Cover story

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The interaction of light with surface plasmons — collective excitations of free electrons — in metallic nanostructures leads to novel optical phenomena. These structures typically consist of ordered arrays of particles or holes with sizes of the order of 100 nm. However, surface plasmons can interact with each other over much longer distances, so the ability to organize nanoscale particles or holes over multiple length scales could lead to new plasmonic metamaterials. Teri Odom and co-workers have developed a new nanofabrication technique — soft interference lithography — to produce such metamaterials. These structures include various infinite and finite-area arrays of nanoholes and nanoparticles as well as patterns that contain both metallic and dielectric materials. The free-standing gold film of nanoholes shown on the cover (which measures about 13 μm across) demonstrates the hierachical patterning capabilities of soft interference lithography. **[Letter p549]**

GROWTH FACTORS

Despite many years of study, there is still much debate concerning the mechanism by which semiconductor nanowires grow. Previous studies have suggested that, because of increased competition for material, the rate at which nanowires grow vertically from a surface decreases as the spacing between them is reduced. Now, Erik Bakkers and co-workers report an unexpected synergistic effect when gallium phosphide nanowires are grown from a substrate patterned with gold catalysts. It is found that a growth regime exists in which reducing the wire-to-wire spacing actually leads to an increase in growth rate and this may be a general phenomenon for other materials systems. **[Letter p541; News & Views p534]**

GRATE EXPECTATIONS

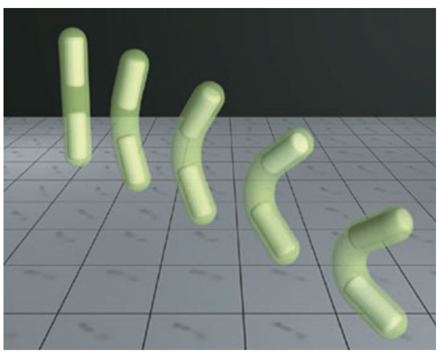
Most methods for making periodic nano-gratings involve expensive lithographic techniques that do not lend themselves to high-throughput production. Now, Stephen Chou, William Russel and co-workers have developed a low-cost method for patterning nano-gratings over relatively large areas. In their technique, a thin polymer film is sandwiched between two flat plates that are then pulled apart. The polymer layer, which must be in a glassy state, fractures to leave two complementary gratings on the separated surfaces. The grating period is always approximately four times the initial thickness of the polymer. **[Letter p545; News & Views p537]**

IT TAKES TWO

The integration of organic and inorganic semiconductors on the nanoscale offers the possibility of developing new photonic devices. Arto Nurmikko and co-workers have illustrated the potential of this approach by making a hybrid nanocomposite that contains alternate layers of semiconductor quantum dots and a polymer. They show that the coupling between the optical excitations in the two materials can reach efficiencies of up to 98% at room temperature, and that the polymer can increase the effective absorption cross-section of the quantum dots by up to a factor of ten. **[Letter p555]**

NANORODS GIVEN THE ELBOW

Nanorods comprising different metal sections along their length — each with their own characteristic chemical and optical properties — resemble nanoscale barcodes and can be used as substrates for bioanalytical applications. Now, Geoffrey Ozin and co-workers have processed such nanorods to make flexible nanostructures that can bend around one or more hinges. Nanorods with alternating sections of platinum and gold were encased in polyelectrolyte bilayers by dipping them alternately in baths of positively and negatively charged polymers. After dissolving the gold segments, the remaining platinum sections are connected by flexible polymer hinges. **[Article p565]**



Open and closed — flexible hinges for nanorods.

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DETACH TO DETECT

Small redox-active dye molecules are known to quench the fluorescence of single-walled carbon nanotubes, and adding suitable reagents can reverse the process. Stephen Doorn and co-workers have now extended this idea by adding receptor ligands to the dye molecules to make a biosensor that is four orders of magnitude more sensitive than other nanotube-based sensors. Dye molecules quench the fluorescence of nanotubes, but the fluorescence is restored when target analytes bind to the ligand. The sensitivity depends on how well the ligand and the analyte bind to each other, and the approach can be used to detect a wide range of analytes including proteins and DNA. **[Letter p560]**

INTO THE GROOVE

Nanoparticle ink can, in principle, 'draw' with high resolution but it is difficult to pattern large areas with this approach. Now, Heiko Wolf and colleagues use a soft-lithography printing process to position gold nanoparticles in a variety of geometric shapes over tens to hundreds of micrometres. When a liquid that contains gold nanoparticles is swept across a surface, hydrodynamic forces push the particles towards the receding meniscus. The group pre-patterns the surface with grooves that 'pin' the meniscus and trap the particles. The nanostructures can then be pressed onto a new surface in a repeatable process that could enable high-resolution printable optics and electronics. **[Article p570; News & Views p533]**

IRON MAN

The biomedical applications of magnetic nanoparticles include imaging, separation techniques and controlled drug delivery. Because iron oxide nanoparticles are typically assumed to be chemically inert, enzymes or metal catalysts are bound to their surfaces to make them more functional. To their surprise, Yixun Yan, Sarah Perrett and colleagues found that sub-100-nm iron oxide particles can catalyse certain oxidation reactions. Exploiting this newly discovered capability, the group has designed several 'capture, separate and detect' tests to identify viruses and biomarkers. **[Article p577; News & Views p535]**