Annie K. Powell

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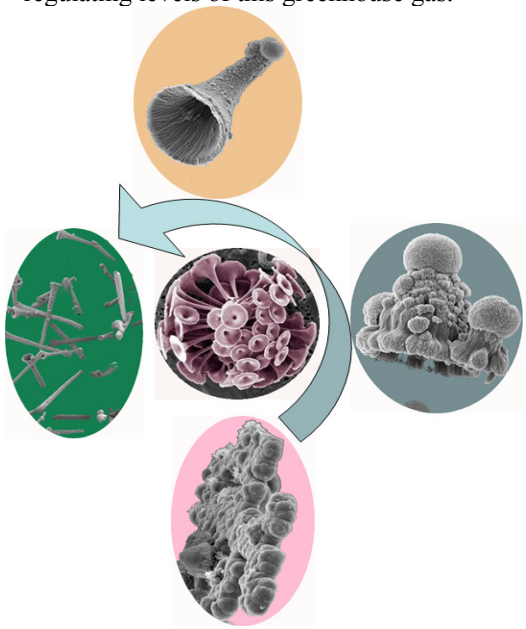
Principal Research Interests

Research in my group is focused on the synthesis and investigation of materials with nanoscale dimensions as well as with systems arranged into hierarchical structures. A central physical method for characterising our systems is single crystal X-ray diffraction. For the magnetic materials we produce we use SQUID susceptometry and Mössbauer spectroscopy for further characterisation. Our activities can be divided into four main areas:

- Synthesis of high nuclearity oxygen bridged metal aggregates. Metal oxide/hydroxide fragments are trapped within ligand shells and show properties deriving from their nanoscopic dimensions including "Single Molecule Magnetism" and highly active oxide rich cavities in mesoporous systems. We are also interested in organising the individual aggregates into arrays.
- Hydrothermal synthesis of inorganic network structures. This synthetic method can enable us to isolate metastable phases which have interesting magnetic properties and can be super dense or have very open structures with up to 70% free space for storage of guest molecules or catalysis.
- Hybrid inorganic/organic systems. Here we synthesise ligand systems designed to divide space into certain motifs through supramolecular interactions and complex these with various metal ion "synthons" leading to hybrid materials with unusual structural and physical features.
- Biomineralisation processes. We investigate the effects of templating and structure-directing species on the formation of iron oxide and calcium carbonate minerals which occur in nature as "biominerals" such as shells and teeth. The iron oxides are of importance from many aspects including health, where iron is a vital element and must be safely stored in the form of ferritin through to novel magnetic sensors used by birds and bees to navigate. Calcium carbonate mineralisation processes are of importance industrially in understanding and controlling limescale deposition, for materials research through the different properties of the three polymorphs and from the health aspect e.g. in the balance organss in the middle ear. In the environment, the sequestering of carbon dioxide to produce calcium carbonate by coccolithophores is an important process in regulating levels of this greenhouse gas.



Biomimetic assembly of nanoscale bundles of calcite forming "microtrumpets" reminiscent of the cocclithophore *discosphaera tubifera* (centre of picture).

Selected Publications

1. "Strategies for producing cluster-based magnetic arrays", W. Schmitt, M. Murugesu, J.C. Goodwin, J.P. Hill, A. Mandel, R. Bhalla, C.E. Anson, S.L. Heath and A.K. Powell, Polyhedron, 2001, **20**, 1687-1697.
2. "Cation-π-binding of an alkali metal ion by pendant α,α-dimethylbenzyl groups within a dinuclear iron(III) structural unit", W. Schmitt, C.E. Anson, J.P. Hill and A.K. Powell, *J. Am. Chem. Soc.* 2003, **125**, 11142-11143.
3. "$[Al_{15}(\mu_3\text{-}O)_4(\mu_3\text{-}OH)_6(\mu\text{-}OH)_{14}(hpdta)_4]^{3-}$ - A new Al_{15} aggregate which forms a supramolecular zeotype", W. Schmitt, E. Baissa, A. Mandel, C.E. Anson and A.K. Powell, *Angew. Chem. Int. Ed. Engl.*, 2001, **40**, 3578-3581.
4. "Antiferromagnetic three-dimensional order induced by carboxylate bridges in a two-dimensional network of $[Cu_3(dcp)_2(H_2O)_4]$ trimers", P. King, R. Clérac, C. E. Anson, C. Coulon and A. K. Powell, *Inorg. Chem.* 2003, **42**, 3492-3500.
5. "Engineering of ferrimagnetic Cu12-cluster arrays through supramolecularIInteractions", M Murugesu, CE Anson and AK Powell, *J. Chem. Soc., Chem. Commun.*, 2002, 1054-1055.
6. "Biomimetic assembly of calcite microtrumpets: Crystal tectonics in action", S. B. Mukkamala and A. K. Powell, *Chem.Comm*. 2004, DOI:10.1039/b401754d.