

Honours and MSc projects for 2009

New Molecular Switches: Towards Bistable Polymetallic Materials

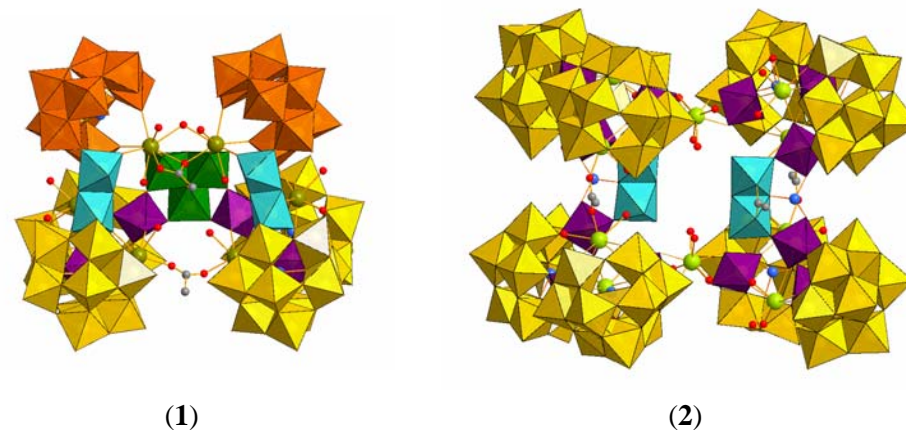
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Molecular materials with physical properties that can be controlled by external parameters, such as temperature, light or magnetic field are important synthetic targets because they form the basis of molecular devices. The miniaturisation required by technological advances in electronics makes the demand for such nanoscale devices inevitable. Bistable systems can be reversibly interconverted between two different states by an external stimulus, with hysteresis accompanying the interconversion. Molecular systems that display bistability have tremendous potential for high density data storage and as molecular switches. Research in the Boskovic group is focused on two families of compounds that can display bistability: single-molecule magnets (SMMs) and valence tautomeric (VT) complexes.

Honours and MSc projects will involve organic and inorganic synthesis and the characterisation and investigation of the resulting species using X-ray crystallography, magnetic measurements, electrochemistry and IR, NMR, EPR and UV-visible spectroscopy. The following projects are available for 2009:

(1) *Single Molecule Magnets Encapsulated in Polyoxometalates.*

An important synthetic challenge is to achieve the magnetic isolation of SMMs. One promising approach is to synthesise complexes where SMMs are effectively embedded within diamagnetic polyoxometalate frameworks. Lacunary polyoxometalates are potential precursors for these complexes and we have recently synthesised novel polyoxotungstate-encapsulated Gd₆ and Yb₁₀ complexes (**1** and **2**) towards this aim. This project will involve the synthesis of aquo- and organo-soluble salts of various polyoxometalates and an investigation of their reactivity with sources of paramagnetic metal centres, including preformed polynuclear complexes, targeting polyoxometalate-encapsulated SMMs.



(2) *Polymetallic Valence Tautomers.*

VT complexes display an intramolecular electron transfer between redox-active metals and ligands that is stimulated by heat, light or pressure. Most reported VT complexes contain a single metal and redox-active ligands derived from catechol or phenoxyl amines. We are exploring the potential of polymetallic complexes that incorporate more than one redox-active ligand to achieve systems that can be switched between three or more different states. Such complexes may ultimately find applications in molecular electronics beyond that of simple on and off switches. We have recently synthesised novel dinuclear Ni and Co complexes towards this goal (**3** and **4**). This project will involve the synthesis of new polynucleating redox-active ligands that incorporate phenoxyl amine groups and an investigation of their complexes with redox-active 3d metals, targeting polymetallic VT complexes.

