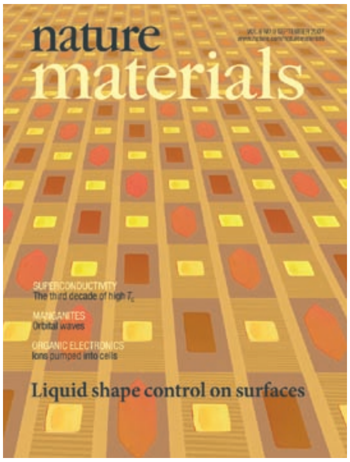


Cover story

Vol.6 No.9 September 2007

It is well known that topographical patterning can contribute to making surfaces repel liquids. With the right choice of surface chemistry, however, the liquids can be sucked into the spaces between the features instead. Stone and colleagues now find that such topography can control the shape the liquid makes on the surface. In their experiments, the researchers place a droplet on a surface patterned with an array of microposts. When the liquid is sucked between the posts, the droplet boundary advances in different directions at different speeds. This results in the droplet adopting a variety of polygonal shapes, including octagons, squares, hexagons and circles, depending on the liquid's contact angle and the pattern of the posts on the surface. These observations suggest a designers' 'tool box' for controlling liquid shapes on surfaces.
[Letter p661; News & Views p627]

ONE AT A TIME

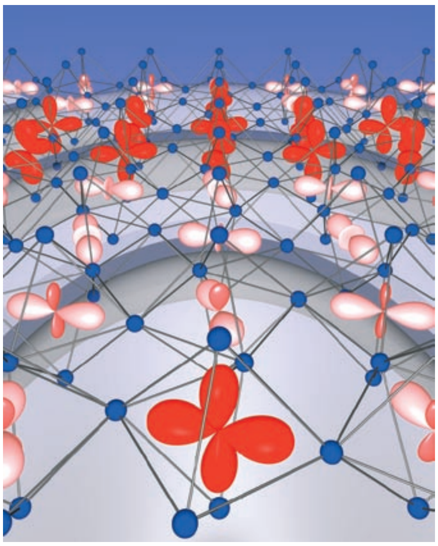
The minimum amount of gas that a sensor could possibly detect is a single molecule. Kostya Novoselov and colleagues now show that a graphene sheet can actually detect gas at this ultimate resolution. They have measured the conductance of a single graphene layer immersed in very dilute gas and observed variations in well-defined steps, which they attribute to the variation in charge density due to absorption or desorption of single molecules of gas. Yet another demonstration of the strong potential of graphene for future applications. **[Letter p652]**

AT THE LIMITS OF MAGNETIC STABILITY

Most theoretical models describing the properties of magnetic materials either deal with single molecules or with clusters of hundreds of atoms. Tor Strandberg and colleagues now take an important step towards bridging this gap by deriving a theory that describes the behaviour of transition-metal dimers such as Co_2 or Rh_2. Of particular interest for applications is the magnetic anisotropy energy — the variation of energy as a function of magnetization direction. Increasing magnetic anisotropy enables more stable magnetic memories to be made. Remarkably, the authors predict that these transition-metal dimers have the largest magnetic anisotropy per particle than any other known compound.
[Letter p648]

MANGANITES IN THE SPOTLIGHT

Many correlated electron systems such as manganites can be driven from an insulating to a metallic state by mere exposure to intense light. Particularly interesting is the dynamics of such phase transitions that can be probed by using ultrashort pulses of light. So far however, only relatively slow dynamics were probed. Andrea Cavalleri and colleagues now venture into a new timescale by using laser pulses of less than 10 fs duration when studying the photo-induced insulator-metal transition in manganites. In their experiments, the authors discover coherent oscillations that are suggestive of the much-debated orbital waves. **[Letter p643]**



Coherent orbital waves in a manganite.

p643

ALL SORTS OF DEFECTS

The ability of a superconductor to carry electrical current without losses makes it a natural candidate for various applications with low energy consumption. The challenge for materials scientists is to find effective ways to maximise the amount of current that can flow without losses. Steve Foltyn and co-authors review the efforts in the last few years with the goal of modifying high temperature superconductors by introducing defects, ironically aimed at improving the quality of these materials in terms of applications. As highlighted by Alexis Malozemoff in his commentary, these efforts are also one of the fundamental steps to reach commercialisation of high temperature superconductors.
[Review Article p631, Commentary p617]

QUARTZ UNDER PRESSURE

The high-pressure behaviour of quartz-like materials can help to understand silica polyphormism, and consequently, transformations taking place in the Earth's mantle. $AlPO_4$, considered as the archetypal quartz-like homeotype, has been widely studied because of the supposed existence of a reversible pressure-induced amorphization. By combining X-ray diffraction and calculations, Julio Pellicer-Porres and colleagues now demonstrate the existence of two high-pressure crystalline polymorphs in $AlPO_4$ which exhibits the same two-stage densification mechanism as silica. Interestingly, phosphorous becomes six-fold coordinated by oxygen adopting a configuration never observed before, therefore opening new avenues in high-pressure phosphorous chemistry.
[Article p698]

ORGANIC ELECTRONICS PUMPS ION

Organic electronics has already made considerable inroads into the semiconductor industry, with plastic light-emitting diodes, solar cells and transistors attracting the most attention. However, a lesser-known topic within this research area concerns the use of conducting polymers in biomedical applications. Berggren and colleagues report an organic electronic ion pump, which can control the levels of calcium ions in cells that are located in reservoirs on the pump's surface. The device can address individual cells in a temporally and spatially selective manner, inducing physiological signalling events that can be recorded at the single-cell level.
[Article p673; News & Views p626]

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