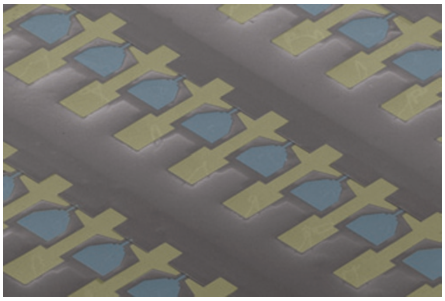
Curly contacts

Nano Letters http://dx.doi.org/10.1021/nl201773d (2011)



Applying reliable electrical contacts to self-assembled molecular monolayers poses a persistent challenge in molecular electronics. Evaporated metal top electrodes can cause short circuits at monolayer defects, and solution-processed conducting polymer electrodes may show temperature-dependent electrical characteristics that disguise the physics of molecular charge transport. Carlos Cesar Bof Bufon and colleagues have now developed a process that allows them to contact molecular monolayers using predefined metal and inorganic semiconductor layers. Their approach is based on epitaxially grown strained membranes that curl up as an underlying sacrificial layer is removed. The membranes can be designed such that they contact a molecular monolayer on a predefined bottom electrode after the release. Alternatively, one side of a multilayered membrane can be functionalized to form a rolled-up cylindrical semiconductor–monolayer–semiconductor junction. The approach enables device cross-sections below 1 μm^2. The authors have studied contacts from gold and III–V semiconductors so far, and they suggest that their method could be expanded to other strained layers. *CM*

As sensitive as human skin

Angew. Chem. Int. Ed. http://dx.doi.org/10.1002/anie.201102560 (2011)

A pressure-responsive polymer brush with sensitivity approaching that of the human skin (~10 kPa) is described by Andreas Fery and Wilhelm Huck and collaborators. The polymer's response to the pressure applied by an AFM tip is visualized through the fluorescence intensity of a dye covalently attached to the backbone of the brush. As the AFM tip compresses the polymer, a reversible interaction between the dye and the quaternary ammonium groups of the polymer is formed. The interaction quenches the fluorescence output, and a black spot appears in the image captured by a confocal microscope. The authors can directly correlate the pressure experienced by the polymer with the fluorescence intensity observed. With a sensitivity on the order of 10 kPa, spatial resolution lower than 1 μm and subsecond response time both in compression and tension, the system is a promising platform for scientists to develop mechanoresponsive surfaces. *AM*

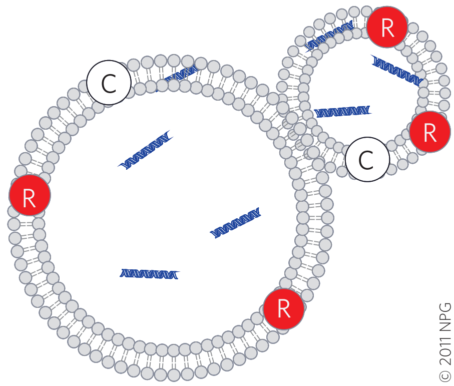
Hydrogen on the spot

Adv. Mater. http://dx.doi.org/10.1002/adma.201101976 (2011)

Monitoring gas concentrations is crucial for many processes, for example to ensure efficiency as well as safety of catalytic processes. The use of plasmonic nanostructures, where the presence of gas molecules leads to changes in optical properties, has already enabled sensing on the nanoscale and with single-molecule precision. Timur Shegai and Christoph Langhammer have now implemented a nanofabrication strategy for tunable plasmonic nanostructures suitable for hydrogen monitoring in ultrasmall volumes. Using a single-step lithographic approach, they fabricated truncated gold nanocones, followed by the deposition of an insulating spacer layer and a palladium layer on top of the cones. Palladium readily absorbs hydrogen in its crystal lattice, which alters the plasmon resonance of the palladium, an effect that is further enhanced by the gold nanocones. In this way, small changes in hydrogen pressure can readily be detected, with the benefit that only a single nanocone device needs to be used. Moreover, through the use of other metals a broad range of catalytic processes could be monitored on the nanoscale. *JH*

Replication and reproduction

Nature Chem. http://dx.doi.org/10.1038/nchem.1127 (2011)



Cell replication involves the creation of a new compartment with a copy of the genetic material inside (usually RNA or DNA). To study such processes of DNA self-replication and compartment self-reproduction, especially with regards to understanding the origin of life, model protocells — putative cell precursors — have been engineered, such as self-replicating DNA within lipid compartments, and self-reproductive giant vesicles. Now, Kensuke Kurihara *et al.* have combined the two. They demonstrated the self-reproduction of giant vesicles chemically linked to the self-replication of DNA. The vesicles bear an amphiphilic catalyst and are filled with DNA and polymerase-chain-reaction reagents, which amplify the DNA before the vesicles reproduce on the addition of an amphiphilic membrane precursor that produces membrane molecules through hydrolysis assisted by the catalyst. Electrostatic interactions of the polyanionic DNA with the inner leaflet of the cationic vesicle membrane induce a morphological change that leads to division and partitioning of the DNA into the daughter compartment. *PP*

Heat at the borders

Nano Letters http://dx.doi.org/10.1021/nl202118d (2011)

Graphene exhibits the highest thermal conductivity ever observed. Its thermal transport has been studied theoretically and experimentally, mostly in single-crystalline graphene. Unfortunately, large-scale growth, for example by chemical vapour deposition (CVD), usually yields polycrystalline sheets. Akbar Bagri and colleagues have performed molecular dynamic simulations of the thermal transport across various grain boundary orientations in graphene. They assumed a constant heat flow through the material, calculated the temperature profile and from that estimated the thermal conductivity. Interestingly, they found abrupt jumps in the temperature at the grain boundaries, which depend on the boundary orientation and grain size. The estimated grain boundary thermal conductivity is much higher than in the case of other materials with high thermal conductivity, such as nanocrystalline diamond. The results are particularly important in view of potential applications based on CVD-grown graphene. It will be interesting to see how the experiments will compare with these predictions. *FP*

Written by Christian Martin, Fabio Pulizzi, Alberto Moscatelli, Joerg Heber and Pep Pàmies.