Useful structural or dynamic function by complex systems based on inorganic clusters

Craig L. Hill

Department of Chemistry, Emory University,
Atlanta, GA, 30322 USA, E-mail: chill@emory.edu

Myriad synthetic systems with considerable geometrical or structural complexity are now known, but few of these systems exhibit useful complex function arising from such structural complexity. We will describe ongoing work based on multi-component inorganic clusters that achieve the following intellectually engaging and/or practically important phenomena.

Self-repairing and self-buffering catalytic systems. These are based on controlled interconverting ensembles of nontoxic metal oxygen anion clusters (polyoxometalates or "POMs") that achieve some long-sought goals in green chemistry and in systems and nanoengineering: (1) use of the most desirable oxidant (air) and solvent (water), (2) mineralization of by-products, (3) autocontrol of system pH to preserve delicate substrates, etc. (*Nature*, **2001**, 414, 191-195, etc.)

Nanostructures that entrap, detect and catalyze air-based decontamination of toxics. Both gelating nanoarrays and metal-organic-framework (MOF) materials based on covalently linked multi-component POMs that facilitate all three of the above functions, important to human health and safety, have been achieved (*J. Am. Chem. Soc.* **2007**, in press)

Nanomolecules with quantum spin chemistry. The largest and most complex inorganic molecules to date have been thoroughly characterized. A large number of interacting spins gives rise to unusual magnetic characteristics suggesting possible applications in quantum computing *Chem. Comm.* **2005**, 3138-3140 (featured cover article), *Chem. Comm.* **2005**, 5621-5623)("Hot Article")