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Department of Chemistry

Special Seminar

4 p.m. Friday, October 31, 2014 • 331 Smith Hall



Assistant Professor

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Teaching Sponges New Tricks: Redox Reactivity and Charge Transport in Microporous Metal-Organic Frameworks

Research focuses on the functional chemistry of inorganic and metal-organic materials, with a current emphasis on porous materials and high-nuclearity metal clusters.

Website: <http://web.mit.edu/dincalab/mircea.html>

Abstract

Traditional applications of metal-organic frameworks (MOFs) are focused on gas storage and separation, which take advantage of the inherent porosity and high surface area of these materials. The MOFs' use in technologies that require charge transport have lagged behind, however, because MOFs are poor conductors of electricity. We show that design principles honed from decades of previous research in molecular conductors can be employed to produce MOFs with remarkable charge mobility and conductivity values that rival or indeed surpass those of common organic semiconductors and even graphite. We expect that such high surface area, ordered, and crystalline conductors will be used for a variety of applications in thermoelectrics, energy storage, electrocatalysis, electrochromics, or new types of photovoltaics. Another virtually untapped area of MOF chemistry is related to their potential to mediate redox reactivity. We show that MOFs can be thought of as unique weak-field ligands that give rise to unusual molecular coordination environments where small molecules can react in a matrix-like environment, akin to the metal binding pockets of metalloproteins. By employing a mild synthetic method and a suite of spectroscopic techniques, we have undertaken forays into the redox chemistry of the MOFs' metal nodes, an exciting new area for small molecule reactivity.

Host: Professor Connie Lu