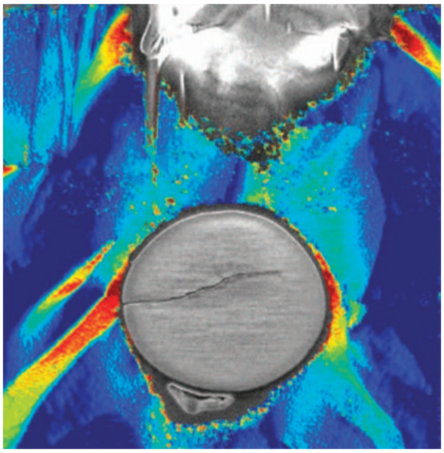
Plastic protection

Nature Commun. **3,** 1164 (2012)



The mechanical properties of materials subject to extremely high deformation rates and large strain are crucial for their use in technologies such as jet engine turbine blades and body armour. Although these phenomena have been extensively studied in conventional materials such as metals, ceramics and polymers, they are less well understood in nanoscale composites. Edwin Thomas and colleagues examine the response of a composite material consisting of alternating glassy and rubbery layers to microscopic bullets, and find a significant enhancement in their capacity to stop the projectiles. Using scanning electron microscopy techniques with a resolution below 10 nm, they observe how the layered structure of the composite dissipates the energy of the impact through a range of processes including kinking, layer compression and domain fragmentation, to form a liquid phase. This unique behaviour opens up an entire family of layered composites, which may lead to increasingly light and thin protective coatings for a range of different technologies. *AT*

Lego sets from DNA bricks

Science **338,** 1177–1183 (2012)

For some years, nanostructures made entirely of DNA or RNA through one-pot reactions, either from long strands that fold to a predesigned shape (DNA origami) or from the self-assembly of small structures (DNA tiles), have become more and more complex. However, the DNA origami approach requires a new design and synthesis procedure for every nanostructure, and DNA tiles have only produced two-dimensional shapes. Yonggang Ke and colleagues have now synthesized 102 distinct three-dimensional shapes — solid, hollow or with varied surface patterns — from DNA bricks, which are helicoidal, short single-DNA strands each having four sticky ends (which can be of the type head or complementary tail). Hundreds of bricks with pre-designed but unpurified sequences of heads and tails self-assemble into the prescribed shape in one step by simply mixing them together in approximately equal ratios. Although at present larger nanostructures lead to lower yields, the programmability, generality, robustness and modularity of the brick approach should make it attractive to applications where geometrical sophistication and (bio)chemical specificity are required. *PP*

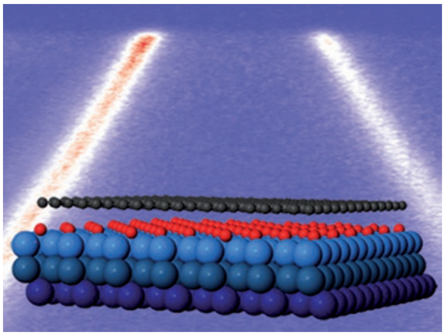
Tolerant therapy

Nature Biotechnol. http://doi.org/jsr (2012)

The inactivation of T cells is one route that researchers are taking in their search for therapies to treat autoimmune diseases, such as multiple sclerosis, rheumatoid arthritis and airway allergies. In previous studies involving this strategy of inducing tolerance of T cells in disease situations, the pathogenic role of these cells has been exploited. Soluble peptides or peptides linked to white blood cells have primarily been used. These materials, however, have faced numerous challenges in their clinical translation. Now, Getts and colleagues show that peptide antigens coupled to polymeric microparticles can be used to induce T cell tolerance in a mouse model for multiple sclerosis. They show that the peptide-coupled microparticles are able to both prevent the onset of the disease, as well as alter the course of it in mice already affected. The researchers use either poly(lactide-*co*-glycolide) or polystyrene microparticles and, in light of their stability, ease of preparation and storage, the peptide-coupled microparticles offer practical advantages compared with cell-based therapies. *AS*

Graphene levitation

ACS Nano **6,** 9551–9558 (2012)



Although exfoliation is still the most popular method for producing graphene, its epitaxial growth is the preferable route for large-area fabrication of graphene-based devices or spectroscopic studies. Such epitaxial growth can be routinely achieved on various substrates, such as transition metal surfaces or SiC, but the interaction of the substrate with graphene usually perturbs the monolayer's characteristic and desirable electronic properties. Silvano Lizzit and colleagues now show that intercalation of oxygen through a complete graphene layer grown on Ir(111) can decouple the monolayer from its substrate and restore its usual electronic structure. An intact, entirely free-standing graphene monolayer can be produced by this process, which at present works at a specific temperature and relatively high oxygen pressure. The whole process can also be reversed by de-intercalating and desorbing the oxygen. In this case, the original electronic properties of the graphene on Ir(111) are restored, but with a moderate etching of the graphene lattice, rendering subsequent oxygen intercalations easier and at progressively lower pressures and temperatures. *KT*

Smooth order

Adv. Mater. http://doi.org/fz9hr4 (2012)

Thin films of block copolymers (BCPs), which self-organize into nanometre-sized domains, can, in principle, be used for nanofabrication processes if one of the BCP phases is removed by selective etching. Generally, however, such films do not display long-range order, and additional optical or electron-beam lithography is required to prefabricate structures that impose alignment on the BCP domains. Georges Hadziioannou and colleagues now present a patterning process that avoids such lithography steps. Instead of fabricating lines or pillars to induce order, they expose a thin film of an azobenzene-containing polymer to interfering laser light. The periodic variation in light intensity leads to photoisomerization of the azogroups in the copolymer that, when swollen with additional monomers, translates into a smooth sinusoidal thickness variation that can be fixed by crosslinking. A polystyrene-*b*-polyethyleneoxide BCP film spin coated on this base layer forms a hexagonal array of cylindrical domains with long-range order and low defect density. If the etch resistance of one of the BCP phases can be increased, the films could be used as patterning masks, the authors suggest. *CM*

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