

Addressing Sustainability Challenges with Earth Abundant Metal Catalysis

How chemists interact with and ultimately use the elements on the periodic table is one of the primary sustainability challenges for the 21st century. Applications ranging from alternative energy to the synthesis of pharmaceuticals and every day products need to rely on terrestrially abundant elements such as iron rather than rare ones that have a large environmental footprint associated with mining and purification. Our research group is exploring the new chemistry enabled by catalysis with Earth abundant transition metals. Motivations are two-fold. First we strive to discover highly effective catalysts with applications in the pharmaceutical, flavor and fragrance, silicones, energy and polymer science industries and often engage with industrial collaborators. Second, we seek to uncover the unique pathways that enable these transformations, many of which are distinct from precious metals and rely on the unique electronic structures of the first row transition metals. My lecture will focus on the distinct chemistry enabled by iron and cobalt catalysts and the design principles that were used in catalyst discovery. Applications will be emphasized throughout with special emphasis on broad challenges that confront the field such as air-stable, easily handled precursors, functional group tolerance, ligand design and understanding reaction mechanism.