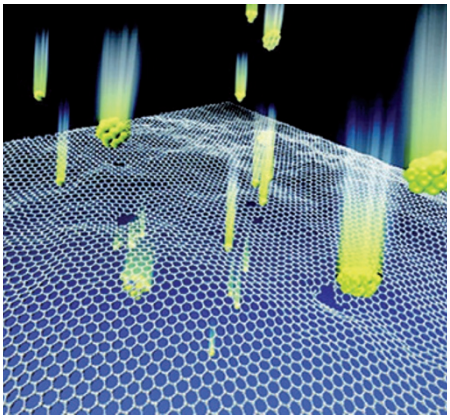
Atomic turnover

Nano Lett. **12,** 141–144 (2012)



In its pure state, graphene, a single layer of carbon atoms, already exhibits a range of exceptional physical properties. Even more interesting features can be achieved by chemical modification. However, altering graphene in a controlled way is still a challenge. Hongtao Wang and co-workers have now shown that using a two-step process it is possible to replace carbon atoms with those of other elements. The first step consists of creating carbon vacancies by bombarding a graphene sheet with ions emerging after laser ablation of a target material in a pulsed laser deposition chamber. The second step then consists of filling the vacancies, which can be achieved in different ways. The researchers succeeded in depositing platinum atoms by using an electron beam, and cobalt and indium atoms by sputtering. The work shows that the creation of vacancies could be instrumental in fabricating graphene structures that can be tailored to a range of applications, including gas and magnetic sensors, supercapacitors and spintronics devices. *FP*

Designer nanopores

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In biology, protein channels can regulate the permeability of lipid bilayer membranes for ions and molecules. These characteristics have inspired researchers to investigate solid-state nanopores for DNA sequencing and sensing applications. However, the shape and the surface chemistry of such top-down fabricated nanopores can only be controlled with limited precision. Nicholas Bell and colleagues now report the design and assembly of hybrid organic–inorganic nanopores with well-defined diameters. Their method is based on DNA origami — the synthesis of DNA strands that self-assemble into predesigned three-dimensional shapes. The researchers use this method to construct funnel-like structures with a leash that can be pulled through a nanopore in a silicon nitride membrane. The assembly scheme is robust and reversible and the pores can already be used to detect the translocation of single DNA strands. The researchers suggest that their origami structures could be modified further to induce additional functionality for stochastic sensing applications. *CM*

Tailoring interfacial curvature

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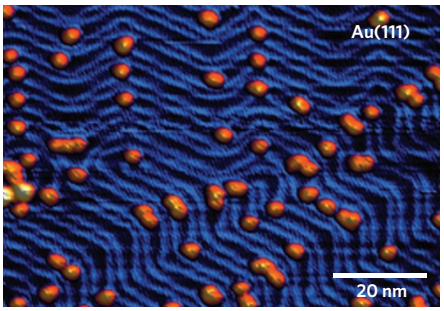
Floating objects that deform a liquid surface often clump together as a result of gradients in surface height (this is the 'Cheerios effect', named after the cereal that forms aggregates or clings to the sides of a bowl of milk). However, for micrometre-sized particles sitting at and locally deforming a fluid interface, gravitational forces are irrelevant and instead capillary interactions resulting from the minimization of gradients of curvature (and thus surface area) can drive particle assembly. Marcello Cavallaro and colleagues have now exploited the coupling between curvature-driven capillary forces and particle geometry to tailor the curvature field around vertical microposts that pin the contact line of an oil/water interface, and to direct the location of assembly of curvature-inducing microrods. By varying the cross-section of the microposts, the researchers created attractive and repulsive sites for particle assembly to achieve complex particle configurations, such as end-to-end and side-to-side clusters of microrods at the corners of a square micropost. Such curvature-driven migration and assembly should occur for colloidal particles of any material and shape that deform fluid interfaces. *PP*

A soft landing for magnets

Nano Lett. **12,** 518–521 (2012)



The interest in molecular magnets is based on the broad range of quantum effects made possible by the versatility offered in the design of the molecular structures. Yet, molecular magnets are delicate structures that can be difficult to handle. In particular, their deposition and binding to functional surfaces can be challenging. Steffen Kahle and colleagues have now demonstrated that electrospray ion beam deposition (ES-IBD) is sufficiently gentle to preserve the integrity of molecular magnets even when anchored on substrates. In ES-IBD, a solution of molecular magnets — in this case manganese-12-acetate — is sprayed into the deposition system at ambient conditions. The molecules are then selected by a mass spectrometer and deposited with low energy on various substrates. Scanning microscopy and transport experiments confirm that the molecules can be individually bonded while maintaining their magnetic properties. Although ES-IBD has been previously shown to be useful for the deposition of organic molecules, the suitability of this technique even for sensitive molecular magnets suggests its future relevance in the practical utilization of magnetic molecule systems. *JH*

A synthetic nanotube

J. Am. Chem. Soc. **134,** 142–145 (2012)

Polymerizing organic molecules to form synthetic nanotubes would allow researchers to take advantage of organic chemistry tools for nanotechnology applications. Joseph W. Lauher and his group have adopted an approach for producing tubular polymers in which macrocyclic monomers are designed to stack through π–π interactions, and which contain polymerizable units — two diacetylene groups in this case. The 34-atom monomer designed by the researchers forms a triclinic crystal with a favourable stacking distance to enable, on annealing, a single-crystal-to-single-crystal polymerization reaction covalently connecting the stacked monomers to form a synthetic nanotube. In principle, the monomer's cross-section is large enough to allow the inclusion of small molecules, however, the central opening of the nanotube becomes partially obstructed by a conformational tilt as the polymerization proceeds. Although the researchers demonstrate that it is possible with this approach to produce a fully chemically characterized tubular addition polymer (with a 1-nm-opening across the long axis and indefinite tube length), the challenge ahead is to make the nanotubes soluble and functional with *ad hoc* chemical modifications. *AM*

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