CAREER: Synthesis, Characterization and Reactivity of Iron-Functionalized Polyoxovanadate-Alkoxide Clusters for the Activation of Small Molecules

In considering the global challenges society faces today, the issue of securing future energy resources is particularly conspicuous. As fossil fuels are depleted, chemists have turned their focus to investigating synthetic methods for obtaining alternative energy resources. A central challenge to developing sustainable and renewable fuel production strategies is the activation of small molecules. In nature, multi-metallic assemblies are bridged by electronically flexible main group elements that promote multi-electron cooperative small molecule activation across a bimetallic system or cluster. Drawing inspiration from these systems, Dr. Matson is investigating the electronic interactions between metal-oxide clusters and transition metals. The goal of this project is to understand how transition metals work cooperatively to mediate the multi-electron activation of thermodynamically strong bonds of chemical pollutants. Dr. Matson is actively engaged in a number of outreach activities in Rochester, building upon her previous training as a chemistry teacher. These events are designed to improve the dissemination of scientific knowledge to young students by increasing exposure through demonstrations and training teachers to be more effective in their communication with students.

With funding from the Chemical Synthesis Program of the Chemistry Division of the National Science Foundation, Dr. Matson and her research group are investigating the synthesis and reactivity of a family of iron-functionalized polyoxovandate-alkoxide clusters. These hexanuclear, multi-metallic, *Lindqvist* clusters possess rich redox chemistry, making them ideal platforms for the mediation of multi-electron transformations pertinent to the activation of small molecules (e.g. CO_2. N_2, NO_x, etc.). In addition to establishing a general synthetic route to access iron-functionalized polyoxovanadate-alkoxide clusters, Dr. Matson is working to develop an understanding of the electronic properties of these delocalized systems through stoichiometric redox reactivity. These research efforts are generating a unique class of metalloligands to support multi-electron transformations using first-row transition metal centers; with a focus on the ability of the metal-oxide framework to serve as a *redox-active reservoir*. Dr. Matson is actively engaged in multiple outreach initiatives targeted at facilitating dissemination of scientific content to young students. The research and outreach initiatives ongoing in the Matson Lab will lead to significant broader impacts on chemistry education and research within the community.