    43 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1544.3213
Gas products amount        (mol)      3.54E-0012
Products heat capacity     (J/K)         42.7089
Products entropy           (J/K)         90.7194
Products enthalpy          (KJ)        -229.8021
Mass  of the system        (Kg)           0.0354
 Al 1                      (L)[]          0.3125
 Al 2O  3                  (C)[]          0.4865
 Si 1                      (C)[]          0.2010
*
    44 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1596.5056
Gas products amount        (mol)      1.06E-0010
Products heat capacity     (J/K)         43.2437
Products entropy           (J/K)         92.2541
Products enthalpy          (KJ)        -236.0858
Mass  of the system        (Kg)           0.0356
 Al 1                      (L)[]          0.2966
 Al 2O  3                  (C)[]          0.4978
 Si 1                      (C)[]          0.2057
*
    45 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)         1616.7641
Gas products amount        (mol)      1.40E-0010
Products heat capacity     (J/K)         43.6703
Products entropy           (J/K)         92.9181
Products enthalpy          (KJ)        -243.8443
Mass  of the system        (Kg)           0.0359
 Al 1                      (L)[]          0.2806
 Al 2O  3                  (C)[]          0.5091
 Si 1                      (C)[]          0.2103
*
    46 wt% SiO2
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
```

```
 Temperature                (K)          1683.0158
 Gas products amount        (mol)       1.72E-0010
 Products heat capacity     (J/K)          44.2917
 Products entropy           (J/K)          94.8114
 Products enthalpy          (KJ)         -249.6801
 Mass  of the system        (Kg)            0.0361
  Al 1                      (L)[]           0.2646
  Al 2O  3                  (C)[]           0.5204
  Si 1                      (C)[]           0.2150
*
     47 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1683.0158
 Gas products amount        (mol)       9.99E-0011
 Products heat capacity     (J/K)          44.6596
 Products entropy           (J/K)          94.9478
 Products enthalpy          (KJ)         -258.5488
 Mass  of the system        (Kg)            0.0364
  Al 1                      (L)[]           0.2486
  Al 2O  3                  (C)[]           0.5317
  Si 1                      (C)[]           0.2197
*
     48 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.8027     1689.5913     1690.0140
 Gas products amount        (mol)       1.46E-0010    1.56E-0010    8.35E-0011
 Products heat capacity     (J/K)          44.9847       45.0610       44.4969
 Products entropy           (J/K)          96.4406       95.2618      103.9794
 Products enthalpy          (KJ)         -265.2613     -267.2535     -252.5208
 Phase transition enthalpy  (KJ)           14.7327
 Mass  of the system        (Kg)            0.0367
  Al 1                      (L)[]           0.2326        0.2326        0.2326
  Al 2O  3                  (C)[]           0.5430        0.5430        0.5430
  Si 1                      (C)[]           0.1940        0.2244        0.0000
  Si 1                      (L)[]           0.0303        0.0000        0.2244
*
     49 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1690.2701     1689.8027     1690.7376
 Gas products amount        (mol)       8.54E-0011    5.80E-0011    1.92E-0010
 Products heat capacity     (J/K)          45.3064       45.4203       44.8631
 Products entropy           (J/K)          97.5085       95.7412      104.3891
 Products enthalpy          (KJ)         -272.8315     -275.8184     -261.2033
 Phase transition enthalpy  (KJ)           14.6151
 Mass  of the system        (Kg)            0.0370
  Al 1                      (L)[]           0.2166        0.2166        0.2166
  Al 2O  3                  (C)[]           0.5543        0.5543        0.5543
  Si 1                      (C)[]           0.1755        0.2206        0.0000
  Si 1                      (L)[]           0.0536        0.0085        0.2290
*
     50 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.9231     1689.5761     1690.2701
 Gas products amount        (mol)       1.16E-0010    1.42E-0010    6.41E-0011
 Products heat capacity     (J/K)          45.6299       45.8265       45.2309
 Products entropy           (J/K)          98.5927       95.5475      104.7733
 Products enthalpy          (KJ)         -280.5166     -285.6629     -270.0714
 Phase transition enthalpy  (KJ)           15.5915
 Mass  of the system        (Kg)            0.0372
  Al 1                      (L)[]           0.2006        0.2006        0.2006
  Al 2O  3                  (C)[]           0.5656        0.5656        0.5656
  Si 1                      (C)[]           0.1566        0.2337        0.0000
  Si 1                      (L)[]           0.0771        0.0000        0.2337
*
     51 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
```

```
 Temperature                (K)          1689.9371     1689.6624     1690.2118
 Gas products amount        (mol)       2.55E-0010    3.27E-0010    1.56E-0010
 Products heat capacity     (J/K)          45.9600       46.2184       45.6056
 Products entropy           (J/K)          99.6934       95.6962      105.1743
 Products enthalpy          (KJ)         -288.3195     -295.0747     -279.0568
 Phase transition enthalpy  (KJ)           16.0179
 Mass  of the system        (Kg)           0.0375
  Al 1                      (L)[]          0.1846        0.1846        0.1846
  Al 2O  3                  (C)[]          0.5770        0.5770        0.5770
  Si 1                      (C)[]          0.1379        0.2384        0.0000
  Si 1                      (L)[]          0.1005        0.0000        0.2384
*
     52 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6691     1689.4011     1689.9371
 Gas products amount        (mol)       9.78E-0011    8.70E-0011    1.07E-0010
 Products heat capacity     (J/K)          46.2934       46.6148       46.0088
 Products entropy           (J/K)         100.8111       95.8376      105.2155
 Products enthalpy          (KJ)         -296.2427     -304.6478     -288.7992
 Phase transition enthalpy  (KJ)           15.8486
 Mass  of the system        (Kg)           0.0378
  Al 1                      (L)[]          0.1687        0.1687        0.1687
  Al 2O  3                  (C)[]          0.5883        0.5883        0.5883
  Si 1                      (C)[]          0.1189        0.2431        0.0090
  Si 1                      (L)[]          0.1241        0.0000        0.2341
*
     53 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.8379     1689.6691     1690.0066
 Gas products amount        (mol)       4.51E-0011    6.57E-0011    3.11E-0011
 Products heat capacity     (J/K)          46.6344       47.0198       46.3723
 Products entropy           (J/K)         101.9462       95.9960      105.9926
 Products enthalpy          (KJ)         -304.2890     -314.3448     -297.4505
 Phase transition enthalpy  (KJ)           16.8943
 Mass  of the system        (Kg)           0.0381
  Al 1                      (L)[]          0.1527        0.1527        0.1527
  Al 2O  3                  (C)[]          0.5996        0.5996        0.5996
  Si 1                      (C)[]          0.1003        0.2477        0.0000
  Si 1                      (L)[]          0.1475        0.0000        0.2477
*
     54 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.3533     1688.8687     1689.8379
 Gas products amount        (mol)       5.78E-0011    4.20E-0011    6.45E-0011
 Products heat capacity     (J/K)          46.9776       47.4260       46.7891
 Products entropy           (J/K)         103.0991       96.1268      106.0297
 Products enthalpy          (KJ)         -312.4621     -324.2452     -307.5093
 Phase transition enthalpy  (KJ)           16.7359
 Mass  of the system        (Kg)           0.0384
  Al 1                      (L)[]          0.1367        0.1367        0.1367
  Al 2O  3                  (C)[]          0.6109        0.6109        0.6109
  Si 1                      (C)[]          0.0813        0.2524        0.0093
  Si 1                      (L)[]          0.1711        0.0000        0.2431
*
     55 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.6927     1689.3533     1690.0320
 Gas products amount        (mol)       2.21E-0010    6.64E-0010    7.83E-0011
 Products heat capacity     (J/K)          47.3302       47.8449       47.1641
 Products entropy           (J/K)         104.2702       96.2961      106.8432
 Products enthalpy          (KJ)         -320.7636     -334.2399     -316.4152
 Phase transition enthalpy  (KJ)           17.8247
 Mass  of the system        (Kg)           0.0387
  Al 1                      (L)[]          0.1207        0.1207        0.1207
  Al 2O  3                  (C)[]          0.6222        0.6222        0.6222
  Si 1                      (C)[]          0.0627        0.2571        0.0000
  Si 1                      (L)[]          0.1944        0.0000        0.2571
```

*

56 wt% SiO2

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.8536	1689.6927	1690.0146
Gas products amount	(mol)	1.26E-0010	5.83E-0010	3.37E-0011
Products heat capacity	(J/K)	47.6871	48.2700	47.5693
Products entropy	(J/K)	105.4600	96.4639	107.2779
Products enthalpy	(KJ)	-329.1983	-344.4018	-326.1262
Phase transition enthalpy	(KJ)	18.2757		
Mass of the system	(Kg)	0.0390		
Al 1	(L)[]	0.1047	0.1047	0.1047
Al 2O 3	(C)[]	0.6335	0.6335	0.6335
Si 1	(C)[]	0.0440	0.2618	0.0000
Si 1	(L)[]	0.2178	0.0000	0.2618

*

57 wt% SiO2

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1689.9356	1689.8536	1690.0176
Gas products amount	(mol)	1.40E-0010	2.87E-0011	1.53E-0010
Products heat capacity	(J/K)	48.0494	48.6742	47.9812
Products entropy	(J/K)	106.6689	97.0399	107.7201
Products enthalpy	(KJ)	-337.7678	-354.0409	-335.9914
Phase transition enthalpy	(KJ)	18.0495		
Mass of the system	(Kg)	0.0393		
Al 1	(L)[]	0.0887	0.0887	0.0887
Al 2O 3	(C)[]	0.6448	0.6448	0.6448
Si 1	(C)[]	0.0253	0.2566	0.0000
Si 1	(L)[]	0.2412	0.0099	0.2664

*

58 wt% SiO2

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	1694.0520
Gas products amount	(mol)	1.35E-0010
Products heat capacity	(J/K)	48.4167
Products entropy	(J/K)	108.2848
Products enthalpy	(KJ)	-345.8220
Mass of the system	(Kg)	0.0397
Al 1	(L)[]	0.0727
Al 2O 3	(C)[]	0.6562
Si 1	(L)[]	0.2711

*

59 wt% SiO2

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	1694.0520
Gas products amount	(mol)	2.15E-0010
Products heat capacity	(J/K)	48.8425
Products entropy	(J/K)	108.7424
Products enthalpy	(KJ)	-356.0097
Mass of the system	(Kg)	0.0400
Al 1	(L)[]	0.0567
Al 2O 3	(C)[]	0.6675
Si 1	(L)[]	0.2758

*

60 wt% SiO2

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	1734.6737
Gas products amount	(mol)	1.28E-0010
Products heat capacity	(J/K)	49.4558
Products entropy	(J/K)	110.3773
Products enthalpy	(KJ)	-364.3589
Mass of the system	(Kg)	0.0403
Al 1	(L)[]	0.0408
Al 2O 3	(C)[]	0.6788
Si 1	(L)[]	0.2805

*

61 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1762.1647
 Gas products amount        (mol)       1.03E-0010
 Products heat capacity     (J/K)          50.0256
 Products entropy           (J/K)         111.6463
 Products enthalpy          (KJ)         -373.4948
 Mass  of the system        (Kg)            0.0406
  Al 1                      (L)[]           0.0248
  Al 2O  3                  (C)[]           0.6901
  Si 1                      (L)[]           0.2851
*
```

62 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1789.3360
 Gas products amount        (mol)       1.63E-0010
 Products heat capacity     (J/K)          50.6075
 Products entropy           (J/K)         112.9182
 Products enthalpy          (KJ)         -382.7932
 Mass  of the system        (Kg)            0.0410
  Al 1                      (L)[]           0.0088
  Al 2O  3                  (C)[]           0.7014
  Si 1                      (L)[]           0.2898
*
```

63 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1789.3360
 Gas products amount        (mol)       1.70E-0010
 Products heat capacity     (J/K)          51.0557
 Products entropy           (J/K)         113.5870
 Products enthalpy          (KJ)         -392.1797
 Mass  of the system        (Kg)            0.0413
  Al 2O  3                  (C)[]           0.6991
  O  2Si 1                  (C)  [CRIST     0.0120
  Si 1                      (L)[]           0.2889
*
```

64 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1752.2891
 Gas products amount        (mol)       1.58E-0010
 Products heat capacity     (J/K)          51.3138
 Products entropy           (J/K)         113.3821
 Products enthalpy          (KJ)         -401.8438
 Mass  of the system        (Kg)            0.0417
  Al 2O  3                  (C)[]           0.6802
  O  2Si 1                  (C)  [CRIST     0.0387
  Si 1                      (L)[]           0.2811
*
```

65 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1716.0933
 Gas products amount        (mol)       3.19E-0010
 Products heat capacity     (J/K)          51.5827
 Products entropy           (J/K)         113.1798
 Products enthalpy          (KJ)         -411.6231
 Mass  of the system        (Kg)            0.0420
  Al 2O  3                  (C)[]           0.6613
  O  2Si 1                  (C)  [CRIST     0.0654
  Si 1                      (L)[]           0.2732
*
```

66 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1691.5552
 Gas products amount        (mol)       1.08E-0010
 Products heat capacity     (J/K)          51.9143
 Products entropy           (J/K)         113.3134
```

```
 Products enthalpy          (KJ)         -420.9614
 Mass  of the system        (Kg)            0.0424
  Al 2O  3                  (C)[]           0.6424
  O  2Si 1                  (C)  [CRIST     0.0921
  Si 1                      (L)[]           0.2654
*
     67 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.7241     1689.4409     1690.0072
 Gas products amount        (mol)       1.57E-0010    2.06E-0010    1.50E-0010
 Products heat capacity     (J/K)          52.4562       53.1170       52.3629
 Products entropy           (J/K)         112.7113      102.4826      114.1562
 Products enthalpy          (KJ)         -431.6986     -448.9850     -429.2567
 Phase transition enthalpy  (KJ)           19.7283
 Mass  of the system        (Kg)            0.0428
  Al 2O  3                  (C)[]           0.6235        0.6235        0.6235
  O  2Si 1                  (C)  [CRIST     0.1188        0.1188        0.1188
  Si 1                      (C)[]           0.0319        0.2576        0.0000
  Si 1                      (L)[]           0.2257        0.0000        0.2576
*
     68 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.8717     1689.7241     1690.0193
 Gas products amount        (mol)       1.58E-0010    6.83E-0011    1.85E-0010
 Products heat capacity     (J/K)          52.9951       53.5663       52.8270
 Products entropy           (J/K)         112.4674      103.6512      115.0627
 Products enthalpy          (KJ)         -442.0016     -456.9011     -437.6156
 Phase transition enthalpy  (KJ)           19.2854
 Mass  of the system        (Kg)            0.0431
  Al 2O  3                  (C)[]           0.6046        0.6046        0.6046
  O  2Si 1                  (C)  [CRIST     0.1455        0.1455        0.1455
  Si 1                      (C)[]           0.0568        0.2498        0.0000
  Si 1                      (L)[]           0.1930        0.0000        0.2498
*
     69 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.5679     1689.2640     1689.8717
 Gas products amount        (mol)       2.40E-0010    2.96E-0010    2.16E-0010
 Products heat capacity     (J/K)          53.5415       54.0190       53.3343
 Products entropy           (J/K)         112.2192      104.8167      115.4302
 Products enthalpy          (KJ)         -452.4883     -464.9985     -447.0618
 Phase transition enthalpy  (KJ)           17.9367
 Mass  of the system        (Kg)            0.0435
  Al 2O  3                  (C)[]           0.5857        0.5857        0.5857
  O  2Si 1                  (C)  [CRIST     0.1722        0.1722        0.1722
  Si 1                      (C)[]           0.0816        0.2420        0.0119
  Si 1                      (L)[]           0.1605        0.0000        0.2301
*
     70 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.7907     1689.5679     1690.0135
 Gas products amount        (mol)       1.27E-0010    1.03E-0010    1.48E-0010
 Products heat capacity     (J/K)          54.1006       54.4846       53.7800
 Products entropy           (J/K)         111.9666      106.0279      116.9235
 Products enthalpy          (KJ)         -463.1633     -473.1997     -454.7862
 Phase transition enthalpy  (KJ)           18.4136
 Mass  of the system        (Kg)            0.0439
  Al 2O  3                  (C)[]           0.5668        0.5668        0.5668
  O  2Si 1                  (C)  [CRIST     0.1989        0.1989        0.1989
  Si 1                      (C)[]           0.1066        0.2342        0.0000
  Si 1                      (L)[]           0.1277        0.0000        0.2342
*
     71 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.3308     1688.8710     1689.7907
 Gas products amount        (mol)       6.89E-0011    7.47E-0011    6.16E-0011
```

```
 Products heat capacity     (J/K)          54.6647       54.9525       54.3052
 Products entropy           (J/K)         111.7093      107.2284      117.3060
 Products enthalpy          (KJ)         -474.0312     -481.6040     -464.5728
 Phase transition enthalpy  (KJ)           17.0312
 Mass  of the system        (Kg)            0.0443
  Al 2O  3                  (C)[]           0.5479        0.5479        0.5479
  O  2Si 1                  (C)  [CRIST     0.2256        0.2256        0.2256
  Si 1                      (C)[]           0.1311        0.2264        0.0121
  Si 1                      (L)[]           0.0953        0.0000        0.2143
*
     72 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.7097     1689.3308     1690.0885
 Gas products amount        (mol)       1.07E-0010    1.40E-0010    2.32E-0011
 Products heat capacity     (J/K)          55.2454       55.4359       54.7682
 Products entropy           (J/K)         111.4474      108.4887      118.8548
 Products enthalpy          (KJ)         -485.0972     -490.0975     -472.5787
 Phase transition enthalpy  (KJ)           17.5188
 Mass  of the system        (Kg)            0.0447
  Al 2O  3                  (C)[]           0.5291        0.5291        0.5291
  O  2Si 1                  (C)  [CRIST     0.2523        0.2523        0.2523
  Si 1                      (C)[]           0.1562        0.2186        0.0000
  Si 1                      (L)[]           0.0624        0.0000        0.2186
*
     73 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1690.0645     1689.7097     1690.4194
 Gas products amount        (mol)       6.30E-0011    5.06E-0011    1.39E-0010
 Products heat capacity     (J/K)          55.8368       55.9278       55.2774
 Products entropy           (J/K)         111.1807      109.7695      119.8568
 Products enthalpy          (KJ)         -496.3670     -498.7518     -481.7044
 Phase transition enthalpy  (KJ)           17.0474
 Mass  of the system        (Kg)            0.0451
  Al 2O  3                  (C)[]           0.5102        0.5102        0.5102
  O  2Si 1                  (C)  [CRIST     0.2790        0.2790        0.2790
  Si 1                      (C)[]           0.1813        0.2108        0.0000
  Si 1                      (L)[]           0.0295        0.0000        0.2108
*
     74 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1679.5136
 Gas products amount        (mol)       7.20E-0011
 Products heat capacity     (J/K)          56.3655
 Products entropy           (J/K)         110.7204
 Products enthalpy          (KJ)         -508.1645
 Mass  of the system        (Kg)            0.0456
  Al 2O  3                  (C)[]           0.4913
  O  2Si 1                  (C)  [CRIST     0.3058
  Si 1                      (C)[]           0.2030
*
     75 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1643.9481
 Gas products amount        (mol)       3.77E-0011
 Products heat capacity     (J/K)          56.6624
 Products entropy           (J/K)         110.8185
 Products enthalpy          (KJ)         -519.1915
 Mass  of the system        (Kg)            0.0460
  Al 2O  3                  (C)[]           0.4724
  O  2Si 1                  (C)  [CRIST     0.3325
  Si 1                      (C)[]           0.1952
*
     76 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1603.5740
 Gas products amount        (mol)       5.00E-0011
```

```
 Products heat capacity     (J/K)          56.9430
 Products entropy           (J/K)         110.7267
 Products enthalpy          (KJ)         -530.6926
 Mass  of the system        (Kg)            0.0464
  Al 2O  3                  (C)[]           0.4535
  O  2Si 1                  (C)  [CRIST     0.3592
  Si 1                      (C)[]           0.1874
*
     77 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1564.8540
 Gas products amount        (mol)       6.17E-0011
 Products heat capacity     (J/K)          58.1697
 Products entropy           (J/K)         109.9320
 Products enthalpy          (KJ)         -543.6056
 Mass  of the system        (Kg)            0.0469
  Al 2O  5Si 1              (C)  [ANDAL     0.6907
  O  2Si 1                  (C)  [CRIST     0.1298
  Si 1                      (C)[]           0.1796
*
     78 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1519.3219
 Gas products amount        (mol)       5.69E-0011
 Products heat capacity     (J/K)          58.3495
 Products entropy           (J/K)         109.5813
 Products enthalpy          (KJ)         -555.8231
 Mass  of the system        (Kg)            0.0473
  Al 2O  5Si 1              (C)  [ANDAL     0.6606
  O  2Si 1                  (C)  [CRIST     0.1676
  Si 1                      (C)[]           0.1718
*
     79 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1471.0037
 Gas products amount        (mol)       9.32E-0013
 Products heat capacity     (J/K)          59.2301
 Products entropy           (J/K)         109.2415
 Products enthalpy          (KJ)         -568.8701
 Mass  of the system        (Kg)            0.0478
  Al 2O  5Si 1              (C)  [KIANI     0.6306
  O  2Si 1                  (C)  [CRIST     0.2054
  Si 1                      (C)[]           0.1639
*
     80 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1426.4334
 Gas products amount        (mol)       1.38E-0011
 Products heat capacity     (J/K)          59.3956
 Products entropy           (J/K)         108.8008
 Products enthalpy          (KJ)         -581.4892
 Mass  of the system        (Kg)            0.0482
  Al 2O  5Si 1              (C)  [KIANI     0.6006
  O  2Si 1                  (C)  [CRIST     0.2433
  Si 1                      (C)[]           0.1561
*
     81 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1377.2139
 Gas products amount        (mol)       8.18E-0012
 Products heat capacity     (J/K)          59.5421
 Products entropy           (J/K)         108.1070
 Products enthalpy          (KJ)         -594.6151
 Mass  of the system        (Kg)            0.0487
  Al 2O  5Si 1              (C)  [KIANI     0.5706
  O  2Si 1                  (C)  [CRIST     0.2811
```

```
  Si 1                      (C)[]           0.1483
*
     82 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1327.3617
 Gas products amount        (mol)       1.58E-0012
 Products heat capacity     (J/K)          59.7010
 Products entropy           (J/K)         107.3117
 Products enthalpy          (KJ)         -608.0184
 Mass  of the system        (Kg)            0.0492
  Al 2O  5Si 1              (C)  [KIANI     0.5405
  O  2Si 1                  (C)  [CRIST     0.3189
  Si 1                      (C)[]           0.1405
*
     83 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1277.4917
 Gas products amount        (mol)       5.22E-0014
 Products heat capacity     (J/K)          59.8763
 Products entropy           (J/K)         106.4324
 Products enthalpy          (KJ)         -621.6699
 Mass  of the system        (Kg)            0.0497
  Al 2O  5Si 1              (C)  [KIANI     0.5105
  O  2Si 1                  (C)  [CRIST     0.3568
  Si 1                      (C)[]           0.1327
*
     84 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1225.6052
 Gas products amount        (mol)       1.26E-0012
 Products heat capacity     (J/K)          60.0511
 Products entropy           (J/K)         105.3624
 Products enthalpy          (KJ)         -635.7003
 Mass  of the system        (Kg)            0.0502
  Al 2O  5Si 1              (C)  [KIANI     0.4805
  O  2Si 1                  (C)  [CRIST     0.3946
  Si 1                      (C)[]           0.1249
*
     85 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1176.4054
 Gas products amount        (mol)       6.64E-0012
 Products heat capacity     (J/K)          60.2599
 Products entropy           (J/K)         104.3187
 Products enthalpy          (KJ)         -649.8346
 Mass  of the system        (Kg)            0.0507
  Al 2O  5Si 1              (C)  [KIANI     0.4504
  O  2Si 1                  (C)  [CRIST     0.4325
  Si 1                      (C)[]           0.1171
*
     86 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1125.2545
 Gas products amount        (mol)       4.57E-0011
 Products heat capacity     (J/K)          60.4630
 Products entropy           (J/K)         103.0599
 Products enthalpy          (KJ)         -664.3622
 Mass  of the system        (Kg)            0.0513
  Al 2O  5Si 1              (C)  [KIANI     0.4204
  O  2Si 1                  (C)  [CRIST     0.4703
  Si 1                      (C)[]           0.1093
*
     87 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1079.8121
```

```
 Gas products amount        (mol)       8.05E-0014
 Products heat capacity     (J/K)          60.4429
 Products entropy           (J/K)         101.1378
 Products enthalpy          (KJ)         -679.7468
 Mass  of the system        (Kg)            0.0518
  Al 2O  5Si 1              (C)  [KIANI     0.3904
  O  2Si 1                  (C)  [CRIST     0.0525
  O  2Si 1                  (C)  [QUART     0.4556
  Si 1                      (C)[]           0.1015
*
     88 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1032.6310
 Gas products amount        (mol)       2.87E-0011
 Products heat capacity     (J/K)          60.5694
 Products entropy           (J/K)          99.6861
 Products enthalpy          (KJ)         -694.7876
 Mass  of the system        (Kg)            0.0524
  Al 2O  5Si 1              (C)  [KIANI     0.3604
  O  2Si 1                  (C)  [QUART     0.5460
  Si 1                      (C)[]           0.0937
*
     89 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           988.5014
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          60.7652
 Products entropy           (J/K)          98.3863
 Products enthalpy          (KJ)         -709.8359
 Mass  of the system        (Kg)            0.0529
  Al 2O  5Si 1              (C)  [KIANI     0.3303
  O  2Si 1                  (C)[]           0.0019
  O  2Si 1                  (C)  [QUART     0.5819
  Si 1                      (C)[]           0.0859
*
     90 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           936.6296
 Gas products amount        (mol)       5.31E-0014
 Products heat capacity     (J/K)          60.8904
 Products entropy           (J/K)          96.4450
 Products enthalpy          (KJ)         -725.6723
 Mass  of the system        (Kg)            0.0535
  Al 2O  5Si 1              (C)  [KIANI     0.3003
  O  2Si 1                  (C)[]           0.5552
  O  2Si 1                  (C)  [QUART     0.0664
  Si 1                      (C)[]           0.0781
*
     91 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           881.9523
 Gas products amount        (mol)       2.41E-0013
 Products heat capacity     (J/K)          60.9945
 Products entropy           (J/K)          94.1290
 Products enthalpy          (KJ)         -741.9848
 Mass  of the system        (Kg)            0.0541
  Al 2O  5Si 1              (C)  [KIANI     0.2703
  O  2Si 1                  (C)[]       8.02E-0004
  O  2Si 1                  (C)  [QUART     0.6587
  Si 1                      (C)[]           0.0703
*
     92 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.0000
 Gas products amount        (mol)       2.82E-0011
 Products heat capacity     (J/K)          71.1820
```

```
 Products entropy           (J/K)          92.7428
 Products enthalpy          (KJ)         -757.6418
 Mass  of the system        (Kg)            0.0547
  Al 2O  5Si 1              (C)  [KIANI     0.2402
  O  2Si 1                  (C)[]           0.6973
  Si 1                      (C)[]           0.6625
*
```

93 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           793.0141
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          67.2171
 Products entropy           (J/K)          89.4018
 Products enthalpy          (KJ)         -775.1146
 Mass  of the system        (Kg)            0.0553
  Al 2O  5Si 1              (C)  [KIANI     0.2102
  O  2Si 1                  (C)[]           0.7351
  Si 1                      (C)[]           0.0546
*
```

94 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           743.5277
 Gas products amount        (mol)       1.22E-0010
 Products heat capacity     (J/K)          64.8760
 Products entropy           (J/K)          86.3974
 Products enthalpy          (KJ)         -792.4233
 Mass  of the system        (Kg)            0.0560
  Al 2O  5Si 1              (C)  [KIANI     0.1802
  O  2Si 1                  (C)[]           0.7730
  Si 1                      (C)[]           0.0468
*
```

95 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           698.9899
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          63.5831
 Products entropy           (J/K)          83.6472
 Products enthalpy          (KJ)         -809.6967
 Mass  of the system        (Kg)            0.0566
  Al 2O  5Si 1              (C)  [KIANI     0.1501
  O  2Si 1                  (C)[]           0.8108
  Si 1                      (C)[]           0.0390
*
```

96 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           637.3091
 Gas products amount        (mol)       4.46E-0013
 Products heat capacity     (J/K)          62.2287
 Products entropy           (J/K)          79.0171
 Products enthalpy          (KJ)         -828.3710
 Mass  of the system        (Kg)            0.0573
  Al 2O  5Si 1              (C)  [KIANI     0.1201
  O  2Si 1                  (C)[]           0.8487
  Si 1                      (C)[]           0.0312
*
```

97 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           578.0909
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          61.2470
 Products entropy           (J/K)          74.1208
 Products enthalpy          (KJ)         -847.2260
 Mass  of the system        (Kg)            0.0580
  Al 2O  5Si 1              (C)  [KIANI     0.0901
  O  2Si 1                  (C)[]           0.8865
  Si 1                      (C)[]           0.0234
```

```
*
     98 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           543.0000
 Gas products amount        (mol)       1.78E-0014
 Products heat capacity     (J/K)          60.8407
 Products entropy           (J/K)          71.3827
 Products enthalpy          (KJ)         -864.9695
 Mass  of the system        (Kg)            0.0586
  Al 2O  5Si 1              (C)  [KIANI     0.0601
  O  2Si 1                  (C)[]           0.9243
  Si 1                      (C)[]           0.0156
*
     99 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           537.0073      536.5907      537.4240
 Gas products amount        (mol)       5.99E-0011    7.66E-0011    1.50E-0014
 Products heat capacity     (J/K)          77.1991       81.6242       61.4296
 Products entropy           (J/K)          64.4212       62.3411       71.8337
 Products enthalpy          (KJ)         -885.2861     -886.4030     -881.3057
 Phase transition enthalpy  (KJ)            5.0974
 Mass  of the system        (Kg)            0.0594
  Al 2O  5Si 1              (C)  [KIANI     0.0300        0.0300        0.0300
  O  2Si 1                  (C)[]           0.2108        0.0000        0.9622
  O  2Si 1                  (L)[]           0.7513        0.9622        0.0000
  Si 1                      (C)[]           0.0078        0.0078        0.0078
*
     100 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       1.50E-0014
 Products heat capacity     (J/K)          83.5000
 Products entropy           (J/K)          57.0591
 Products enthalpy          (KJ)         -906.1113
 Mass  of the system        (Kg)            0.0601
  O  2Si 1                  (L)[]           1.0000
```

Mg/SiO_2

```
     Content of SiO2 - 0 wt% SiO2
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           336.8270
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          25.3581
 Products entropy           (J/K)          35.7447
 Products enthalpy          (KJ)            0.9707
 Mass  of the system        (Kg)            0.0243
  Mg 1                      (C)[]           1.0000
*
     1 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          26.0597
 Products entropy           (J/K)          39.2834
 Products enthalpy          (KJ)           -2.9183
 Mass  of the system        (Kg)            0.0245
  Mg 1                      (C)[]           0.9738
  Mg 1O  1                  (C)[]           0.0134
  Mg 2Si 1                  (C)             0.0128
*
     2 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           388.0000
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          26.1755
 Products entropy           (J/K)          39.1937
 Products enthalpy          (KJ)           -8.1852
 Mass  of the system        (Kg)            0.0246
  Mg 1                      (C)[]           0.9476
  Mg 1O  1                  (C)[]           0.0268
  Mg 2Si 1                  (C)             0.0255
*
     3 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           474.3304
 Gas products amount        (mol)       1.24E-0013
 Products heat capacity     (J/K)          27.3081
 Products entropy           (J/K)          44.4849
 Products enthalpy          (KJ)          -11.2005
  Mg 1                      (C)[]           0.9382
  Mg 1O  1                  (C)[]           0.0247
  Mg 2Si 1                  (C)             0.0124
*
     4 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           543.0000
 Gas products amount        (mol)       4.56E-0012
 Products heat capacity     (J/K)          28.2199
 Products entropy           (J/K)          48.1807
 Products enthalpy          (KJ)          -14.6729
 Mass  of the system        (Kg)            0.0249
  Mg 1                      (C)[]           0.8953
  Mg 1O  1                  (C)[]           0.0537
  Mg 2Si 1                  (C)             0.0511
*
     5 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           570.2453
 Gas products amount        (mol)       3.37E-0011
```

```
 Products heat capacity     (J/K)          28.6634
 Products entropy           (J/K)          49.5284
 Products enthalpy          (KJ)          -19.3379
 Mass  of the system        (Kg)            0.0251
  Mg 1                      (C)[]           0.8691
  Mg 1O  1                  (C)[]           0.0671
  Mg 2Si 1                  (C)             0.0638
*
     6 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           639.4229
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          29.5630
 Products entropy           (J/K)          52.8275
 Products enthalpy          (KJ)          -22.8218
 Mass  of the system        (Kg)            0.0252
  Mg 1                      (C)[]           0.8429
  Mg 1O  1                  (C)[]           0.0805
  Mg 2Si 1                  (C)             0.0766
*
     7 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           692.1492
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          30.2724
 Products entropy           (J/K)          55.1776
 Products enthalpy          (KJ)          -26.8035
 Mass  of the system        (Kg)            0.0254
  Mg 1                      (C)[]           0.8167
  Mg 1O  1                  (C)[]           0.0939
  Mg 2Si 1                  (C)             0.0894
*
     8 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           728.3680
 Gas products amount        (mol)       2.11E-0012
 Products heat capacity     (J/K)          30.7983
 Products entropy           (J/K)          56.7237
 Products enthalpy          (KJ)          -31.3190
  Mg 1                      (C)[]           0.8301
  Mg 1O  1                  (C)[]           0.0680
  Mg 2Si 1                  (C)             0.0340
*
     9 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           797.6828
 Gas products amount        (mol)       4.00E-0014
 Products heat capacity     (J/K)          31.6637
 Products entropy           (J/K)          59.5610
 Products enthalpy          (KJ)          -34.8392
 Mass  of the system        (Kg)            0.0257
  Mg 1                      (C)[]           0.7644
  Mg 1O  1                  (C)[]           0.1207
  Mg 2Si 1                  (C)             0.1149
*
     10 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.0000
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          32.3184
 Products entropy           (J/K)          61.5268
 Products enthalpy          (KJ)          -38.9784
 Mass  of the system        (Kg)            0.0258
  Mg 1                      (C)[]           0.7382
  Mg 1O  1                  (C)[]           0.1342
  Mg 2Si 1                  (C)             0.1276
```

*

11 wt% SiO2

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	903.0000
Gas products amount	(mol)	7.57E-0011
Products heat capacity	(J/K)	33.0094
Products entropy	(J/K)	63.5969
Products enthalpy	(KJ)	-42.9972
Mass of the system	(Kg)	0.0260
Mg 1	(C)[]	0.7120
Mg 1O 1	(C)[]	0.1476
Mg 2Si 1	(C)	0.1404

*

12 wt% SiO2

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	922.7773	922.5462	923.0083
Gas products amount	(mol)	1.38E-0011	1.61E-0011	1.53E-0014
Products heat capacity	(J/K)	33.5908	33.3342	35.1052
Products entropy	(J/K)	65.3186	64.3305	71.1492
Products enthalpy	(KJ)	-47.3218	-48.2338	-41.9402
Phase transition enthalpy	(KJ)	6.2936		
Mass of the system	(Kg)	0.0262		
Mg 1	(C)[]	0.5864	0.6858	0.0000
Mg 1	(L)[]	0.0994	0.0000	0.6858
Mg 1O 1	(C)[]	0.1610	0.1610	0.1610
Mg 2Si 1	(C)	0.1532	0.1532	0.1532

*

13 wt% SiO2

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	922.2368	921.8684	922.6051
Gas products amount	(mol)	7.78E-0012	1.50E-0011	6.34E-0014
Products heat capacity	(J/K)	34.1955	33.4568	34.9807
Products entropy	(J/K)	67.1692	64.3309	70.1861
Products enthalpy	(KJ)	-51.5961	-54.2159	-48.8115
Phase transition enthalpy	(KJ)	5.4044		
Mass of the system	(Kg)	0.0263		
Mg 1	(C)[]	0.3766	0.6596	0.0757
Mg 1	(L)[]	0.2831	0.0000	0.5840
Mg 1O 1	(C)[]	0.1744	0.1744	0.1744
Mg 2Si 1	(C)	0.1659	0.1659	0.1659

*

14 wt% SiO2

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	922.9484	922.8796	923.0173
Gas products amount	(mol)	9.36E-0012	4.01E-0012	1.17E-0011
Products heat capacity	(J/K)	34.8054	33.7795	35.2517
Products entropy	(J/K)	69.0437	65.0927	70.7622
Products enthalpy	(KJ)	-55.9257	-59.5725	-54.3396
Phase transition enthalpy	(KJ)	5.2329		
Mass of the system	(Kg)	0.0265		
Mg 1	(C)[]	0.1709	0.5638	0.0000
Mg 1	(L)[]	0.4626	0.0697	0.6335
Mg 1O 1	(C)[]	0.1878	0.1878	0.1878
Mg 2Si 1	(C)	0.1787	0.1787	0.1787

*

15 wt% SiO2

Volume of gas products	(litres)	0.0000
Pressure of gas products	(atm)	1.0000
Temperature	(K)	933.1917
Gas products amount	(mol)	1.97E-0013
Products heat capacity	(J/K)	35.3473
Products entropy	(J/K)	70.9521
Products enthalpy	(KJ)	-60.3019
Mass of the system	(Kg)	0.0267
Mg 1	(L)[]	0.6073
Mg 1O 1	(C)[]	0.2012
Mg 2Si 1	(C)	0.1915

```
*
     16 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           987.8079
 Gas products amount        (mol)       3.87E-0011
 Products heat capacity     (J/K)          35.5414
 Products entropy           (J/K)          72.7710
 Products enthalpy          (KJ)          -64.7685
 Mass  of the system        (Kg)            0.0269
  Mg 1                      (L)[]           0.5811
  Mg 1O  1                  (C)[]           0.2147
  Mg 2Si 1                  (C)             0.2042
*
     17 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1043.1168
 Gas products amount        (mol)       1.80E-0011
 Products heat capacity     (J/K)          35.7466
 Products entropy           (J/K)          74.5180
 Products enthalpy          (KJ)          -69.2795
 Mass  of the system        (Kg)            0.0270
  Mg 1                      (L)[]           0.5549
  Mg 1O  1                  (C)[]           0.2281
  Mg 2Si 1                  (C)             0.2170
*
     18 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1099.2392
 Gas products amount        (mol)       7.92E-0012
 Products heat capacity     (J/K)          35.9618
 Products entropy           (J/K)          76.2047
 Products enthalpy          (KJ)          -73.8304
 Mass  of the system        (Kg)            0.0272
  Mg 1                      (L)[]           0.5287
  Mg 1O  1                  (C)[]           0.2415
  Mg 2Si 1                  (C)             0.2298
*
     19 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1155.3827
 Gas products amount        (mol)       6.32E-0011
 Products heat capacity     (J/K)          36.1834
 Products entropy           (J/K)          77.8120
 Products enthalpy          (KJ)          -78.4496
 Mass  of the system        (Kg)            0.0274
  Mg 1                      (L)[]           0.5026
  Mg 1O  1                  (C)[]           0.2549
  Mg 2Si 1                  (C)             0.2425
*
     20 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1200.0000
 Gas products amount        (mol)       4.74E-0013
 Products heat capacity     (J/K)          36.3869
 Products entropy           (J/K)          78.9996
 Products enthalpy          (KJ)          -83.5606
 Mass  of the system        (Kg)            0.0276
  Mg 1                      (L)[]           0.4764
  Mg 1O  1                  (C)[]           0.2683
  Mg 2Si 1                  (C)             0.2553
*
     21 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1258.0000
 Gas products amount        (mol)       8.36E-0011
```

```
 Products heat capacity     (J/K)          36.6191
 Products entropy           (J/K)          80.5379
 Products enthalpy          (KJ)          -88.2594
 Mass  of the system        (Kg)            0.0278
  Mg 1                      (L)[]           0.4502
  Mg 1O  1                  (C)[]           0.2817
  Mg 2Si 1                  (C)             0.2681
*
     22 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1324.8703
 Gas products amount        (mol)       2.99E-0010
 Products heat capacity     (J/K)          36.8638
 Products entropy           (J/K)          82.2599
 Products enthalpy          (KJ)          -92.7027
 Mass  of the system        (Kg)            0.0280
  Mg 1                      (L)[]           0.4240
  Mg 1O  1                  (C)[]           0.2951
  Mg 2Si 1                  (C)             0.2808
*
     23 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1367.9009
 Gas products amount        (mol)       5.37E-0011
 Products heat capacity     (J/K)          37.0658
 Products entropy           (J/K)          83.2636
 Products enthalpy          (KJ)          -98.1009
 Mass  of the system        (Kg)            0.0282
  Mg 1                      (L)[]           0.3978
  Mg 1O  1                  (C)[]           0.3086
  Mg 2Si 1                  (C)             0.2936
*
     24 wt% SiO2
 Volume of gas products   (litres)          2.4037    9.61E-0005       50.2946
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1368.1684     1367.9009     1368.4360
 Gas products amount        (mol)           0.0207    8.28E-0007        0.4335
 Products heat capacity     (J/K)          36.9259       37.2061       31.3433
 Products entropy           (J/K)          85.0224       83.0857      123.6107
 Products enthalpy          (KJ)         -102.5344     -105.1839      -49.7461
 Phase transition enthalpy  (KJ)           55.4377
 Mass  of the system        (Kg)            0.0284
1 Mg 1                      (G)             0.0177    7.09E-0007        0.3714
1 Mg 2                      (G)         1.40E-0005    1.12E-0009    2.94E-0004
  Mg 1                      (L)[]           0.3539        0.3717        0.0000
  Mg 1O  1                  (C)[]           0.3220        0.3220        0.3220
  Mg 2Si 1                  (C)             0.3064        0.3064        0.3064
*
     25 wt% SiO2
 Volume of gas products   (litres)          4.3733    4.89E-0005       47.0698
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.9004     1367.6323     1368.1684
 Gas products amount        (mol)           0.0377    4.22E-0007        0.4057
 Products heat capacity     (J/K)          36.8381       37.3480       31.8600
 Products entropy           (J/K)          86.4224       82.8978      120.8339
 Products enthalpy          (KJ)         -107.5538     -112.3754      -60.4793
 Phase transition enthalpy  (KJ)           51.8962
 Mass  of the system        (Kg)            0.0286
1 Mg 1                      (G)             0.0321    3.58E-0007        0.3452
1 Mg 2                      (G)         2.54E-0005    2.25E-0009    2.73E-0004
  Mg 1                      (L)[]           0.3134        0.3455        0.0000
  Mg 1O  1                  (C)[]           0.3354        0.3354        0.3354
  Mg 2Si 1                  (C)             0.3191        0.3191        0.3191
*
     26 wt% SiO2
 Volume of gas products   (litres)          6.3541    8.36E-0005       43.8200
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1368.1984     1367.9004     1368.4963
 Gas products amount        (mol)           0.0548    7.21E-0007        0.3776
```

```
 Products heat capacity     (J/K)          36.7520       37.4927       32.3850
 Products entropy           (J/K)          87.8421       82.7221      118.0321
 Products enthalpy          (KJ)         -112.6437     -119.6479      -71.3443
 Phase transition enthalpy  (KJ)           48.3036
 Mass  of the system        (Kg)           0.0288
1 Mg 1                      (G)            0.0463    6.09E-0007        0.3191
1 Mg 2                      (G)         3.66E-0005    9.63E-0010    2.52E-0004
  Mg 1                      (L)[]          0.2730        0.3193        0.0000
  Mg 1O  1                  (C)[]          0.3488        0.3488        0.3488
  Mg 2Si 1                  (C)            0.3319        0.3319        0.3319
*
     27 wt% SiO2
 Volume of gas products   (litres)         8.3790    1.94E-0005       40.5038
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1367.9039     1367.6094     1368.1984
 Gas products amount        (mol)          0.0722    1.67E-0007        0.3491
 Products heat capacity     (J/K)          36.6616       37.6385       32.9165
 Products entropy           (J/K)          89.2821       82.5284      115.1754
 Products enthalpy          (KJ)         -117.8061     -127.0450      -82.3843
 Phase transition enthalpy  (KJ)           44.6608
 Mass  of the system        (Kg)           0.0290
1 Mg 1                      (G)            0.0606    1.40E-0007        0.2929
1 Mg 2                      (G)         4.80E-0005    8.80E-0010    2.32E-0004
  Mg 1                      (L)[]          0.2325        0.2931        0.0000
  Mg 1O  1                  (C)[]          0.3622        0.3622        0.3622
  Mg 2Si 1                  (C)            0.3446        0.3446        0.3446
*
     28 wt% SiO2
 Volume of gas products   (litres)        10.4168        0.0000       37.1581
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1368.2087     1367.9039     1368.5135
 Gas products amount        (mol)          0.0898    1.49E-0010        0.3202
 Products heat capacity     (J/K)          36.5733       37.7874       33.4566
 Products entropy           (J/K)          90.7427       82.3482      112.2926
 Products enthalpy          (KJ)         -123.0427     -134.5263      -93.5626
 Phase transition enthalpy  (KJ)           40.9636
 Mass  of the system        (Kg)           0.0292
1 Mg 1                      (G)            0.0748    1.24E-0010        0.2667
1 Mg 2                      (G)         5.92E-0005    1.67E-0015    2.11E-0004
  Mg 1                      (L)[]          0.1921        0.2669        0.0000
  Mg 1O  1                  (C)[]          0.3756        0.3756        0.3756
  Mg 2Si 1                  (C)            0.3574        0.3574        0.3574
*
     29 wt% SiO2
 Volume of gas products   (litres)        12.4911    6.44E-0005       33.7558
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1368.2350     1367.9203     1368.5496
 Gas products amount        (mol)          0.1076    5.56E-0007        0.2909
 Products heat capacity     (J/K)          36.4823       37.9380       34.0040
 Products entropy           (J/K)          92.2242       82.1576      109.3616
 Products enthalpy          (KJ)         -128.3544     -142.1254     -104.9107
 Phase transition enthalpy  (KJ)           37.2147
 Mass  of the system        (Kg)           0.0294
1 Mg 1                      (G)            0.0890    4.59E-0007        0.2406
1 Mg 2                      (G)         7.04E-0005    7.27E-0010    1.90E-0004
  Mg 1                      (L)[]          0.1517        0.2408        0.0000
  Mg 1O  1                  (C)[]          0.3891        0.3891        0.3891
  Mg 2Si 1                  (C)            0.3702        0.3702        0.3702
*
     30 wt% SiO2
 Volume of gas products   (litres)        14.6034    2.06E-0005       30.2963
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1367.8965     1367.5580     1368.2350
 Gas products amount        (mol)          0.1259    1.78E-0007        0.2611
 Products heat capacity     (J/K)          36.3878       38.0900       34.5587
 Products entropy           (J/K)          93.7273       81.9537      106.3793
 Products enthalpy          (KJ)         -133.7430     -149.8491     -116.4352
 Phase transition enthalpy  (KJ)           33.4139
 Mass  of the system        (Kg)           0.0296
1 Mg 1                      (G)            0.1033    1.46E-0007        0.2144
1 Mg 2                      (G)         8.18E-0005    1.22E-0009    1.70E-0004
```

```
  Mg 1                      (L)[]          0.1111        0.2146        0.0000
  Mg 1O  1                  (C)[]          0.4025        0.4025        0.4025
  Mg 2Si 1                  (C)            0.3829        0.3829        0.3829
*
     31 wt% SiO2
 Volume of gas products   (litres)        16.7306    4.66E-0007       26.7993
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1368.1988     1367.8965     1368.5010
 Gas products amount        (mol)          0.1442    4.02E-0009        0.2310
 Products heat capacity     (J/K)         36.2959       38.2456       35.1226
 Products entropy           (J/K)         95.2523       81.7665      103.3682
 Products enthalpy          (KJ)        -139.2104     -157.6588     -128.1080
 Phase transition enthalpy  (KJ)          29.5508
 Mass  of the system        (Kg)           0.0298
1 Mg 1                      (G)            0.1175    3.27E-0009        0.1882
1 Mg 2                      (G)        9.29E-0005    2.59E-0012    1.49E-0004
  Mg 1                      (L)[]          0.0708        0.1884        0.0000
  Mg 1O  1                  (C)[]          0.4159        0.4159        0.4159
  Mg 2Si 1                  (C)            0.3957        0.3957        0.3957
*
     32 wt% SiO2
 Volume of gas products   (litres)        18.9018    1.58E-0005       23.2397
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1367.8682     1367.5376     1368.1988
 Gas products amount        (mol)          0.1629    1.37E-0007        0.2003
 Products heat capacity     (J/K)         36.1992       38.4021       35.6936
 Products entropy           (J/K)         96.7998       81.5569      100.2980
 Products enthalpy          (KJ)        -144.7584     -165.6104     -139.9729
 Phase transition enthalpy  (KJ)          25.6375
 Mass  of the system        (Kg)           0.0300
1 Mg 1                      (G)            0.1318    1.10E-0007        0.1621
1 Mg 2                      (G)        1.04E-0004    9.24E-0010    1.28E-0004
  Mg 1                      (L)[]          0.0303        0.1622        0.0000
  Mg 1O  1                  (C)[]          0.4293        0.4293        0.4293
  Mg 2Si 1                  (C)            0.4085        0.4085        0.4085
*
     33 wt% SiO2
 Volume of gas products   (litres)        19.7296       19.7285       19.7366
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1375.0737     1374.7921     1375.3553
 Gas products amount        (mol)          0.1692        0.1692        0.1692
 Products heat capacity     (J/K)         36.3398       36.2880       36.6911
 Products entropy           (J/K)         98.3637       97.3650      105.1429
 Products enthalpy          (KJ)        -150.3878     -151.7620     -141.0601
 Phase transition enthalpy  (KJ)          10.7019
 Mass  of the system        (Kg)           0.0302
1 Mg 1                      (G)            0.1359        0.1359        0.1359
1 Mg 2                      (G)        1.06E-0004    1.06E-0004    1.06E-0004
  Mg 1O  1                  (C)[]          0.4427        0.4427        0.4427
  Mg 2Si 1                  (L)            0.0541        0.0000        0.4212
  Mg 2Si 1                  (C)            0.3671        0.4212        0.0000
*
     34 wt% SiO2
 Volume of gas products   (litres)        16.0520       16.0476       16.0538
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1374.8098     1374.5459     1375.0737
 Gas products amount        (mol)          0.1377        0.1377        0.1377
 Products heat capacity     (J/K)         37.1736       36.8769       37.2953
 Products entropy           (J/K)         99.9302       94.2068      102.2790
 Products enthalpy          (KJ)        -156.1024     -163.9773     -152.8707
 Phase transition enthalpy  (KJ)          11.1067
 Mass  of the system        (Kg)           0.0305
1 Mg 1                      (G)            0.1098        0.1098        0.1098
1 Mg 2                      (G)        8.58E-0005    8.59E-0005    8.58E-0005
  Mg 1O  1                  (C)[]          0.4561        0.4561        0.4561
  Mg 2Si 1                  (L)            0.3077        0.0000        0.4340
  Mg 2Si 1                  (C)            0.1263        0.4340        0.0000
*
     35 wt% SiO2
 Volume of gas products   (litres)        12.9970
 Pressure of gas products   (atm)          1.0000
```

```
 Temperature                (K)          1450.5419
 Gas products amount        (mol)           0.1057
 Products heat capacity     (J/K)          38.0314
 Products entropy           (J/K)         101.4088
 Products enthalpy          (KJ)         -161.9809
 Mass  of the system        (Kg)            0.0307
1 Mg 1                      (G)             0.0836        0.9997  (atm)
1 Mg 2                      (G)         5.70E-0005    3.41E-0004  (atm)
  Mg 1O  1                  (C)[]           0.4696
  Mg 2Si 1                  (L)             0.4468
*
```

36 wt% SiO2

```
 Volume of gas products   (litres)         10.0053
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1612.7767
 Gas products amount        (mol)           0.0732
 Products heat capacity     (J/K)          38.9311
 Products entropy           (J/K)         102.6111
 Products enthalpy          (KJ)         -167.7998
 Mass  of the system        (Kg)            0.0309
1 Mg 1                      (G)             0.0575        0.9997  (atm)
  Mg 1O  1                  (C)[]           0.4830
  Mg 2Si 1                  (L)             0.4595
*
```

37 wt% SiO2

```
 Volume of gas products   (litres)          6.6715        5.9599       62.9262
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.5840     1749.3923     1749.7758
 Gas products amount        (mol)           0.0450        0.0402        0.4241
 Products heat capacity     (J/K)          39.7650       39.8255       34.9872
 Products entropy           (J/K)         103.4102      102.9562      139.2994
 Products enthalpy          (KJ)         -173.7682     -174.5625     -110.9702
 Phase transition enthalpy  (KJ)          63.5923
 Mass  of the system        (Kg)            0.0312
1 Mg 1                      (G)             0.0351        0.0313        0.3306
1 Mg 2                      (G)         1.48E-0005    1.32E-0005    1.40E-0004
1 O  1Si 1                  (G)         9.26E-0006    8.26E-0006    8.85E-0005
  Mg 1O  1                  (C)[]           0.4964        0.4964        0.4963
  Mg 2Si 1                  (L)             0.4664        0.4723        0.0000
  Si 1                      (L)[]           0.0022        0.0000        0.1729
*
```

38 wt% SiO2

```
 Volume of gas products   (litres)          7.2656        0.9847       59.9411
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.6798     1749.5840     1749.7756
 Gas products amount        (mol)           0.0490        0.0066        0.4040
 Products heat capacity     (J/K)          39.9552       40.4887       35.4809
 Products entropy           (J/K)         104.0878      100.0811      137.6902
 Products enthalpy          (KJ)         -179.8385     -186.8493     -121.0419
 Phase transition enthalpy  (KJ)          65.8074
 Mass  of the system        (Kg)            0.0314
1 Mg 1                      (G)             0.0379        0.0051        0.3125
1 Mg 2                      (G)         1.60E-0005    2.17E-0006    1.32E-0004
1 O  1Si 1                  (G)         1.01E-0005    1.36E-0006    8.36E-0005
  Mg 1O  1                  (C)[]           0.5098        0.5098        0.5097
  Mg 2Si 1                  (L)             0.4334        0.4851        0.0000
  Si 1                      (L)[]           0.0189        0.0000        0.1776
*
```

39 wt% SiO2

```
 Volume of gas products   (litres)          7.8721    2.18E-0004       56.9266
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.9828     1749.6798     1750.2858
 Gas products amount        (mol)           0.0530    1.47E-0006        0.3836
 Products heat capacity     (J/K)          40.1480       40.8163       35.9833
 Products entropy           (J/K)         104.7760       99.7547      136.0668
 Products enthalpy          (KJ)         -186.0029     -194.7890     -131.2511
 Phase transition enthalpy  (KJ)          63.5379
 Mass  of the system        (Kg)            0.0317
1 Mg 1                      (G)             0.0407    1.13E-0006        0.2944
1 Mg 2                      (G)         1.72E-0005    4.76E-0010    1.24E-0004
1 O  1Si 1                  (G)         1.10E-0005    3.02E-0010    7.96E-0005
```

```
  Mg 1O  1                  (C)[]          0.5232        0.5232        0.5231
  Mg 2Si 1                  (L)            0.4004        0.4646        0.0000
  Si 1                      (L)[]          0.0357        0.0122        0.1823
*
     40 wt% SiO2
 Volume of gas products   (litres)         8.4986    4.34E-0005       53.8378
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1749.7081     1749.4334     1749.9828
 Gas products amount        (mol)          0.0573    2.93E-0007        0.3628
 Products heat capacity     (J/K)         40.3418       41.0635       36.4919
 Products entropy           (J/K)        105.4749      100.0528      134.4009
 Products enthalpy          (KJ)        -192.2633     -201.7506     -141.6492
 Phase transition enthalpy  (KJ)          60.1014
 Mass  of the system        (Kg)           0.0319
1 Mg 1                      (G)            0.0436    2.22E-0007        0.2763
1 Mg 2                      (G)        1.84E-0005    4.99E-0010    1.17E-0004
1 O  1Si 1                  (G)        1.17E-0005    3.16E-0010    7.42E-0005
  Mg 1O  1                  (C)[]          0.5366        0.5366        0.5366
  Mg 2Si 1                  (L)            0.3672        0.4361        0.0000
  Si 1                      (L)[]          0.0525        0.0273        0.1869
*
     41 wt% SiO2
 Volume of gas products   (litres)         9.1314    9.49E-0006       25.3474
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1749.4470     1749.1858     1749.7081
 Gas products amount        (mol)          0.0615    6.40E-0008        0.1709
 Products heat capacity     (J/K)         40.5392       41.3145       39.1623
 Products entropy           (J/K)        106.1848      100.3557      116.5363
 Products enthalpy          (KJ)        -198.6223     -208.8218     -180.5094
 Phase transition enthalpy  (KJ)          28.3124
 Mass  of the system        (Kg)           0.0322
1 Mg 1                      (G)            0.0465    4.81E-0008        0.1291
  Mg 1O  1                  (C)[]          0.5500        0.5501        0.5500
  Mg 2Si 1                  (L)            0.3341        0.4075        0.2038
  Si 1                      (L)[]          0.0693        0.0424        0.1170
*
     42 wt% SiO2
 Volume of gas products   (litres)         9.7655        0.0000       47.5274
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1749.6110     1749.4470     1749.7751
 Gas products amount        (mol)          0.0658    8.17E-0011        0.3203
 Products heat capacity     (J/K)         40.7412       41.5706       37.5340
 Products entropy           (J/K)        106.9060      100.6756      130.9982
 Products enthalpy          (KJ)        -205.0827     -215.9845     -162.9268
 Phase transition enthalpy  (KJ)          53.0577
 Mass  of the system        (Kg)           0.0324
1 Mg 1                      (G)            0.0493    1.11E-0011        0.2401
1 Mg 2                      (G)        2.08E-0005    2.58E-0014    1.01E-0004
1 O  1Si 1                  (G)        1.32E-0005    2.51E-0012    6.42E-0005
  Mg 1O  1                  (C)[]          0.5635        0.5635        0.5634
  Mg 2Si 1                  (L)            0.3011        0.3790        0.0000
  Si 1                      (L)[]          0.0860        0.0575        0.1963
*
     43 wt% SiO2
 Volume of gas products   (litres)        10.4095    1.24E-0006       44.2998
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1749.6941     1749.6110     1749.7772
 Gas products amount        (mol)          0.0702    8.33E-0009        0.2986
 Products heat capacity     (J/K)         40.9464       41.8305       38.0678
 Products entropy           (J/K)        107.6387      100.9982      129.2583
 Products enthalpy          (KJ)        -211.6463     -223.2657     -173.8169
 Phase transition enthalpy  (KJ)          49.4487
 Mass  of the system        (Kg)           0.0327
1 Mg 1                      (G)            0.0522    5.03E-0013        0.2221
1 Mg 2                      (G)        2.20E-0005    3.06E-0012    9.37E-0005
1 O  1Si 1                  (G)        1.40E-0005    1.94E-0012    5.94E-0005
  Mg 1O  1                  (C)[]          0.5769        0.5769        0.5768
  Mg 2Si 1                  (L)            0.2681        0.3504        0.0000
  Si 1                      (L)[]          0.1028        0.0727        0.2010
*
     44 wt% SiO2
```

```
 Volume of gas products   (litres)         11.0649        0.0025       41.0322
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.9907     1749.6941     1750.2874
 Gas products amount        (mol)           0.0746    1.69E-0005        0.2765
 Products heat capacity     (J/K)          41.1553       42.0943       38.6115
 Products entropy           (J/K)         108.3833      101.3257      127.5017
 Products enthalpy          (KJ)         -218.3158     -230.6650     -184.8629
 Phase transition enthalpy  (KJ)           45.8021
 Mass  of the system        (Kg)            0.0329
1 Mg 1                      (G)             0.0550    1.25E-0005        0.2040
1 Mg 2                      (G)          2.32E-0005    5.26E-0009    8.61E-0005
  Mg 1O  1                  (C)[]           0.5903        0.5903        0.5902
  Mg 2Si 1                  (L)             0.2351        0.3219        0.0000
  Si 1                      (L)[]           0.1196        0.0878        0.2056
*
```

45 wt% SiO2

```
 Volume of gas products   (litres)         11.7452    3.81E-0005       37.6921
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.6600     1749.3292     1749.9907
 Gas products amount        (mol)           0.0792    2.57E-0007        0.2540
 Products heat capacity     (J/K)          41.3647       42.3618       39.1620
 Products entropy           (J/K)         109.1398      101.6444      125.6985
 Products enthalpy          (KJ)         -225.0931     -238.2084     -196.1191
 Phase transition enthalpy  (KJ)           42.0893
 Mass  of the system        (Kg)            0.0332
1 Mg 1                      (G)             0.0579    1.87E-0007        0.1859
1 Mg 2                      (G)          2.44E-0005    6.29E-0010    7.85E-0005
  Mg 1O  1                  (C)[]           0.6037        0.6037        0.6037
  Mg 2Si 1                  (L)             0.2020        0.2934        0.0000
  Si 1                      (L)[]           0.1364        0.1029        0.2103
*
```

46 wt% SiO2

```
 Volume of gas products   (litres)         12.4185    1.31E-0004       34.2996
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.7188     1749.6600     1749.7775
 Gas products amount        (mol)           0.0837    8.83E-0007        0.2312
 Products heat capacity     (J/K)          41.5803       42.6351       39.7218
 Products entropy           (J/K)         109.9090      101.9870      123.8674
 Products enthalpy          (KJ)         -231.9825     -245.8441     -207.5585
 Phase transition enthalpy  (KJ)           38.2856
 Mass  of the system        (Kg)            0.0335
1 Mg 1                      (G)             0.0608    6.40E-0007        0.1678
1 Mg 2                      (G)          2.57E-0005    5.40E-0010    7.09E-0005
  Mg 1O  1                  (C)[]           0.6171        0.6171        0.6171
  Mg 2Si 1                  (L)             0.1689        0.2648        0.0000
  Si 1                      (L)[]           0.1531        0.1180        0.2150
*
```

47 wt% SiO2

```
 Volume of gas products   (litres)         13.1130    1.07E-0004       15.4250
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.4475     1749.1763     1749.7188
 Gas products amount        (mol)           0.0884    7.23E-0007        0.1040
 Products heat capacity     (J/K)          41.7981       42.9109       41.6019
 Products entropy           (J/K)         110.6908      102.3152      112.1675
 Products enthalpy          (KJ)         -238.9861     -253.6414     -236.4022
 Phase transition enthalpy  (KJ)           17.2392
 Mass  of the system        (Kg)            0.0338
1 Mg 1                      (G)             0.0636    5.20E-0007        0.0748
  Mg 1O  1                  (C)[]           0.6305        0.6305        0.6305
  Mg 2Si 1                  (L)             0.1359        0.2363        0.1182
  Si 1                      (L)[]           0.1699        0.1332        0.1764
*
```

48 wt% SiO2

```
 Volume of gas products   (litres)         13.8184    4.40E-0005       27.3547
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.6134     1749.4475     1749.7792
 Gas products amount        (mol)           0.0931    2.97E-0007        0.1844
 Products heat capacity     (J/K)          42.0198       43.1932       40.8704
 Products entropy           (J/K)         111.4856      102.6675      120.1235
 Products enthalpy          (KJ)         -246.1055     -261.5350     -230.9910
 Phase transition enthalpy  (KJ)           30.5440
```

```
 Mass  of the system        (Kg)            0.0340
1 Mg 1                      (G)             0.0665    2.11E-0007        0.1316
  Mg 1O  1                  (C)[]           0.6439        0.6440        0.6439
  Mg 2Si 1                  (L)             0.1028        0.2077        0.0000
  Si 1                      (L)[]           0.1867        0.1483        0.2244
*
     49 wt% SiO2
 Volume of gas products   (litres)         14.5305    4.54E-0005       23.7946
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.6977     1749.6134     1749.7819
 Gas products amount        (mol)           0.0979    3.06E-0007        0.1604
 Products heat capacity     (J/K)          42.2460       43.4800       41.4592
 Products entropy           (J/K)         112.2938      103.0232      118.2044
 Products enthalpy          (KJ)         -253.3453     -269.5667     -243.0030
 Phase transition enthalpy  (KJ)           26.5637
 Mass   of the system        (Kg)            0.0343
1 Mg 1                      (G)             0.0693    2.17E-0007        0.1135
  Mg 1O  1                  (C)[]           0.6574        0.6574        0.6574
  Mg 2Si 1                  (L)             0.0698        0.1792        0.0000
  Si 1                      (L)[]           0.2035        0.1634        0.2290
*
     50 wt% SiO2
 Volume of gas products   (litres)         15.2559    5.06E-0005       20.1769
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1749.6608     1749.3166     1750.0049
 Gas products amount        (mol)           0.1028    3.41E-0007        0.1360
 Products heat capacity     (J/K)          42.4760       43.7704       42.0585
 Products entropy           (J/K)         113.1156      103.3733      116.2582
 Products enthalpy          (KJ)         -260.7073     -277.7542     -255.2085
 Phase transition enthalpy  (KJ)           22.5457
 Mass  of the system        (Kg)            0.0346
1 Mg 1                      (G)             0.0722    2.39E-0007        0.0955
  Mg 1O  1                  (C)[]           0.6708        0.6708        0.6708
  Mg 2Si 1                  (L)             0.0367        0.1507        0.0000
  Si 1                      (L)[]           0.2203        0.1786        0.2337
*
     51 wt% SiO2
 Volume of gas products   (litres)         16.5655
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1757.5009
 Gas products amount        (mol)           0.1112
 Products heat capacity     (J/K)          42.6891
 Products entropy           (J/K)         114.4565
 Products enthalpy          (KJ)         -267.3119
 Mass  of the system        (Kg)            0.0349
1 Mg 1                      (G)             0.0774        0.9996  (atm)
  Mg 1O  1                  (C)[]           0.6842
  Si 1                      (L)[]           0.2384
*
     52 wt% SiO2
 Volume of gas products   (litres)         13.4233
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1839.5799
 Gas products amount        (mol)           0.0861
 Products heat capacity     (J/K)          43.5548
 Products entropy           (J/K)         114.4444
 Products enthalpy          (KJ)         -276.3408
 Mass  of the system        (Kg)            0.0352
1 Mg 1                      (G)             0.0593        0.9988  (atm)
1 O  1Si 1                  (G)          1.07E-0004    9.96E-0004  (atm)
  Mg 1O  1                  (C)[]           0.6975
  Si 1                      (L)[]           0.2430
*
     53 wt% SiO2
 Volume of gas products   (litres)         10.0320
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1938.8568
 Gas products amount        (mol)           0.0610
 Products heat capacity     (J/K)          44.5069
 Products entropy           (J/K)         114.8493
 Products enthalpy          (KJ)         -284.5554
```

```
 Mass  of the system        (Kg)            0.0355
1 Mg 1                      (G)             0.0415        0.9931  (atm)
1 O  1Si 1                  (G)          5.06E-0004       0.0067  (atm)
  Mg 1O  1                  (C)[]           0.7106
  Si 1                      (L)[]           0.2474
*
     54 wt% SiO2
 Volume of gas products   (litres)          6.5678
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2052.5888
 Gas products amount        (mol)           0.0377
 Products heat capacity     (J/K)          45.5372
 Products entropy           (J/K)         115.8068
 Products enthalpy          (KJ)         -291.5547
 Mass  of the system        (Kg)            0.0358
1 Mg 1                      (G)             0.0244        0.9513  (atm)
1 O  1Si 1                  (G)             0.0023        0.0485  (atm)
  Mg 1O  1                  (C)[]           0.7224
  Si 1                      (L)[]           0.2510
*
     55 wt% SiO2
 Volume of gas products   (litres)          3.5539        1.9467       14.9172
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2119.8886     2119.6176     2120.1596
 Gas products amount        (mol)           0.0198        0.0108        0.0830
 Products heat capacity     (J/K)          46.4239       46.4861       45.9839
 Products entropy           (J/K)         116.2400      115.2154      123.4842
 Products enthalpy          (KJ)         -299.4751     -301.6474     -284.1161
 Phase transition enthalpy  (KJ)           17.5313
 Mass  of the system        (Kg)            0.0361
1 Mg 1                      (G)             0.0112        0.0062        0.0471
1 O  1Si 1                  (G)             0.0037        0.0020        0.0158
  Mg 1O  1                  (C)[]           0.7207        0.7360        0.6129
  Mg 2O  4Si 1              (C)             0.0120        0.0000        0.0965
  Si 1                      (L)[]           0.2523        0.2558        0.2278
*
     56 wt% SiO2
 Volume of gas products   (litres)          2.8271    1.59E-0004       75.2063
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2120.0426     2119.8886     2120.1967
 Gas products amount        (mol)           0.0157    8.86E-0007        0.4183
 Products heat capacity     (J/K)          47.0329       47.1427       44.2206
 Products entropy           (J/K)         116.5880      114.7882      162.6675
 Products enthalpy          (KJ)         -307.6446     -311.4604     -209.9471
 Phase transition enthalpy  (KJ)          101.5133
 Mass  of the system        (Kg)            0.0365
1 Mg 1                      (G)             0.0088    5.73E-0007        0.2352
1 O  1Si 1                  (G)             0.0030    3.26E-0008        0.0790
  Mg 1O  1                  (C)[]           0.6814        0.7080        0.0000
  Mg 2O  4Si 1              (C)             0.0587        0.0378        0.5926
  Si 1                      (L)[]           0.2482        0.2542        0.0931
*
     57 wt% SiO2
 Volume of gas products   (litres)          2.1058    3.38E-0004       70.8642
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2119.8608     2119.6019     2120.1197
 Gas products amount        (mol)           0.0117    1.88E-0006        0.3942
 Products heat capacity     (J/K)          47.6504       47.7321       44.9807
 Products entropy           (J/K)         116.9422      115.6017      160.7200
 Products enthalpy          (KJ)         -315.9616     -318.8037     -223.1444
 Phase transition enthalpy  (KJ)           95.6592
 Mass  of the system        (Kg)            0.0368
1 Mg 1                      (G)             0.0065    1.05E-0006        0.2197
1 O  1Si 1                  (G)             0.0022    3.51E-0007        0.0737
  Mg 1O  1                  (C)[]           0.6417        0.6614       -0.0000
  Mg 2O  4Si 1              (C)             0.1056        0.0902        0.6085
  Si 1                      (L)[]           0.2440        0.2484        0.0979
*
     58 wt% SiO2
 Volume of gas products   (litres)          1.3522    6.70E-0005       66.4955
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
```

```
 Temperature                (K)          2120.0282     2119.8608     2120.1957
 Gas products amount        (mol)           0.0075    3.72E-0007        0.3699
 Products heat capacity     (J/K)          48.2820       48.3345       45.7513
 Products entropy           (J/K)         117.3029      116.4421      158.7770
 Products enthalpy          (KJ)         -324.4288     -326.2539     -236.4957
 Phase transition enthalpy  (KJ)           89.7582
 Mass  of the system        (Kg)            0.0371
1 Mg 1                      (G)             0.0042    2.29E-0007        0.2042
1 O  1Si 1                  (G)             0.0014    1.22E-0008        0.0686
  Mg 1O  1                  (C)[]           0.6023        0.6148        0.0000
  Mg 2O  4Si 1              (C)             0.1523        0.1425        0.6243
  Si 1                      (L)[]           0.2398        0.2427        0.1027
*
```

59 wt% SiO2

```
 Volume of gas products   (litres)      4.03E-0004
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2120.0282
 Gas products amount        (mol)       2.24E-0006
 Products heat capacity     (J/K)          48.9476
 Products entropy           (J/K)         117.2962
 Products enthalpy          (KJ)         -333.8455
 Mass  of the system        (Kg)            0.0375
  Mg 1O  1                  (C)[]           0.5682
  Mg 2O  4Si 1              (C)             0.1949
  Si 1                      (L)[]           0.2369
*
```

60 wt% SiO2

```
 Volume of gas products   (litres)      4.93E-0004
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2120.0282
 Gas products amount        (mol)       2.74E-0006
 Products heat capacity     (J/K)          49.5714
 Products entropy           (J/K)         118.1622
 Products enthalpy          (KJ)         -341.5859
 Mass  of the system        (Kg)            0.0378
  Mg 1O  1                  (C)[]           0.5216
  Mg 2O  4Si 1              (C)             0.2472
  Si 1                      (L)[]           0.2311
*
```

61 wt% SiO2

```
 Volume of gas products   (litres)      8.33E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2093.6844
 Gas products amount        (mol)       4.69E-0007
 Products heat capacity     (J/K)          50.0815
 Products entropy           (J/K)         118.4169
 Products enthalpy          (KJ)         -350.7924
 Mass  of the system        (Kg)            0.0382
  Mg 1O  1                  (C)[]           0.4751
  Mg 2O  4Si 1              (C)             0.2996
  Si 1                      (L)[]           0.2253
*
```

62 wt% SiO2

```
 Volume of gas products   (litres)      2.98E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2072.7008
 Gas products amount        (mol)       1.70E-0008
 Products heat capacity     (J/K)          50.6244
 Products entropy           (J/K)         118.7970
 Products enthalpy          (KJ)         -359.9070
 Mass  of the system        (Kg)            0.0385
  Mg 1O  1                  (C)[]           0.4285
  Mg 2O  4Si 1              (C)             0.3520
  Si 1                      (L)[]           0.2196
*
```

63 wt% SiO2

```
 Volume of gas products   (litres)      5.05E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2051.7822
 Gas products amount        (mol)       2.90E-0007
 Products heat capacity     (J/K)          51.1755
```

```
 Products entropy           (J/K)         119.1785
 Products enthalpy          (KJ)         -369.1969
 Mass  of the system        (Kg)            0.0389
  Mg 1O  1                  (C)[]           0.3819
  Mg 2O  4Si 1              (C)             0.4043
  Si 1                      (L)[]           0.2138
*
```

64 wt% SiO2

```
 Volume of gas products   (litres)      2.25E-0005
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2030.9574
 Gas products amount        (mol)       1.31E-0007
 Products heat capacity     (J/K)          51.7350
 Products entropy           (J/K)         119.5617
 Products enthalpy          (KJ)         -378.6654
 Mass  of the system        (Kg)            0.0393
  Mg 1O  1                  (C)[]           0.3353
  Mg 2O  4Si 1              (C)             0.4567
  Si 1                      (L)[]           0.2080
*
```

65 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2010.2288
 Gas products amount        (mol)       5.07E-0010
 Products heat capacity     (J/K)          52.3032
 Products entropy           (J/K)         119.9471
 Products enthalpy          (KJ)         -388.3183
 Mass  of the system        (Kg)            0.0397
  Mg 1O  1                  (C)[]           0.2887
  Mg 2O  4Si 1              (C)             0.5090
  Si 1                      (L)[]           0.2022
*
```

66 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1989.5903
 Gas products amount        (mol)       1.07E-0009
 Products heat capacity     (J/K)          52.8802
 Products entropy           (J/K)         120.3343
 Products enthalpy          (KJ)         -398.1606
 Mass  of the system        (Kg)            0.0400
  Mg 1O  1                  (C)[]           0.2422
  Mg 2O  4Si 1              (C)             0.5614
  Si 1                      (L)[]           0.1964
*
```

67 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1969.0422
 Gas products amount        (mol)       9.74E-0010
 Products heat capacity     (J/K)          53.4661
 Products entropy           (J/K)         120.7235
 Products enthalpy          (KJ)         -408.1975
 Mass  of the system        (Kg)            0.0404
  Mg 1O  1                  (C)[]           0.1956
  Mg 2O  4Si 1              (C)             0.6137
  Si 1                      (L)[]           0.1907
*
```

68 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1948.5797
 Gas products amount        (mol)       2.32E-0010
 Products heat capacity     (J/K)          54.0610
 Products entropy           (J/K)         121.1147
 Products enthalpy          (KJ)         -418.4363
 Mass  of the system        (Kg)            0.0408
  Mg 1O  1                  (C)[]           0.1490
  Mg 2O  4Si 1              (C)             0.6661
  Si 1                      (L)[]           0.1849
```

```
*
     69 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1928.2035
 Gas products amount        (mol)       1.69E-0010
 Products heat capacity     (J/K)          54.6651
 Products entropy           (J/K)         121.5077
 Products enthalpy          (KJ)         -428.8814
 Mass  of the system        (Kg)            0.0413
  Mg 1O  1                  (C)[]           0.1024
  Mg 2O  4Si 1              (C)             0.7185
  Si 1                      (L)[]           0.1791
*
     70 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1907.9114
 Gas products amount        (mol)       3.88E-0010
 Products heat capacity     (J/K)          55.2785
 Products entropy           (J/K)         121.9026
 Products enthalpy          (KJ)         -439.5393
 Mass  of the system        (Kg)            0.0417
  Mg 1O  1                  (C)[]           0.0558
  Mg 2O  4Si 1              (C)             0.7708
  Si 1                      (L)[]           0.1733
*
     71 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1887.6980
 Gas products amount        (mol)       3.39E-0010
 Products heat capacity     (J/K)          55.9013
 Products entropy           (J/K)         122.2994
 Products enthalpy          (KJ)         -450.4180
 Mass  of the system        (Kg)            0.0421
  Mg 1O  1                  (C)[]           0.0093
  Mg 2O  4Si 1              (C)             0.8232
  Si 1                      (L)[]           0.1676
*
     72 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1824.4151     1824.1817     1824.6485
 Gas products amount        (mol)       1.59E-0010    2.52E-0010    8.43E-0011
 Products heat capacity     (J/K)          56.1293       56.0677       56.1788
 Products entropy           (J/K)         122.0830      121.5043      122.5476
 Products enthalpy          (KJ)         -461.5150     -462.5707     -460.6673
 Phase transition enthalpy  (KJ)           1.9034
 Mass  of the system        (Kg)            0.0425
  Mg 2O  4Si 1              (C)             0.7714        0.8039        0.7453
  Mg 2O  6Si 2              (L)[KLINOEN     0.0557        0.0093        0.0930
  O  2Si 1                  (C)  [CRIST     0.0112        0.0250        0.0000
  Si 1                      (L)[]           0.1618        0.1618        0.1618
*
     73 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1802.3281
 Gas products amount        (mol)       1.80E-0010
 Products heat capacity     (J/K)          56.4010
 Products entropy           (J/K)         121.7338
 Products enthalpy          (KJ)         -472.7196
 Mass  of the system        (Kg)            0.0430
  Mg 2O  4Si 1              (C)             0.7815
  O  2Si 1                  (C)  [CRIST     0.0625
  Si 1                      (L)[]           0.1560
*
     74 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
```

```
 Temperature                (K)          1762.9140
 Gas products amount        (mol)       1.08E-0010
 Products heat capacity     (J/K)          56.2345
 Products entropy           (J/K)         121.3057
 Products enthalpy          (KJ)         -484.2369
 Mass  of the system        (Kg)            0.0435
  Mg 1O  3Si 1              (C)             0.0836
  Mg 2O  4Si 1              (C)             0.6939
  O  2Si 1                  (C)  [CRIST     0.0722
  Si 1                      (L)[]           0.1502
*
     75 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1739.4580
 Gas products amount        (mol)       1.60E-0010
 Products heat capacity     (J/K)          54.8192
 Products entropy           (J/K)         120.6999
 Products enthalpy          (KJ)         -496.2643
 Mass  of the system        (Kg)            0.0439
  Mg 1O  3Si 1              (C)             0.4410
  Mg 2O  4Si 1              (C)             0.4145
  Si 1                      (L)[]           0.1444
*
     76 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1690.3487
 Gas products amount        (mol)       6.56E-0011
 Products heat capacity     (J/K)          54.6053
 Products entropy           (J/K)         119.8961
 Products enthalpy          (KJ)         -508.8131
 Mass  of the system        (Kg)            0.0444
  Mg 1O  3Si 1              (C)             0.5570
  Mg 2O  4Si 1              (C)             0.3043
  Si 1                      (L)[]           0.1387
*
     77 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1690.0492     1689.7497     1690.3487
 Gas products amount        (mol)       2.69E-0011    2.88E-0011    2.65E-0011
 Products heat capacity     (J/K)          54.6021       54.9419       54.5327
 Products entropy           (J/K)         119.6038      114.3479      120.6771
 Products enthalpy          (KJ)         -520.7042     -529.5868     -518.8903
 Phase transition enthalpy  (KJ)           10.6964
 Mass  of the system        (Kg)            0.0449
  Mg 1O  3Si 1              (C)             0.6731        0.6731        0.6731
  Mg 2O  4Si 1              (C)             0.1940        0.1940        0.1940
  Si 1                      (C)[]           0.0225        0.1329        0.0000
  Si 1                      (L)[]           0.1104        0.0000        0.1329
*
     78 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.7494     1689.4497     1690.0492
 Gas products amount        (mol)       1.56E-0010    3.70E-0011    2.36E-0010
 Products heat capacity     (J/K)          54.6493       54.8857       54.4898
 Products entropy           (J/K)         119.0867      115.4307      121.5528
 Products enthalpy          (KJ)         -533.8748     -540.0535     -529.7071
 Phase transition enthalpy  (KJ)           10.3463
 Mass  of the system        (Kg)            0.0454
  Mg 1O  3Si 1              (C)             0.7911        0.7911        0.7911
  Mg 2O  4Si 1              (C)             0.0819        0.0819        0.0819
  Si 1                      (C)[]           0.0512        0.1270        0.0000
  Si 1                      (L)[]           0.0758        0.0000        0.1270
*
     79 wt% SiO2
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1689.8938     1689.7494     1690.0381
```

```
 Gas products amount        (mol)       3.65E-0010    5.01E-0010    9.12E-0011
 Products heat capacity     (J/K)          54.8235       54.9503       54.5676
 Products entropy           (J/K)         118.4299      116.4750      122.3751
 Products enthalpy          (KJ)         -546.2435     -549.5473     -539.5761
 Phase transition enthalpy  (KJ)            9.9712
 Mass  of the system        (Kg)            0.0459
  Mg 1O  3Si 1              (C)             0.8674        0.8674        0.8674
  O  2Si 1                  (C)  [CRIST     0.0113        0.0113        0.0113
  Si 1                      (C)[]           0.0811        0.1213        0.0000
  Si 1                      (L)[]           0.0402        0.0000        0.1213
*
     80 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1677.3782
 Gas products amount        (mol)       4.62E-0011
 Products heat capacity     (J/K)          55.6285
 Products entropy           (J/K)         117.5123
 Products enthalpy          (KJ)         -559.9444
 Mass  of the system        (Kg)            0.0464
  Mg 1O  3Si 1              (C)             0.8261
  O  2Si 1                  (C)  [CRIST     0.0584
  Si 1                      (C)[]           0.1156
*
     81
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1622.7690
 Gas products amount        (mol)       2.47E-0011
 Products heat capacity     (J/K)          56.2737
 Products entropy           (J/K)         117.1231
 Products enthalpy          (KJ)         -572.9601
 Mass  of the system        (Kg)            0.0470
  Mg 1O  3Si 1              (C)             0.7848
  O  2Si 1                  (C)  [CRIST     0.1055
  Si 1                      (C)[]           0.1098
*
     82 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1559.3355
 Gas products amount        (mol)       4.67E-0012
 Products heat capacity     (J/K)          56.9066
 Products entropy           (J/K)         116.3373
 Products enthalpy          (KJ)         -586.7837
 Mass  of the system        (Kg)            0.0475
  Mg 1O  3Si 1              (C)             0.7435
  O  2Si 1                  (C)  [CRIST     0.1525
  Si 1                      (C)[]           0.1040
*
     83 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1495.9200
 Gas products amount        (mol)       1.17E-0010
 Products heat capacity     (J/K)          57.5356
 Products entropy           (J/K)         115.4378
 Products enthalpy          (KJ)         -600.9330
 Mass  of the system        (Kg)            0.0481
  Mg 1O  3Si 1              (C)             0.7022
  O  2Si 1                  (C)  [CRIST     0.1996
  Si 1                      (C)[]           0.0982
*
     84 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1432.4921
 Gas products amount        (mol)       2.38E-0011
 Products heat capacity     (J/K)          58.1601
 Products entropy           (J/K)         114.4123
 Products enthalpy          (KJ)         -615.4189
```

```
 Mass  of the system        (Kg)            0.0486
  Mg 1O  3Si 1              (C)             0.6609
  O  2Si 1                  (C)  [CRIST     0.2467
  Si 1                      (C)[]           0.0924
*
     85 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1368.9550
 Gas products amount        (mol)       1.13E-0012
 Products heat capacity     (J/K)          58.7790
 Products entropy           (J/K)         113.2438
 Products enthalpy          (KJ)         -630.2586
 Mass  of the system        (Kg)            0.0492
  Mg 1O  3Si 1              (C)             0.6196
  O  2Si 1                  (C)  [CRIST     0.2938
  Si 1                      (C)[]           0.0867
*
     86 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1305.4549
 Gas products amount        (mol)       1.33E-0011
 Products heat capacity     (J/K)          59.3903
 Products entropy           (J/K)         111.9236
 Products enthalpy          (KJ)         -645.4527
 Mass  of the system        (Kg)            0.0498
  Mg 1O  3Si 1              (C)             0.5782
  O  2Si 1                  (C)  [CRIST     0.3409
  Si 1                      (C)[]           0.0809
*
     87 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1258.0000
 Gas products amount        (mol)       7.77E-0011
 Products heat capacity     (J/K)          59.4631
 Products entropy           (J/K)         110.7568
 Products enthalpy          (KJ)         -660.6494
 Mass  of the system        (Kg)            0.0504
  Mg 1O  3Si 1              (C)             0.5369
  O  2Si 1                  (C)  [CRIST     0.3879
  Si 1                      (C)[]           0.0751
*
     88 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1186.6339
 Gas products amount        (mol)       2.81E-0011
 Products heat capacity     (J/K)          60.0697
 Products entropy           (J/K)         108.7875
 Products enthalpy          (KJ)         -676.9827
 Mass  of the system        (Kg)            0.0511
  Mg 1O  3Si 1              (C)             0.4956
  O  2Si 1                  (C)  [CRIST     0.4350
  Si 1                      (C)[]           0.0693
*
     89 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1109.8141
 Gas products amount        (mol)       3.80E-0011
 Products heat capacity     (J/K)          60.6346
 Products entropy           (J/K)         106.2557
 Products enthalpy          (KJ)         -694.0537
 Mass  of the system        (Kg)            0.0517
  Mg 1O  3Si 1              (C)             0.4502
  Mg 2O  6Si 2              (C)[KLINOEN     0.0041
  O  2Si 1                  (C)  [CRIST     0.4821
  Si 1                      (C)[]           0.0636
*
```

```
     90 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1067.6546
 Gas products amount        (mol)       2.49E-0012
 Products heat capacity     (J/K)          61.1988
 Products entropy           (J/K)         104.1355
 Products enthalpy          (KJ)         -710.7966
 Mass  of the system        (Kg)            0.0524
  Mg 2O  6Si 2              (C)[KLINOEN     0.4130
  O  2Si 1                  (C)  [QUART     0.5292
  Si 1                      (C)[]           0.0578
*
     91 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1013.0529
 Gas products amount        (mol)       1.86E-0013
 Products heat capacity     (J/K)          61.3800
 Products entropy           (J/K)         102.3505
 Products enthalpy          (KJ)         -727.3959
 Mass  of the system        (Kg)            0.0531
  Mg 2O  6Si 2              (C)[KLINOEN     0.3717
  O  2Si 1                  (C)  [QUART     0.5763
  Si 1                      (C)[]           0.0520
*
     92 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           947.7070
 Gas products amount        (mol)       1.57E-0012
 Products heat capacity     (J/K)          61.4648
 Products entropy           (J/K)          99.6786
 Products enthalpy          (KJ)         -745.0581
 Mass  of the system        (Kg)            0.0538
  Mg 2O  6Si 2              (C)[KLINOEN     0.3304
  O  2Si 1                  (C)[]           0.0546
  O  2Si 1                  (C)  [QUART     0.5688
  Si 1                      (C)[]           0.0462
*
     93 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           881.6261
 Gas products amount        (mol)       3.74E-0011
 Products heat capacity     (J/K)          61.5588
 Products entropy           (J/K)          96.6290
 Products enthalpy          (KJ)         -763.1957
 Mass  of the system        (Kg)            0.0545
  Mg 2O  6Si 2              (C)[KLINOEN     0.2891
  O  2Si 1                  (C)[]           0.6696
  O  2Si 1                  (C)  [QUART 7.87E-0004
  Si 1                      (C)[]           0.0404
*
     94 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           822.0601
 Gas products amount        (mol)       7.00E-0012
 Products heat capacity     (J/K)          69.5469
 Products entropy           (J/K)          93.1057
 Products enthalpy          (KJ)         -781.8684
 Mass  of the system        (Kg)            0.0552
  Mg 2O  6Si 2              (C)[KLINOEN     0.2478
  O  2Si 1                  (C)[]           0.7175
  Si 1                      (C)[]           0.0347
*
     95 wt% SiO2
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           760.9440
```

```
 Gas products amount        (mol)       1.67E-0011
 Products heat capacity     (J/K)          65.9936
 Products entropy           (J/K)          89.1777
 Products enthalpy          (KJ)         -801.0027
 Mass  of the system        (Kg)            0.0560
  Mg 2O  6Si 2              (C)[KLINOEN     0.2065
  O  2Si 1                  (C)[]           0.7646
  Si 1                      (C)[]           0.0289
*
```

96 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           698.9899
 Gas products amount        (mol)       4.92E-0013
 Products heat capacity     (J/K)          63.8198
 Products entropy           (J/K)          84.9101
 Products enthalpy          (KJ)         -820.5090
 Mass  of the system        (Kg)            0.0567
  Mg 2O  6Si 2              (C)[KLINOEN     0.1652
  O  2Si 1                  (C)[]           0.8117
  Si 1                      (C)[]           0.0231
*
```

97 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           628.5455
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          62.3458
 Products entropy           (J/K)          79.3869
 Products enthalpy          (KJ)         -840.9465
 Mass  of the system        (Kg)            0.0575
  Mg 2O  6Si 2              (C)[KLINOEN     0.1239
  O  2Si 1                  (C)[]           0.8588
  Si 1                      (C)[]           0.0173
*
```

98 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           557.2239
 Gas products amount        (mol)       1.47E-0014
 Products heat capacity     (J/K)          61.0840
 Products entropy           (J/K)          73.0440
 Products enthalpy          (KJ)         -861.8753
 Mass  of the system        (Kg)            0.0584
  Mg 2O  6Si 2              (C)[KLINOEN     0.0826
  O  2Si 1                  (C)[]           0.9058
  Si 1                      (C)[]           0.0116
*
```

99 wt% SiO2

```
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)           536.6136      536.2940      536.9332
 Gas products amount        (mol)       1.10E-0014    1.10E-0014    1.10E-0014
 Products heat capacity     (J/K)          73.1077       81.2446       61.2758
 Products entropy           (J/K)          66.2699       62.4528       71.8203
 Products enthalpy          (KJ)         -883.1471     -885.1968     -880.1666
 Phase transition enthalpy  (KJ)            5.0301
 Mass  of the system        (Kg)            0.0592
  Mg 2O  6Si 2              (C)[KLINOEN     0.0413        0.0413        0.0413
  O  2Si 1                  (C)[]           0.3882        0.0000        0.9528
  O  2Si 1                  (L)[]           0.5647        0.9529    1.12E-0004
  Si 1                      (C)[]           0.0058        0.0058        0.0058
*
```

100 wt% SiO2

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           511.6791
 Gas products amount        (mol)       1.10E-0014
 Products heat capacity     (J/K)          83.5000
 Products entropy           (J/K)          58.9855
 Products enthalpy          (KJ)         -905.1370
```

```
 Mass  of the system        (Kg)            0.0601
  O  2Si 1                  (L)[]           1.0000
*
```

Al/Fe_2O_3

```
     Content of Fe2O3 - 0 wt% Fe2O3
Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           307.3328
 Gas products amount        (mol)       6.54E-0012
 Products heat capacity     (J/K)          24.4999
 Products entropy           (J/K)          29.0910
 Products enthalpy          (KJ)            0.2224
 Mass  of the system        (Kg)            0.0270
  Al 1                      (C)[]           1.0000
*
     1 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           365.4451
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          25.3815
 Products entropy           (J/K)          33.3976
 Products enthalpy          (KJ)           -1.5574
 Mass  of the system        (Kg)            0.0272
  Al 1                      (C)[]           0.9765
  Al 3Fe 1                  (C)  []         0.0171
  Al 2O  3                  (C)[]           0.0064
*
     2 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           442.0596
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          26.3634
 Products entropy           (J/K)          38.3264
 Products enthalpy          (KJ)           -2.8524
 Mass  of the system        (Kg)            0.0274
  Al 1                      (C)[]           0.9530
  Al 3Fe 1                  (C)  []         0.0343
  Al 2O  3                  (C)[]           0.0128
*
     3 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           500.0100
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          27.1405
 Products entropy           (J/K)          41.6461
 Products enthalpy          (KJ)           -4.6284
 Mass  of the system        (Kg)            0.0277
  Al 1                      (C)[]           0.9295
  Al 3Fe 1                  (C)  []         0.0514
  Al 2O  3                  (C)[]           0.0192
*
     4 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           579.4158
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          28.2392
 Products entropy           (J/K)          45.7680
 Products enthalpy          (KJ)           -5.8060
 Mass  of the system        (Kg)            0.0279
  Al 1                      (C)[]           0.9059
  Al 3Fe 1                  (C)  []         0.0685
  Al 2O  3                  (C)[]           0.0255
*
     5 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           645.6759
```

```
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          29.2726
 Products entropy           (J/K)          48.9421
 Products enthalpy          (KJ)           -7.3232
 Mass  of the system        (Kg)            0.0282
  Al 1                      (C)[]           0.8824
  Al 3Fe 1                  (C)  []         0.0857
  Al 2O  3                  (C)[]           0.0319
*
```

6 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           686.3645
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          30.0091
 Products entropy           (J/K)          50.8283
 Products enthalpy          (KJ)           -9.5937
 Mass  of the system        (Kg)            0.0284
  Al 1                      (C)[]           0.8589
  Al 3Fe 1                  (C)  []         0.1028
  Al 2O  3                  (C)[]           0.0383
*
```

7 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          32.0116
 Products entropy           (J/K)          55.6634
 Products enthalpy          (KJ)           -9.5981
 Mass  of the system        (Kg)            0.0286
  Al 1                      (C)[]           0.8354
  Al 3Fe 1                  (C)  []         0.1199
  Al 2O  3                  (C)[]           0.0447
*
```

8 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.5000
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)          33.0309
 Products entropy           (J/K)          57.6849
 Products enthalpy          (KJ)          -11.5988
 Mass  of the system        (Kg)            0.0289
  Al 1                      (C)[]           0.8119
  Al 3Fe 1                  (C)  []         0.1371
  Al 2O  3                  (C)[]           0.0511
*
```

9 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           917.1177
 Gas products amount        (mol)       4.53E-0011
 Products heat capacity     (J/K)          34.5021
 Products entropy           (J/K)          60.4280
 Products enthalpy          (KJ)          -12.9160
 Mass  of the system        (Kg)            0.0292
  Al 1                      (C)[]           0.7883
  Al 3Fe 1                  (C)  []         0.1542
  Al 2O  3                  (C)[]           0.0575
*
```

10 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           933.5329
 Gas products amount        (mol)       4.71E-0014
 Products heat capacity     (J/K)          34.9568
 Products entropy           (J/K)          61.1720
 Products enthalpy          (KJ)          -16.0399
 Mass  of the system        (Kg)            0.0294
  Al 1                      (C)[]           0.7647
```

```
 Al 1                      (L)[]       9.94E-0005
 Al 3Fe 1                  (C)  []         0.1713
 Al 2O  3                  (C)[]           0.0638
*
    11 wt% Fe2O3
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.5234      933.4320      933.6148
Gas products amount        (mol)       1.35E-0014    1.30E-0014    1.45E-0014
Products heat capacity     (J/K)          34.4835       35.0732       33.3383
Products entropy           (J/K)          64.4789       61.2984       70.6548
Products enthalpy          (KJ)          -16.8350      -19.8044      -11.0692
Phase transition enthalpy  (KJ)            8.7352
Mass  of the system        (Kg)            0.0297
 Al 1                      (C)[]           0.4892        0.7412        0.0000
 Al 1                      (L)[]           0.2521    1.09E-0004        0.7413
 Al 3Fe 1                  (C)  []         0.1885        0.1885        0.1885
 Al 2O  3                  (C)[]           0.0702        0.0702        0.0702
*
    12 wt% Fe2O3
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.4618      933.3062      933.6173
Gas products amount        (mol)       6.64E-0014    1.46E-0013    1.30E-0014
Products heat capacity     (J/K)          34.1799       35.1915       33.4986
Products entropy           (J/K)          66.8929       61.4261       70.5742
Products enthalpy          (KJ)          -18.5345      -23.6383      -15.0976
Phase transition enthalpy  (KJ)            8.5407
Mass  of the system        (Kg)            0.0300
 Al 1                      (C)[]           0.2888        0.7177        0.0000
 Al 1                      (L)[]           0.4290    1.19E-0004        0.7178
 Al 3Fe 1                  (C)  []         0.2056        0.2056        0.2056
 Al 2O  3                  (C)[]           0.0766        0.0766        0.0766
*
    13 wt% Fe2O3
Volume of gas products   (litres)          0.0000        0.0000        0.0000
Pressure of gas products   (atm)           1.0000        1.0000        1.0000
Temperature                (K)           933.3861      933.1580      933.6142
Gas products amount        (mol)       1.06E-0011    8.31E-0011    4.13E-0014
Products heat capacity     (J/K)          33.8723       35.3119       33.6620
Products entropy           (J/K)          69.3524       61.5539       70.4920
Products enthalpy          (KJ)          -20.2661      -27.5469      -19.2022
Phase transition enthalpy  (KJ)            8.3447
Mass  of the system        (Kg)            0.0302
 Al 1                      (C)[]           0.0885        0.6943        0.0000
 Al 1                      (L)[]           0.6058        0.0000        0.6943
 Al 3Fe 1                  (C)  []         0.2227        0.2227        0.2227
 Al 2O  3                  (C)[]           0.0830        0.0830        0.0830
*
    14 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)           955.0000
Gas products amount        (mol)       2.32E-0011
Products heat capacity     (J/K)          33.8823
Products entropy           (J/K)          71.1750
Products enthalpy          (KJ)          -22.6608
Mass  of the system        (Kg)            0.0305
 Al 1                      (L)[]           0.6708
 Al 3Fe 1                  (C)  []         0.2398
 Al 2O  3                  (C)[]           0.0894
*
    15 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1042.0000
Gas products amount        (mol)       8.26E-0011
Products heat capacity     (J/K)          34.2889
Products entropy           (J/K)          74.0729
Products enthalpy          (KJ)          -23.9447
Mass  of the system        (Kg)            0.0308
```

```
 Al 1                      (L)[]           0.6473
 Al 3Fe 1                  (C)  []         0.2570
 Al 2O  3                  (C)[]           0.0958
*
    16 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1117.2049
Gas products amount        (mol)       1.46E-0011
Products heat capacity     (J/K)          34.6961
Products entropy           (J/K)          76.4166
Products enthalpy          (KJ)          -25.6679
Mass  of the system        (Kg)            0.0311
 Al 1                      (L)[]           0.6237
 Al 3Fe 1                  (C)  []         0.2741
 Al 2O  3                  (C)[]           0.1022
*
    17 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1200.0100
Gas products amount        (mol)       1.03E-0010
Products heat capacity     (J/K)          35.1569
Products entropy           (J/K)          78.8679
Products enthalpy          (KJ)          -27.1575
Mass  of the system        (Kg)            0.0314
 Al 1                      (L)[]           0.6002
 Al 3Fe 1                  (C)  []         0.2912
 Al 2O  3                  (C)[]           0.1085
*
    18 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1261.3692
Gas products amount        (mol)       1.32E-0010
Products heat capacity     (J/K)          35.5954
Products entropy           (J/K)          80.5994
Products enthalpy          (KJ)          -29.4384
Mass  of the system        (Kg)            0.0317
 Al 1                      (L)[]           0.5767
 Al 3Fe 1                  (C)  []         0.3084
 Al 2O  3                  (C)[]           0.1149
*
    19 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1333.4187
Gas products amount        (mol)       7.24E-0011
Products heat capacity     (J/K)          36.1027
Products entropy           (J/K)          82.5709
Products enthalpy          (KJ)          -31.3768
Mass  of the system        (Kg)            0.0320
 Al 1                      (L)[]           0.5532
 Al 3Fe 1                  (C)  []         0.3255
 Al 2O  3                  (C)[]           0.1213
*
    20 wt% Fe2O3
Volume of gas products   (litres)          0.0000
Pressure of gas products   (atm)           1.0000
Temperature                (K)          1410.9533
Gas products amount        (mol)       2.05E-0012
Products heat capacity     (J/K)          36.6678
Products entropy           (J/K)          84.6225
Products enthalpy          (KJ)          -33.1484
Mass  of the system        (Kg)            0.0324
 Al 1                      (L)[]           0.5297
 Al 3Fe 1                  (C)  []         0.3426
 Al 2O  3                  (C)[]           0.1277
*
    21 wt% Fe2O3
Volume of gas products   (litres)          0.0000        0.0000        0.0000
```

Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1432.8957	1432.6180	1433.1735
Gas products amount	(mol)	1.01E-0011	3.55E-0012	5.67E-0011
Products heat capacity	(J/K)	36.9725	37.0516	36.4070
Products entropy	(J/K)	85.8949	85.1899	90.9341
Products enthalpy	(KJ)	-35.3747	-37.0174	-23.6326
Phase transition enthalpy	(KJ)	13.3848		
Mass of the system	(Kg)	0.0327		
Al 1	(L)[]	0.5323	0.5061	0.7190
Al 3Fe 1	(C) []	0.3156	0.3598	0.0000
Al 2O 3	(C)[]	0.1341	0.1341	0.1341
Fe 1	(C)[]	0.0180	0.0000	0.1469

*

22 wt% Fe2O3

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1433.3717	1432.8957	1433.8477
Gas products amount	(mol)	1.36E-0011	8.23E-0012	2.59E-0011
Products heat capacity	(J/K)	37.1533	37.3618	36.6795
Products entropy	(J/K)	87.0656	85.2054	91.2936
Products enthalpy	(KJ)	-37.4363	-41.7683	-27.5901
Phase transition enthalpy	(KJ)	14.1782		
Mass of the system	(Kg)	0.0330		
Al 1	(L)[]	0.5508	0.4826	0.7057
Al 3Fe 1	(C) []	0.2617	0.3769	0.0000
Al 2O 3	(C)[]	0.1405	0.1405	0.1405
Fe 1	(C)[]	0.0470	0.0000	0.1539

*

23 wt% Fe2O3

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1433.0080	1432.6442	1433.3717
Gas products amount	(mol)	3.27E-0011	6.06E-0011	1.67E-0012
Products heat capacity	(J/K)	37.3344	37.6760	36.9557
Products entropy	(J/K)	88.2530	85.2073	91.6307
Products enthalpy	(KJ)	-39.5399	-46.6359	-31.6708
Phase transition enthalpy	(KJ)	14.9651		
Mass of the system	(Kg)	0.0334		
Al 1	(L)[]	0.5697	0.4591	0.6923
Al 3Fe 1	(C) []	0.2072	0.3940	0.0000
Al 2O 3	(C)[]	0.1469	0.1469	0.1469
Fe 1	(C)[]	0.0763	0.0000	0.1609

*

24 wt% Fe2O3

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1432.7489	1432.4897	1433.0080
Gas products amount	(mol)	2.89E-0011	1.39E-0011	3.78E-0011
Products heat capacity	(J/K)	37.5198	37.9972	37.2379
Products entropy	(J/K)	89.4659	85.2117	91.9779
Products enthalpy	(KJ)	-41.6880	-51.6026	-35.8335
Phase transition enthalpy	(KJ)	15.7691		
Mass of the system	(Kg)	0.0337		
Al 1	(L)[]	0.5886	0.4356	0.6789
Al 3Fe 1	(C) []	0.1527	0.4112	0.0000
Al 2O 3	(C)[]	0.1532	0.1532	0.1532
Fe 1	(C)[]	0.1055	0.0000	0.1679

*

25 wt% Fe2O3

Volume of gas products	(litres)	0.0000	0.0000	0.0000
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1433.2025	1432.7489	1433.6561
Gas products amount	(mol)	2.45E-0011	9.46E-0011	3.42E-0012
Products heat capacity	(J/K)	37.7122	38.3270	37.5276
Products entropy	(J/K)	90.7120	85.2274	92.3589
Products enthalpy	(KJ)	-43.8804	-56.6562	-40.0442
Phase transition enthalpy	(KJ)	16.6120		
Mass of the system	(Kg)	0.0341		
Al 1	(L)[]	0.6070	0.4121	0.6655
Al 3Fe 1	(C) []	0.0989	0.4283	0.0000
Al 2O 3	(C)[]	0.1596	0.1596	0.1596

```
  Fe 1                      (C)[]           0.1345        0.0000        0.1749
*
     26 wt% Fe2O3
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1432.9201     1432.6377     1433.2025
 Gas products amount        (mol)       1.36E-0010    5.60E-0013    1.51E-0010
 Products heat capacity     (J/K)          37.9051       38.6620       37.8216
 Products entropy           (J/K)          91.9747       85.2334       92.7187
 Products enthalpy          (KJ)          -46.1190      -61.8303      -44.3852
 Phase transition enthalpy  (KJ)           17.4451
 Mass  of the system        (Kg)            0.0344
  Al 1                      (L)[]           0.6259        0.3886        0.6521
  Al 3Fe 1                  (C)   []        0.0443        0.4454        0.0000
  Al 2O  3                  (C)[]           0.1660        0.1660        0.1660
  Fe 1                      (C)[]           0.1638        0.0000        0.1819
*
     27 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1461.9300
 Gas products amount        (mol)       6.76E-0013
 Products heat capacity     (J/K)          38.1786
 Products entropy           (J/K)          93.8555
 Products enthalpy          (KJ)          -47.7071
 Mass  of the system        (Kg)            0.0348
  Al 1                      (L)[]           0.6388
  Al 2O  3                  (C)[]           0.1724
  Fe 1                      (C)[]           0.1888
*
     28 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1495.8999
 Gas products amount        (mol)       9.60E-0013
 Products heat capacity     (J/K)          38.5583
 Products entropy           (J/K)          95.1345
 Products enthalpy          (KJ)          -50.9028
 Mass  of the system        (Kg)            0.0352
  Al 1                      (L)[]           0.6254
  Al 2O  3                  (C)[]           0.1788
  Fe 1                      (C)[]           0.1958
*
     29 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1549.7217
 Gas products amount        (mol)       2.37E-0011
 Products heat capacity     (J/K)          38.9938
 Products entropy           (J/K)          96.9208
 Products enthalpy          (KJ)          -53.3990
 Mass  of the system        (Kg)            0.0355
  Al 1                      (L)[]           0.6120
  Al 2O  3                  (C)[]           0.1852
  Fe 1                      (C)[]           0.2028
*
     30 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1613.2062
 Gas products amount        (mol)       2.31E-0010
 Products heat capacity     (J/K)          39.4687
 Products entropy           (J/K)          98.9333
 Products enthalpy          (KJ)          -55.5748
 Mass  of the system        (Kg)            0.0359
  Al 1                      (L)[]           0.5986
  Al 2O  3                  (C)[]           0.1915
  Fe 1                      (C)[]           0.2098
*
     31 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
```

```
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1665.0000
 Gas products amount        (mol)      2.11E-0011
 Products heat capacity     (J/K)         39.9364
 Products entropy           (J/K)        100.6477
 Products enthalpy          (KJ)         -58.2688
 Mass  of the system        (Kg)           0.0363
  Al 1                      (L)[]          0.5852
  Al 2O  3                  (C)[]          0.1979
  Fe 1                      (C)[]          0.2168
*
     32 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1716.3830
 Gas products amount        (mol)      2.83E-0011
 Products heat capacity     (J/K)         40.8845
 Products entropy           (J/K)        102.4382
 Products enthalpy          (KJ)         -60.8952
 Mass  of the system        (Kg)           0.0368
  Al 1                      (L)[]          0.5719
  Al 2O  3                  (C)[]          0.2043
  Fe 1                      (C)[]          0.2238
*
     33 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1765.7320
 Gas products amount        (mol)      1.03E-0011
 Products heat capacity     (J/K)         41.4167
 Products entropy           (J/K)        104.1119
 Products enthalpy          (KJ)         -63.7879
 Mass  of the system        (Kg)           0.0372
  Al 1                      (L)[]          0.5585
  Al 2O  3                  (C)[]          0.2107
  Fe 1                      (C)[]          0.2308
*
     34 wt% Fe2O3
 Volume of gas products   (litres)         0.0000        0.0000        0.0000
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1808.8120     1808.5134     1809.1106
 Gas products amount        (mol)      1.28E-0010    1.38E-0011    2.41E-0010
 Products heat capacity     (J/K)         42.2290       41.9522       42.5032
 Products entropy           (J/K)        106.2619      105.6431      106.8750
 Products enthalpy          (KJ)         -65.8981      -67.0177      -64.7890
 Phase transition enthalpy  (KJ)           2.2287
 Mass  of the system        (Kg)           0.0376
  Al 1                      (L)[]          0.5451        0.5451        0.5451
  Al 2O  3                  (C)[]          0.2171        0.2171        0.2171
  Fe 1                      (C)[]          0.1180        0.2371        0.0000
  Fe 1                      (L)[]          0.1198    6.99E-0004        0.2378
*
     35 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1838.1741
 Gas products amount        (mol)      1.16E-0009
 Products heat capacity     (J/K)         42.9894
 Products entropy           (J/K)        108.1578
 Products enthalpy          (KJ)         -68.5763
 Mass  of the system        (Kg)           0.0380
  Al 1                      (L)[]          0.5317
  Al 2O  3                  (C)[]          0.2235
  Fe 1                      (L)[]          0.2448
*
     36 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1890.5064
 Gas products amount        (mol)      1.33E-0010
 Products heat capacity     (J/K)         43.5229
```

```
 Products entropy           (J/K)         109.9981
 Products enthalpy          (KJ)          -71.4432
 Mass  of the system        (Kg)            0.0385
  Al 1                      (L)[]           0.5184
  Al 2O  3                  (C)[]           0.2299
  Fe 1                      (L)[]           0.2518
*
     37 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1944.4539
 Gas products amount        (mol)       1.06E-0010
 Products heat capacity     (J/K)          44.0759
 Products entropy           (J/K)         111.8847
 Products enthalpy          (KJ)          -74.3096
 Mass  of the system        (Kg)            0.0390
  Al 1                      (L)[]           0.5050
  Al 2O  3                  (C)[]           0.2362
  Fe 1                      (L)[]           0.2588
*
     38 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1978.6793
 Gas products amount        (mol)       1.93E-0010
 Products heat capacity     (J/K)          44.6159
 Products entropy           (J/K)         113.3395
 Products enthalpy          (KJ)          -78.1243
 Mass  of the system        (Kg)            0.0394
  Al 1                      (L)[]           0.4916
  Al 2O  3                  (C)[]           0.2426
  Fe 1                      (L)[]           0.2658
*
     39 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2052.6395
 Gas products amount        (mol)       1.65E-0010
 Products heat capacity     (J/K)          45.2363
 Products entropy           (J/K)         115.6997
 Products enthalpy          (KJ)          -80.2400
 Mass  of the system        (Kg)            0.0399
  Al 1                      (L)[]           0.4782
  Al 2O  3                  (C)[]           0.2490
  Fe 1                      (L)[]           0.2728
*
     40 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2085.0126
 Gas products amount        (mol)       2.32E-0011
 Products heat capacity     (J/K)          45.8087
 Products entropy           (J/K)         117.1549
 Products enthalpy          (KJ)          -84.3127
 Mass  of the system        (Kg)            0.0404
  Al 1                      (L)[]           0.4648
  Al 2O  3                  (C)[]           0.2554
  Fe 1                      (L)[]           0.2798
*
     41 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2160.6196
 Gas products amount        (mol)       8.72E-0010
 Products heat capacity     (J/K)          46.4734
 Products entropy           (J/K)         119.5736
 Products enthalpy          (KJ)          -86.4809
 Mass  of the system        (Kg)            0.0409
  Al 1                      (L)[]           0.4515
  Al 2O  3                  (C)[]           0.2618
  Fe 1                      (L)[]           0.2868
```

```
*
     42 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2204.9098
 Gas products amount        (mol)       7.08E-0010
 Products heat capacity     (J/K)          47.1051
 Products entropy           (J/K)         121.3334
 Products enthalpy          (KJ)          -90.1768
 Mass  of the system        (Kg)            0.0414
  Al 1                      (L)[]           0.4381
  Al 2O  3                  (C)[]           0.2682
  Fe 1                      (L)[]           0.2938
*
     43 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2268.5409
 Gas products amount        (mol)       1.32E-0010
 Products heat capacity     (J/K)          47.7948
 Products entropy           (J/K)         123.5367
 Products enthalpy          (KJ)          -93.0242
 Mass  of the system        (Kg)            0.0420
  Al 1                      (L)[]           0.4247
  Al 2O  3                  (C)  [GAMMA     0.0016
  Al 2O  3                  (C)[]           0.2729
  Fe 1                      (L)[]           0.3008
*
     44 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2272.8769
 Gas products amount        (mol)       1.16E-0009
 Products heat capacity     (J/K)          48.7066
 Products entropy           (J/K)         125.9541
 Products enthalpy          (KJ)          -95.5490
 Mass  of the system        (Kg)            0.0425
  Al 1                      (L)[]           0.4113
  Al 2O  3                  (C)  [GAMMA     0.2809
  Fe 1                      (L)[]           0.3078
*
     45 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2287.2664
 Gas products amount        (mol)       1.16E-0009
 Products heat capacity     (J/K)          49.3604
 Products entropy           (J/K)         127.2186
 Products enthalpy          (KJ)         -100.8988
 Mass  of the system        (Kg)            0.0431
  Al 1                      (L)[]           0.3979
  Al 2O  3                  (C)  [GAMMA     0.2873
  Fe 1                      (L)[]           0.3147
*
     46 wt% Fe2O3
 Volume of gas products   (litres)      7.64E-0005    1.00E-0004    3.63E-0005
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2326.1307     2325.8553     2326.4062
 Gas products amount        (mol)       3.87E-0007    5.07E-0007    1.84E-0007
 Products heat capacity     (J/K)          50.5068       49.7245       51.8373
 Products entropy           (J/K)         129.6999      127.4656      133.5001
 Products enthalpy          (KJ)         -103.5503     -108.7496      -94.7071
 Phase transition enthalpy  (KJ)           14.0425
 Mass  of the system        (Kg)            0.0437
  Al 1                      (L)[]           0.3846        0.3846        0.3846
  Al 2O  3                  (L)[]           0.1087       -0.0000        0.2937
  Al 2O  3                  (C)[]           0.1850        0.2937        0.0000
  Fe 1                      (L)[]           0.3217        0.3217        0.3217
*
     47 wt% Fe2O3
 Volume of gas products   (litres)      3.74E-0005    8.27E-0005        0.0000
```

```
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2326.5711     2326.1307     2327.0114
 Gas products amount        (mol)      1.90E-0007    4.19E-0007    4.67E-0010
 Products heat capacity     (J/K)         51.5646       50.3663       52.5538
 Products entropy           (J/K)        131.8634      128.4357      134.6930
 Products enthalpy          (KJ)        -107.2440     -115.2202     -100.6595
 Phase transition enthalpy  (KJ)          14.5607
 Mass  of the system        (Kg)           0.0443
  Al 1                      (L)[]          0.3712        0.3712        0.3712
  Al 2O  3                  (L)[]          0.1644        0.0000        0.3001
  Al 2O  3                  (C)[]          0.1357        0.3001        0.0000
  Fe 1                      (L)[]          0.3287        0.3287        0.3287
*
     48 wt% Fe2O3
 Volume of gas products   (litres)      3.54E-0005    1.82E-0005    4.18E-0005
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2324.1102     2323.6463     2324.5742
 Gas products amount        (mol)      1.79E-0007    9.25E-0008    2.12E-0007
 Products heat capacity     (J/K)         52.6725       51.0198       53.2903
 Products entropy           (J/K)        134.0871      129.3723      135.8494
 Products enthalpy          (KJ)        -111.0405     -122.0119     -106.9397
 Phase transition enthalpy  (KJ)          15.0722
 Mass  of the system        (Kg)           0.0449
  Al 1                      (L)[]          0.3578        0.3578        0.3578
  Al 2O  3                  (L)[]          0.2231        0.0000        0.3065
  Al 2O  3                  (C)[]          0.0834        0.3065        0.0000
  Fe 1                      (L)[]          0.3357        0.3357        0.3357
*
     49 wt% Fe2O3
 Volume of gas products   (litres)      5.97E-0005    2.32E-0006    6.71E-0005
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2326.1490     2325.8685     2326.4295
 Gas products amount        (mol)      3.03E-0007    1.18E-0008    3.40E-0007
 Products heat capacity     (J/K)         53.7794       51.7020       54.0472
 Products entropy           (J/K)        136.3726      130.4396      137.1376
 Products enthalpy          (KJ)        -114.9423     -128.7485     -113.1623
 Phase transition enthalpy  (KJ)          15.5862
 Mass  of the system        (Kg)           0.0455
  Al 1                      (L)[]          0.3444        0.3444        0.3444
  Al 2O  3                  (L)[]          0.2771        0.0000        0.3129
  Al 2O  3                  (C)[]          0.0357        0.3129        0.0000
  Fe 1                      (L)[]          0.3427        0.3427        0.3427
*
     50 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)        2330.6400
 Gas products amount        (mol)      1.35E-0009
 Products heat capacity     (J/K)         54.8258
 Products entropy           (J/K)        138.5181
 Products enthalpy          (KJ)        -119.4343
 Mass  of the system        (Kg)           0.0462
  Al 1                      (L)[]          0.3310
  Al 2O  3                  (L)[]          0.3192
  Fe 1                      (L)[]          0.3497
*
     51 wt% Fe2O3
 Volume of gas products   (litres)      1.30E-0004
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)        2385.2051
 Gas products amount        (mol)      6.44E-0007
 Products heat capacity     (J/K)         55.6268
 Products entropy           (J/K)        141.1251
 Products enthalpy          (KJ)        -123.0850
 Mass  of the system        (Kg)           0.0468
  Al 1                      (L)[]          0.3177
  Al 2O  3                  (L)[]          0.3256
  Fe 1                      (L)[]          0.3567
*
     52 wt% Fe2O3
 Volume of gas products   (litres)          0.7784    3.98E-0004       81.8444
```

```
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2410.2492     2409.9617     2410.5368
 Gas products amount        (mol)          0.0038    1.95E-0006        0.4004
 Products heat capacity     (J/K)         56.3319       56.4511       43.9045
 Products entropy           (J/K)        143.5788      143.0856      194.9794
 Products enthalpy          (KJ)        -127.3350     -128.5240       -3.4345
 Phase transition enthalpy  (KJ)         125.0896
 Mass  of the system        (Kg)           0.0475
1 Al 1                      (G)        2.79E-0004    1.43E-0007        0.0293
1 Fe 1                      (G)        7.29E-0005    3.72E-0008        0.0077
1 Al 2O  1                  (G)            0.0048    2.45E-0006        0.5034
1 Al 2                      (G)        3.91E-0006    2.00E-0009    4.11E-0004
  Al 1                      (L)[]          0.3015        0.3043        0.0157
  Al 2O  3                  (L)[]          0.3297        0.3320        0.0874
  Fe 1                      (L)[]          0.3636        0.3637        0.3560
*
```

53 wt% Fe2O3

```
 Volume of gas products   (litres)         2.4973    2.71E-0004       83.7184
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2410.3687     2410.2492     2410.4882
 Gas products amount        (mol)          0.0122    1.33E-0006        0.4096
 Products heat capacity     (J/K)         56.9174       57.3002       44.4658
 Products entropy           (J/K)        146.1026      144.5195      197.5949
 Products enthalpy          (KJ)        -131.7117     -135.5277       -7.5901
 Phase transition enthalpy  (KJ)         127.9376
 Mass  of the system        (Kg)           0.0482
1 Al 1                      (G)        8.81E-0004    9.57E-0008        0.0295
1 Fe 1                      (G)        2.30E-0004    2.50E-0008        0.0077
1 Al 2O  1                  (G)            0.0151    1.64E-0006        0.5075
1 Al 2                      (G)        1.24E-0005    1.34E-0009    4.15E-0004
  Al 1                      (L)[]          0.2822        0.2909        0.0000
  Al 2O  3                  (L)[]          0.3310        0.3384        0.0919
  Fe 1                      (L)[]          0.3705        0.3707        0.3630
*
```

54 wt% Fe2O3

```
 Volume of gas products   (litres)         4.2744    1.48E-0004       75.6625
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2410.4285     2410.3687     2410.4883
 Gas products amount        (mol)          0.0209    7.26E-0007        0.3702
 Products heat capacity     (J/K)         57.5195       58.1748       46.5752
 Products entropy           (J/K)        148.7023      145.9926      193.9586
 Products enthalpy          (KJ)        -136.2201     -142.7518      -27.1304
 Phase transition enthalpy  (KJ)         115.6214
 Mass  of the system        (Kg)           0.0489
1 Al 1                      (G)            0.0015    5.16E-0008        0.0263
1 Fe 1                      (G)        3.88E-0004    1.35E-0008        0.0069
1 Al 2O  1                  (G)            0.0255    8.86E-0007        0.4518
1 Al 2                      (G)        2.09E-0005    7.24E-0010    3.69E-0004
  Al 1                      (L)[]          0.2629        0.2775        0.0185
  Al 2O  3                  (L)[]          0.3324        0.3448        0.1253
  Fe 1                      (L)[]          0.3773        0.3777        0.3708
*
```

55 wt% Fe2O3

```
 Volume of gas products   (litres)         6.1322    2.87E-0004       42.8964
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        2410.0654     2409.7022     2410.4285
 Gas products amount        (mol)          0.0300    1.40E-0006        0.2099
 Products heat capacity     (J/K)         58.1359       59.0760       52.5000
 Products entropy           (J/K)        151.3812      147.4915      174.7022
 Products enthalpy          (KJ)        -140.8659     -150.2421      -84.6509
 Phase transition enthalpy  (KJ)          65.5912
 Mass  of the system        (Kg)           0.0497
1 Al 1                      (G)            0.0021    9.83E-0008        0.0147
1 Fe 1                      (G)        5.49E-0004    2.57E-0008        0.0038
1 Al 2O  1                  (G)            0.0361    1.69E-0006        0.2523
1 Al 2                      (G)        2.95E-0005    1.38E-0009    2.06E-0004
  Al 1                      (L)[]          0.2435        0.2641        0.1195
  Al 2O  3                  (L)[]          0.3336        0.3512        0.2286
  Fe 1                      (L)[]          0.3841        0.3847        0.3808
*
```

56 wt% Fe2O3

```
 Volume of gas products   (litres)          8.0139    2.16E-0004       75.5484
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.4393     2410.0654     2410.8133
 Gas products amount        (mol)           0.0392    1.06E-0006        0.3696
 Products heat capacity     (J/K)          58.7771       60.0053       48.4262
 Products entropy           (J/K)         154.1437      149.0626      196.9639
 Products enthalpy          (KJ)         -145.6566     -157.9045      -42.4389
 Phase transition enthalpy  (KJ)          115.4656
 Mass  of the system        (Kg)            0.0505
1 Al 1                      (G)             0.0027    7.30E-0008        0.0255
1 Fe 1                      (G)          7.08E-0004    1.91E-0008        0.0067
1 Al 2O  1                  (G)             0.0464    1.25E-0006        0.4374
1 Al 2                      (G)          3.79E-0005    1.02E-0009    3.57E-0004
  Al 1                      (L)[]           0.2242        0.2508        0.0000
  Al 2O  3                  (L)[]           0.3350        0.3576        0.1451
  Fe 1                      (L)[]           0.3910        0.3917        0.3850
*
```

58 wt% Fe2O3

```
 Volume of gas products   (litres)         11.9870    3.20E-0004       67.6783
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.1759     2409.9125     2410.4393
 Gas products amount        (mol)           0.0587    1.57E-0006        0.3311
 Products heat capacity     (J/K)          60.1159       61.9535       51.5784
 Products entropy           (J/K)         159.9349      152.3338      195.2499
 Products enthalpy          (KJ)         -155.6997     -174.0219      -70.5731
 Phase transition enthalpy  (KJ)          103.4488
 Mass  of the system        (Kg)            0.0521
1 Al 1                      (G)             0.0039    1.05E-0007        0.0221
1 Fe 1                      (G)             0.0010    2.73E-0008        0.0058
1 Al 2O  1                  (G)             0.0673    1.80E-0006        0.3797
1 Al 2                      (G)          5.50E-0005    1.47E-0009    3.10E-0004
  Al 1                      (L)[]           0.1854        0.2240        0.0063
  Al 2O  3                  (L)[]           0.3376        0.3703        0.1858
  Fe 1                      (L)[]           0.4046        0.4057        0.3999
*
```

59 wt% Fe2O3

```
 Volume of gas products   (litres)         14.0590    4.72E-0004       66.0806
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.3322     2410.1759     2410.4886
 Gas products amount        (mol)           0.0688    2.31E-0006        0.3233
 Products heat capacity     (J/K)          60.8199       62.9751       52.8451
 Products entropy           (J/K)         162.9716      154.0581      195.9550
 Products enthalpy          (KJ)         -160.9661     -182.4520      -81.4601
 Phase transition enthalpy  (KJ)          100.9919
 Mass  of the system        (Kg)            0.0529
1 Al 1                      (G)             0.0045    1.52E-0007        0.0213
1 Fe 1                      (G)             0.0012    3.97E-0008        0.0056
1 Al 2O  1                  (G)             0.0776    2.61E-0006        0.3648
1 Al 2                      (G)          6.34E-0005    2.13E-0009    2.98E-0004
  Al 1                      (L)[]           0.1661        0.2106        0.0015
  Al 2O  3                  (L)[]           0.3390        0.3767        0.1995
  Fe 1                      (L)[]           0.4115        0.4127        0.4071
*
```

60 wt% Fe2O3

```
 Volume of gas products   (litres)         16.2039    6.58E-0005       58.3433
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.4105     2410.3322     2410.4888
 Gas products amount        (mol)           0.0793    3.22E-0007        0.2855
 Products heat capacity     (J/K)          61.5468       64.0307       55.0871
 Products entropy           (J/K)         166.1095      155.8366      192.8249
 Products enthalpy          (KJ)         -166.4077     -191.1704     -102.0106
 Phase transition enthalpy  (KJ)          89.1599
 Mass  of the system        (Kg)            0.0538
1 Al 1                      (G)             0.0051    2.08E-0008        0.0185
1 Fe 1                      (G)             0.0013    5.44E-0009        0.0048
1 Al 2O  1                  (G)             0.0880    3.57E-0007        0.3168
1 Al 2                      (G)          7.19E-0005    2.92E-0010    2.59E-0004
  Al 1                      (L)[]           0.1468        0.1972        0.0156
  Al 2O  3                  (L)[]           0.3403        0.3831        0.2292
  Fe 1                      (L)[]           0.4183        0.4197        0.4148
*
```

61 wt% Fe2O3

Volume of gas products	(litres)	18.4440	4.92E-0004	60.0486
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	2410.0828	2409.7551	2410.4105
Gas products amount	(mol)	0.0902	2.41E-0006	0.2938
Products heat capacity	(J/K)	62.2944	65.1219	55.9162
Products entropy	(J/K)	169.3532	157.6558	195.7400
Products enthalpy	(KJ)	-172.0329	-200.2293	-108.4279
Phase transition enthalpy	(KJ)	91.8015		
Mass of the system	(Kg)	0.0547		
1 Al 1	(G)	0.0057	1.53E-0007	0.0187
1 Fe 1	(G)	0.0015	4.00E-0008	0.0049
1 Al 2O 1	(G)	0.0985	2.63E-0006	0.3207
1 Al 2	(G)	8.05E-0005	2.14E-0009	2.62E-0004
Al 1	(L)[]	0.1274	0.1839	0.0000
Al 2O 3	(L)[]	0.3416	0.3895	0.2337
Fe 1	(L)[]	0.4252	0.4267	0.4218

*

62 wt% Fe2O3

Volume of gas products	(litres)	20.7322	4.23E-0004	56.6355
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	2410.2859	2410.0828	2410.4890
Gas products amount	(mol)	0.1014	2.07E-0006	0.2771
Products heat capacity	(J/K)	63.0723	66.2505	57.5683
Products entropy	(J/K)	172.7079	159.5618	195.4744
Products enthalpy	(KJ)	-177.8507	-209.5392	-122.9722
Phase transition enthalpy	(KJ)	86.5670		
Mass of the system	(Kg)	0.0557		
1 Al 1	(G)	0.0063	1.29E-0007	0.0173
1 Fe 1	(G)	0.0017	3.38E-0008	0.0045
1 Al 2O 1	(G)	0.1089	2.22E-0006	0.2974
1 Al 2	(G)	8.90E-0005	1.81E-0009	2.43E-0004
Al 1	(L)[]	0.1081	0.1705	0.0000
Al 2O 3	(L)[]	0.3430	0.3959	0.2514
Fe 1	(L)[]	0.4320	0.4336	0.4291

*

63 wt% Fe2O3

Volume of gas products	(litres)	23.1053	3.47E-0004	53.1012
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	2410.3877	2410.2859	2410.4895
Gas products amount	(mol)	0.1130	1.70E-0006	0.2598
Products heat capacity	(J/K)	63.8765	67.4185	59.2781
Products entropy	(J/K)	176.1799	161.5309	195.1977
Products enthalpy	(KJ)	-183.8718	-219.1828	-138.0295
Phase transition enthalpy	(KJ)	81.1534		
Mass of the system	(Kg)	0.0566		
1 Al 1	(G)	0.0069	1.04E-0007	0.0160
1 Fe 1	(G)	0.0018	2.72E-0008	0.0042
1 Al 2O 1	(G)	0.1192	1.79E-0006	0.2741
1 Al 2	(G)	9.75E-0005	1.46E-0009	2.24E-0004
Al 1	(L)[]	0.0887	0.1571	-0.0000
Al 2O 3	(L)[]	0.3443	0.4022	0.2691
Fe 1	(L)[]	0.4388	0.4406	0.4365

*

62 wt% Fe2O3

Volume of gas products	(litres)	20.7433	5.94E-0006	55.8421
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	2410.0393	2409.6910	2410.3877
Gas products amount	(mol)	0.1015	2.91E-0008	0.2732
Products heat capacity	(J/K)	63.0705	66.2505	57.6896
Products entropy	(J/K)	172.7079	159.5508	194.9705
Products enthalpy	(KJ)	-177.8507	-209.5658	-124.1870
Phase transition enthalpy	(KJ)	85.3788		
Mass of the system	(Kg)	0.0557		
1 Al 1	(G)	0.0063	1.93E-0009	0.0171
1 Fe 1	(G)	0.0017	7.12E-0011	0.0045
1 Al 2O 1	(G)	0.1089	3.10E-0008	0.2932
1 Al 2	(G)	8.90E-0005	2.72E-0011	2.40E-0004
Al 1	(L)[]	0.1080	0.1705	0.0024
Al 2O 3	(L)[]	0.3429	0.3959	0.2534
Fe 1	(L)[]	0.4320	0.4336	0.4292

```
*
     63 wt% Fe2O3
 Volume of gas products   (litres)         23.1106    3.82E-0004       53.1041
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.3165     2410.0393     2410.5937
 Gas products amount        (mol)           0.1131    1.87E-0006        0.2598
 Products heat capacity     (J/K)          63.8758       67.4185       59.2779
 Products entropy           (J/K)         176.1799      161.5241      195.2008
 Products enthalpy          (KJ)         -183.8718     -219.1994     -138.0221
 Phase transition enthalpy  (KJ)           81.1773
 Mass  of the system        (Kg)            0.0566
1 Al 1                      (G)             0.0069    1.15E-0007        0.0160
1 Fe 1                      (G)             0.0018    3.00E-0008        0.0042
1 Al 2O  1                  (G)             0.1193    1.97E-0006        0.2741
1 Al 2                      (G)         9.75E-0005    1.61E-0009    2.24E-0004
  Al 1                      (L)[]           0.0887        0.1571        0.0000
  Al 2O  3                  (L)[]           0.3443        0.4022        0.2691
  Fe 1                      (L)[]           0.4388        0.4406        0.4365
*
     64 wt% Fe2O3
 Volume of gas products   (litres)         25.5676    3.27E-0004       49.4421
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.4034     2410.3165     2410.4903
 Gas products amount        (mol)           0.1251    1.60E-0006        0.2419
 Products heat capacity     (J/K)          64.7085       68.6278       61.0486
 Products entropy           (J/K)         179.7747      163.5649      194.9113
 Products enthalpy          (KJ)         -190.1060     -229.1796     -153.6194
 Phase transition enthalpy  (KJ)           75.5602
 Mass  of the system        (Kg)            0.0576
1 Al 1                      (G)             0.0076    9.67E-0008        0.0146
1 Fe 1                      (G)             0.0020    2.53E-0008        0.0038
1 Al 2O  1                  (G)             0.1296    1.66E-0006        0.2507
1 Al 2                      (G)         1.06E-0004    1.36E-0009    2.05E-0004
  Al 1                      (L)[]           0.0694        0.1437        0.0000
  Al 2O  3                  (L)[]           0.3456        0.4086        0.2868
  Fe 1                      (L)[]           0.4457        0.4476        0.4438
*
     65 wt% Fe2O3
 Volume of gas products   (litres)         28.1022    2.07E-0005       45.6744
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.7453     2410.4034     2411.0871
 Gas products amount        (mol)           0.1375    1.01E-0007        0.2234
 Products heat capacity     (J/K)          65.5693       69.8758       62.8764
 Products entropy           (J/K)         183.4850      165.6639      194.6284
 Products enthalpy          (KJ)         -196.5436     -239.5009     -169.6824
 Phase transition enthalpy  (KJ)           69.8186
 Mass  of the system        (Kg)            0.0587
1 Al 1                      (G)             0.0082    5.99E-0009        0.0133
1 Fe 1                      (G)             0.0021    1.57E-0009        0.0035
1 Al 2O  1                  (G)             0.1399    1.03E-0007        0.2274
1 Al 2                      (G)         1.14E-0004    8.90E-0011    1.86E-0004
  Al 1                      (L)[]           0.0502        0.1304        0.0000
  Al 2O  3                  (L)[]           0.3470        0.4150        0.3045
  Fe 1                      (L)[]           0.4525        0.4546        0.4511
*
     66 wt% Fe2O3
 Volume of gas products   (litres)         30.7635    3.91E-0004       41.7247
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2410.4034     2410.0616     2410.7453
 Gas products amount        (mol)           0.1505    1.91E-0006        0.2041
 Products heat capacity     (J/K)          66.4649       71.1801       64.7848
 Products entropy           (J/K)         187.3617      167.8483      194.3145
 Products enthalpy          (KJ)         -203.2633     -250.3000     -186.5035
 Phase transition enthalpy  (KJ)           63.7965
 Mass  of the system        (Kg)            0.0598
1 Al 1                      (G)             0.0088    1.11E-0007        0.0119
1 Fe 1                      (G)             0.0023    2.91E-0008        0.0031
1 Al 2O  1                  (G)             0.1504    1.91E-0006        0.2040
1 Al 2                      (G)         1.23E-0004    1.56E-0009    1.67E-0004
  Al 1                      (L)[]           0.0307        0.1170        0.0000
  Al 2O  3                  (L)[]           0.3483        0.4214        0.3223
```

```
  Fe 1                      (L)[]          0.4593        0.4616        0.4585
*
     67 wt% Fe2O3
 Volume of gas products   (litres)        33.4965    3.67E-0005       37.6498
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         2410.7041     2410.4034     2411.0047
 Gas products amount        (mol)          0.1639    1.79E-0007        0.1842
 Products heat capacity     (J/K)         67.3947       72.5283       66.7581
 Products entropy           (J/K)        191.3689      170.1246      194.0030
 Products enthalpy          (KJ)        -210.2127     -261.4219     -203.8632
 Phase transition enthalpy  (KJ)          57.5587
 Mass  of the system        (Kg)           0.0609
1 Al 1                      (G)            0.0094    1.03E-0008        0.0105
1 Fe 1                      (G)            0.0025    2.68E-0009        0.0028
1 Al 2O  1                  (G)            0.1608    1.76E-0007        0.1807
1 Al 2                      (G)         1.31E-0004    1.44E-0010    1.48E-0004
  Al 1                      (L)[]          0.0114        0.1036        0.0000
  Al 2O  3                  (L)[]          0.3497        0.4278        0.3400
  Fe 1                      (L)[]          0.4662        0.4686        0.4659
*
     68 wt% Fe2O3
 Volume of gas products   (litres)        34.5475
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         2466.2364
 Gas products amount        (mol)          0.1652
 Products heat capacity     (J/K)         68.8014
 Products entropy           (J/K)        195.4757
 Products enthalpy          (KJ)        -217.5047
 Mass  of the system        (Kg)           0.0620
1 Al 1                      (G)            0.0098        0.1366  (atm)
1 Fe 1                      (G)            0.0037        0.0245  (atm)
1 Al 2O  1                  (G)            0.1561        0.8380  (atm)
1 Al 2                      (G)         1.21E-0004    8.45E-0004  (atm)
  Al 2O  3                  (L)[]          0.3583
  Fe 1                      (L)[]          0.4720
*
     69 wt% Fe2O3
 Volume of gas products   (litres)        32.8558
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         2593.1201
 Gas products amount        (mol)          0.1494
 Products heat capacity     (J/K)         70.8733
 Products entropy           (J/K)        199.5256
 Products enthalpy          (KJ)        -225.1289
 Mass  of the system        (Kg)           0.0633
1 Al 1                      (G)            0.0097        0.1524  (atm)
1 Fe 1                      (G)            0.0077        0.0581  (atm)
1 Al 2O  1                  (G)            0.1303        0.7886  (atm)
1 Al 2                      (G)         9.08E-0005    7.12E-0004  (atm)
  Al 2O  3                  (L)[]          0.3772
  Fe 1                      (L)[]          0.4749
*
     70 wt% Fe2O3
 Volume of gas products   (litres)        30.9429
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         2705.2977
 Gas products amount        (mol)          0.1349
 Products heat capacity     (J/K)         72.9669
 Products entropy           (J/K)        203.4600
 Products enthalpy          (KJ)        -233.2436
 Mass  of the system        (Kg)           0.0645
1 Al 1                      (G)            0.0091        0.1619  (atm)
1 Fe 1                      (G)            0.0135        0.1160  (atm)
1 Al 2O  1                  (G)            0.1055        0.7210  (atm)
1 Al 2                      (G)         6.64E-0005    5.89E-0004  (atm)
  Al 2O  3                  (L)[]          0.3957
  Fe 1                      (L)[]          0.4761
*
     71 wt% Fe2O3
 Volume of gas products   (litres)        29.2120
 Pressure of gas products   (atm)          1.0000
```

```
 Temperature                (K)          2811.5242
 Gas products amount        (mol)           0.1225
 Products heat capacity     (J/K)          75.0739
 Products entropy           (J/K)         207.6309
 Products enthalpy          (KJ)         -240.9684
 Mass  of the system        (Kg)            0.0658
1 Al 1                      (G)             0.0082        0.1629  (atm)
1 Fe 1                      (G)             0.0219        0.2110  (atm)
1 Al 1O  1                  (G)          8.66E-0005       0.0011  (atm)
1 Al 2O  1                  (G)             0.0813        0.6244  (atm)
  Al 2O  3                  (L)[]           0.4137
  Fe 1                      (L)[]           0.4747
*
```

72 wt% Fe2O3

```
 Volume of gas products   (litres)         27.3602
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2904.8502
 Gas products amount        (mol)           0.1111
 Products heat capacity     (J/K)          77.2220
 Products entropy           (J/K)         211.6742
 Products enthalpy          (KJ)         -249.3492
 Mass  of the system        (Kg)            0.0672
1 Al 1                      (G)             0.0068        0.1522  (atm)
1 Fe 1                      (G)             0.0317        0.3436  (atm)
1 Al 1O  1                  (G)          1.40E-0004       0.0020  (atm)
1 Al 2O  1                  (G)             0.0580        0.5016  (atm)
  Al 2O  3                  (L)[]           0.4314
  Fe 1                      (L)[]           0.4719
*
```

73 wt% Fe2O3

```
 Volume of gas products   (litres)         25.3746
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2990.3623
 Gas products amount        (mol)           0.1001
 Products heat capacity     (J/K)          79.4257
 Products entropy           (J/K)         215.6549
 Products enthalpy          (KJ)         -258.2427
 Mass  of the system        (Kg)            0.0686
1 Al 1                      (G)             0.0050        0.1260  (atm)
1 Fe 1                      (G)             0.0425        0.5216  (atm)
1 Al 1O  1                  (G)          1.98E-0004       0.0032  (atm)
1 Al 2O  1                  (G)             0.0356        0.3486  (atm)
  Al 2O  3                  (L)[]           0.4486
  Fe 1                      (L)[]           0.4681
*
```

74 wt% Fe2O3

```
 Volume of gas products   (litres)         23.1057
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          3071.8335
 Gas products amount        (mol)           0.0887
 Products heat capacity     (J/K)          81.7002
 Products entropy           (J/K)         219.5318
 Products enthalpy          (KJ)         -267.6886
 Mass  of the system        (Kg)            0.0701
1 Al 1                      (G)             0.0026        0.0760  (atm)
1 Fe 1                      (G)             0.0536        0.7586  (atm)
1 Al 1O  1                  (G)          2.34E-0004       0.0043  (atm)
1 Al 2O  1                  (G)             0.0142        0.1602  (atm)
  Al 2O  3                  (L)[]           0.4654
  Fe 1                      (L)[]           0.4639
*
```

75 wt% Fe2O3

```
 Volume of gas products   (litres)         19.9931        9.6962      104.6871
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3126.0238     3125.6120     3126.4357
 Gas products amount        (mol)           0.0754        0.0366        0.3949
 Products heat capacity     (J/K)          83.8440       84.5957       77.6618
 Products entropy           (J/K)         223.0619      218.6641      259.2347
 Products enthalpy          (KJ)         -276.8402     -290.5860     -163.7779
 Phase transition enthalpy  (KJ)          126.8081
 Mass  of the system        (Kg)            0.0716
```

```
1 Al 1                      (G)         1.20E-0005    5.30E-0006    6.70E-0005
1 Fe 1                      (G)             0.0566        0.0274        0.2968
1 O  1                      (G)         1.25E-0004    6.38E-0005    6.26E-0004
1 Al 1O  1                  (G)         4.67E-0005    2.19E-0005    2.50E-0004
1 Al 2O  1                  (G)         1.09E-0005    4.66E-0006    6.20E-0005
1 Fe 1O  1                  (G)             0.0020        0.0010        0.0101
1 O  2                      (G)         6.38E-0005    3.44E-0005    3.05E-0004
  Al 2O  3                  (L)[]           0.4723        0.4723        0.4718
  Fe 1                      (L)[]           0.4579        0.4868        0.2199
  Fe 1O  1                  (L)[]           0.0110        0.0123        0.0000
*
```

76 wt% Fe2O3

```
 Volume of gas products   (litres)         12.6688    3.27E-0004       77.0279
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3125.2704     3125.0193     3125.5216
 Gas products amount        (mol)           0.0478    1.23E-0006        0.2907
 Products heat capacity     (J/K)          85.7234       86.6478       81.0272
 Products entropy           (J/K)         225.5371      220.1186      253.0643
 Products enthalpy          (KJ)         -286.8594     -303.7951     -200.8215
 Phase transition enthalpy  (KJ)          102.9736
 Mass  of the system        (Kg)            0.0732
1 Fe 1                      (G)             0.0350    9.02E-0007        0.2128
1 O  1                      (G)         8.18E-0005    2.11E-0009    4.97E-0004
1 Al 1O  1                  (G)         2.79E-0005    7.19E-0010    1.70E-0004
1 Fe 1O  1                  (G)             0.0013    3.41E-0008        0.0080
1 O  2                      (G)         4.43E-0005    1.14E-0009    2.69E-0004
  Al 2O  3                  (L)[]           0.4534        0.4535        0.4531
  Fe 1                      (L)[]           0.4447        0.4793        0.2689
  Fe 1O  1                  (L)[]           0.0654        0.0672        0.0560
*
```

77 wt% Fe2O3

```
 Volume of gas products   (litres)          4.9720    3.23E-0004      166.5880
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3125.4156     3125.2704     3125.5607
 Gas products amount        (mol)           0.0188    1.22E-0006        0.6286
 Products heat capacity     (J/K)          87.6917       88.0545       75.8990
 Products entropy           (J/K)         228.1265      226.0007      297.2296
 Products enthalpy          (KJ)         -297.3411     -303.9854      -81.3551
 Phase transition enthalpy  (KJ)          222.6302
 Mass  of the system        (Kg)            0.0749
1 Al 1                      (G)         2.58E-0006    1.68E-0010    8.65E-0005
1 Fe 1                      (G)             0.0134    8.73E-0007        0.4499
1 O  1                      (G)         3.14E-0005    2.04E-0009        0.0011
1 Al 1O  1                  (G)         1.07E-0005    6.96E-0010    3.59E-0004
1 Al 2O  1                  (G)         2.26E-0006    1.47E-0010    7.58E-0005
1 Fe 1O  2                  (G)         2.14E-0006    1.39E-0010    7.17E-0005
1 Fe 1O  1                  (G)         5.08E-0004    3.30E-0008        0.0170
1 O  2                      (G)         1.70E-0005    1.10E-0009    5.69E-0004
  Al 2O  3                  (L)[]           0.4346        0.4346        0.4339
  Fe 1                      (L)[]           0.4315        0.4448        0.0000
  Fe 1O  1                  (L)[]           0.1199        0.1206        0.0970
*
```

78 wt% Fe2O3

```
 Volume of gas products   (litres)       2.59E-0004
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          3079.3616
 Gas products amount        (mol)       9.93E-0007
 Products heat capacity     (J/K)          89.5275
 Products entropy           (J/K)         230.8281
 Products enthalpy          (KJ)         -308.3176
 Mass  of the system        (Kg)            0.0767
  Al 2O  3                  (L)[]           0.4157
  Fe 1                      (L)[]           0.4103
  Fe 1O  1                  (L)[]           0.1741
*
```

79 wt% Fe2O3

```
 Volume of gas products   (litres)       2.78E-0006
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2956.3395
 Gas products amount        (mol)       1.11E-0008
 Products heat capacity     (J/K)          91.0720
```

```
 Products entropy           (J/K)         233.5424
 Products enthalpy          (KJ)         -319.8256
 Mass  of the system        (Kg)            0.0786
  Al 2O  3                  (L)[]           0.3968
  Fe 1                      (L)[]           0.3757
  Fe 1O  1                  (L)[]           0.2275
*
```

80 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2831.6175
 Gas products amount        (mol)       2.44E-0010
 Products heat capacity     (J/K)          92.6930
 Products entropy           (J/K)         236.2274
 Products enthalpy          (KJ)         -331.9046
 Mass  of the system        (Kg)            0.0805
  Al 2O  3                  (L)[]           0.3779
  Fe 1                      (L)[]           0.3412
  Fe 1O  1                  (L)[]           0.2809
*
```

81 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2705.1711
 Gas products amount        (mol)       4.06E-0010
 Products heat capacity     (J/K)          94.3965
 Products entropy           (J/K)         238.8616
 Products enthalpy          (KJ)         -344.5978
 Mass  of the system        (Kg)            0.0825
  Al 2O  3                  (L)[]           0.3590
  Fe 1                      (L)[]           0.3066
  Fe 1O  1                  (L)[]           0.3344
*
```

82 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2576.9680
 Gas products amount        (mol)       9.99E-0011
 Products heat capacity     (J/K)          96.1888
 Products entropy           (J/K)         241.4182
 Products enthalpy          (KJ)         -357.9526
 Mass  of the system        (Kg)            0.0847
  Al 2O  3                  (L)[]           0.3401
  Fe 1                      (L)[]           0.2721
  Fe 1O  1                  (L)[]           0.3878
*
```

83 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2446.9605
 Gas products amount        (mol)       2.07E-0010
 Products heat capacity     (J/K)          98.0772
 Products entropy           (J/K)         243.8636
 Products enthalpy          (KJ)         -372.0234
 Mass  of the system        (Kg)            0.0870
  Al 2O  3                  (L)[]           0.3212
  Fe 1                      (L)[]           0.2375
  Fe 1O  1                  (L)[]           0.4413
*
```

84 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2327.0197
 Gas products amount        (mol)       6.26E-0011
 Products heat capacity     (J/K)         100.0695
 Products entropy           (J/K)         246.6677
 Products enthalpy          (KJ)         -385.6775
 Mass  of the system        (Kg)            0.0894
  Al 2O  3                  (L)[]           0.3023
  Fe 1                      (L)[]           0.2030
  Fe 1O  1                  (L)[]           0.4947
```

```
*
     85 wt% Fe2O3
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2326.7374     2326.4552     2327.0197
 Gas products amount        (mol)       1.31E-0010    1.99E-0011    2.53E-0010
 Products heat capacity     (J/K)          99.9374       97.8878      102.1745
 Products entropy           (J/K)         248.4447      242.5867      254.8387
 Products enthalpy          (KJ)         -402.5542     -416.1859     -387.6752
 Phase transition enthalpy  (KJ)           28.5107
 Mass  of the system        (Kg)           0.0919
  Al 2O  3                  (L)[]          0.1355        0.0000        0.2834
  Al 2O  3                  (C)[]          0.1479        0.2834        0.0000
  Fe 1                      (L)[]          0.1684        0.1684        0.1684
  Fe 1O  1                  (L)[]          0.5481        0.5481        0.5481
*
     86 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2306.6680
 Gas products amount        (mol)       7.94E-0010
 Products heat capacity     (J/K)         100.2044
 Products entropy           (J/K)         250.8599
 Products enthalpy          (KJ)         -419.1615
 Mass  of the system        (Kg)           0.0946
  Al 2O  3                  (C)[]          0.2645
  Fe 1                      (L)[]          0.1339
  Fe 1O  1                  (L)[]          0.6016
*
     87 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2145.6096
 Gas products amount        (mol)       4.42E-0011
 Products heat capacity     (J/K)         102.1224
 Products entropy           (J/K)         253.1010
 Products enthalpy          (KJ)         -436.7614
 Mass  of the system        (Kg)           0.0974
  Al 2O  3                  (C)[]          0.2456
  Fe 1                      (L)[]          0.0994
  Fe 1O  1                  (L)[]          0.6550
*
     88 wt% Fe2O3
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          2052.6949     2052.3348     2053.0551
 Gas products amount        (mol)       6.62E-0011    5.50E-0011    7.72E-0011
 Products heat capacity     (J/K)         104.3437      104.1727      104.5120
 Products entropy           (J/K)         255.5129      252.4359      258.5414
 Products enthalpy          (KJ)         -455.4335     -462.9274     -448.0580
 Phase transition enthalpy  (KJ)           14.8694
 Mass  of the system        (Kg)           0.1004
  Al 2Fe 1O  4              (C)  []        0.1917        0.3865        0.0000
  Al 2O  3                  (C)[]          0.1143        0.0000        0.2267
  Fe 1                      (L)[]          0.0648        0.0648        0.0648
  Fe 1O  1                  (L)[]          0.6292        0.5487        0.7085
*
     89 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1947.2833
 Gas products amount        (mol)       6.71E-0011
 Products heat capacity     (J/K)         106.5183
 Products entropy           (J/K)         257.7198
 Products enthalpy          (KJ)         -475.3308
 Mass  of the system        (Kg)           0.1036
  Al 2Fe 1O  4              (C)  []        0.3543
  Fe 1                      (L)[]          0.0303
  Fe 1O  1                  (L)[]          0.6154
*
     90 wt% Fe2O3
```

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1782.3700
 Gas products amount        (mol)       1.67E-0013
 Products heat capacity     (J/K)         108.6583
 Products entropy           (J/K)         258.7834
 Products enthalpy          (KJ)         -496.2327
 Mass  of the system        (Kg)            0.1071
  Al 2Fe 1O  4              (C)  []         0.3227
  Fe 3O  4                  (C)[]           0.0148
  Fe 1O  1                  (L)[]           0.6625
*
```

91 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1665.0000
 Gas products amount        (mol)       1.15E-0010
 Products heat capacity     (J/K)         109.6785
 Products entropy           (J/K)         255.8818
 Products enthalpy          (KJ)         -520.1479
 Mass  of the system        (Kg)            0.1107
  Al 2Fe 1O  4              (C)  []         0.2899
  Fe 3O  4                  (C)[]           0.1609
  Fe 1O  1                  (L)[]           0.5492
*
```

92 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1649.7963     1649.4619     1650.1306
 Gas products amount        (mol)       1.41E-0011    2.00E-0011    6.78E-0012
 Products heat capacity     (J/K)         111.3461      111.2598      111.4526
 Products entropy           (J/K)         254.1759      249.6096      259.8207
 Products enthalpy          (KJ)         -543.3586     -550.8932     -534.0445
 Phase transition enthalpy  (KJ)           16.8487
 Mass  of the system        (Kg)            0.1146
  Al 2Fe 1O  4              (C)  []         0.2577        0.2577        0.2577
  Fe 3O  4                  (C)[]           0.3042        0.3042        0.3042
  Fe 1O  1                  (C)[]           0.2422        0.4382        0.0000
  Fe 1O  1                  (L)[]           0.1959        0.0000        0.4382
*
```

93 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1568.6891
 Gas products amount        (mol)       2.11E-0011
 Products heat capacity     (J/K)         112.0539
 Products entropy           (J/K)         251.5326
 Products enthalpy          (KJ)         -569.3671
 Mass  of the system        (Kg)            0.1188
  Al 2Fe 1O  4              (C)  []         0.2255
  Fe 3O  4                  (C)[]           0.4474
  Fe 1O  1                  (C)[]           0.3272
*
```

94 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1413.0242
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)         112.8988
 Products entropy           (J/K)         247.6874
 Products enthalpy          (KJ)         -597.3430
 Mass  of the system        (Kg)            0.1233
  Al 2Fe 1O  4              (C)  []         0.1933
  Fe 3O  4                  (C)[]           0.5906
  Fe 1O  1                  (C)[]           0.2162
*
```

95 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1251.9255
 Gas products amount        (mol)       6.61E-0012
```

```
 Products heat capacity     (J/K)         115.1768
 Products entropy           (J/K)         242.0430
 Products enthalpy          (KJ)         -627.5330
 Mass  of the system        (Kg)            0.1282
  Al 2Fe 1O  4              (C)  []         0.1610
  Fe 3O  4                  (C)[]           0.7338
  Fe 1O  1                  (C)[]           0.1051
*
     96 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1084.3435
 Gas products amount        (mol)       3.15E-0013
 Products heat capacity     (J/K)         118.9006
 Products entropy           (J/K)         233.6145
 Products enthalpy          (KJ)         -660.1984
 Mass  of the system        (Kg)            0.1334
  Al 2Fe 1O  4              (C)  []         0.1146
  Al 2O  3                  (C)[]           0.0083
  Fe 3O  4                  (C)[]           0.8770
*
     97 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           892.9289
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)         129.4359
 Products entropy           (J/K)         215.3144
 Products enthalpy          (KJ)         -695.7166
 Mass  of the system        (Kg)            0.1392
  Al 2Fe 1O  4              (C)  []         0.0966
  Fe 2O  3                  (C)[]           0.2598
  Fe 3O  4                  (C)[]           0.6436
*
     98 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           724.7554
 Gas products amount        (mol)       1.30E-0014
 Products heat capacity     (J/K)         141.7294
 Products entropy           (J/K)         189.8108
 Products enthalpy          (KJ)         -734.3372
 Mass  of the system        (Kg)            0.1454
  Al 2Fe 1O  4              (C)  []         0.0644
  Fe 2O  3                  (C)[]           0.5065
  Fe 3O  4                  (C)[]           0.4291
*
     99 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           529.7988
 Gas products amount        (mol)       6.88E-0014
 Products heat capacity     (J/K)         128.4855
 Products entropy           (J/K)         152.1993
 Products enthalpy          (KJ)         -776.6924
 Mass  of the system        (Kg)            0.1522
  Al 2Fe 1O  4              (C)  []         0.0322
  Fe 2O  3                  (C)[]           0.7533
  Fe 3O  4                  (C)[]           0.2145
*
     100 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           307.6578
 Gas products amount        (mol)       1.26E-0013
 Products heat capacity     (J/K)         105.5161
 Products entropy           (J/K)          90.6848
 Products enthalpy          (KJ)         -822.0056
 Mass  of the system        (Kg)            0.1597
  Fe 2O  3                  (C)[]           1.0000
*
```

Mg/Fe_2O_3

```
     Content of Fe2O3 - 0 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           337.7174
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          25.3685
 Products entropy           (J/K)          35.8117
 Products enthalpy          (KJ)            0.9927
 Mass  of the system        (Kg)            0.0243
  Mg 1                      (C)[]           1.0000
*
     1 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           337.7174
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          25.4762
 Products entropy           (J/K)          35.8316
 Products enthalpy          (KJ)           -1.7713
 Mass  of the system        (Kg)            0.0245
  Fe 1                      (C)[]           0.0070
  Mg 1                      (C)[]           0.9854
  Mg 1O  1                  (C)[]           0.0076
*
     2 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           385.2873
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          26.1535
 Products entropy           (J/K)          39.2605
 Products enthalpy          (KJ)           -3.3551
 Mass  of the system        (Kg)            0.0247
  Fe 1                      (C)[]           0.0140
  Mg 1                      (C)[]           0.9709
  Mg 1O  1                  (C)[]           0.0151
*
     3 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           439.9957
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          26.9184
 Products entropy           (J/K)          42.8274
 Products enthalpy          (KJ)           -4.7558
 Mass  of the system        (Kg)            0.0249
  Fe 1                      (C)[]           0.0210
  Mg 1                      (C)[]           0.9563
  Mg 1O  1                  (C)[]           0.0227
*
     4 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           495.3556
 Gas products amount        (mol)       1.22E-0013
 Products heat capacity     (J/K)          27.6951
 Products entropy           (J/K)          46.1248
 Products enthalpy          (KJ)           -6.1412
 Mass  of the system        (Kg)            0.0252
  Fe 1                      (C)[]           0.0280
  Mg 1                      (C)[]           0.9417
  Mg 1O  1                  (C)[]           0.0303
*
     5 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           550.1467
```

```
 Gas products amount        (mol)       1.34E-0011
 Products heat capacity     (J/K)          28.4704
 Products entropy           (J/K)          49.1495
 Products enthalpy          (KJ)           -7.5419
 Mass  of the system        (Kg)            0.0254
  Fe 1                      (C)[]           0.0350
  Mg 1                      (C)[]           0.9272
  Mg 1O  1                  (C)[]           0.0379
*
```

6 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          29.9432
 Products entropy           (J/K)          54.7860
 Products enthalpy          (KJ)           -7.1675
 Mass  of the system        (Kg)            0.0256
  Fe 1                      (C)[]           0.0420
  Mg 1                      (C)[]           0.9126
  Mg 1O  1                  (C)[]           0.0454
*
```

7 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          30.1058
 Products entropy           (J/K)          54.9059
 Products enthalpy          (KJ)          -10.1900
 Mass  of the system        (Kg)            0.0258
  Fe 1                      (C)[]           0.0490
  Mg 1                      (C)[]           0.8980
  Mg 1O  1                  (C)[]           0.0530
*
```

8 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           746.1039
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)          31.2225
 Products entropy           (J/K)          58.5651
 Products enthalpy          (KJ)          -10.7756
 Mass  of the system        (Kg)            0.0261
  Fe 1                      (C)[]           0.0560
  Mg 1                      (C)[]           0.8835
  Mg 1O  1                  (C)[]           0.0606
*
```

9 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           800.0000
 Gas products amount        (mol)       1.59E-0012
 Products heat capacity     (J/K)          32.0453
 Products entropy           (J/K)          60.9215
 Products enthalpy          (KJ)          -12.1880
 Mass  of the system        (Kg)            0.0263
  Fe 1                      (C)[]           0.0630
  Mg 1                      (C)[]           0.8689
  Mg 1O  1                  (C)[]           0.0681
*
```

10 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           848.5000
 Gas products amount        (mol)       5.17E-0013
 Products heat capacity     (J/K)          32.8273
 Products entropy           (J/K)          62.9949
 Products enthalpy          (KJ)          -13.7794
 Mass  of the system        (Kg)            0.0266
  Fe 1                      (C)[]           0.0699
```

```
 Mg 1                      (C)[]          0.8543
 Mg 1O  1                  (C)[]          0.0757
*
    11 wt% Fe2O3
Volume of gas products   (litres)         0.0000
Pressure of gas products   (atm)          1.0000
Temperature                (K)          910.0071
Gas products amount        (mol)       4.60E-0012
Products heat capacity     (J/K)          33.8171
Products entropy           (J/K)          65.5070
Products enthalpy          (KJ)         -14.9433
Mass  of the system        (Kg)           0.0268
 Fe 1                      (C)[]          0.0769
 Mg 1                      (C)[]          0.8398
 Mg 1O  1                  (C)[]          0.0833
*
    12 wt% Fe2O3
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.6192      922.2287      923.0098
Gas products amount        (mol)       5.15E-0014    4.84E-0014    7.12E-0014
Products heat capacity     (J/K)          34.4866       34.1877       36.3953
Products entropy           (J/K)          67.3027       66.1531       74.6422
Products enthalpy          (KJ)         -16.7338      -17.7948       -9.9594
Phase transition enthalpy  (KJ)           7.8354
Mass  of the system        (Kg)           0.0271
 Fe 1                      (C)[]          0.0839        0.0839        0.0839
 Mg 1                      (C)[]          0.7135        0.8252        0.0000
 Mg 1                      (L)[]          0.1117        0.0000        0.8252
 Mg 1O  1                  (C)[]          0.0909        0.0909        0.0909
*
    13 wt% Fe2O3
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.5489      922.0854      923.0124
Gas products amount        (mol)       5.94E-0014    4.72E-0014    8.08E-0014
Products heat capacity     (J/K)          35.1964       34.4000       36.5915
Products entropy           (J/K)          69.4070       66.3454       74.7699
Products enthalpy          (KJ)         -18.3008      -21.1267      -13.3508
Phase transition enthalpy  (KJ)           7.7759
Mass  of the system        (Kg)           0.0273
 Fe 1                      (C)[]          0.0909        0.0909        0.0909
 Mg 1                      (C)[]          0.5160        0.8106        0.0000
 Mg 1                      (L)[]          0.2946        0.0000        0.8106
 Mg 1O  1                  (C)[]          0.0984        0.0984        0.0984
*
    14 wt% Fe2O3
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.7447      922.4744      923.0150
Gas products amount        (mol)       1.08E-0013    2.19E-0013    3.31E-0014
Products heat capacity     (J/K)          35.9212       34.6238       36.7915
Products entropy           (J/K)          71.5523       66.5613       74.9001
Products enthalpy          (KJ)         -19.8982      -24.5049      -16.8082
Phase transition enthalpy  (KJ)           7.6967
Mass  of the system        (Kg)           0.0276
 Fe 1                      (C)[]          0.0979        0.0979        0.0979
 Mg 1                      (C)[]          0.3196        0.7961        0.0000
 Mg 1                      (L)[]          0.4765        0.0000        0.7961
 Mg 1O  1                  (C)[]          0.1060        0.1060        0.1060
*
    15 wt% Fe2O3
Volume of gas products   (litres)         0.0000        0.0000        0.0000
Pressure of gas products   (atm)          1.0000        1.0000        1.0000
Temperature                (K)          922.7354      922.4536      923.0173
Gas products amount        (mol)       1.67E-0012    1.05E-0011    4.30E-0014
Products heat capacity     (J/K)          36.6592       34.8463       36.9955
Products entropy           (J/K)          73.7395       66.7659       75.0328
Products enthalpy          (KJ)         -21.5269      -27.9635      -20.3332
Phase transition enthalpy  (KJ)           7.6303
Mass  of the system        (Kg)           0.0278
```

```
  Fe 1                      (C)[]          0.1049        0.1049        0.1049
  Mg 1                      (C)[]          0.1223        0.7815        0.0000
  Mg 1                      (L)[]          0.6592        0.0000        0.7815
  Mg 1O  1                  (C)[]          0.1136        0.1136        0.1136
*
     16 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          955.0000
 Gas products amount        (mol)       1.04E-0010
 Products heat capacity     (J/K)          37.3753
 Products entropy           (J/K)          76.4380
 Products enthalpy          (KJ)         -22.7336
 Mass  of the system        (Kg)           0.0281
  Fe 1                      (C)[]          0.1119
  Mg 1                      (L)[]          0.7669
  Mg 1O  1                  (C)[]          0.1211
*
     17 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)          994.6002
 Gas products amount        (mol)       1.01E-0012
 Products heat capacity     (J/K)          38.0256
 Products entropy           (J/K)          78.1185
 Products enthalpy          (KJ)         -24.8961
 Mass  of the system        (Kg)           0.0284
  Fe 1                      (C)[]          0.1189
  Mg 1                      (L)[]          0.7524
  Mg 1O  1                  (C)[]          0.1287
*
     19 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1099.3007
 Gas products amount        (mol)       1.18E-0011
 Products heat capacity     (J/K)          38.0716
 Products entropy           (J/K)          82.3181
 Products enthalpy          (KJ)         -28.3548
 Mass  of the system        (Kg)           0.0290
  Fe 1                      (C)[]          0.1329
  Mg 1                      (L)[]          0.7232
  Mg 1O  1                  (C)[]          0.1439
*
     20 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1152.6811
 Gas products amount        (mol)       1.02E-0012
 Products heat capacity     (J/K)          38.1299
 Products entropy           (J/K)          84.3223
 Products enthalpy          (KJ)         -30.1608
 Mass  of the system        (Kg)           0.0293
  Fe 1                      (C)[]          0.1399
  Mg 1                      (L)[]          0.7087
  Mg 1O  1                  (C)[]          0.1514
*
     21 wt% Fe2O3
 Volume of gas products   (litres)         0.0000
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         1184.0000
 Gas products amount        (mol)       5.30E-0011
 Products heat capacity     (J/K)          38.1973
 Products entropy           (J/K)          85.5570
 Products enthalpy          (KJ)         -32.8730
 Mass  of the system        (Kg)           0.0296
  Fe 1                      (C)[]          0.1469
  Mg 1                      (L)[]          0.6941
  Mg 1O  1                  (C)[]          0.1590
*
     22 wt% Fe2O3
```

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1260.6605
 Gas products amount        (mol)       2.66E-0011
 Products heat capacity     (J/K)          37.9615
 Products entropy           (J/K)          88.2168
 Products enthalpy          (KJ)          -33.8774
 Mass  of the system        (Kg)            0.0299
  Fe 1                      (C)[]           0.1539
  Mg 1                      (L)[]           0.6795
  Mg 1O  1                  (C)[]           0.1666
*
```

23 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1333.9395
 Gas products amount        (mol)       3.93E-0010
 Products heat capacity     (J/K)          38.2658
 Products entropy           (J/K)          90.6157
 Products enthalpy          (KJ)          -35.1261
 Mass  of the system        (Kg)            0.0302
  Fe 1                      (C)[]           0.1609
  Mg 1                      (L)[]           0.6650
  Mg 1O  1                  (C)[]           0.1741
*
```

24 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1333.9395
 Gas products amount        (mol)       9.14E-0010
 Products heat capacity     (J/K)          38.5215
 Products entropy           (J/K)          91.6767
 Products enthalpy          (KJ)          -38.1627
 Mass  of the system        (Kg)            0.0305
  Fe 1                      (C)[]           0.1679
  Mg 1                      (L)[]           0.6504
  Mg 1O  1                  (C)[]           0.1817
*
```

25 wt% Fe2O3

```
 Volume of gas products   (litres)          2.1959    3.40E-0006       93.5038
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.6910     1367.4175     1367.9645
 Gas products amount        (mol)           0.0189    2.93E-0008        0.8061
 Products heat capacity     (J/K)          38.4964       38.7525       27.8483
 Products entropy           (J/K)          93.8647       92.0949      167.4541
 Products enthalpy          (KJ)          -39.7383      -42.1593       60.9312
 Phase transition enthalpy  (KJ)          103.0905
 Mass  of the system        (Kg)            0.0308
1 Mg 1                      (G)             0.0149    2.30E-0008        0.6350
1 Mg 2                      (G)         1.18E-0005    1.45E-0010    5.03E-0004
  Fe 1                      (C)[]           0.1749        0.1749        0.1749
  Mg 1                      (L)[]           0.6209        0.6358    3.17E-0004
  Mg 1O  1                  (C)[]           0.1893        0.1893        0.1893
*
```

26 wt% Fe2O3

```
 Volume of gas products   (litres)          4.2304    3.53E-0004       92.4032
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.8390     1367.6910     1367.9871
 Gas products amount        (mol)           0.0365    3.05E-0006        0.7966
 Products heat capacity     (J/K)          38.4880       38.9813       28.2053
 Products entropy           (J/K)          95.7854       92.3766      166.8403
 Products enthalpy          (KJ)          -41.7768      -46.4401       55.4253
 Phase transition enthalpy  (KJ)          101.8653
 Mass  of the system        (Kg)            0.0312
1 Mg 1                      (G)             0.0284    2.37E-0006        0.6208
1 Mg 2                      (G)         2.25E-0005    1.49E-0008    4.92E-0004
  Fe 1                      (C)[]           0.1819        0.1819        0.1819
  Mg 1                      (L)[]           0.5928        0.6213        0.0000
  Mg 1O  1                  (C)[]           0.1969        0.1969        0.1969
*
```

27 wt% Fe2O3

```
 Volume of gas products   (litres)          6.3147    8.72E-0005       91.2289
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.9131     1367.8390     1367.9872
 Gas products amount        (mol)           0.0544    7.52E-0007        0.7865
 Products heat capacity     (J/K)          38.4786       39.2151       28.5758
 Products entropy           (J/K)          97.7489       92.6604      166.1739
 Products enthalpy          (KJ)          -43.8607      -50.8216       49.7439
 Phase transition enthalpy  (KJ)          100.5655
 Mass  of the system        (Kg)            0.0315
1 Mg 1                      (G)             0.0420    5.79E-0007        0.6062
1 Mg 2                      (G)          3.32E-0005    1.83E-0009    4.80E-0004
  Fe 1                      (C)[]           0.1889        0.1889        0.1889
  Mg 1                      (L)[]           0.5647        0.6067        0.0000
  Mg 1O  1                  (C)[]           0.2044        0.2044        0.2044
*
```

28 wt% Fe2O3

```
 Volume of gas products   (litres)          8.4519    1.05E-0004       90.0846
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1368.3782     1367.9131     1368.8432
 Gas products amount        (mol)           0.0728    9.01E-0007        0.7762
 Products heat capacity     (J/K)          38.4691       39.4540       28.9561
 Products entropy           (J/K)          99.7565       92.9486      165.5106
 Products enthalpy          (KJ)          -45.9914      -55.3044       43.9594
 Phase transition enthalpy  (KJ)          99.2638
 Mass  of the system        (Kg)            0.0319
1 Mg 1                      (G)             0.0555    6.87E-0007        0.5917
1 Mg 2                      (G)          4.39E-0005    1.09E-0009    4.68E-0004
  Fe 1                      (C)[]           0.1958        0.1958        0.1958
  Mg 1                      (L)[]           0.5366        0.5921        0.0000
  Mg 1O  1                  (C)[]           0.2120        0.2120        0.2120
*
```

29 wt% Fe2O3

```
 Volume of gas products   (litres)         10.6428    5.30E-0005       88.8264
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1368.0052     1367.6323     1368.3782
 Gas products amount        (mol)           0.0917    4.57E-0007        0.7656
 Products heat capacity     (J/K)          38.4568       39.6975       29.3425
 Products entropy           (J/K)         101.8083       93.2328      164.8044
 Products enthalpy          (KJ)          -48.1691      -59.9001       38.0089
 Phase transition enthalpy  (KJ)          97.9090
 Mass  of the system        (Kg)            0.0322
1 Mg 1                      (G)             0.0691    3.44E-0007        0.5771
1 Mg 2                      (G)          5.47E-0005    2.71E-0010    4.57E-0004
  Fe 1                      (C)[]           0.2028        0.2028        0.2028
  Mg 1                      (L)[]           0.5084        0.5776        0.0000
  Mg 1O  1                  (C)[]           0.2196        0.2196        0.2196
*
```

30 wt% Fe2O3

```
 Volume of gas products   (litres)         12.8805    2.00E-0005       86.9550
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.7255     1367.4458     1368.0052
 Gas products amount        (mol)           0.1110    1.72E-0007        0.7497
 Products heat capacity     (J/K)          38.4448       39.9468       29.8069
 Products entropy           (J/K)         103.9074       93.5265      163.6072
 Products enthalpy          (KJ)          -50.3969      -64.5979       31.2717
 Phase transition enthalpy  (KJ)          95.8696
 Mass  of the system        (Kg)            0.0326
1 Mg 1                      (G)             0.0828    1.28E-0007        0.5588
1 Mg 2                      (G)          6.56E-0005    1.29E-0009    4.43E-0004
  Fe 1                      (C)[]           0.2098        0.2098        0.2098
  Mg 1                      (L)[]           0.4802        0.5630        0.0038
  Mg 1O  1                  (C)[]           0.2272        0.2272        0.2272
*
```

31 wt% Fe2O3

```
 Volume of gas products   (litres)         15.1565    1.32E-0004       86.2613
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.8564     1367.7255     1367.9873
 Gas products amount        (mol)           0.1307    1.14E-0006        0.7437
 Products heat capacity     (J/K)          38.4352       40.2027       30.1430
 Products entropy           (J/K)         106.0545       93.8407      163.3548
 Products enthalpy          (KJ)          -52.6758      -69.3842       25.7102
```

```
 Phase transition enthalpy  (KJ)          95.0945
 Mass  of the system        (Kg)           0.0330
1 Mg 1                      (G)            0.0963    8.37E-0007        0.5480
1 Mg 2                      (G)         7.63E-0005    3.52E-0009    4.34E-0004
  Fe 1                      (C)[]          0.2168        0.2168        0.2168
  Mg 1                      (L)[]          0.4521        0.5484        0.0000
  Mg 1O  1                  (C)[]          0.2347        0.2347        0.2347
*
     32 wt% Fe2O3
 Volume of gas products   (litres)        17.4903    8.10E-0005       84.8829
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1367.9219     1367.8564     1367.9874
 Gas products amount        (mol)          0.1508    6.99E-0007        0.7318
 Products heat capacity     (J/K)         38.4245       40.4642       30.5651
 Products entropy           (J/K)        108.2513       94.1575      162.5572
 Products enthalpy          (KJ)         -55.0074      -74.2875       19.2823
 Phase transition enthalpy  (KJ)          93.5698
 Mass  of the system        (Kg)           0.0334
1 Mg 1                      (G)            0.1098    5.09E-0007        0.5331
1 Mg 2                      (G)         8.70E-0005    4.02E-0010    4.22E-0004
  Fe 1                      (C)[]          0.2238        0.2238        0.2238
  Mg 1                      (L)[]          0.4240        0.5339    4.06E-0004
  Mg 1O  1                  (C)[]          0.2423        0.2423        0.2423
*
     33 wt% Fe2O3
 Volume of gas products   (litres)        19.8939    5.70E-0005       83.6142
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1367.8554     1367.5322     1368.1785
 Gas products amount        (mol)          0.1715    4.91E-0007        0.7208
 Products heat capacity     (J/K)         38.4115       40.7310       30.9823
 Products entropy           (J/K)        110.5001       94.4683      161.8503
 Products enthalpy          (KJ)         -57.3941      -79.3254       12.8523
 Phase transition enthalpy  (KJ)          92.1777
 Mass  of the system        (Kg)           0.0337
1 Mg 1                      (G)            0.1235    3.52E-0007        0.5189
1 Mg 2                      (G)         9.77E-0005    2.96E-0009    4.11E-0004
  Fe 1                      (C)[]          0.2308        0.2308        0.2308
  Mg 1                      (L)[]          0.3958        0.5193        0.0000
  Mg 1O  1                  (C)[]          0.2499        0.2499        0.2499
*
     34 wt% Fe2O3
 Volume of gas products   (litres)        22.3332    7.86E-0005       82.2255
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1367.9214     1367.8554     1367.9875
 Gas products amount        (mol)          0.1925    6.78E-0007        0.7089
 Products heat capacity     (J/K)         38.4010       41.0055       31.4163
 Products entropy           (J/K)        112.8024       94.8060      161.0645
 Products enthalpy          (KJ)         -59.8376      -84.4563        6.1845
 Phase transition enthalpy  (KJ)          90.6408
 Mass  of the system        (Kg)           0.0341
1 Mg 1                      (G)            0.1370    4.82E-0007        0.5043
1 Mg 2                      (G)         1.09E-0004    1.52E-0009    4.00E-0004
  Fe 1                      (C)[]          0.2378        0.2378        0.2378
  Mg 1                      (L)[]          0.3677        0.5047        0.0000
  Mg 1O  1                  (C)[]          0.2574        0.2574        0.2574
*
     35 wt% Fe2O3
 Volume of gas products   (litres)        24.8456    9.39E-0005       80.8457
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         1368.2131     1367.9214     1368.5048
 Gas products amount        (mol)          0.2141    8.10E-0007        0.6967
 Products heat capacity     (J/K)         38.3900       41.2861       31.8624
 Products entropy           (J/K)        115.1605       95.1440      160.2762
 Products enthalpy          (KJ)         -62.3403      -89.7225       -0.6225
 Phase transition enthalpy  (KJ)          89.1000
 Mass  of the system        (Kg)           0.0346
1 Mg 1                      (G)            0.1505    5.69E-0007        0.4898
1 Mg 2                      (G)         1.19E-0004    4.50E-0010    3.87E-0004
  Fe 1                      (C)[]          0.2448        0.2448        0.2448
  Mg 1                      (L)[]          0.3395        0.4902        0.0000
  Mg 1O  1                  (C)[]          0.2650        0.2650        0.2650
```

*

36 wt% Fe2O3

Volume of gas products	(litres)	27.4204	3.79E-0005	79.3835
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1367.9265	1367.6400	1368.2131
Gas products amount	(mol)	0.2364	3.27E-0007	0.6843
Products heat capacity	(J/K)	38.3758	41.5727	32.3175
Products entropy	(J/K)	117.5759	95.4797	159.4496
Products enthalpy	(KJ)	-64.9039	-95.1314	-7.6213
Phase transition enthalpy	(KJ)	87.5101		
Mass of the system	(Kg)	0.0350		
1 Mg 1	(G)	0.1642	2.27E-0007	0.4752
1 Mg 2	(G)	1.30E-0004	1.43E-0009	3.76E-0004
Fe 1	(C)[]	0.2518	0.2518	0.2518
Mg 1	(L)[]	0.3113	0.4756	0.0000
Mg 1O 1	(C)[]	0.2726	0.2726	0.2726

*

37 wt% Fe2O3

Volume of gas products	(litres)	30.0490	2.91E-0006	38.9741
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1367.6631	1367.3998	1367.9265
Gas products amount	(mol)	0.2591	2.51E-0008	0.3360
Products heat capacity	(J/K)	38.3629	41.8665	37.3223
Products entropy	(J/K)	120.0511	95.8250	127.2467
Products enthalpy	(KJ)	-67.5310	-100.6721	-57.6875
Phase transition enthalpy	(KJ)	42.9846		
Mass of the system	(Kg)	0.0354		
1 Mg 1	(G)	0.1777	1.72E-0008	0.2305
1 Mg 2	(G)	1.41E-0004	1.23E-0010	1.83E-0004
Fe 1	(C)[]	0.2588	0.2588	0.2588
Mg 1	(L)[]	0.2832	0.4610	0.2303
Mg 1O 1	(C)[]	0.2802	0.2802	0.2802

*

38 wt% Fe2O3

Volume of gas products	(litres)	32.7473	3.65E-0005	76.3726
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1367.9066	1367.8254	1367.9878
Gas products amount	(mol)	0.2823	3.15E-0007	0.6584
Products heat capacity	(J/K)	38.3504	42.1693	33.2628
Products entropy	(J/K)	122.5884	96.1996	157.7430
Products enthalpy	(KJ)	-70.2238	-106.3233	-22.1326
Phase transition enthalpy	(KJ)	84.1907		
Mass of the system	(Kg)	0.0359		
1 Mg 1	(G)	0.1913	2.13E-0007	0.4461
1 Mg 2	(G)	1.51E-0004	6.73E-0010	3.53E-0004
Fe 1	(C)[]	0.2658	0.2658	0.2658
Mg 1	(L)[]	0.2550	0.4465	0.0000
Mg 1O 1	(C)[]	0.2877	0.2877	0.2877

*

39 wt% Fe2O3

Volume of gas products	(litres)	35.5192	7.14E-0005	74.8462
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1368.2132	1367.9066	1368.5197
Gas products amount	(mol)	0.3061	6.16E-0007	0.6450
Products heat capacity	(J/K)	38.3388	42.4789	33.7550
Products entropy	(J/K)	125.1892	96.5727	156.8734
Products enthalpy	(KJ)	-72.9841	-112.1311	-29.6405
Phase transition enthalpy	(KJ)	82.4906		
Mass of the system	(Kg)	0.0363		
1 Mg 1	(G)	0.2048	4.12E-0007	0.4316
1 Mg 2	(G)	1.62E-0004	6.51E-0010	3.41E-0004
Fe 1	(C)[]	0.2728	0.2728	0.2728
Mg 1	(L)[]	0.2269	0.4319	0.0000
Mg 1O 1	(C)[]	0.2953	0.2953	0.2953

*

40 wt% Fe2O3

Volume of gas products	(litres)	38.3655	3.04E-0005	73.2332
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	1367.7809	1367.3486	1368.2132
Gas products amount	(mol)	0.3307	2.62E-0007	0.6313
Products heat capacity	(J/K)	38.3223	42.7947	34.2577

```
 Products entropy           (J/K)         127.8574       96.9355      155.9603
 Products enthalpy          (KJ)          -75.8161     -118.1169      -37.3717
 Phase transition enthalpy  (KJ)           80.7452
 Mass  of the system        (Kg)            0.0368
1 Mg 1                      (G)             0.2185    1.73E-0007        0.4170
1 Mg 2                      (G)          1.73E-0004    1.36E-0010    3.30E-0004
  Fe 1                      (C)[]           0.2798        0.2798        0.2798
  Mg 1                      (L)[]           0.1987        0.4173        0.0000
  Mg 1O  1                  (C)[]           0.3029        0.3029        0.3029
*
     41 wt% Fe2O3
 Volume of gas products   (litres)         41.2732    1.92E-0004       71.6093
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1368.1256     1367.7809     1368.4703
 Gas products amount        (mol)           0.3557    1.66E-0006        0.6171
 Products heat capacity     (J/K)          38.3108       43.1214       34.7750
 Products entropy           (J/K)         130.5947       97.3392      155.0378
 Products enthalpy          (KJ)          -78.7213     -124.2144      -45.2834
 Phase transition enthalpy  (KJ)           78.9311
 Mass  of the system        (Kg)            0.0373
1 Mg 1                      (G)             0.2320    1.08E-0006        0.4025
1 Mg 2                      (G)          1.84E-0004    3.41E-0009    3.18E-0004
  Fe 1                      (C)[]           0.2868        0.2868        0.2868
  Mg 1                      (L)[]           0.1706        0.4028        0.0000
  Mg 1O  1                  (C)[]           0.3104        0.3104        0.3104
*
     42 wt% Fe2O3
 Volume of gas products   (litres)         44.2678    2.15E-0006       69.9108
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.6275     1367.1294     1368.1256
 Gas products amount        (mol)           0.3816    1.85E-0008        0.6027
 Products heat capacity     (J/K)          38.2933       43.4536       35.3041
 Products entropy           (J/K)         133.4041       97.7186      154.0756
 Products enthalpy          (KJ)          -81.7030     -130.5203      -53.4247
 Phase transition enthalpy  (KJ)           77.0956
 Mass  of the system        (Kg)            0.0377
1 Mg 1                      (G)             0.2456    1.19E-0008        0.3879
1 Mg 2                      (G)          1.94E-0004    1.48E-0010    3.07E-0004
  Fe 1                      (C)[]           0.2938        0.2938        0.2938
  Mg 1                      (L)[]           0.1424        0.3882        0.0000
  Mg 1O  1                  (C)[]           0.3180        0.3180        0.3180
*
     43 wt% Fe2O3
 Volume of gas products   (litres)         47.3279    4.96E-0005       68.1784
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.8077     1367.6275     1367.9879
 Gas products amount        (mol)           0.4080    4.28E-0007        0.5878
 Products heat capacity     (J/K)          38.2793       43.7981       35.8480
 Products entropy           (J/K)         136.2887       98.1455      153.0930
 Products enthalpy          (KJ)          -84.7646     -136.9440      -61.7766
 Phase transition enthalpy  (KJ)           75.1674
 Mass  of the system        (Kg)            0.0382
1 Mg 1                      (G)             0.2592    2.72E-0007        0.3734
1 Mg 2                      (G)          2.05E-0004    2.14E-0010    2.96E-0004
  Fe 1                      (C)[]           0.3008        0.3008        0.3008
  Mg 1                      (L)[]           0.1143        0.3737        0.0000
  Mg 1O  1                  (C)[]           0.3256        0.3256        0.3256
*
     44 wt% Fe2O3
 Volume of gas products   (litres)         50.4776    4.76E-0005       66.4069
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1367.8983     1367.8077     1367.9888
 Gas products amount        (mol)           0.4352    4.10E-0007        0.5725
 Products heat capacity     (J/K)          38.2645       44.1510       36.4069
 Products entropy           (J/K)         139.2509       98.5734      152.0876
 Products enthalpy          (KJ)          -87.9084     -143.5548      -70.3480
 Phase transition enthalpy  (KJ)           73.2068
 Mass  of the system        (Kg)            0.0388
1 Mg 1                      (G)             0.2727    2.57E-0007        0.3588
1 Mg 2                      (G)          2.16E-0004    8.12E-0010    2.84E-0004
  Fe 1                      (C)[]           0.3078        0.3078        0.3078
```

```
  Mg 1                      (L)[]          0.0861        0.3591        0.0000
  Mg 1O  1                  (C)[]          0.3332        0.3332        0.3332
*
     45 wt% Fe2O3
 Volume of gas products   (litres)        53.7211    6.17E-0005       64.6104
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1368.1963     1367.8983     1368.4943
 Gas products amount        (mol)          0.4630    5.32E-0007        0.5568
 Products heat capacity     (J/K)         38.2521       44.5133       36.9829
 Products entropy           (J/K)        142.2945       99.0100      151.0682
 Products enthalpy          (KJ)         -91.1387     -150.3513      -79.1363
 Phase transition enthalpy  (KJ)          71.2150
 Mass  of the system        (Kg)           0.0393
1 Mg 1                      (G)            0.2862    3.29E-0007        0.3442
1 Mg 2                      (G)        2.26E-0004    5.20E-0010    2.72E-0004
  Fe 1                      (C)[]          0.3148        0.3148        0.3148
  Mg 1                      (L)[]          0.0581        0.3445        0.0000
  Mg 1O  1                  (C)[]          0.3407        0.3407        0.3407
*
     46 wt% Fe2O3
 Volume of gas products   (litres)        57.0474    8.16E-0006       62.7251
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        1367.8845     1367.5728     1368.1963
 Gas products amount        (mol)          0.4917    7.04E-0008        0.5407
 Products heat capacity     (J/K)         38.2341       44.8842       37.5722
 Products entropy           (J/K)        145.4226       99.4451      149.9985
 Products enthalpy          (KJ)         -94.4587     -157.3553      -88.1988
 Phase transition enthalpy  (KJ)          69.1565
 Mass  of the system        (Kg)           0.0398
1 Mg 1                      (G)            0.2999    4.28E-0008        0.3297
1 Mg 2                      (G)        2.37E-0004    2.69E-0010    2.61E-0004
  Fe 1                      (C)[]          0.3217        0.3217        0.3217
  Mg 1                      (L)[]          0.0299        0.3300        0.0000
  Mg 1O  1                  (C)[]          0.3483        0.3483        0.3483
*
     47 wt% Fe2O3
 Volume of gas products   (litres)        60.9117
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)        1370.6833
 Gas products amount        (mol)          0.5241
 Products heat capacity     (J/K)         38.1881
 Products entropy           (J/K)        148.9763
 Products enthalpy          (KJ)         -97.4111
 Mass  of the system        (Kg)           0.0404
1 Mg 1                      (G)            0.3151        0.9996  (atm)
1 Mg 2                      (G)        2.48E-0004    3.94E-0004  (atm)
  Fe 1                      (C)[]          0.3287
  Mg 1O  1                  (C)[]          0.3559
*
     48 wt% Fe2O3
 Volume of gas products   (litres)        63.9671
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)        1487.7633
 Gas products amount        (mol)          0.5071
 Products heat capacity     (J/K)         39.2482
 Products entropy           (J/K)        151.0542
 Products enthalpy          (KJ)        -102.4129
 Mass  of the system        (Kg)           0.0410
1 Mg 1                      (G)            0.3006        0.9997  (atm)
1 Mg 2                      (G)        1.92E-0004    3.19E-0004  (atm)
  Fe 1                      (C)[]          0.3357
  Mg 1O  1                  (C)[]          0.3634
*
     49 wt% Fe2O3
 Volume of gas products   (litres)        69.1150
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)        1665.0000
 Gas products amount        (mol)          0.4896
 Products heat capacity     (J/K)         40.6107
 Products entropy           (J/K)        154.4798
 Products enthalpy          (KJ)        -105.0560
```

```
 Mass  of the system        (Kg)            0.0416
1 Mg 1                      (G)             0.2861        0.9998  (atm)
1 Mg 2                      (G)          1.37E-0004    2.40E-0004  (atm)
  Fe 1                      (C)[]           0.3427
  Mg 1O  1                  (C)[]           0.3710
*
```

50 wt% Fe2O3

```
 Volume of gas products   (litres)         72.0080
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1801.0541
 Gas products amount        (mol)           0.4715
 Products heat capacity     (J/K)          42.7578
 Products entropy           (J/K)         156.8940
 Products enthalpy          (KJ)         -108.9915
 Mass  of the system        (Kg)            0.0422
1 Mg 1                      (G)             0.2716        0.9998  (atm)
1 Mg 2                      (G)          1.07E-0004    1.96E-0004  (atm)
  Fe 1                      (C)[]           0.3497
  Mg 1O  1                  (C)[]           0.3786
*
```

51 wt% Fe2O3

```
 Volume of gas products   (litres)         71.0511
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1850.0906
 Gas products amount        (mol)           0.4529
 Products heat capacity     (J/K)          44.5937
 Products entropy           (J/K)         159.1525
 Products enthalpy          (KJ)         -113.1606
 Mass  of the system        (Kg)            0.0428
1 Mg 1                      (G)             0.2570        0.9998  (atm)
1 Mg 2                      (G)          9.41E-0005    1.83E-0004  (atm)
  Fe 1                      (L)[]           0.3567
  Mg 1O  1                  (C)[]           0.3862
*
```

52 wt% Fe2O3

```
 Volume of gas products   (litres)         73.3900
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1994.8374
 Gas products amount        (mol)           0.4339
 Products heat capacity     (J/K)          45.7426
 Products entropy           (J/K)         161.6522
 Products enthalpy          (KJ)         -116.7719
 Mass  of the system        (Kg)            0.0435
1 Fe 1                      (G)          1.96E-0004    3.52E-0004  (atm)
1 Mg 1                      (G)             0.2425        0.9995  (atm)
1 Mg 2                      (G)          7.33E-0005    1.51E-0004  (atm)
  Fe 1                      (L)[]           0.3635
  Mg 1O  1                  (C)[]           0.3937
*
```

53

```
 Volume of gas products   (litres)         74.5685
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2121.5108
 Gas products amount        (mol)           0.4145
 Products heat capacity     (J/K)          46.9168
 Products entropy           (J/K)         163.6809
 Products enthalpy          (KJ)         -121.1462
 Mass  of the system        (Kg)            0.0441
1 Fe 1                      (G)          7.04E-0004        0.0013  (atm)
1 Mg 1                      (G)             0.2279        0.9985  (atm)
1 Mg 2                      (G)          5.89E-0005    1.29E-0004  (atm)
  Fe 1                      (L)[]           0.3700
  Mg 1O  1                  (C)[]           0.4013
*
```

54 wt% Fe2O3

```
 Volume of gas products   (litres)         74.9842
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2237.8747
 Gas products amount        (mol)           0.3952
 Products heat capacity     (J/K)          48.1328
 Products entropy           (J/K)         165.5180
```

```
 Products enthalpy          (KJ)         -125.8489
 Mass  of the system        (Kg)            0.0448
1 Fe 1                      (G)             0.0020        0.0040  (atm)
1 Mg 1                      (G)             0.2134        0.9959  (atm)
1 Mg 2                      (G)          4.80E-0005    1.12E-0004  (atm)
  Fe 1                      (L)[]           0.3757
  Mg 1O  1                  (C)[]           0.4089
*
     55 wt% Fe2O3
 Volume of gas products   (litres)         75.7136
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2368.4211
 Gas products amount        (mol)           0.3770
 Products heat capacity     (J/K)          49.4503
 Products entropy           (J/K)         167.8930
 Products enthalpy          (KJ)         -129.2503
 Mass  of the system        (Kg)            0.0455
1 Fe 1                      (G)             0.0055        0.0118  (atm)
1 Mg 1                      (G)             0.1988        0.9881  (atm)
  Fe 1                      (L)[]           0.3792
  Mg 1O  1                  (C)[]           0.4164
*
     56 wt% Fe2O3
 Volume of gas products   (litres)         75.1607
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2464.8514
 Gas products amount        (mol)           0.3596
 Products heat capacity     (J/K)          50.7216
 Products entropy           (J/K)         169.7138
 Products enthalpy          (KJ)         -133.9080
 Mass  of the system        (Kg)            0.0463
1 Fe 1                      (G)             0.0105        0.0243  (atm)
1 Mg 1                      (G)             0.1843        0.9755  (atm)
  Fe 1                      (L)[]           0.3811
  Mg 1O  1                  (C)[]           0.4240
*
     57 wt% Fe2O3
 Volume of gas products   (litres)         74.1402
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2547.1007
 Gas products amount        (mol)           0.3433
 Products heat capacity     (J/K)          51.9888
 Products entropy           (J/K)         171.4615
 Products enthalpy          (KJ)         -138.7992
 Mass  of the system        (Kg)            0.0470
1 Fe 1                      (G)             0.0175        0.0430  (atm)
1 Mg 1                      (G)             0.1697        0.9566  (atm)
1 Mg 1O  1                  (G)          8.51E-0005    2.89E-0004  (atm)
  Fe 1                      (L)[]           0.3812
  Mg 1O  1                  (C)[]           0.4315
*
     58 wt% Fe2O3
 Volume of gas products   (litres)         72.7098
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2617.0413
 Gas products amount        (mol)           0.3277
 Products heat capacity     (J/K)          53.2552
 Products entropy           (J/K)         173.1302
 Products enthalpy          (KJ)         -143.9980
 Mass  of the system        (Kg)            0.0478
1 Fe 1                      (G)             0.0259        0.0677  (atm)
1 Mg 1                      (G)             0.1551        0.9315  (atm)
1 Mg 1O  1                  (G)          1.75E-0004    6.35E-0004  (atm)
  Fe 1                      (L)[]           0.3798
  Mg 1O  1                  (C)[]           0.4390
*
     59 wt% Fe2O3
 Volume of gas products   (litres)         71.7138
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2687.9209
 Gas products amount        (mol)           0.3147
```

```
 Products heat capacity     (J/K)          54.5423
 Products entropy           (J/K)         175.2478
 Products enthalpy          (KJ)         -148.1331
 Mass  of the system        (Kg)            0.0486
1 Fe 1                      (G)             0.0378        0.1046  (atm)
1 Mg 1                      (G)             0.1406        0.8940  (atm)
1 Mg 1O  1                  (G)          3.51E-0004       0.0013  (atm)
  Fe 1                      (L)[]           0.3749
  Mg 1O  1                  (C)[]           0.4464
*
```

60 wt% Fe2O3

```
 Volume of gas products   (litres)         69.9016
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2742.7088
 Gas products amount        (mol)           0.3006
 Products heat capacity     (J/K)          55.8310
 Products entropy           (J/K)         176.9657
 Products enthalpy          (KJ)         -153.4833
 Mass  of the system        (Kg)            0.0495
1 Fe 1                      (G)             0.0489        0.1440  (atm)
1 Mg 1                      (G)             0.1260        0.8535  (atm)
1 Mg 1O  1                  (G)          5.74E-0004       0.0023  (atm)
1 Fe 1O  1                  (G)          5.54E-0005    1.27E-0004  (atm)
  Fe 1                      (L)[]           0.3708
  Mg 1O  1                  (C)[]           0.4537
*
```

61 wt% Fe2O3

```
 Volume of gas products   (litres)         67.9646
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2793.2684
 Gas products amount        (mol)           0.2870
 Products heat capacity     (J/K)          57.1470
 Products entropy           (J/K)         178.7371
 Products enthalpy          (KJ)         -158.8681
 Mass  of the system        (Kg)            0.0503
1 Fe 1                      (G)             0.0608        0.1910  (atm)
1 Mg 1                      (G)             0.1115        0.8047  (atm)
1 Mg 1O  1                  (G)          8.81E-0004       0.0038  (atm)
1 Fe 1O  1                  (G)          1.15E-0004    2.80E-0004  (atm)
  Fe 1                      (L)[]           0.3658
  Mg 1O  1                  (C)[]           0.4609
*
```

62 wt% Fe2O3

```
 Volume of gas products   (litres)         66.1480
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2841.9655
 Gas products amount        (mol)           0.2745
 Products heat capacity     (J/K)          58.4909
 Products entropy           (J/K)         180.7038
 Products enthalpy          (KJ)         -163.8996
 Mass  of the system        (Kg)            0.0512
1 Fe 1                      (G)             0.0743        0.2484  (atm)
1 Mg 1                      (G)             0.0970        0.7448  (atm)
1 Mg 1O  1                  (G)             0.0013        0.0061  (atm)
1 Fe 1O  1                  (G)          2.30E-0004    5.98E-0004  (atm)
  Fe 1                      (L)[]           0.3592
  Mg 1O  1                  (C)[]           0.4680
*
```

63 wt% Fe2O3

```
 Volume of gas products   (litres)         63.7914
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2884.9682
 Gas products amount        (mol)           0.2608
 Products heat capacity     (J/K)          59.8840
 Products entropy           (J/K)         182.4749
 Products enthalpy          (KJ)         -169.6886
 Mass  of the system        (Kg)            0.0522
1 Fe 1                      (G)             0.0867        0.3105  (atm)
1 Mg 1                      (G)             0.0825        0.6791  (atm)
1 Mg 1O  1                  (G)             0.0018        0.0089  (atm)
1 Fe 1O  1                  (G)          4.21E-0004       0.0012  (atm)
```

```
  Fe 1                      (L)[]          0.3536
  Mg 1O  1                  (C)[]          0.4749
*
     64 wt% Fe2O3
 Volume of gas products   (litres)        61.0101
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         2924.6688
 Gas products amount        (mol)          0.2460
 Products heat capacity     (J/K)         61.3354
 Products entropy           (J/K)        184.1377
 Products enthalpy          (KJ)        -176.0118
 Mass  of the system        (Kg)           0.0531
1 Fe 1                      (G)            0.0981        0.3795  (atm)
1 Mg 1                      (G)            0.0681        0.6050  (atm)
1 Mg 1O  1                  (G)            0.0024        0.0127  (atm)
1 Fe 1O  1                  (G)         7.36E-0004       0.0022  (atm)
  Fe 1                      (L)[]          0.3489
  Mg 1O  1                  (C)[]          0.4817
*
     65 wt% Fe2O3
 Volume of gas products   (litres)        58.1694
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         2963.6838
 Gas products amount        (mol)          0.2315
 Products heat capacity     (J/K)         62.8414
 Products entropy           (J/K)        185.9110
 Products enthalpy          (KJ)        -182.2296
 Mass  of the system        (Kg)           0.0541
1 Fe 1                      (G)            0.1097        0.4594  (atm)
1 Mg 1                      (G)            0.0538        0.5175  (atm)
1 O  1                      (G)         7.25E-0005       0.0011  (atm)
1 Mg 1O  1                  (G)            0.0030        0.0177  (atm)
1 Fe 1O  1                  (G)            0.0013        0.0043  (atm)
  Fe 1                      (L)[]          0.3439
  Mg 1O  1                  (C)[]          0.4882
*
     66 wt% Fe2O3
 Volume of gas products   (litres)        55.2211
 Pressure of gas products   (atm)          1.0000
 Temperature                (K)         3001.3019
 Gas products amount        (mol)          0.2170
 Products heat capacity     (J/K)         64.4015
 Products entropy           (J/K)        187.7687
 Products enthalpy          (KJ)        -188.3870
 Mass  of the system        (Kg)           0.0552
1 Fe 1                      (G)            0.1206        0.5493  (atm)
1 Mg 1                      (G)            0.0397        0.4156  (atm)
1 O  1                      (G)         1.36E-0004       0.0022  (atm)
1 Mg 1O  1                  (G)            0.0038        0.0242  (atm)
1 Fe 1O  1                  (G)            0.0024        0.0084  (atm)
  Fe 1                      (L)[]          0.3392
  Mg 1O  1                  (C)[]          0.4941
*
     67 wt% Fe2O3
 Volume of gas products   (litres)        52.2229       49.9773      144.5327
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)         3033.3287     3033.0480     3033.6095
 Gas products amount        (mol)          0.2031        0.1943        0.5619
 Products heat capacity     (J/K)         65.9594       66.1372       58.6518
 Products entropy           (J/K)        189.7583      188.6181      236.6296
 Products enthalpy          (KJ)        -194.2852     -197.7437      -52.1129
 Phase transition enthalpy  (KJ)         145.6308
 Mass  of the system        (Kg)           0.0563
1 Fe 1                      (G)            0.1283        0.1228        0.3553
1 Mg 1                      (G)            0.0272        0.0260        0.0751
1 O  1                      (G)         2.50E-0004    2.39E-0004    6.99E-0004
1 Mg 1O  1                  (G)            0.0046        0.0044        0.0127
1 Fe 1O  1                  (G)            0.0043        0.0041        0.0120
1 O  2                      (G)         1.37E-0004    1.31E-0004    3.84E-0004
  Fe 1                      (L)[]          0.3345        0.3426        0.0000
  Fe 1O  1                  (L)[]          0.0032        0.0000        0.1338
```

```
  Mg 1O  1                  (C)[]          0.4976        0.4997        0.4101
*
     68 wt% Fe2O3
 Volume of gas products   (litres)        48.1746       20.0272      139.9359
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        3033.0205     3032.7122     3033.3287
 Gas products amount        (mol)          0.1873        0.0779        0.5441
 Products heat capacity     (J/K)         67.2421       69.4709       59.9762
 Products entropy           (J/K)        191.5373      177.2442      238.1332
 Products enthalpy          (KJ)        -201.1325     -244.4870      -59.7956
 Phase transition enthalpy  (KJ)         184.6914
 Mass  of the system        (Kg)          0.0574
1 Fe 1                      (G)           0.1160        0.0482        0.3373
1 Mg 1                      (G)           0.0246        0.0103        0.0713
1 O  1                      (G)        2.26E-0004    9.32E-0005    6.60E-0004
1 Mg 1O  1                  (G)           0.0041        0.0017        0.0120
1 Fe 1O  1                  (G)           0.0039        0.0016        0.0113
1 O  2                      (G)        1.24E-0004    5.07E-0005    3.63E-0004
  Fe 1                      (L)[]         0.3262        0.4262        0.0000
  Fe 1O  1                  (L)[]         0.0391        0.0000        0.1666
  Mg 1O  1                  (C)[]         0.4857        0.5119        0.4005
*
     69 wt% Fe2O3
 Volume of gas products   (litres)        43.9411    2.97E-0004      135.2516
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        3033.3993     3033.0205     3033.7781
 Gas products amount        (mol)          0.1708    1.16E-0006        0.5258
 Products heat capacity     (J/K)         68.5857       72.0647       61.3561
 Products entropy           (J/K)        193.3888      171.0744      239.7589
 Products enthalpy          (KJ)        -208.2589     -275.9441      -67.6069
 Phase transition enthalpy  (KJ)         208.3371
 Mass  of the system        (Kg)          0.0586
1 Fe 1                      (G)           0.1037    7.03E-0007        0.3193
1 Mg 1                      (G)           0.0219    1.48E-0007        0.0675
1 O  1                      (G)        2.04E-0004    1.37E-0009    6.29E-0004
1 Mg 1O  1                  (G)           0.0037    2.49E-0008        0.0114
1 Fe 1O  1                  (G)           0.0035    2.36E-0008        0.0108
1 O  2                      (G)        1.12E-0004    7.55E-0010    3.46E-0004
  Fe 1                      (L)[]         0.3180        0.4710        0.0000
  Fe 1O  1                  (L)[]         0.0748        0.0150        0.1993
  Mg 1O  1                  (C)[]         0.4740        0.5141        0.3907
*
     70 wt% Fe2O3
 Volume of gas products   (litres)        39.5516    4.42E-0004      130.2673
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        3033.0870     3032.7748     3033.3993
 Gas products amount        (mol)          0.1538    1.72E-0006        0.5065
 Products heat capacity     (J/K)         69.9753       73.1074       62.7915
 Products entropy           (J/K)        195.3178      175.2329      241.3850
 Products enthalpy          (KJ)        -215.6832     -276.6056      -75.9497
 Phase transition enthalpy  (KJ)         200.6559
 Mass  of the system        (Kg)          0.0598
1 Fe 1                      (G)           0.0915    1.02E-0006        0.3015
1 Mg 1                      (G)           0.0193    2.16E-0007        0.0637
1 O  1                      (G)        1.79E-0004    2.00E-0009    5.91E-0004
1 Mg 1O  1                  (G)           0.0033    3.63E-0008        0.0107
1 Fe 1O  1                  (G)           0.0031    3.44E-0008        0.0101
1 O  2                      (G)        9.85E-0005    1.10E-0009    3.25E-0004
  Fe 1                      (L)[]         0.3095        0.4445        0.0000
  Fe 1O  1                  (L)[]         0.1108        0.0580        0.2319
  Mg 1O  1                  (C)[]         0.4622        0.4975        0.3812
*
     71 wt% Fe2O3
 Volume of gas products   (litres)        34.9483    4.73E-0004      125.1372
 Pressure of gas products   (atm)          1.0000        1.0000        1.0000
 Temperature                (K)        3033.3375     3033.0870     3033.5880
 Gas products amount        (mol)          0.1359    1.84E-0006        0.4865
 Products heat capacity     (J/K)         71.4323       74.2000       64.2897
 Products entropy           (J/K)        197.3288      179.5820      243.1273
 Products enthalpy          (KJ)        -223.4235     -277.2538      -84.5049
 Phase transition enthalpy  (KJ)         192.7489
```

```
 Mass  of the system        (Kg)            0.0611
1 Fe 1                      (G)             0.0792    1.07E-0006        0.2834
1 Mg 1                      (G)             0.0167    2.26E-0007        0.0599
1 O  1                      (G)          1.55E-0004    2.10E-0009    5.57E-0004
1 Mg 1O  1                  (G)             0.0028    3.80E-0008        0.0101
1 Fe 1O  1                  (G)             0.0027    3.60E-0008        0.0096
1 O  2                      (G)          8.55E-0005    1.15E-0009    3.06E-0004
  Fe 1                      (L)[]           0.3013        0.4180        0.0000
  Fe 1O  1                  (L)[]           0.1468        0.1011        0.2647
  Mg 1O  1                  (C)[]           0.4503        0.4809        0.3715
*
```

72 wt% Fe2O3

```
 Volume of gas products   (litres)         30.1734    3.98E-0004      119.7365
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3033.0406     3032.7438     3033.3375
 Gas products amount        (mol)           0.1173    1.55E-0006        0.4655
 Products heat capacity     (J/K)          72.9444       75.3338       65.8517
 Products entropy           (J/K)         199.4275      184.1043      244.9116
 Products enthalpy          (KJ)         -231.5012     -277.9802      -93.5365
 Phase transition enthalpy  (KJ)          184.4436
 Mass  of the system        (Kg)            0.0624
1 Fe 1                      (G)             0.0669    8.82E-0007        0.2655
1 Mg 1                      (G)             0.0141    1.86E-0007        0.0561
1 O  1                      (G)          1.31E-0004    1.72E-0009    5.20E-0004
1 Mg 1O  1                  (G)             0.0024    3.13E-0008        0.0094
1 Fe 1O  1                  (G)             0.0023    2.96E-0008        0.0089
1 O  2                      (G)          7.20E-0005    9.47E-0010    2.86E-0004
  Fe 1                      (L)[]           0.2929        0.3916        0.0000
  Fe 1O  1                  (L)[]           0.1827        0.1441        0.2973
  Mg 1O  1                  (C)[]           0.4385        0.4643        0.3619
*
```

73 wt% Fe2O3

```
 Volume of gas products   (litres)         25.1609    4.10E-0004      114.1166
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3033.1466     3033.0406     3033.2526
 Gas products amount        (mol)           0.0978    1.59E-0006        0.4437
 Products heat capacity     (J/K)          74.5310       76.5242       67.4836
 Products entropy           (J/K)         201.6194      188.8438      246.7879
 Products enthalpy          (KJ)         -239.9378     -278.6893     -102.9305
 Phase transition enthalpy  (KJ)          175.7589
 Mass  of the system        (Kg)            0.0638
1 Fe 1                      (G)             0.0546    8.90E-0007        0.2476
1 Mg 1                      (G)             0.0115    1.88E-0007        0.0523
1 O  1                      (G)          1.07E-0004    1.74E-0009    4.84E-0004
1 Mg 1O  1                  (G)             0.0019    3.16E-0008        0.0088
1 Fe 1O  1                  (G)             0.0018    2.99E-0008        0.0083
1 O  2                      (G)          5.86E-0005    9.55E-0010    2.66E-0004
  Fe 1                      (L)[]           0.2846        0.3651        0.0000
  Fe 1O  1                  (L)[]           0.2187        0.1872        0.3300
  Mg 1O  1                  (C)[]           0.4267        0.4477        0.3522
*
```

74 wt% Fe2O3

```
 Volume of gas products   (litres)         19.9495    3.29E-0004       69.4125
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          3032.8164     3032.4861     3033.1466
 Gas products amount        (mol)           0.0776    1.28E-0006        0.2699
 Products heat capacity     (J/K)          76.1817       77.7608       72.2665
 Products entropy           (J/K)         203.9112      193.7772      229.0379
 Products enthalpy          (KJ)         -248.7587     -279.4975     -172.5431
 Phase transition enthalpy  (KJ)          106.9544
 Mass  of the system        (Kg)            0.0652
1 Fe 1                      (G)             0.0423    6.97E-0007        0.1472
1 Mg 1                      (G)             0.0089    1.47E-0007        0.0311
1 O  1                      (G)          8.27E-0005    1.36E-0009    2.88E-0004
1 Mg 1O  1                  (G)             0.0015    2.47E-0008        0.0052
1 Fe 1O  1                  (G)             0.0014    2.34E-0008        0.0050
1 O  2                      (G)          4.54E-0005    7.48E-0010    1.58E-0004
  Fe 1                      (L)[]           0.2762        0.3386        0.1215
  Fe 1O  1                  (L)[]           0.2547        0.2302        0.3152
  Mg 1O  1                  (C)[]           0.4148        0.4311        0.3743
*
```

75 wt% Fe2O3

Volume of gas products	(litres)	14.4660	4.46E-0004	102.1107
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	3033.0344	3032.8164	3033.2524
Gas products amount	(mol)	0.0562	1.74E-0006	0.3970
Products heat capacity	(J/K)	77.9176	79.0633	70.9760
Products entropy	(J/K)	206.3094	198.9632	250.8190
Products enthalpy	(KJ)	-257.9894	-280.2723	-122.9808
Phase transition enthalpy	(KJ)	157.2915		
Mass of the system	(Kg)	0.0667		
1 Fe 1	(G)	0.0300	9.25E-0007	0.2117
1 Mg 1	(G)	0.0063	1.95E-0007	0.0447
1 O 1	(G)	5.87E-0005	1.81E-0009	4.14E-0004
1 Mg 1O 1	(G)	0.0011	3.28E-0008	0.0075
1 Fe 1O 1	(G)	0.0010	3.11E-0008	0.0071
1 O 2	(G)	3.22E-0005	9.93E-0010	2.27E-0004
Fe 1	(L)[]	0.2679	0.3121	0.0000
Fe 1O 1	(L)[]	0.2906	0.2733	0.3954
Mg 1O 1	(C)[]	0.4030	0.4146	0.3329

*

76 wt% Fe2O3

Volume of gas products	(litres)	8.7215	3.47E-0004	95.6780
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	3033.1434	3033.0344	3033.2525
Gas products amount	(mol)	0.0339	1.35E-0006	0.3720
Products heat capacity	(J/K)	79.7359	80.4268	72.8472
Products entropy	(J/K)	208.8223	204.3939	252.9773
Products enthalpy	(KJ)	-267.6613	-281.0939	-133.7280
Phase transition enthalpy	(KJ)	147.3658		
Mass of the system	(Kg)	0.0683		
1 Fe 1	(G)	0.0177	7.02E-0007	0.1937
1 Mg 1	(G)	0.0037	1.48E-0007	0.0409
1 O 1	(G)	3.45E-0005	1.37E-0009	3.79E-0004
1 Mg 1O 1	(G)	6.27E-0004	2.49E-0008	0.0069
1 Fe 1O 1	(G)	5.94E-0004	2.36E-0008	0.0065
1 O 2	(G)	1.90E-0005	7.54E-0010	2.08E-0004
Fe 1	(L)[]	0.2596	0.2857	0.0000
Fe 1O 1	(L)[]	0.3265	0.3164	0.4281
Mg 1O 1	(C)[]	0.3912	0.3980	0.3233

*

77 wt% Fe2O3

Volume of gas products	(litres)	2.7522	2.61E-0004	71.7422
Pressure of gas products	(atm)	1.0000	1.0000	1.0000
Temperature	(K)	3032.6448	3032.1462	3033.1434
Gas products amount	(mol)	0.0107	1.01E-0006	0.2790
Products heat capacity	(J/K)	81.6291	81.8468	76.1705
Products entropy	(J/K)	211.4577	210.0594	246.5126
Products enthalpy	(KJ)	-277.8048	-282.0463	-171.4743
Phase transition enthalpy	(KJ)	110.5720		
Mass of the system	(Kg)	0.0700		
1 Fe 1	(G)	0.0054	5.16E-0007	0.1418
1 Mg 1	(G)	0.0011	1.09E-0007	0.0300
1 O 1	(G)	1.06E-0005	1.01E-0009	2.77E-0004
1 Mg 1O 1	(G)	1.93E-0004	1.82E-0008	0.0050
1 Fe 1O 1	(G)	1.83E-0004	1.73E-0008	0.0048
1 O 2	(G)	5.83E-0006	5.53E-0010	1.52E-0004
Fe 1	(L)[]	0.2512	0.2592	0.0501
Fe 1O 1	(L)[]	0.3626	0.3594	0.4412
Mg 1O 1	(C)[]	0.3793	0.3814	0.3267

*

78 wt% Fe2O3

Volume of gas products	(litres)	1.31E-0004
Pressure of gas products	(atm)	1.0000
Temperature	(K)	2965.4568
Gas products amount	(mol)	5.20E-0007
Products heat capacity	(J/K)	82.7855
Products entropy	(J/K)	214.1859
Products enthalpy	(KJ)	-288.5108
Mass of the system	(Kg)	0.0718
Fe 1	(L)[]	0.2327
Fe 1O 1	(L)[]	0.4025

```
  Mg 1O  1                  (C)[]           0.3648
*
     79 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2844.7361
 Gas products amount        (mol)       5.10E-0010
 Products heat capacity     (J/K)          83.4536
 Products entropy           (J/K)         216.9444
 Products enthalpy          (KJ)         -299.7182
 Mass  of the system        (Kg)            0.0736
  Fe 1                      (L)[]           0.2062
  Fe 1O  1                  (L)[]           0.4455
  Mg 1O  1                  (C)[]           0.3482
*
     80 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2721.5288
 Gas products amount        (mol)       2.34E-0010
 Products heat capacity     (J/K)          84.3181
 Products entropy           (J/K)         219.6981
 Products enthalpy          (KJ)         -311.4948
 Mass  of the system        (Kg)            0.0755
  Fe 1                      (L)[]           0.1798
  Fe 1O  1                  (L)[]           0.4886
  Mg 1O  1                  (C)[]           0.3316
*
     81 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2595.7549
 Gas products amount        (mol)       1.80E-0010
 Products heat capacity     (J/K)          85.3812
 Products entropy           (J/K)         222.4184
 Products enthalpy          (KJ)         -323.9107
 Mass  of the system        (Kg)            0.0776
  Fe 1                      (L)[]           0.1533
  Fe 1O  1                  (L)[]           0.5316
  Mg 1O  1                  (C)[]           0.3151
*
     82 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2467.5995
 Gas products amount        (mol)       1.47E-0010
 Products heat capacity     (J/K)          86.6468
 Products entropy           (J/K)         225.0789
 Products enthalpy          (KJ)         -337.0194
 Mass  of the system        (Kg)            0.0797
  Fe 1                      (L)[]           0.1268
  Fe 1O  1                  (L)[]           0.5747
  Mg 1O  1                  (C)[]           0.2985
*
     83 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2337.2506
 Gas products amount        (mol)       6.35E-0011
 Products heat capacity     (J/K)          88.1186
 Products entropy           (J/K)         227.6457
 Products enthalpy          (KJ)         -350.8799
 Mass  of the system        (Kg)            0.0820
  Fe 1                      (L)[]           0.1003
  Fe 1O  1                  (L)[]           0.6178
  Mg 1O  1                  (C)[]           0.2819
*
     84 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2204.8858
```

```
 Gas products amount        (mol)       1.84E-0010
 Products heat capacity     (J/K)          89.7998
 Products entropy           (J/K)         230.0759
 Products enthalpy          (KJ)         -365.5590
 Mass  of the system        (Kg)            0.0844
  Fe 1                      (L)[]           0.0739
  Fe 1O  1                  (L)[]           0.6608
  Mg 1O  1                  (C)[]           0.2653
*
```

85 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          2070.6857
 Gas products amount        (mol)       1.81E-0010
 Products heat capacity     (J/K)          91.6942
 Products entropy           (J/K)         232.3137
 Products enthalpy          (KJ)         -381.1298
 Mass  of the system        (Kg)            0.0870
  Fe 1                      (L)[]           0.0474
  Fe 1O  1                  (L)[]           0.7039
  Mg 1O  1                  (C)[]           0.2487
*
```

86 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1934.7989
 Gas products amount        (mol)       9.45E-0012
 Products heat capacity     (J/K)          93.8064
 Products entropy           (J/K)         234.2876
 Products enthalpy          (KJ)         -397.6768
 Mass  of the system        (Kg)            0.0897
  Fe 1                      (L)[]           0.0209
  Fe 1O  1                  (L)[]           0.7469
  Mg 1O  1                  (C)[]           0.2322
*
```

87 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1806.9785
 Gas products amount        (mol)       1.83E-0010
 Products heat capacity     (J/K)          95.9280
 Products entropy           (J/K)         235.4488
 Products enthalpy          (KJ)         -415.5780
 Mass  of the system        (Kg)            0.0926
  Fe 3O  4                  (C)[]           0.0230
  Fe 1O  1                  (L)[]           0.7614
  Mg 1O  1                  (C)[]           0.2156
*
```

88 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1730.2210
 Gas products amount        (mol)       8.47E-0012
 Products heat capacity     (J/K)          97.4522
 Products entropy           (J/K)         235.5140
 Products enthalpy          (KJ)         -434.0938
 Mass  of the system        (Kg)            0.0957
  Fe 3O  4                  (C)[]           0.1328
  Fe 1O  1                  (L)[]           0.6682
  Mg 1O  1                  (C)[]           0.1990
*
```

89 wt% Fe2O3

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1657.8730
 Gas products amount        (mol)       1.03E-0011
 Products heat capacity     (J/K)          99.1265
 Products entropy           (J/K)         235.7934
 Products enthalpy          (KJ)         -453.2011
 Mass  of the system        (Kg)            0.0990
  Fe 3O  4                  (C)[]           0.2426
```

```
  Fe 1O  1                  (L)[]           0.5750
  Mg 1O  1                  (C)[]           0.1824
*
     90 wt% Fe2O3
 Volume of gas products   (litres)          0.0000        0.0000        0.0000
 Pressure of gas products   (atm)           1.0000        1.0000        1.0000
 Temperature                (K)          1649.8441     1649.5667     1650.1214
 Gas products amount        (mol)       6.93E-0011    1.14E-0010    1.87E-0011
 Products heat capacity     (J/K)          100.9785      100.8913      101.0775
 Products entropy           (J/K)          234.7380      230.0364      240.0758
 Products enthalpy          (KJ)          -475.7180     -483.4760     -466.9104
 Phase transition enthalpy  (KJ)            16.5656
 Mass  of the system        (Kg)            0.1026
  Fe 3O  4                  (C)[]           0.3523        0.3523        0.3523
  Fe 1O  1                  (C)[]           0.2562        0.4819        0.0000
  Fe 1O  1                  (L)[]           0.2257        0.0000        0.4819
  Mg 1O  1                  (C)[]           0.1658        0.1658        0.1658
*
     91 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1608.9551
 Gas products amount        (mol)       2.16E-0010
 Products heat capacity     (J/K)          102.4768
 Products entropy           (J/K)          234.2088
 Products enthalpy          (KJ)          -498.8532
 Mass  of the system        (Kg)            0.1064
  Fe 3O  4                  (C)[]           0.4621
  Fe 1O  1                  (C)[]           0.3887
  Mg 1O  1                  (C)[]           0.1492
*
     .92 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1486.5129
 Gas products amount        (mol)       3.20E-0011
 Products heat capacity     (J/K)          103.6183
 Products entropy           (J/K)          233.1518
 Products enthalpy          (KJ)          -523.7805
 Mass  of the system        (Kg)            0.1105
  Fe 3O  4                  (C)[]           0.5718
  Fe 1O  1                  (C)[]           0.2955
  Mg 1O  1                  (C)[]           0.1327
*
     93 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1367.6766
 Gas products amount        (mol)       1.72E-0013
 Products heat capacity     (J/K)          105.7165
 Products entropy           (J/K)          231.8602
 Products enthalpy          (KJ)          -549.8713
 Mass  of the system        (Kg)            0.1149
  Fe 3O  4                  (C)[]           0.6816
  Fe 1O  1                  (C)[]           0.2023
  Mg 1O  1                  (C)[]           0.1161
*
     94 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1230.0000
 Gas products amount        (mol)       1.73E-0012
 Products heat capacity     (J/K)          108.6408
 Products entropy           (J/K)          228.2068
 Products enthalpy          (KJ)          -579.8674
 Mass  of the system        (Kg)            0.1197
  Fe 3O  4                  (C)[]           0.7913
  Fe 1O  1                  (C)[]           0.1092
  Mg 1O  1                  (C)[]           0.0995
*
     95 wt% Fe2O3
```

```
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)          1098.5032
 Gas products amount        (mol)       1.44E-0012
 Products heat capacity     (J/K)         112.5596
 Products entropy           (J/K)         223.6376
 Products enthalpy          (KJ)         -611.5375
 Mass  of the system        (Kg)            0.1249
  Fe 3O  4                  (C)[]           0.9011
  Fe 1O  1                  (C)[]           0.0160
  Mg 1O  1                  (C)[]           0.0829
*
     96 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           955.0000
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)         116.8198
 Products entropy           (J/K)         215.1395
 Products enthalpy          (KJ)         -645.8331
 Mass  of the system        (Kg)            0.1306
  Fe 2Mg 1O  4              (C)  []         0.2149
  Fe 3O  4                  (C)[]           0.7621
  Mg 1O  1                  (C)[]           0.0230
*
     97 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           807.2014
 Gas products amount        (mol)       6.54E-0014
 Products heat capacity     (J/K)         147.6047
 Products entropy           (J/K)         199.3965
 Products enthalpy          (KJ)         -684.0189
 Mass  of the system        (Kg)            0.1368
  Fe 2Mg 1O  4              (C)  []         0.2469
  Fe 2O  3                  (C)[]           0.1816
  Fe 3O  4                  (C)[]           0.5716
*
     98 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           665.0000
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)         136.3685
 Products entropy           (J/K)         177.2989
 Products enthalpy          (KJ)         -725.3257
 Mass  of the system        (Kg)            0.1437
  Fe 2Mg 1O  4              (C)  []         0.1646
  Fe 2O  3                  (C)[]           0.4544
  Fe 3O  4                  (C)[]           0.3810
*
     99 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           493.1086
 Gas products amount        (mol)       9.86E-0015
 Products heat capacity     (J/K)         125.1149
 Products entropy           (J/K)         142.6689
 Products enthalpy          (KJ)         -772.2006
 Mass  of the system        (Kg)            0.1513
  Fe 2Mg 1O  4              (C)  []         0.0823
  Fe 2O  3                  (C)[]           0.7272
  Fe 3O  4                  (C)[]           0.1905
*
     100 wt% Fe2O3
 Volume of gas products   (litres)          0.0000
 Pressure of gas products   (atm)           1.0000
 Temperature                (K)           307.3328
 Gas products amount        (mol)       9.00E-0015
 Products heat capacity     (J/K)         105.4568
 Products entropy           (J/K)          90.5733
```

```
 Products enthalpy          (KJ)         -822.0397
 Mass  of the system        (Kg)            0.1597
  Fe 2O  3                  (C)[]           1.0000
*
```

Vita

Armando Delgado Jr. earned his B.S. and M.S. in Mechanical Engineering from the University of Texas at El Paso in 2010 and 2012, respectively. In 2013, he joined the doctoral program in Environmental Science and Engineering at the University of Texas at El Paso where he later changed to the doctoral program in Mechanical Engineering. Armando was a recipient of the U.S. Department of Education's "Graduate Assistance in Areas of National Need" Fellowship and the UTEP Graduate School's Diana Natalicio Doctoral Dissertation Fellowship.

In November 2009, he began working as a research assistant in the Center for Space Exploration Technology and Research under Dr. Evgeny Shafirovich's supervision. He has coauthored four full-length articles published in peer-reviewed journals *Combustion and Flame*, *Journal of Alloys and Compounds*, and *Journal of Thermophysics and Heat Transfer*. He has presented his research at several national and international conferences such as the 66th International Astronautical Congress (2015), AIAA Science and Technology Forum and Exposition (2015), 35th International Symposium on Combustion (2014), 5th Joint Meeting of the Space Resources Roundtable and the Planetary & Terrestrial Mining Sciences Symposium (2014), 12th International Symposium on Self-Propagating High-Temperature Synthesis (2013), and 8th and 9th U.S. National Combustion Meetings (2013 and 2015).

He interned at NASA Kennedy Space Center in 2016, and also attended the Planetary Science Summer School at the Jet Propulsion Laboratory. He participated as a working group moderator in the Space Generation Congress, an international meeting of the Space Generation Advisory Council which is endorsed by the United Nations Office of Outer Space Affairs.

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This thesis/dissertation was typed by Armando Delgado.