Dr Chris J Adams

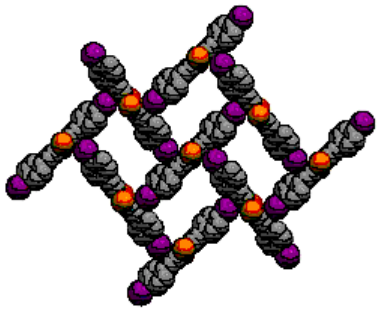
New applications for coordination compounds

e-mail c.j.adams@bris.ac.uk

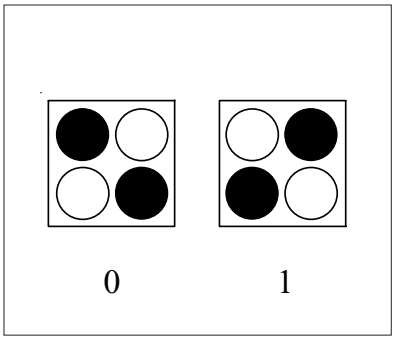
http://www.chm.bris.ac.uk/staff/cadams.htm

My research is focussed upon the way that we can use traditional inorganic coordination compounds in new ways that might have technological relevance. Topics under investigation include:

'Crystal engineering': In most cases, when a substance aggregates into a molecular crystal the resulting arrangement of molecules cannot be predicted in advance; nature determines the lowest energy way of packing things together, and the chemist has very little control. In recent years, however, people have become interested in examining interactions between molecules in the solid state, and have begun trying to synthesise compounds that will pack together in a preordained fashion – the field of 'crystal engineering'. My research has focussed on the use of metals as templates for crystal engineering. As the arrangement of ligands around a given metal ion is readily controllable, by choosing ligands that interact with each other in a predictable manner we can create molecules that crystallise in an ordered and controlled way (right).



'Redox-active molecules for computing': A new way of representing binary information has recently been investigated, that involves putting four redox-active quantum-dots in a square. Oxidising or reducing two of the four quantum dots can be used to represent a '1', and oxidising or reducing the other two can be used to represent a '0' (right). Suitable arrays of these squares can be used to process the binary information, giving a pathway towards molecular computing that might be able to circumvent the impending breakdown of 'Moore's law'. Unfortunately, with quantum dots the technique only works at milliKelvin temperatures; in order to work at room temperature, we need to replace the quantum dots with single molecules. However, there are very few molecules that fulfil the necessary conditions; we are attempting to make some more.



'New surface-mounted metal complexes': Many technologies, from solar-cells to biological sensors, use complexes tethered to some kind of surface. I have recently begun studies into using some metal-bipyridine compounds for these kinds of application.

My work has a large synthetic component; a project would involve a lot of 'wet' chemistry, synthesising organic ligands as well as metal complexes. Characterisation techniques used involve IR, NMR (^{1}H and ^{31}P) and ESR spectroscopies and electrochemistry, as well as X-ray diffraction.

For more information please see http://www.inchm.bris.ac.uk/people/adams.htm