METAL-ORGANIC FRAMEWORK MATERIALS: GAS STORAGE AND SELECTIVITY

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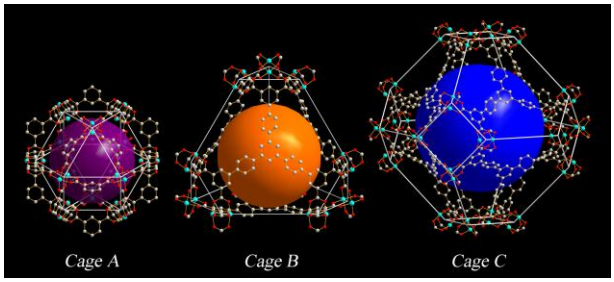
The storage of H_2 in a safe and compact form represents a significant current challenge, and there is wide-ranging interest in the development of stable materials showing permanent porosity that can store and release H_2 with fast kinetics and high reversibility over multiple cycles. The storage and selectivity of other fuel gases such as CH_4, CO_2 and C_2H_2 and volatile organic compounds also represent key targets for the development of selective and functionalised hosts. Porous co-ordination framework compounds have enormous potential in these areas [1], and our approaches to designed, functional hosts will be discussed.



View of polyhedral cages within a MOF complex

Metal-organic frameworks (MOFs) are materials built via connection of bridging polydentate organic ligands with metal centres and clusters. We report the synthesis, structural characterisation and detailed gas adsorption studies and analysis of a range of metal-organic materials including stable carboxylate-linked complexes that exhibit high porosity and surface area coupled with high H_2 capacities at 77 K [2]. Our results indicate that it is not simply pore volume but guest-pore fit, pore functionality and chemical decoration that determine the affinity of substrates within these framework structures. Recent advances include the development of i. highly porous polyhedral solids for H_2 storage (see Figure) [3]; ii. cation exchange in charged porous hosts to modulate and control gas binding and uptake [4]; iii. hysteretic and gated H_2 uptake and release [5]; iv. decorated pores incorporating acid-base functionality and free ligand donor sites [6]; v. pure organic materials showing gas selectivity [7]; selective hosts for CO_2 and SO_2 [8].

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