Cover story

Vol.6 No.7 July 2007

Reflectins are proteins that squids use to make reflective structures. Their function is probably related to camouflage or communication. The fact that they form complex photonic structures, which are not static but can be modulated by the squid, has attracted the interest of materials scientists. Rajesh Naik and colleagues have expressed the gene of a reflectin in a bacterium capable of producing large quantities of this protein so that, once purified, its peculiar optical and self-assembly properties could be revealed. They then used this knowledge to make fibres and diffraction gratings out of the protein, highlighting the extraordinary opportunities that lie in transferring materials from biology to technology. The authors hope that the ability of reflectin to self-organize into gratings that are defect-free over long distances could enable their use in bottom-up fabrication of photonic-crystal devices. **[Article p533]**

SELECTIVE ZEOLITES

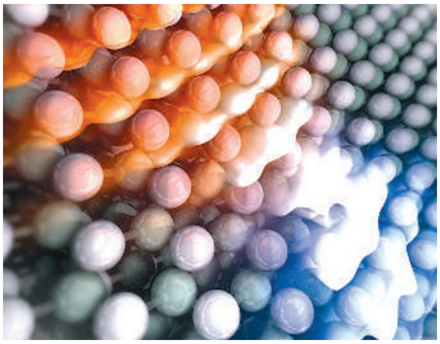
Metal-organic frameworks based on imidazolates exhibit thermal and chemical stability and are promising porous materials for various applications such as catalysis and separation processes. Omar Yaghi and colleagues now report on a synthetic strategy that exploits structure-directing agents, which also serve as linkers, to produce imidazolate frameworks. The cage walls of these porous structures can be functionalized, and the metal ions can be changed without modifying the underlying topology. Gas-adsorption isotherms show that this new class of porous materials also exhibit selectivity for carbon dioxide over methane. **[Letter p501]**

A NATURAL CHOICE

Molecular magnets hold great promise for novel spintronic devices, as functional molecules might replace lithographic integrated circuits. However, to convey information to molecular devices, inorganic contacts are required. Heiko Wende and colleagues have addressed this problem by studying porphyrin molecules on Co and Ni surfaces. Active components in chlorophyll and haemoglobin, metallo-porphyrins are an important class of molecules for biological systems. Wende and colleagues have now demonstrated that the magnetic spin of the Fe ion in the centre of a porphyrin molecule can be switched by the magnetic orientation of the substrate, thereby enabling the study of more complex molecular structures for spintronics applications.
[Article p516; News & Views p471]

THE HOLES GET DISTORTED

GaMnAs is the most widely investigated magnetic semiconductor. Its magnetic properties are strongly influenced by strain, and Andrei Yakunin and colleagues have now investigated the effect at the atomic level. They have incorporated InAs nanoclusters, or quantum dots, within a GaMnAs specimen, which distort the lattice, inducing strain over a range of a few tens of nanometres. Their scanning electron microscope reveals that the states of the positive charges (holes) around a single Mn atom can be strongly influenced by the strain direction, and their observation could be correlated with the previously observed magnetic anisotropy, that is, the tendency of the electron spins to orient in a preferential direction.
[Article p512, News & Views p472]



The hole wavefunction around a single Mn acceptor in GaAs is strongly affected by the local strain.

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SILICON CARBIDE NANOSTRUCTURES

Although the structure and properties of silicon carbide in the bulk phase are attractive for many technological applications, playing with silicon and carbon at the nanoscale offers novel perspectives. Patrice Mélinon and colleagues review the structures that can be obtained by controlling the physics and chemistry of silicon and carbon at this length scale. Nanotubes, nanowires and clusters can be used as building blocks for the synthesis of novel materials, and molecular engineering provides the opportunity to modify the nature of the SiC bonding. Moreover, theoretical principles associated with SiC fullerene-like clusters should lead to nanostructured materials with exceptional properties such as tunable bandgap, low density, exceptional hardness and remarkable transport characteristics.
[Review p479]

MAGNETISM AT THE INTERFACE

The interfaces between some perovskite oxides have shown intriguing properties in the past. For example, although $LaAlO_3$ and $SrTiO_3$ are nominally insulators in their bulk form, interfaces between layers of the two materials can give rise to very high conductivity. In analogy with this observation, Alexander Brinkman and colleagues show now that although the two layers are non-magnetic, magnetic effects can be generated at the interface. The origin of the magnetism is not fully understood at present, however, this observation adds another exciting ingredient to the already fascinating properties of these material systems. **[Letter p493; News & Views p473]**

SMALL MAKES IT BIG AFTER ALL

The need for renewable, non-polluting energy sources is driving research into organic solar cells. Small-bandgap semiconducting polymers have been investigated as likely candidates for efficient solar cells, as low-energy photons should still be able to produce charges in the materials, increasing energy output. Unfortunately, their efficiencies have failed to reach current state-of-the-art. Wong and colleagues present the synthesis of platinum-containing polymers with small bandgaps, which, when used for solar cell applications in blends with a standard fullerene derivative, can achieve average efficiencies of 4.1%. This provides hope that low efficiencies aren't an inherent result of using low-bandgap polymers.
[Article p521]