SCIENCE/TECHNOLOGY CONCENTRATES

August 14,2000
Volume 78, Number 33
CENEAR 78 33 p.32
ISSN 0009-2347

Millennium Special Report
75th Anniversary Issue

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Porous solid assembled from organic cages

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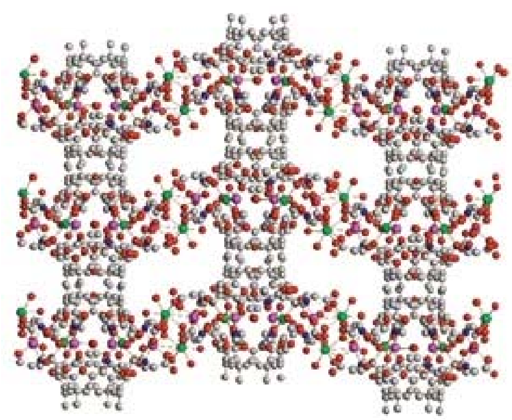
Metal ions can assemble organic cage molecules to form a porous material with a zeolite-like structure, report chemists at Brigham Young University, Provo, Utah [*Chem. Commun.*, **2000,** 1387]. Two years ago, assistant professor of chemistry Roger G. Harrison and coworkers described how cobalt ions can pull two bowl-shaped resorcinarene derivatives together to form a capsule [*J. Am. Chem. Soc.*, **120,** 7111 (1998)]. In the current work, Harrison's group finds that calcium ions can create bridges between those cages, connecting them into a 3-D array containing channels and pores (shown here with carbon atoms in gray; oxygen, red; calcium, green; nitrogen, blue; and cobalt, purple). The pores of the material contain water and isopropyl alcohol molecules that can be driven off by heating. The dehydrated material, which appears to retain its internal structure, takes up water again as it cools.



Quantum dot/polymer composites emit rainbow of colors

By dispersing quantum dots (QDs) in a polymer matrix, a research team at Massachusetts Institute of Technology has produced composites that can emit nearly a full palette of colors when excited by ultraviolet or blue light [*Adv. Mater.*, **12,** 1102 (2000)]. QDs used in this study are nanocrystals of a II-VI semiconductor such as cadmium selenide coated with a zinc sulfide shell. The team--led by Moungi G. Bawendi, a chemistry professor, and Klavs F. Jensen, a professor of chemical engineering and of materials science and engineering--passivates the dots with a coating of tri-*n*-octylphosphine and stabilizes them by dispersing the dots in a polylaurylmethacrylate matrix. The use of these organic materials provides optically clear composites and allows QDs to luminesce almost as efficiently as they do in dilute solution. The size of each nanocrystal determines which pure color it emits, and particles of any desired size can be grown in solution. By layering composites made from dots of different sizes, the researchers can easily produce bright mixed colors, such as white. The composites potentially could be used in full-color flat-panel displays.

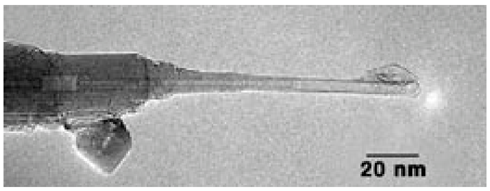
Bleomycin biosynthetic gene cluster cloned

The biosynthetic gene cluster for the anticancer antibiotic bleomycin, the active ingredient of the commercial chemotherapy drug Blenoxane, has been cloned and characterized [*Chem. Biol.*, **7,** 623 (2000)]. Bleomycin is a hybrid peptide-polyketide natural product with a unique bithiazole structure. The drug's gene cluster is one of the most complex ever cloned and analyzed, and bleomycin is one of only a few clinical drugs that have been targeted by such studies. Its biosynthetic system includes 10 nonribosomal peptide synthetase genes, one polyketide synthase gene, five sugar biosynthesis genes, as well as genes encoding a number of other biosynthesis, resistance, and regulatory proteins. The system's elucidation, by assistant professor of chemistry Ben Shen and coworkers at the University of California, Davis, could lead to a better understanding of the mecha-nism of biosynthesis of hybrid peptide-polyketide metabolites and thiazoles. In addition, it should facilitate the engineered biosynthesis of analogs with improved therapeutic efficacy and lower toxicity than bleomycin, which can cause severe lung problems.

Electric field powers molecular carousel

An international research team has shown that electric fields of alternating current can be used to monitor and control certain types of motions in macrocyclic molecules. Investigating the effect on a pair of rotaxanes (organic molecules consisting of a ring threaded on a linear "axle" having bulky stoppers at either end), chemistry professors David A. Leigh of the University of Warwick, England, and Francesco Zerbetto of the University of Bologna, Italy, and their coworkers find that by subjecting the molecules to ac fields they can alter the rate at which the ring spins about its axis [*Nature*, **406,** 608 (2000)]. The discovery of a simple way to manipulate molecules may lead to advances in nanoscale machinery, a field in which researchers seek to make and control microscopic mechanical devices such as molecular motors and turnstiles. While studying the effects of ac fields on the refractive index of solutions of rotaxanes, the team observed "somewhat unexpectedly" a large signal near 50 Hz, a frequency that they note cannot be attributed to intrinsic electronic phenomena. Using computer simulations, NMR spectroscopy, and other techniques, the team concludes that the signals are directly related to the macrocycle's spinning rate.

Multiwall nanotubes whittled to a sharp tip



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A simple and reliable method for peeling and sharpening the end of a multiwall carbon nanotube has been devised by physicists at the University of California, Berkeley, and Lawrence Berkeley National Laboratory [*Nature*, **406,** 586 (2000)]. Whittling a long, rigid multiwall nanotube (containing perhaps dozens of concentric tubes) to a fine, sharp tip consisting of one or a few nanotubes provides an ideal structure for use as a scanning probe microscope tip, an electron field emission tip, an electrode for inserting into biological cells, or a mechanical nanobearing. Physics professor Alex Zettl and graduate students John Cumings and Philip G. Collins shape the multiwall nanotube by bringing its tip into contact with an electrode that applies a specific voltage and current to the nanotube tip, vaporizing its outermost layers. The process can be repeated as often as necessary. The end result, as shown here in a transmission electron micrograph, is a multiwall nanotube that tapers stepwise to a fine, sharp tip.

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