

Organic Chemistry

Hirschmann Lecture Series

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Self-Assembly of Dinuclear Main Group Catalysts For Asymmetric Synthesis

Synthetic efficiency demands that asymmetric synthesis, must be the long term objective for the synthesis of chiral molecules. While most attention has focused on transition metal catalysis, less effort has involved main group asymmetric catalysis. Furthermore, most metal catalysts are mononuclear. Given the nature of most chemical reactions wherein two groups are added, dinuclear catalysts have much more potential due to the ability to tailor the choice of metal to each reactant. A ligand derived from α,α -diarylprolinols and phenols provides spontaneous self-assembly of dinuclear metal complexes with zinc and/or magnesium as the metal. Furthermore, the design potentially allows the introduction of two different metals. The utility of this design for a range of additions using carbonyl and imine groups as well as Michael acceptors as the electrophiles and enolates, nitronates, acetylides, pyrroles, and butenolides as the nucleophiles have been evaluated. Desymmetrization of meso-diols proceeds in enzyme-like fashion. This methodology also provides simplification for the total synthesis of some novel bioactive natural products.