CHEMISTRY

Julie Ann Miller reports from the meeting in Houston of the American Chemical Society

Through a fiber brightly

Systems of optic fibers can be employed to analyze chemicals at a distance, says Tomas Hirschfeld of the Lawrence Livermore Laboratory. The fibers can connect a central laboratory of analytic equipment to sites up to a mile away. The system will save time spent carrying samples within a plant and will allow chemicals to be analyzed in areas too hot, too cold, too radioactive or too corrosive to permit operation of sensitive and expensive equipment. Hirschfeld explains that the optical fibers, recently developed for telephone communications, can be a two-way street for light. He shines laser light through the fiber to cause chemicals at the other end to glow. The chemicals' characteristic fluorescence then travels back through the fiber to the measuring instruments. Hirschfeld designed a "probe tip" in which a sapphire ball acts as a lens for illuminating the sample and collecting the fluorescence. Future application of the technique could include remote measurements of temperature, pressure, flow and magnetic fields.

Tenting the world

From the tents of nomads and the circus big top, the use of fabric in architecture has come a long way and is now being used for sports stadiums, shopping malls and civic centers. Fabric today tops 18 structures around the world, roofing a combined area of 40 acres, says Brian Mead of the DuPont Co. in Wilmington, Del. The fabric is woven from high-strength, glass fibers and coated in a dip tank, and then in an oven, with several layers of "Teflon" fluorocarbon resin, to protect the material against moisture. The fabric is then cut and heat sealed into roof structures strong enough to withstand high and low temperatures and 100-mile-an-hour winds. Mead says that the first long-term fabric structure, a college building in La Verne, Calif., has successfully withstood the elements for seven years.

To make a roof, the fabric is stretched either by tension or by slightly above-atmospheric air pressure, as at the Pontiac "Silverdome" Stadium in Michigan. Mead says that once in the roof the material resembles sheet metal more than fabric. One important benefit of a fabric roof, according to Mead, is that it is translucent; it transmits 7 to 15 percent of the natural light. In the newest U.S. installation, the Florida Festival in Orlando, Fla., 40-foot palm trees and other plants grow beneath the roof. Mead says that scientists are currently working to develop materials that let in even more light to grow natural turf for sports, especially for European soccer where artificial turf is not allowed. In addition to allowing plants to grow, the translucency cuts lighting costs. Other advantages include the roof's low cost, light weight, fire resistance, sound absorption and heat reflectance, which reduces the need for air conditioning. The largest project now underway is a terminal in the new airport in Jeddah, Saudi Arabia. The roof there will cover 105 acres and resemble the much smaller tents of the pilgrims to Mecca. Mead expects use of architectural fabric to continue expanding in the sports industry and elsewhere, including "a variety of specific buildings whose designs are new and, as yet, confidential." And even further beyond the shopping malls, he envisions using fabric to cover a whole city in the far north of Canada. A feasibility study is now underway for such a cover for Winooski, Vt., he says.

Alchemy, but no money-maker

Transmutation of atoms from a base metal into gold has been achieved at the Lawrence Berkeley Laboratory. The gold atoms appear when large highly charged atomic nuclei traveling at almost the speed of light bombard a target foil of the metal called bismuth, which has three more protons in its nucleus than does gold. The scientists are studying how high-velocity particles interact with nuclei of target materials. In the past, such studies used lighter projectiles, such as protons. The new work reported by David J. Morrissey, Glenn T. Seaborg, William Loveland and K. Aleklett used the heavier neon and carbon nuclei as projectiles. The scientists chose to monitor gold formation because its chemical properties allow separation from other elements and because it has a broad range of isotopes that can be detected by their radioactivity. The scientists found a similar distribution of gold isotopes after each bombardment. They also observed that the high-energy projectiles seem to deposit less energy than expected in the target nuclei. Even with peak market costs of gold, these experiments will not lead to riches. "They are not a cost-effective way to make gold," says Morrissey. "In all of our work we produced gold that was only worth less than one billionth of one cent."

Iron deficiency and gastric cancer

Severe iron deficiency may contribute to the high incidence of gastric cancer in Colombia and other countries, suggest Selwyn A. Broitman and Joseph J. Vitale of Boston University Medical Center. Previous research had linked the high rates of gastric cancer in certain areas of Colombia to high concentrations of nitrate in the drinking water. People in those areas have a remarkably high incidence of gastritis; in one area only 25 percent of the people have normal stomachs, Broitman says. The gastritis may be a prescursor condition to cancer.

"It is known that iron deficiency per se may mimic many of the gastric pathological changes described by previous investigators," Broitman and Vitale say. Thus the deficiency may promote gastric cancer. In addition, because iron deficiency is thought to compromise certain host immune defenses, it may allow increased proliferation of malignant cells. Broitman suggests that high nitrate levels in the water initiate the gastric cancers and the iron deficiency speeds development of tumors. Broitman has begun a comparison of iron levels and gastric cancer in various countries. He finds that countries such as Japan, where iron stores in the population are low, have a higher incidence of gastric cancer than those such as Mozambique, where the population has more sufficient iron.

Dust off the ironing board

Permanent press fabrics may become a mere memory unless chemists develop new fabric treatments. All the current treatments for cotton fabrics contain free formaldehyde, which is suspected of causing cancer (see p. 215). Ronald S. Perry of Southeastern Massachusetts University has begun searching for chemicals to tie up the free formaldehyde on treated fabric. So far Perry has found that nitrogen-containing compounds that do not have carbonyl groups are most effective. With such chemicals, such as benzotriazole, he reduces formaldehyde levels as much as 500 parts per million, about half the current level. Eventually he hopes to reduce the level to 10 percent of the free formaldehyde now present. Perry says there is currently no practical alternative to the formaldehyde-containing treatment systems. "We will either turn into a 100 percent plastic society (go to complete use of synthetic fibers) or the consumer will have to take out the iron again," he says.