Professor Malcolm Halcrow
m.a.halcrow@leeds.ac.uk
phone: 0113 343 6506

This proposal is representative of the projects currently on offer in our group. For more details of active research projects, please visit our webpage at: http://www.chem.leeds.ac.uk/People/Halcrow.html

Spin-Crossover Compounds – Switchable Materials from Simple Metal Complexes

This project involves the synthesis and structural chemistry of switchable metal complexes. "Spin-crossover" compounds can undergo a reversible change in magnetic moment upon application of heat, light or some other physical stimulus. This most commonly corresponds to a high-spin-to-low-spin d-electron transition at a transition metal centre, and is accompanied by a colour change. Materials like these, whose colours can be reversibly and rapidly switched, have applications in display devices and in optical computing, among other things.[1]

We have projects in various aspects of this chemistry, involving organic and inorganic synthesis, crystallography, solid and solution-phase magnetic measurements and other analytical techniques as appropriate.

One of our current goals is to prepare materials that undergo a colour change in the presence of different anions. These are nanoporous crystals constructed from spin-crossover centres, whose pores are lined with N–H or O–H functional groups that can hydrogen bond to anions in the lattice. Incubating the materials with solutions of different anions allows us to exchange the anions in the pores, changing the hydrogen bonding to the iron centres in the material and changing their spin state and colour. The aim is to prepare an anion sensor that can be used to detect environmental pollutants (like nitrate from fertiliser) or biochemical electrolytes (like chloride in blood) with the naked eye.

In another project, we are pursuing different ways to incorporate new functionality into spin-crossover materials.[3,4] Our current goal is to find a new spin-crossover molecule that is suitable to use in molecular devices and nanoscience, which will widen the range of applications that spin-crossover materials can be used for. Such a compound should have the following attributes:

- It should be easily modified at just one position on the periphery of its ligand(s), so it can be cleanly tethered to other components in a molecular device, or to a surface;
- It should be soluble and stable in water and organic solvents, so it can be used for as many applications as possible;
- It should work at room temperature.

In forty years of spin-crossover research, no one has yet made a compound that meets all these criteria, which pose a challenging problem of molecular design and synthesis.

Please contact Prof Malcolm Halcrow (m.a.halcrow@leeds.ac.uk) for further details about this opportunity.

References