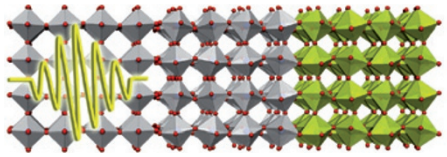
Beaten to action

Phys. Rev. Lett. **108,** 136801 (2012)



Oxide materials have attracted considerable interest because of their electronic properties such as magnetism, superconductivity and ferroelectricity. However, although factors such as strain have been used successfully to control many of these properties, dynamic aspects such as the role of lattice vibrations remain much less explored. To this end, Andrea Caviglia and colleagues studied thin films of $NdNiO_3$ grown on a $LaAlO_3$ substrate, and found that at room temperature $NdNiO_3$ is metallic and at cryogenic temperatures it is insulating. They then excited the thin films with ultrashort mid-infrared light pulses with energies tuned to typical values for vibrational excitations. For a period of a nanosecond this turns the low-temperature insulating phase metallic. Of course, such metal–insulator transitions have previously been induced by various means, even in this compound. What is so unusual about these results, however, is that the effect occurs when the pump energy corresponds to the lattice vibrations of the substrate, and not of the $NdNiO_3$ film. These substrate lattice vibrations reach into the film and cause the metal–insulator transition, emphasizing the intricate link between structure and lattice dynamics even across oxide thin-films. *JH*

Close to the edge

Nano Lett. http://doi.org/hsm (2012)

Graphene electronic devices can take advantage of the very high conductivity of this single layer of carbon atoms. But how is the current actually distributed in a graphene flake of finite size? According to Jungseok Chae and co-authors there is a strong current enhancement at the edges. They used a scanning gate microscope to monitor the variation of current induced by a gate voltage applied locally on the surface of a graphene transistor. Nothing remarkable occurs when no charges are present in the flake, but a considerable enhancement is evident when either holes or electrons are there. The team explained the observation by the opening of a conduction band induced by zigzag edges, which is significant regardless of the flake size, but can be dominant in very narrow ones. The results could therefore be important for the design of devices based on graphene nanoribbons, typically only a few tens of nanometres wide. *FP*

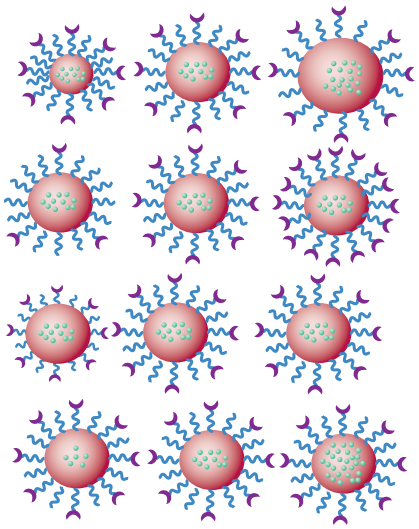
Picking holes

Angew. Chem. Int. Ed. http://doi.org/fz4rft (2012)

Polymersomes — vesicles formed from the assembly of amphiphilic block copolymers — are known to encapsulate a variety of molecular guests including enzymes, DNA and drug molecules. For biomedical applications, the controlled release of such guests is an important characteristic and, so far, the permeability of their membranes has been be tuned by, for example, altering the chemical structure of the polymeric building blocks or the solution pH. Now, Giuseppe Battaglia, Brigitte Voit and colleagues have shown that pressure-induced changes also affect the permeability of polymersomes. They synthesized a family of pH-sensitive, photo-crosslinkable polymersomes and show that formation of pores within the membrane, and hence the selective release of different-sized dendritic molecules, can be controlled by the shear rate applied to the polymersomes. The crosslinked membrane has a more intrinsic resistance to pore formation. Moreover, by changing the solution pH, the transport of reagents to an enzyme encapsulated within the polymersomes can be controlled, even in the absence of transmembrane proteins. *AS*

Optimized for the clinic

Sci. Transl. Med. **4,** 128ra39 (2012)



Although nanoparticles encapsulating anticancer drugs and targeting membrane antigens have long been investigated, their clinical application has been hampered by difficulties in finding the physicochemical parameters that lead to optimal targeting efficacy, controlled drug release and the evasion of immune responses. Now, Jeffrey Hrkach and colleagues present an approach for the screening and optimization of block-copolymer nanoparticles entrapping docetaxel — a chemotherapeutic drug — and functionalized with poly(ethylene glycol) decorated with a small molecule that targets the extracellular domain of PSMA, a receptor expressed in the neovasculature of various solid tumours. The researchers evaluated both *in vitro* and *in vivo* a combinatorial library of nanoparticles of the same constituents but with systematically varied particle size, surface hydrophilicity, drug loading, targeting ligand density and drug-release properties, and found that the optimal nanoparticles showed similar pharmacokinetic profiles and minimal liver accumulation in tumour-bearing mice, rats and monkeys. The study also reports initial clinical data in humans that is consistent with these results. The combinatorial screening and optimization approach should be applicable to the clinical translation of other drugs and targeting molecules. *PP*

Honey, I shrunk the mask

Appl. Phys. Lett. **100,** 133113 (2012)

The fabrication of surface patterns with feature sizes on the scale of tens of nanometres generally requires the use of electron-beam lithography, either for the preparation of nanoimprinting moulds or for the direct writing of polymer resist. Bo Zhang and colleagues now report a lithography technique with 21-nm feature sizes that does not rely on expensive electron-beam lithography equipment. Initially, the researchers use photolithography to fabricate a nickel-plated silicon mould with an upscaled version of the desired pattern through anisotropic etching and electroplating. This mould can then be used to repeatedly emboss multilayer films of polyolefin. On heating these films shrink, reducing the size of the embossed structures by more than 90% and enabling the fabrication of mask layers with 21-nm-wide line openings. The researchers show that they can control the feature size through the embossing pressure and the annealing temperature, and they use their process for the fabrication of suspended graphene-nanoribbon sensor devices. *CM*

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