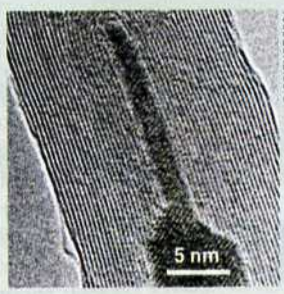
CONCENTRATES

Nanotube squeeze play

Controlled electron irradiation can transform multiwalled carbon nanotubes (MWNTs) into tiny high-pressure chambers, according to an international team led by Florian Banhart and Litao Sun of Germany's University of Mainz (*Science* 2006, *312,* 1199). Irradiating an MWNT at high temperature knocks carbon atoms out of the material's characteristic carbon lattice. The nanotube restores this atomic network and heals itself by contracting, creating pressures up to 40 gigapascal within its core in the process. When Banhart and Sun's group filled the MWNTs with iron carbide or cobalt nanowires and irradiated the assembly, they found that the contracting tubes could squeeze the solid material like toothpaste through a tube (shown with an Fe_3C nanowire). Because the technique uses transmission electron microscopy to induce the MWNT's self-compression, it offers researchers a way to directly observe pressure-induced atomic motion. This is in contrast with diamond anvil compression techniques, which rely on spectroscopic techniques to study materials under high pressure.



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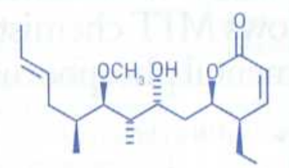
Web cameras see chemistry anywhere

With an eye on making environmental, medical, food quality, and other chemical-based analyses cheap and easy wherever a computer can run, scientists in Italy and Sweden have co-opted standard liquid-crystal display monitors and webcams to serve as optical systems for detecting chemicals (*Angew. Chem. Int. Ed.* 2006, *45,* 3800). With Internet connections, the technique could lead to distributed sensing applications such as "mapping outbreaks of flu and environmental disturbances in a way that is impossible today," suggests Ingemar Lundström of Linköping University, in Sweden. As a proof of principle, he and his colleagues exposed semitransparent films of gas-sensitive porphyrin-based compounds to low concentrations of pollutants including carbon monoxide and nitric oxides. Using a programmed sequence of 50 colors on an LCD monitor, the researchers illuminated the gas-bearing films while detecting the transmitted light with a Web camera. With software of their own design running on the same computer driving the monitor and webcam, the researchers showed that they could extract optical fingerprints for each pollutant. In time, the researchers say, the world's computer network could become a tool for chemical surveillance on any scale.

Polypropionates via asymmetric catalysis

The ability to use different catalysts to obtain complementary stereochemical outcomes in the catalytic asymmetric synthesis of polypropionates has been demonstrated by Scott G. Nelson and coworkers of the University of Pittsburgh (*J. Am. Chem. Soc.* 2006, *128,* 7438). The researchers developed the alkaloid-catalyzed acyl halide-aldehyde cyclocondensation reaction several years ago. They have now extended its applicability to the catalytic asymmetric synthesis of repeating propionate units, which are commonly found in polyketides and other natural products. They demonstrated the reaction's potential by using it to carry out the catalytic asymmetric synthesis of (–)-pironetin (shown), a polyketide with immunosuppressive and anticancer activities. "There are very few reactions in asymmetric catalysis that are effective enough to allow use in the synthesis of stereochemically complex targets," says Eric N. Jacobsen of Harvard University of the polypropionate reaction.

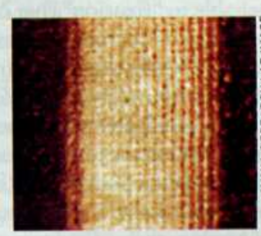


Free radicals and neural diseases

A new study offers the first evidence that explains the link between cellular stress caused by free radicals and the protein misfolding that is associated with several neurodegenerative diseases, according to its authors. Patients with these diseases, which include Parkinson's and Alzheimer's, produce excess amounts of nitric oxide free radical. Stuart A. Lipton of Burnham Institute for Medical Research in La Jolla, Calif., and colleagues report that the NO group S-nitrosylates critical cysteine residues in protein-disulfide isomerase (PDI). The reaction alters PDI's structure and interferes with its role in fixing misfolded proteins in nerve cells (*Nature* 2006, *441,* 513). The misfolded proteins then accumulate and damage or kill off the affected neurons. The researchers suggest that the elevated levels of S-nitrosylated PDI in Alzheimer's and Parkinson's patients could serve as a biomarker for development of these diseases. Reducing levels of this damaged protein could have therapeutic benefit, they add.

Nanowriting with conducting polymers

Molecularly ordered nanoscale patterns of conducting polymers can be prepared with high precision by using a scanning probe method, a new study reports (*J. Am. Chem. Soc.* 2006, *128,* 6774). Scientists at the Naval Research Laboratory, Washington, D.C., and Georgia Institute of Technology developed a procedure in which a solid "ink"—poly(3-dodecylthiophene) in this study—is applied to a customized atomic force microscope cantilever that's equipped with a fast-acting tip heater. Referred to as thermal dip pen nanolithography, the method was used to pattern a silica surface with polymer structures measuring less than 100 nm in width and ranging in thickness (height) from a single monolayer (shown) to tens of monolayers. On the basis of single- and multilayered pattern thicknesses, the team concludes that the polymer structures are ordered with the alkyl groups perpendicular to the surface, an orientation that favors charge-carrier mobility.



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