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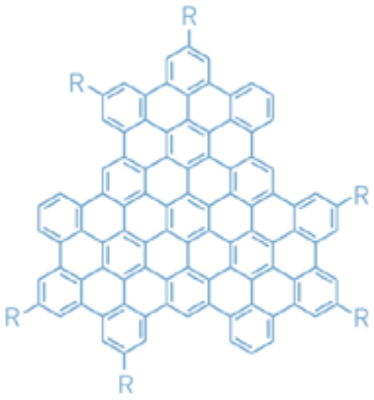
Superphenalene liquid crystals



By decorating 96-carbon superphenalenes (shown) with long hydrocarbon chains (indicated by R groups), Klaus Müllen and coworkers at Max Planck Institute for Polymer Research in Mainz, Germany, have made compounds that have good film-forming properties and that can be processed into soft, highly soluble columnar liquid-crystalline materials [*Angew. Chem. Int. Ed.*, **43**, 755 (2004)]. Despite the compounds' large aromatic core, they easily dissolve in common organic solvents at room temperature--a phenomenon the researchers attribute to inefficient packing of the R groups around otherwise well-organized self-assembled columns. The group achieves roughly 68% overall yield for the two-step synthesis of the compounds from readily available starting materials. They also have made molecules in which the R groups are benzoate esters that could be further modified.

Detonating dendrimer delivers double drug dose

The first exploding dendrimers--highly branched compounds that release multiple "payload" molecules simultaneously after a single triggering event--were reported independently last year by three groups: those of F. M. H. (Vincent) de Groot of Syntarga B.V., Nijmegen, the Netherlands; Doron Shabat of Tel Aviv University; and Dominic V. McGrath of the University of Arizona, Tucson (C&EN, Sept. 29, 2003, page 4). Drug delivery is considered a leading potential application

of such dendrimers. Shabat and coworkers have now taken a step toward that goal. They load a "self-immolative dendrimer" with two different drugs--the anticancer agents doxorubicin and camptothecin--and use a catalytic antibody to bind to an enzyme substrate on the molecule, triggering release of both agents in cancer cells [*J. Am. Chem. Soc.*, **126**, 1726 (2004)]. Earlier, de Groot and coworkers had released four molecules of the anticancer agent Taxol from "cascade-release dendrimers," but not under physiological conditions. The new study "clearly illustrates the application of these materials in the therapeutic arena," McGrath comments.

O_3-destroying ClOOCl sighted in stratosphere

The first measurement of chlorine monoxide dimer (ClOOCl) in the stratosphere bolsters current theory about ozone loss [*J. Geophys. Res.*, published online Feb. 4, http://www.agu.org/pubs/crossref/2004/2003JD003811.shtml]. Researchers first hypothesized the existence of ClOOCl in 1987, when they suggested that this molecule plays a crucial, catalytic role in atmospheric ozone decomposition over the poles. The theory is widely accepted, yet ClOOCl has not been directly observed in the atmosphere until now. "If it didn't exist, our understanding of ozone loss in the polar vortex would be severely undermined," explains David M. Wilmouth, a chemistry postdoc at Harvard University. Wilmouth, senior project scientist Richard M. Stimpfle, and colleagues not only observed and measured the dimer, but they compared the actual rates of formation and loss with those that had been expected. Their measurements came from a collaborative field campaign involving U.S. and European researchers and included flights of a NASA aircraft into Russian airspace over the Arctic. Wilmouth says the direct measurements of ClOOCl will help scientists develop better predictive models of ozone loss over the poles.

Greener route to pure silicon

The main industrial process for making elemental silicon--used in manufacturing semiconductor chips, silicones, and other materials--is the thermal reduction of SiO_2 (quartz) by carbon above 1,700 ºC. An unwelcome by-product is CO_2, millions of tons of which are released annually to the atmosphere from this process. An electrochemical method to produce silicon that avoids CO_2 is now reported by chemical engineering reader George Z. Chen of the University of Nottingham, in England, and coworkers at Wuhan University, in China [*Angew. Chem. Int. Ed.*, **43**, 733 (2004)]. The researchers based their process on an electrochemical method that is used to reduce metal oxides to pure metals. They pressed SiO_2 powder into pellets and sintered these to make them porous. The pellets were next sandwiched between pieces of nickel foil, and this cathode assembly was immersed in molten $CaCl_2$ electrolyte. During electrolysis, O_2 is

liberated, and the pellets are converted over several hours to nearly pure silicon. The researchers showed that the method is general by mixing SiO_2 powder with metal oxides to produce alloys.

Thermoelectric science heats up

Two back-to-back papers report advances in the field of thermoelectric materials, which can convert heat into electricity and may one day be key to more efficient refrigeration and energy production [*Science*, **303**, 816 and 818 (2004)]. Michigan State University's Mercouri G. Kanatzidis and coworkers report that the bulk materials $AgPb_{10}SbTe_{12}$ and $AgPb_{18}SbTe_{20}$ have a conversion efficiency, or ZT, of about 2.2 at 800 K. The few examples of materials with comparable ZT values have been made from nanostructured thin-film superlattices, but these materials aren't available in the large quantities needed for most applications. Kanatzidis' materials don't achieve the ZT of 3 required for them to be efficient enough for refrigeration, but when coupled with a heat source--coal-burning installations or vehicle exhaust, for instance--the materials could be used to generate power with high efficiencies. To better understand thermoelectric materials, Chih-Kang (Ken) Shih and Li Shi of the University of Texas, Austin, and colleagues demonstrate a technique--scanning thermoelectric microscopy--for probing semiconductor nanostructures. Using the technique, the group was able to resolve a p-n semiconductor junction to within 2 nm.

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