chemistry

COHERENT LIGHT

Pulsed carbon dioxide laser

Canadian scientists have achieved what they consider to be a major advance in gas laser technology. Researchers at the Defense Research Establishment in Valcartier, Quebec, led by Dr. J. A. Beaulieu, are now able to operate carbon dioxide lasers at the atmospheric pressure of the gas rather than at the near vacuum conditions required of present gas lasers.

This was accomplished by changing the mode of excitation. Instead of a long discharge, a large number of small discharges was used, thus producing a pulsing effect. The pulsed operation reduces the amount of heat produced in the laser, eliminating the need for vacuum cooling.

Prototype lasers using the technique have already produced infrared pulses with 100 times the power of other gas lasers. Because these pulsed lasers operate at atmospheric pressure, they can be made of inexpensive plastics and plywood. This simplicity means extremely cheap but powerful lasers will be available.

SEMICONDUCTORS

Ion implantation method

An improved ion implantation technique has been developed by the Tokyo Shibaura Electric Co. Ion implantation is a process whereby the impurities that give semiconductor chips their conductivity are electronically introduced.

In the new method, boron and phosphorus atoms are ionized, and accelerated by ultrahigh voltage (several hundred kilovolts) and then shot in a controlled stream into a single semiconductor crystal. By controlling voltage, current, acceleration and time, more impurity atoms can be introduced into the critical, narrow base region of the chip than could be done by conventional diffusion techniques. The technique paves the way for ultrathin transistors for microwave communications equipment in-including radar, integrated circuits and ultrahigh frequency broadcasting.

GASOLINE

Predicting storage stability

It is often necessary at military installations to store gasoline for up to five years or more. Many gasolines will deteriorate before that. A team of scientists from the U.S. Bureau of Mines, Bartlesville, Okla., has devised a test method to predict how long gasolines can be stored.

The method is based on the amounts of gum and lead precipitates that form in stored gasoline. Charles C. Allbright and Cecil C. Ward took gasoline samples placed in an oven for 16 hours at 200 degrees F. and compared them with samples of the same gasolines stored over 8, 16 and 32-week periods at 110 degrees F. On the basis of the amount of gum and lead precipitates formed in 16 hours—and with the aid of a mathematical equation—it is possible to predict the amount of deterioration in gasoline stored for as long as five years.

MINING

Improving on nature

Scientists have been adding plastics to construction materials to give them greater strength (SN: 11/29, p. 514). Now the U.S. Department of the Interior is looking at them to strengthen the walls of mines. Preliminary tests by the Mining Research Laboratory in Spokane, Wash., have demonstrated that adding plastic to rock can increase its strength and even heal a broken rock so that it is stronger than before. One type of porous rock, volcanic tuff, was made 3.5 times as strong.

The treatment involves impregnating the rock with monomers of three types of plastics—methylmethacrylate, monochlorostyrene, or polyester-styrene—by forcing them into cracks, joints and pores. Then a typical polymerization reaction is carried out by adding heat and catalysts to link the molecules together so they form a solid made up of long-chain molecules. The material is also being considered for tunnels and is being tested for strengthening concrete dams.

POLYMERS

Fireproof chemical coating

As a result of the 1967 Apollo fire that claimed the lives of three astronauts, a new fireproof coating has been developed for NASA by Raybestos-Manhattan, Inc., Bridgeport, Conn. The material, which can be sprayed on, is a fluorinated rubber to which inert ingredients such as silica have been added. Called Fluorel, it is dissolved in a methylethylketone solution and can be sprayed from conventional spraying equipment. The chemical coating can resist temperatures as high as 2,200 degrees F.

Its developers are considering it for industrial, aircraft and electronic applications.

EFFLUENTS

Feed from distilleries

Australian chemical engineers have devised a way to convert distillery waste into a stock feed supplement for animals. After molasses has been fermented and the alcohol or rum extracted, an aqueous liquid waste remains containing carbohydrates, protein, fats and minerals. The problem is to remove the water from it.

Normal evaporation via conventional heat exchangers is out because of calcium sulfate deposition on the exchanger surface. Similarly, superheated steam would be too costly.

The solution of the Australian Commonwealth Scientific and Industrial Research Organization is submerged combustion, whereby a fuel-air mixture is burned under the surface of the liquid. The hot flue gases bubble through, producing violent agitation, which helps to drive off the water. Liquefied petroleum gas is the fuel of choice.

N. C. Grave of the CSIRO in Melbourne reports that the waste, called dunder, could be readily concentrated to 50 percent solids. To produce stock feed supplement, the concentrate would be spray dried. Carbohydrates would make up about 50 percent of the feed.

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