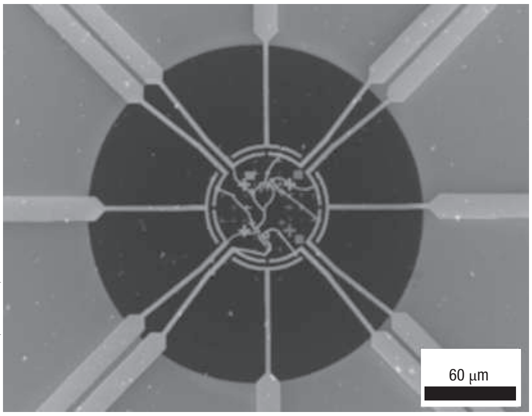
## Stable liposomes

Phospholipid liposomes are of potential interest for applications such as drug delivery because they are both biofunctional and have compartments that can be used to encapsulate, store and release molecules. In suspension, however, liposomes tend to stick to each other and fuse into larger ones, resulting in leakage and chemical mixing, thereby significantly limiting their practical use. Steve Granick and Liangfang Zhang now present a methodology for producing particle-covered liposomes that repel each other and are therefore stable against fusion (*Nano Lett.* doi:10.1021/nl052455y; 2006). They used sonication to mix phospholipid liposomes and charged polystyrene nanoparticles at volume fractions up to 50%, and demonstrated stability of up to 50 days. These impermeable liposomes could not only prove useful as delivery vehicles for drugs, but could also serve as vessels for chemical reactions. Furthermore, the authors envisage that by functionalizing the nanoparticles such that their wettability can be optically modified, they could be used to switch the liposomes from impermeable to permeable, thereby allowing controllable release of their contents.

## Under pressure



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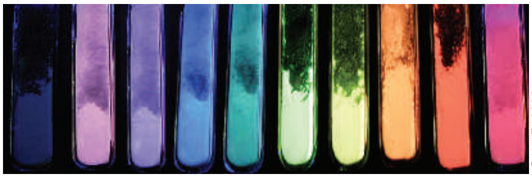
Pressure sensors in which single-walled carbon nanotubes (SWNTs) are used as the piezoresistive strain gauges may give rise to higher sensitivity and scalability compared with current silicon-based devices, according to Cristoph Stampfer and colleagues (*Nano Lett.* **6**, 233–237; 2006). The researchers have developed a fabrication method for preparing an ultrathin atomically grown alumina membrane into which a SWNT is integrated. The SWNT adheres to the surface of the alumina by van der Waals forces, and is clamped into position by two metal electrodes. Measurements up to 130 kPa and current–voltage tests proved the basic functionality of this setup (pictured). Electromechanical measurements showed the SWNTs have a piezoresistive strain gauge factor of 210, which slightly exceeds that of current systems. Further studies are required to resolve some anomalies observed at higher pressures, and to better understand the contributions from the strain-dependent resistance at different temperatures, but this may be another step towards functional nanoelectromechanical devices.

## Rainbow zeolites

Zeolites are to be praised once again for being perfect hosts. Japanese researchers have used the large empty cages in the framework structure of a zeolite to bring together multiple luminescent components. In contrast to what would happen if these were mixed in a fluid solution, in the cages of zeolites all emissions can survive and be detected. Moreover, the emissions can be finely tuned thus obtaining a promising material for devices such as thermosensors and full-colour displays (Y. Wada, M. Sato and Y. Tsukahara. *Angew. Chem. Int. Edn* **45,** 1925–1928; 2006). The luminescent components were red-emitting europium ions and green-emitting terbium ions. They were incorporated in the zeolite framework together with an organic sensitizer: either 4-acetylbiphenyl, which emits blue light and, along with europium and terbium ions, affords simultaneous red, green and blue photoluminescence; or benzophenone, which does not add an extra emission but functions as a photosensitizer, boosting the quantum yield of luminescence from the europium and terbium. It was possible to change the photoluminescence colour over a wide range (see picture) by varying the amounts of ions and organic sensitizer. Another unique advantage of using zeolites as a host, was that the ratio of the three colour components could be changed as a function of the excitation wavelength and temperature.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## Magnetic nanodisks don't switch simply

Patterned magnetic structures on the nanometre scale hold great promise for spintronics applications such as field sensors or for recording media, where they could lead to a higher storage density. At these small length scales, size-effects are important and lead to new physical effects. Ana-Vanessa Jausovec and colleagues study the switching behaviour of magnetic disks that have a diameter that is at the boundary of different size effects (A.-V. Jausovec, G. Xiong and R. P. Cowburn *Appl. Phys. Lett.* **88,** 052501; 2006). Small disks show a single-domain magnetic ground state, whereas for larger-scale disks the ground state is a vortex. When the magnetic field is cycled through the intermediate-sized disks, a transition from the single-domain state at low field to the vortex state at high magnetic fields is observed. Interestingly, at fields between these two stable configurations a new metastable state appears. Earlier theory predicted such a metastable state with the magnetic moments partly parallel, partly in a vortex-like configuration. Whether these switching effects can be harvested for future applications remains to be seen, but clearly they demonstrate the complexity of the physics on such small scales.

### COHERENT TILL THE END

In *Applied Physics Letters*, Joseph Berry and his colleagues describe the use of the high resolution of spectral-hole-burning spectroscopy to obtain the longest coherence time reported so far for InGaAs semiconductor quantum dots (J. J. Berry, M. J. Stevens, R. P. Mirkin and K. L. Silverman *Appl. Phys. Lett.* **88,** 061114; 2006). This work forms part of the considerable competition within the quantum information community to find the most suitable material to be used as a qubit. Many critics have argued that the optically excited charges in a quantum dot lose their coherence too quickly, giving no time to perform any operation that relies on their quantum properties. Knowledge of the coherence time is essential, but very challenging, in part because the quantum-dot characteristics vary during the time intervals needed to perform the experiments (typically seconds or longer). The technique used by Berry *et al.* is based on measuring the absorption spectrum of a quantum-dot ensemble by means of two narrow-linewidth laser beams, and is largely immune to any time-dependent variations in the quantum dots. They found a coherence time just short of 2 ns, which should be enough to perform a large number of operations before the charges lose their quantum character.