chemistry

SEMICONDUCTORS

Silicon carbide for cathode-ray tubes

The source of high-energy electrons in conventional cathode-ray tubes is generally made of nickel that is coated with barium and calcium carbonate. Scientists at GEC-English Electric Co., London, see silicon carbide as a better material to emit these electrons. It offers extremely long life, practically no warm-up time and operates on low power. But the big stumbling block to commercial production is the high cost of the process.

To manufacture such emitters, one-centimeter silicon carbide crystals are made by heating single crystals of silicon carbide at 4,750 degrees F. At this temperature, the silicon carbide goes directly from solid to vapor state. The vapor then condenses, forming the one-centimeter silicon carbide crystals. These crystals act as substrates for the deposition of the silicon carbide layers necessary to make silicon carbide a semiconductor.

These layers can be formed either by placing the crystals in a saturated silicon carbide solution or by heating trichlorosilane with hexane at 3,000 degrees F. to form silicon carbide vapor, which then deposits on the substrate crystals.

COAL

Working on gas turbines

Research engineers at the Aeronautical Research Laboratories in Melbourne, Australia, are trying to develop a coal-burning gas turbine. In this electric-power production method, coal would be burned to produce a gas which would drive a turbine to generate electricity.

The main obstacle facing the Australian engineers is fan-blade erosion, the same problem that forced the U.S. Bureau of Mines to drop its coal-turbine project back in 1964. The erosion comes from particles of coal ash produced by incomplete combustion. To overcome this, they are improving combustion, using chromium in the turbine blades and changing the turbine design. They have devised a special combustion chamber with a ceramic liner in the combustion zone that gives high wall temperatures and a combustion efficiency of 98 percent.

Chromium-plated blades were found to be far more resistant to wear than any other materials tested in a gas turbine engine, and blades in which chromium had been diffused rather than plated fared even better. The gas turbine was designed with an additional turbine stage to lower particle velocities and thus reduce blade wear.

ALLOTROPES

White carbon made in lab

White carbon, a form of carbon discovered in natural form in 1968, has been produced artificially in the laboratory by Dr. A. G. Whittaker and P. L. Kintner of Aerospace Corp., El Segundo, Calif. The new form was made by heating burned graphite to between 2,700 and 3,000 degrees K. in a low-pressure atmosphere of argon. The experiment indicates that white carbon is formed when graphite is changed directly into a gas without passing through the liquid stage.

Confirmation that the carbon produced was the new allotrope came from the scanning electron microscope, which showed a difference between the white crystals and the underlying graphite crystals, and the electron microprobe, which proved that the material was nearly pure carbon. Electron diffraction characterized the structure of the white crystals.

CHEMOSTERILIZATION

Birth control

Chemosterilization—a weapon used successfully to control insect population—is now pointed at rats. The Upjohn Co. of Kalamazoo, Mich., has developed a chemical sterilant belonging to a family called chlorohydrins that permanently stops sperm production in rats after one dose, without affecting their health or libido.

Having mated with a sterile male, a female will display symptoms of pregnancy and will not mate again for 11 days, more than twice her normal, nonreceptive period. Thus the number of future litters is reduced.

According to Dr. R. J. Ericsson of Upjohn's fertility research department, the one-shot drug is relatively nontoxic to man and other animals. It can be mixed in the food or water, and it eliminates the problem of bait shyness found in other contraceptive compounds. At present it is in the field-testing stage.

METALLURGY

Zinc recovery method

While some U.S. scientists are hunting for new zinc deposits (SN: 6/14, p. 576), a group of researchers in India has found a way to recover the metal from zinc wastes. In the Central Electrochemical Research Institute's process a suspension of finely divided waste material is electrolyzed in an alkaline solution between an iron anode and stainless steel cathode.

During the electrolysis, impurities such as iron are separated out as a hydroxide. The starting waste material need not be dissolved in water or purified beforehand, and the zinc produced can be obtained in sheet or powder form, which can then be melted into ingots. Even wastes with low zinc content can be utilized without purification. The alkaline electrolyte can be used repeatedly, and the iron content of the recovered metal is 0.10 to 0.15 percent.

COAL MINING

Strongest bill yet

The Senate unanimously passed last week the stiffest U.S. coal mine legislation to date. The bill provides for a coal dust standard of 3 milligrams per cubic centimeter (SN: 3/22, p. 278), three years after enactment, going down to 2 milligrams within six years. The bill eliminates the distinction between gassy and nongassy mines. It also abolishes the Coal Mine Review Board, which, under the previous legislation, could overrule the Secretary of the Interior. The secretary's powers are further strengthened by the present bill.