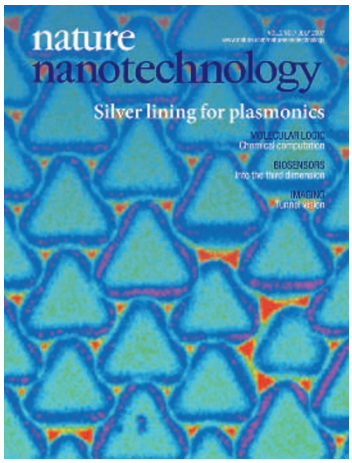


Cover story

Vol.2 No.7 July 2007

Individual silver nanocrystals display distinct optical characteristics, and they are also ideal building blocks for making plasmonic materials with novel optical properties. These larger structures couple strongly to external electromagnetic fields, with the details of the interaction depending on the shape and arrangement of the nanocrystals. Peidong Yang and co-workers have now shown that the Langmuir–Blodgett technique can be used to control the interparticle spacing, density and packing symmetry of the nanocrystals, thereby allowing the optical response of the system to be tuned over the entire visible range. The cover shows a false-colour scanning electron microscopy image of a monolayer of octahedral silver nanocrystals assembled with this technique. The individual octahedra measure about 250 nm across, and form a hexagonal lattice when they are compressed. Experiments were also formed with truncated cubes and cuboctahedra. **[Article p435]**

TAKE THE STRAIN

When a graphene sheet is rolled up to make a carbon nanotube, the electronic properties of the nanotube depend on the direction in which the sheet has been rolled. Some nanotubes are semiconductors, whereas others are conductors. However, experiments have confirmed that axial strain can also influence their electron transport properties, and that torsional strain changes the properties of multiwall nanotubes. Now Sean Washburn and co-workers have explored the torsion–transport relationship in single-walled carbon nanotubes for the first time with a self-contained nanotube-based nanoelectromechanical structure. **[Letter p413]**

AN END TO FATIGUE

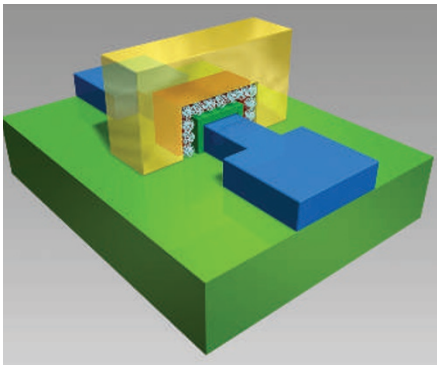
When a material is subjected to increasing levels of stress it will eventually fail. However, if this stress is repeatedly turned on and off in cycles, the material can succumb to fatigue, which causes it to fail at much lower stress levels. Despite more than a decade of research into the mechanical properties of carbon nanotube structures, data on their fatigue behaviour have not been reported before. Now Pulickel Ajayan, Jonghwan Suhr and colleagues have shown that arrays of multiwalled nanotubes, when subjected to repeated compressive strain, can exhibit viscoelastic behaviour similar to that observed in soft-tissue membranes. Furthermore, no fatigue failure is observed, even after half a million cycles. This combination of soft-tissue-like behaviour and outstanding fatigue resistance suggests that nanotube structures could mimic artificial tissues. **[Letter p417]**

TUNNEL VISION

The chain of biochemical events responsible for vision is triggered when a retinal molecule found in photoreceptor cells in the eye changes shape on exposure to light, causing it to be released from the active site of a protein. This molecule is initially bent, and straightens out when one of its carbon–carbon double bonds isomerizes from the *cis* to the *trans* form. Now, Kazu Suenaga and co-workers have anchored individual retinal molecules to C_{60} molecules, trapped them inside single-walled carbon nanotubes and imaged them using a high-resolution transmission electron microscope. Sequential images show the retinal molecules moving and changing shape, allowing us to see what happens in our eyes when we look at something. **[Letter p422; News & Views p391]**

MIND THE GAP

Most transistor-based biosensors work by detecting a change in operating voltage when biomolecules attach to the surface of the sensor. However, these devices often have limited sensitivity or require complex processing. Yang-Kyu Choi and colleagues describe a new approach to biosensing with a field-effect transistor (FET) in which the molecules actually participate in how the device operates. The group made a vertical FET with a silicon conducting channel at the bottom, a silicon dioxide insulating layer and a 'gate' electrode comprising a layer of chromium topped with a wider layer of gold, which creates a gap between the gold and the insulator. When biomolecules bind together and fill this gap, the operating voltage of the FET changes significantly. Compared with planar devices, this vertical structure should be easier to integrate into larger circuits. **[Letter p430; News & Views p393]**



Upright approach — vertical FETs as biosensors.

p430

AT THE DOUBLE

The double-slit experiment has been performed with photons, electrons, atoms and even larger particles, and has played an important role in the history of both optics and quantum physics. Now Rashid Zia and Mark Brongersma have repeated this famous experiment with objects called surface plasmon polaritons (SPPs). The experiments reveal that there are strong parallels between the propagation of SPPs along the surface of metallic nanostructures and the propagation of light in glass waveguides. The results agree with theory if it is assumed that SPPs — which are made of both photons and electrons — are only supported by metal stripes with widths above a certain minimum value. **[Letter p426; News & Views p396]**

INSIDE OUT

Bacteria are commonly used as vehicles to deliver small fragments of DNA — known as plasmids — into mammalian cells. The DNA can be genetically engineered into the bacteria, to be released when the bacteria infect the cells. Although this method is efficient, Rashid Bashir and colleagues have now demonstrated a simpler technique that does not involve complicated genetic engineering procedures. Instead, they attach a fluorescent gene onto the surface of a nanoparticle and then attach these to the surface of the bacteria. Because the cargo is on the outside, there is no need to break open the bacteria to deliver the DNA. When injected into mice and cells in culture, the genes unloaded from the nanoparticles and expressed the fluorescent proteins. **[Article p441, News & Views p394]**