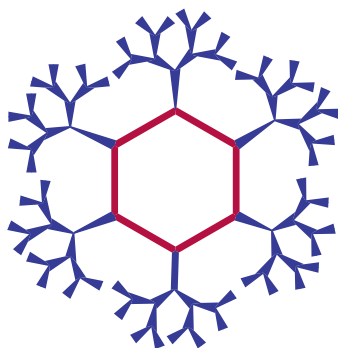


Super stamps

Nano Lett. doi:10.1021/nl062766o (2007)

Direct patterning of metallic nanostructures has been achieved using solid-state 'superionic' stamps (S4) — a potentially energy-efficient approach for high-throughput manufacture of electronic devices. Fang and colleagues use silver sulphide for the solid-state stamp, synthesizing a pellet that is flattened on one side to provide a 300- μm surface for stamping. Patterns are made on the stamp using focused ion beam milling, and when the stamp is brought into contact with a silver substrate, an electrical potential applied across the two progressively dissolves metal from the silver surface onto the stamp, engraving the pattern onto the surface. The patterns can be repeated with high fidelity, and at 50-nm resolution. The S4 approach has distinct advantages in that it can reproduce acute angles, and has more dimensional control compared with other methods. In addition, S4 can operate at room temperature and low voltages, making it energy efficient, and it also has the potential for large-scale fabrication.

New cavity rules



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Cavities at the core of branched three-dimensional organic molecules called dendrimers are of interest for delivery and recognition applications. In general, however, the presence of branching groups in dendrimers hinders the formation of pores, usually leading to time-consuming procedures and unsatisfactory yields. Now, inspired by recent advances in supramolecular chemistry, Peter Stang and colleagues have found a way to form such cavities efficiently by exploiting non-covalent interactions between dendrimers and metal centres. Dendrimers with two branches able to coordinate to metal centres, at an angle from each other, were chosen as building units (blue lines in figure). Their reaction with dimetallic complexes, acting as bridges (red lines), resulted in larger

assemblies featuring well-defined cavities as a core. By choosing particular characteristics for the building blocks and bridges, the shape and size of the cavities could be controlled. Indeed, 120° dendrimers attached to linear bridges formed hexagonal cavities (pictured), and when 60° bridges were used instead of linear ones, rhomboidal pores were obtained. This effective and highly versatile approach is promising for the design of cavity-cored dendrimers.

Stable electrocatalysts

Science **315**, 220–222 (2007)

Although fuel cells are expected to become an important source of clean energy for both stationary and mobile applications, they still suffer from the instability of the widely used platinum electrocatalysts during oxygen reduction reactions (ORR). Radoslav Adzic *et al.* now report that gold clusters can have a stabilizing effect on underlying platinum layers in highly oxidizing conditions, and suppress platinum dissolution during ORR, without decreasing the oxygen-reduction kinetics. In contrast to pure platinum, they observe insignificant changes in the activities and surface area of gold-modified platinum when cycling under the same conditions. The researchers believe the gold clusters confer stability by raising the platinum oxidation potential, and their approach should prove useful for improving platinum-based catalysts and

for stabilizing other precious metals under oxidizing conditions.

Switchable viscosity

J. Am. Chem. Soc. **129**, 1553–1559 (2007)

The viscosity of photorheological fluids can be tuned by exposure to light. Such fluids have a number of potential applications, including microfluidic technology and sensors. Their use up to now has been limited, however, as their formulations have required complicated photoresponsive molecules. Ketner *et al.* report a photorheological fluid that consists of two very simple solutes: the cationic surfactant cetyl trimethylammonium bromide (CTAB) and the photoisomerizable *ortho*-methoxycinnamic acid (OMCA). When CTAB is mixed with the widely available *trans*-OMCA, they aggregate to form worm-like micelles, which intertwine, producing a highly viscous solution. Under UV irradiation the OCMA isomerizes to the *cis* geometry, which interacts differently with CTAB causing a drastic reduction in the length of the micelles. These micelles are too short to intertwine, so the viscosity of the solution drops by up to four orders of magnitude. This process cannot be reversed for OMCA as the *cis* isomer has a much less intense absorption band than the *trans*, making the *cis*–*trans* isomerization more difficult. The authors hope that judicious choice of an alternative should make reversal possible.

Protected coatings

Chem. Mater. **19**, 402–411 (2007)

Inhibition of corrosion is an important issue for many materials forming the outer surface of devices. Mikhail Zheludkevich and his colleagues in Portugal and Germany have now developed an active coating involving assemblies of polyelectrolyte layers that release corrosive inhibitors on demand. The polyelectrolytes are sensitive to pH, and can be tuned to release the inhibitor at a pH likely to corrode the material. To create the 'nanocontainers' at a suitable size to sit within the coating, the researchers formed the polyelectrolyte layers around 70-nm particles of SiO₂; the inhibitor being entrapped within the layers during the assembly process. These systems were then embedded within a SiO₂/ZrO₂ sol–gel coating. Zheludkevich *et al.* compared two pieces of aluminium, one with the coating containing the nanocontainers, and the other with a coating in which the



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inhibitor was directly introduced into the sol–gel matrix. The nanocontainer coating showed no signs of corrosion after 14 days' immersion in 0.5% NaCl, whereas the other coating had corrosion-induced defects after immersion in 0.005% NaCl — 100 times more dilute — indicating controlled release of the inhibitor vastly improved its corrosion-prevention.