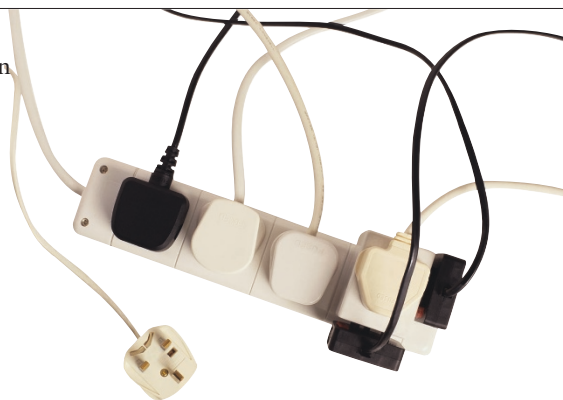


Molecules get plugged in

Materials chemists prefer building molecular machines from the bottom up. By exploiting the principles of supra-molecular self-assembly Ballardini *et al.* (*Journal of the American Chemical Society*; <http://dx.doi.org/10.1021/ja025813x>) have constructed a system that mimics the function of an electrical extension cable. Like a real cable, the system has several components.

A rubidium terpyridil cation (the electron donor) is linked to a crown-ether that acts as a socket. The wire contains a bipyridinium unit (as the electron acceptor) and is connected to another socket (a fluorescent crown ether). When all these components are connected, the excited rubidium terpyridil ion transfers electrons to the bipyridinium unit of the

wire, which quenches the luminescence of the crown ether socket. But unlike a real extension cable, this system responds to three types of stimuli: light irradiation, pH change and electrochemical (redox) energy. Connection and disconnection of the two plug–socket systems is reversible, and can be independently controlled by varying these factors.



Catalysts go to bed

Ionic liquids — salts that remain molten at room temperature — are often heralded as environmentally friendly alternatives to organic solvents. But convincing the chemical industry to turn green takes more than a new material. In volume terms, the production of aldehydes from petroleum products — a process known as hydroformylation — is one of the biggest in the industry. Aldehydes are needed to make alcohols for liquid detergents or cosmetic applications. The reaction uses a catalyst such as rhodium to produce aldehydes, but separation and recovery of the homogeneous catalyst is a big problem. Christian Mehnert and colleagues, writing in the *Journal of the American Chemical Society* (<http://dx.doi.org/10.1021/ja279242>), propose a new approach based on the dissolution of a catalyst in a layer of ionic liquid anchored to a solid support. Solid (heterogeneous) catalysts are attractive because they eliminate the need for catalyst separation. The authors covalently bonded fragments of the ionic-liquid molecule to the surface of a silica gel substrate. The modified surface was able to retain a layer of free ionic liquid in which a rhodium catalyst was dissolved. The supported catalyst performed as well as the homogeneous system, and this approach may work for other processes.

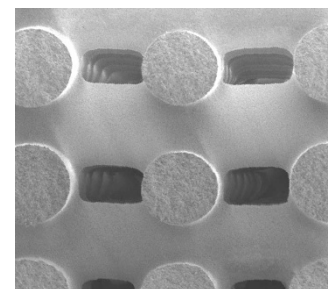
A laser switch for crystal growth

By using different types of polarized light, Bruce Garetz and co-workers can nucleate and grow different crystal structures from the same solution. A report in *Physical Review Letters* (**89**, 175501; 2002) describes how shining intense pulses from a near-infrared laser on a supersaturated aqueous solution of glycine triggers the growth of different crystal phases (polymorphs) depending on the polarization of the light. Glycine is a small amino acid that has three structural polymorphs: α , β and γ . In this experiment, the use of linearly polarized light results in γ -glycine crystals, and circularly polarized light stimulates

the growth of α -glycine, but never the other way round. The authors stress that this process is very different from the photochemical nucleation that is responsible for light-induced chemical vapour deposition, and the formation of atmospheric aerosols. They claim that laser control over crystal nucleation in these solutions must result from an interaction between the solute molecules and the electric field of the light. Crystallization is of great technological importance to the pharmaceutical industry, and researchers can only dream of selecting a specific drug polymorph.

New look for colloids

Most children quickly learn how to build sandcastles, and discover that adding a little water, but not too much, helps the castle stick together. But making complex three-dimensional structures from colloids — in which tiny particles are fully suspended in a liquid — is not child's play. Jennifer Lewis and co-workers have developed techniques for assembling periodic 3D structures by directly 'writing' them with colloidal inks (*Advanced Materials* **14**, 1279–1283; 2002). The inks are rapidly deposited in a layer-by-layer sequence from a robotic nozzle, in a manner similar to that of an ink-jet printer. Their success in building porous structures, in which the features are self-supporting, relies on carefully tailoring the interparticle interactions so that the ink has the correct viscoelastic response. The ink used to create the periodic lattice shown above contains polyamine-coated silica microspheres that form a self-supporting colloidal gel at pH 10, and retains its shape when dried. The colloidal structures can incorporate multiple length scales, and are attractive for making photonic bandgap materials, catalyst supports and biological scaffolds.



Nanotube networking

Growth of carbon nanotubes usually requires a catalyst — typically Ni, Co or Fe particles. Although these catalysts promote the growth of ordered nanotubes, they also require complex purifying treatments to remove them from the final product. Catalyst-free growth of nanotubes was first achieved by annealing the carbon face of hexagonal silicon carbide (SiC) substrates in a vacuum, but these nanotubes were multiwalled and therefore less interesting for electronic applications. In a recent issue of Nano Letters (2, 1043–1046; 2002), Phaedon Avouris and his group at IBM report the growth of ordered networks of single-walled carbon nanotubes from the silicon face of SiC substrates without using a catalyst. The nanotubes were formed by annealing the SiC at high temperature in a vacuum, and grew horizontally on the surface in ordered networks. The nanotubes were also observed to follow the local structure of the surface, indicating that it may be possible to generate specific surface arrangements by appropriate substrate patterning.

FULLY PLASTIC LEDs

Flexibility is one of the main advantages of using light-emitting plastics for display technologies. Until now, the longest operating lifetimes for these devices (tens of thousands of hours) have been achieved by coating layers of organic materials on rigid glass substrates. The glass helps minimize degradation of the metal cathode and organic interface by reducing its exposure to humid conditions, which otherwise results in luminescence decay. Weaver and colleagues (*Applied Physics Letters* **81**, 2929–2931; 2002) have now managed to fabricate a long-lasting phosphorescent organic light-emitting device (OLED) on a plastic substrate. The trick is to coat a thick polyethylene terephthalate substrate with a hybrid organic–inorganic multilayer film that reduces the permeation of moisture to the metal cathode. These flexible OLEDs have greatly extended operating lifetimes, and in combination with conventional processing techniques, could eventually lead to fully plastic OLEDs for flexible displays.