CHEMISTRY

From our reporter at the American Chemical Society meeting in Chicago

Joining plastics and metals

The 100 or so elements, when combined and recombined into molecules, can and do exhibit a universe of properties. Metal oxides, for example, can be magnetic, can conduct electricity and can be catalysts to facilitate chemical reactions. Organic polymers (the plastics) can be flexible, easily molded and stable. Chemists, following their imaginations to flexible magnets, easily molded semiconductors and other bits of modern alchemy, would like to combine the properties of both metal oxides and polymers.

Inorganic chemists Michael T. Pope and six colleagues from Georgetown University have now reported synthesizing a new class of organometal oxide complexes. They start with a spherical cluster of several metal and oxygen atoms that carries a negative charge, then add organic molecules such as methane or phenol. The addition of these organic groups neutralizes the charge on the whole complex, making it possible to link the complexes in a repeating series, a polymer. The organometal oxide complexes could, in the near future, be designed with some properties of both metal oxides and polymers, Pope says.

Pressuring tumors with hydrogen

Zapping polyethylene plastics with gamma rays led three Texas chemists to another idea—zapping cancerous mice with high pressure and hydrogen. Strangely enough, after a few days in the pressure chamber, the animals' active skin tumors "dried up," turned black and began dropping off like old scabs.

Malcolm Dole of Baylor University in Waco explained the team's unusual experiment. He and colleagues F. Ray Wilson of Baylor and William R. Fife of Texas A&M University were studying the effects of hydrogen on the free radicals that are created when polyethylene is irradiated with gamma rays. Dole found that hydrogen gas greatly accelerates decay of the free radicals. He had heard that free radicals also exist in malignant tumor cells. So he and the team decided to test the effects of hydrogen on mice with skin tumors.

They sealed mice in a chamber something like a deep-sea diving bell. They filled it with a nonexplosive mixture of 97.5 percent hydrogen and 2.5 percent oxygen (enough to support respiration) then raised the pressure to 8.3 atmospheres. The tumors, after 10 days, had turned from reddish brown to black and had begun to pinch off at the base and fall off. The high pressure and reducing atmosphere might be interfering with the life processes in the tumor cells, the team suggests, and might be allowing the animals' immune systems to fight back.

The team plans to try the system out on other animals with other types of cancer—perhaps breast and lung cancers and melanomas—where, says Dole, the potential for hydrogen therapy exists.

New technique to crack pollution

A technique developed by Ford Motor Co. scientists promises to provide answers to some very important questions about atmospheric pollutants. Chemists have suspected that the hydroxyl radical (OH) is a major player in the reaction of automobile emissions in the lower atmosphere to form smog and in the reaction of airplane exhausts and aerosol propellants in the upper atmosphere to destroy ozone. But the precise measurements of OH concentrations in the atmosphere have eluded them and prevented complete understanding of the chemical mechanisms at work. Ford's newly developed technique should make such measurements possible, its scientists report.

Charles C. Wang and four colleagues described the technique and some initial measurements this week, and will publish the results in an upcoming issue of SCIENCE. They have combined the use of a tunable dye laser with a special photon-counting technique that allows them to measure OH concentrations at ambient air pressure. "This represents," Wang says, "an improvement by a factor of 1,000 over previous methods."

The laser measuring technique, used at ambient air pressures, should help explain the mysteries of urban and rural smog and how to control it, Wang says. NASA is also interested in the device and wants to install it in a high-flying U-2 airplane to test hydroxyl concentrations in the stratosphere. This should help to unravel the tangle of chemical reactions that may be occurring when aerosol propellants break down.

Fine-tuning on fluorocarbons

A new piece of laboratory data reconfirms the fluorocarbon-ozone destruction hypothesis with some fine tuning.

Photochemists Pierre J. Ausloos and Richard E. Rebbert of the National Bureau of Standards in Gaithersburg, Md., studied the breakdown of fluorocarbons 11 ($CFCl_3$) and 12 (CF_2Cl_2) under simulated stratospheric conditions. They found, using xenon and zinc light sources to supply ultraviolet radiation, that chlorine molecules are indeed released from the fluorocarbons when subjected to wavelengths from 215 to 190 nanometers (those predicted to be photochemically reactive with the propellants). The team showed that at the longer wavelengths, one reactive chlorine atom is released per fluorocarbon molecule, but at the shorter wavelengths, two chlorine atoms are probably released per fluorocarbon molecule. The chlorine released then initiates a chain reaction leading to ozone destruction.

This finding does not necessarily signify a "double threat" to the ozone layer, Ausloos says, but will probably shift calculations of the detrimental effects of fluorocarbons up by a small percentage. The team also identified some intermediate chemical species that exist during the photochemical breakdown, and found that air temperatures can play a slightly larger role in the speed of the reactions than had been suspected.

Hormone droplet and breast cancer

One tiny drop of a newly found hormone has been gathered from the brains of 80,000 slaughtered swine. Researchers at the University of Texas at Austin will "pick the brains" of more than a quarter million more of the swine in order to get enough prolactin inhibiting hormone to study. And if their suspicions are confirmed, the hormone may play a role in the treatment of human breast cancer.

Medicinal chemist Karl Folkers and five colleagues reported isolating and purifying the hormone from swine hypothalami. As the name implies, the hormone inhibits the body's production of prolactin. This pituitary hormone regulates, among others, breast development and lactation, and it has been implicated, Folkers says, in the development and control of breast tumor tissue in one-third of breast tumor patients tested. Finding and studying the prolactin inhibiting hormone may prove significant in treating breast tumors and other diseases, Folkers says.

Swine hypothalami will be used as a source of the hormone in pure form until its structure can be determined chemically and it can be synthesized in larger amounts. Extensive animal testing must be completed, Folkers says, before the hormone is made available for clinical trials.