chemistry

INFRARED ANALYSIS

Rotational barrier puzzle

Scientists have known for years that ions rotate. They also know that some ions, such as phosphonium (phosphorus and hydrogen, plus a halide like bromine or iodine) are prevented from rotating. Conventional theory has it that the barrier to rotation is electrostatic energy produced by the interaction of plus and minus charges.

But now an anomaly has crept up in the work of Dr. J. R. Durig of the chemistry department of the University of South Carolina. Using low frequency infrared waves, he has discovered that the energy barrier that prevents rotation in phosphonium salt crystals shows an improper dependence on the distance between ions in the interior of the crystal. If the barrier were due to electrostatic forces, this would not be the case. He is now trying to determine what the forces are.

WATER POLLUTION

Potential analytical tool

A way has been demonstrated to measure the diffusion of oxygen and nutrients through slime water and the respiration of microorganisms found there, according to a report in the December ENVIRONMENTAL SCIENCE AND TECHNOLOGY.

Dr. William J. Whalen of the research division of St. Vincent Charity Hospital in Cleveland and his co-workers took a microscope slide with a slime film on it and placed it at the bottom of a special chamber through which contaminated water was passed to simulate environmental conditions. A microelectrode, 1.5 microns in diameter, measured the oxygen concentration at different levels in the film, based on changes in electric current.

In this way, an oxygen profile of the slime film was obtained, showing that oxygen concentration decreased until it stabilized at 50 microns below the surface. Other profiles using nutrients were obtained, indicating that the method could be used to measure how much oxygen aquatic microorganisms use up and how rapidly oxygen and nutrients spread through the water and through a film of microorganisms.

X-RAY DIFFRACTION

Silicon monoxide composition

One of the arguments rattling around solid state research these days concerns the chemical composition of what are called silicon monoxide films, which are used to protect semiconductor material. One group contends that the films are actually made of silicon and silicon dioxide; the other maintains it is silicon monoxide, silicon dioxide and disilicon trioxide, all of which are molecules composed of different numbers of silicon and oxygen atoms.

X-ray diffraction studies by Drs. Stephen C.H. Lin and Madhukar Joshi of IBM Burlington at Essex Junction, Vt., support the silicon and silicon dioxide group. The researchers report in the December JOURNAL OF THE ELECTROCHEMICAL SOCIETY that they obtained silicon monoxide samples from a commercial firm and subjected them to X-ray bombardment. The resulting peaks plotted on a radial distribution curve were shown to be contributed by a combination of silicon and silicon dioxide.

COMPOSITES

New dental fillings

One of the problems with the fillings used in front teeth is that present materials (silicate cement and methylmethacrylate) allow X-rays to pass through them more readily than does the tooth itself. The result is a dark area on the film, which hinders a dentist in detecting decay around and under the filling.

A new composite material developed by Dr. R.L. Bowen of the American Dental Association, working at the National Bureau of Standards, absorbs X-rays, thus permitting X-ray diagnosis. The composite, made of dimethacrylate resin, radiopaque glass and fused silica, is impervious to X-rays, just like normal teeth, and resembles such teeth in color and translucency properties.

METALLURGY

Pollution-cutting copper smelter

In the conventional processing of copper ore in a smelter, the extreme heat produces sulfur oxides, which are emitted as air pollutants. A new process developed by Anaconda Co., to be instituted in a multimillion-dollar plant at Tucson, Ariz., not only eliminates the air pollution but could save time and money.

As in the old process, the unusable material is first floated away, leaving sulfide-containing copper ore. But instead of heat, sulfuric acid is brought in to produce copper sulfate, which is then electrolyzed to give pure copper. An alternative being considered is to precipitate the copper out as cuprous cyanide and then obtain the pure copper by adding hydrogen. Either method would make copper processing a one-step operation.

RADIOISOTOPES

Using waste products

Radioactive krypton and xenon gases are waste products of nuclear reactors. The present procedure is to dispose of them in storage tanks, which are kept buried underground.

Investigators at Idaho Nuclear Corp. say that a cryogenic recovery and purification system now makes it practical to recover the gases and exploit their radioactive properties. To date, krypton and xenon with respective purities of 85 and 92 percent have been obtained, C.L. Bendixsen, G.F. Offutt and B.R. Wheeler reported at the American Nuclear Society meeting in San Francisco.

Some uses envisioned for the krypton are in self-luminescent light sources, leak-detection equipment, thickness gauges and gas chromatography, while xenon could wind up in long-life light bulbs and as an anesthetic.