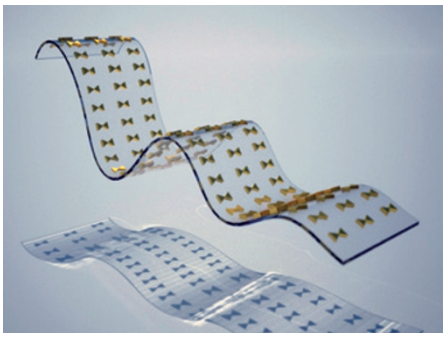
Around the bend

Adv. Mater. **23,** 4422–4430 (2011)



There have been some impressive examples of photonic devices aimed at new platforms such as stretchable substrates. However, although larger-scale conventional devices such as light-emitting diodes have been widely demonstrated for such platforms, the fabrication of nanoscale structures has remained challenging. Hatice Altug and colleagues have now developed a deposition technique that is able to fabricate plasmonic structures on flexible substrates with nanoscale precision. Their approach is based on nanostencil lithography, where a stencil mask is placed on a substrate and the desired metallic structures are evaporated on the substrate through the holes in the mask. Removal of the mask exposes the desired structures. In the present case, a silicon nitride mask was used to deposit gold nanostructures on a stretchable polymer substrate, with a remarkable accuracy of 10 nm. The polymer sheets are very flexible and can, for example, be placed around the surface of an optical fibre. The rise in the use of plasmonic phenomena for applications such as molecular sensing suggests that this low-cost and high-throughput fabrication process could lead to devices for such uses. *JH*

Microfluidic origami

J. Am. Chem. Soc. **133,** 17564–17566 (2011)

Paper-based microfluidic devices can potentially serve as cheap and disposable tools for analytics and diagnostics. To create a three-dimensional system of liquid reservoirs and channels, however, several sheets of paper need to be patterned, stacked and aligned in a lengthy process. Hong Liu and Richard Crooks now report an origami-inspired scheme for the simple fabrication of microfluidic devices from a single folded piece of chromatography paper. Using photolithography, the researchers pattern channels, reservoirs and a frame on the paper. The frame then guides the folding and ensures that the elements of the microfluidic system are aligned before the paper is clamped between two metal plates with access holes. Using a five-layer design, the researchers demonstrate a simple colorimetric assay for glucose and bovine serum albumin, which allows them to detect the analytes separately on two different layers of the system. They suggest that their process could be used for the automated fabrication of paper-based microfluidic devices, and that more complex systems could be designed by increasing the number of folds. *CM*

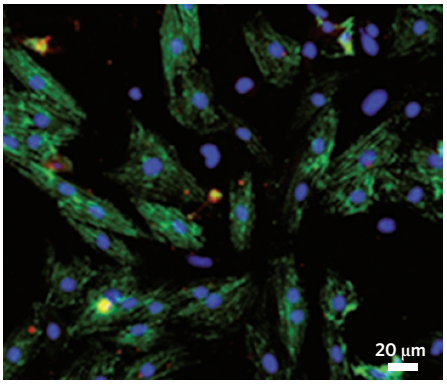
Carbon in hot spots

Nano Lett. http://dx.doi.org/10.1021/nl203224z (2011)

Progress in transmission electron microscopy (TEM) has achieved levels of precision where not only is it possible to image single atoms of light elements, but it is also possible to observe dynamic phenomena with the same spatial resolution. For example, Benedikt Westenfelder and colleagues have been able to observe what happens to hydrocarbon adsorbates on a graphene sheet when exposed to temperatures as high as 2,000 K. Current flowing through the graphene sheet was used to produce localised heat. Once a temperature of 300 K was reached the hydrocarbons were observed to form large layers of amorphous carbon. However, above 2,000 K, the amorphous carbon transformed into a polycrystalline graphene with a small grain size and a considerable number of free armchair edges. Aside from the importance for hydrocarbon transformation, the results demonstrate the power of low-energy TEM that could be extended to investigate other material systems. *FP*

Aiming at the injured heart

Nano Lett. **11,** 4411–4414 (2011)



After myocardial infarction, blood vessels in the heart's left ventricle become permeable. It is also known that an infarcted heart overexpresses the AT1 receptor for angiotensin — a peptide in the blood that induces vasoconstriction and therefore an increase in blood pressure. Now, Tal Dvir and colleagues have designed nanoparticles that target infarcted hearts, by taking advantage of the leaky vasculature and the abundance of AT1. The researchers synthesized nano-sized liposomes conjugated with a peptide specific for the AT1 receptor, and show that in incubated cardiac cells approximately half of the cells were targeted by these liposomes, compared with less than one third targeted by liposomes conjugated with a peptide bearing the same amino acids, but in a scrambled order. After intravenous injection in mice, the liposomes accumulated mostly in the left ventricle of the injured hearts, probably because of the enhanced permeation and retention effect occurring in the permeable vasculature; no accumulation was seen in healthy hearts. Drug-loaded, heart-targeting liposomes could become an attractive alternative to direct injection of therapeutics into the injured heart. *PP*

Design rules for superlattices

Science **334,** 204–208 (2011)

The shape of building blocks and the interactions between them often determine the structure the blocks self-assemble into. Except for the simplest lattices — such as the face-centred cubic — designing the building blocks that spontaneously assemble into the desired ordered structure is difficult. Robert Macfarlane and colleagues now report six design rules that can be used to obtain nine specific superlattices from gold nanoparticles functionalized with DNA linkers. The rules provide relationships between three design parameters for the superlattices — crystallographic symmetry, lattice parameters and nanoparticle size within a lattice — and the variables that control the assembly of the DNA–nanoparticle conjugates: hydrodynamic radii, number of linkers and the number of possible hybridizations between linkers. In fact, the authors find that nanoparticles with the same hydrodynamic radius show no differences in their self-assembly. Furthermore, the linkers' rehybridization rate can be used to select between two lattices of similar thermodynamic stability. The synthesis of desired crystal structures by using programmable linker interactions should now be easier, provided one plays by the rules. *PP*

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