Zirconium Mediated One-pot Synthesis of γ-Amino Acids from Carbon Dioxide

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Zirconium Mediated One-pot Synthesis of $\gamma$-Amino Acids from Carbon Dioxide

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The usage of organometallic compounds will offer a broad exploration for new methods and techniques in organic synthesis. One of our interests lies in the utilization of CO$_2$ with the application of organometallics because metal complexes have been displaying a wide variety of coordination modes with CO$_2$. The purpose of this project is to develop zirconium mediated processes for the synthesis of $\gamma$–amino acids using CO$_2$. CO$_2$ insertion to zirconium complexes will provide a new method for $\gamma$–amino acid synthesis in one-pot reaction. The complexes are air sensitive and the reaction requires to be carried out under nitrogen. In our method zirconium complexes are prepared from a variety of $\alpha,\beta$–unsaturated imines to form five-membered azazirconacyclopentenes, followed by insertion of CO$_2$ into the resulting complexes which afford seven-membered azazirconacarboxylates. NMR spectroscopy is utilized to confirm these intermediates. To obtain the desired $\gamma$–amino acids, hydrolysis of the seven-membered zirconacycle is the key to cleave zirconium-oxygen and zirconium-nitrogen bonds. Our methodology for $\gamma$–amino acid synthesis will demonstrate the reaction efficiency of transition metals and CO$_2$. 