INORGANIC SEMINAR

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Bismuth Catalysis: Transition-Metal Reactivity from a Main-Group Element

Recently, group 15 elements have attracted significant attention due to their applicability as catalysts in a wide range of organic transformations with bismuth in particular emerging as a highly promising candidate. In organic synthesis, Bi^{III} salts have been widely explored as soft Lewis acid catalysts and as transmetalating agents in transition metal-catalyzed reactions. These processes are redox-neutral and primarily depend on the Lewis acidity of the Bi^{III} center rather than its redox behaviour. Despite its promise for organic synthesis, the field remained largely dormant for many years as it required stoichiometric amounts of bismuth, posing challenges for atom economy and sustainability. In recent years, bismuth has evolved from being viewed simply as a Lewis acid catalyst to gaining recognition as a redox catalyst in organic synthesis. Bismuth redox catalysis commonly operates through interconversion between Bi(III)/Bi(V) and Bi(I)/Bi(III) oxidation states, enabling a diverse array of bond-forming transformations. The rational design of ligand frameworks around the bismuth center has led to the development of robust catalytic systems applicable to a wide range of bismuth-mediated redox transformations. In this seminar, I will discuss these catalytic cycles with a particular focus on ligand design strategies and their impact on reactivity.

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