chemistry

LASER MATERIALS

The high and the mighty

Two laser advances have been reported: use of a halogen-derived crystal to double the very-high frequency output of a solid-state laser and development of a 17-gigawatt peak-output glass laser.

Perkin-Elmer scientists have developed a technique to double the infrared-radiation frequency (in the range of 9,000 angstroms) generated by a gallium-arsenide laser. By introducing a lithium-iodate crystal, the final output is a visible blue beam.

The super power neodymium glass laser is being developed by Compagnie Generale d'Electricite in France for delivery this summer to the Naval Research Laboratory in Washington, D.C. The new instrument, which will support fusion-plasma physics research, uses five amplifier stages and measures some 35 feet in length overall. Although it has an energy output of 500 joules, fracturing of the glass laser will be minimized by the very short, 30-nanosecond, pulses.

ROCKET PROPULSION

Classified propellant revealed

The Air Force has lifted the security mantle covering a much improved oxidizer intended for use with storable fuels, such as hydrazine. The new compound, chlorine pentafluoride, ClF_5, was developed by the Rocketdyne Division of North American Rockwell in California. According to developers, ClF_5 can replace the more conventional nitrogen tetroxide for use in spacecraft restartable engines and provide either a reduction in the oxidizer weight or an increase in total energy. In the burning process, ClF_5 yields the same specific impulse as liquid oxygen, Rocketdyne discloses.

Developers believe ClF_5 provides more energy for its weight than any known storable oxidizer. Although its manufacture is still only in the pilot-production stages, indications are that the compound ultimately will be fully competitive with the relatively inexpensive N_2O_4 which is now used broadly for thrust in tactical missile systems.

BIOELECTRIC POWER

Human blood drives fuel cell

An experimental fuel cell employing human blood as a primary chemical source has been successfully demonstrated by Leesona Corp. at its Leesona Moos Laboratories in Great Neck, N.Y. The prototype has an output of only 20 microwatts per square centimeter of electrode, but researchers predict that by cascading the units power sufficient to drive a pacemaker or even an artificial heart (about 10 watts) could be produced in the future. To achieve this, however, improvement must be obtained in the power yield versus electrode weight and volume.

Developers are Drs. J. H. Fishman and J. F. Henry. Electrodes, they say, implaced directly in the blood stream, consist of a gold-palladium alloy bonded to a substrate of noble metal. Alloy compositions are varied to serve as selective catalysts—one electrode reacts with oxygen and the other with glucose in the blood.

Researchers at Emory University in Atlanta are also working on a glucose-powered fuel cell (SN: 1/31, p. 128).

DESALINATION

Efficiency studies

Four study contracts have been let by the Interior Department's Office of Saline Water as the first phase of a program to cut cost and raise the efficiency of large-scale desalting plants.

Under the $75,000-each awards, Aerojet General, El Monte, Calif., Aqua-Chem, Inc., Waukesha, Wis., Baldwin-Lima-Hamilton, Philadelphia, Pa., and Westinghouse Electric, Philadelphia, will have six months to perform conceptual design studies.

They will also provide cost proposals for detailed designs of a model plant capable of simulating operation of a full-size facility—one capable of producing fresh water at a rate of 200 million gallons per day. OSW, reportedly, would like to begin construction by June 1971.

The lowest-cost technique presently in use is with the vertical tube evaporator. The multistage flash process, however, is a faster, more efficient operation. For future large plant distillation the best attributes of both processes might be combined.

MINING

Nonpolluting copper smelting

A method to extract copper from ore concentrate without the production of either air or water pollutants will be studied by IIT Research Institute in Chicago. Researchers there will attempt to develop a suitable chemical separation process which also would yield pure sulfur and iron oxide for commercial by-products.

A recent regulation in Arizona, typical of tightening government control of pollution, specifies that copper smelters must reduce sulfur dioxide emissions by 90 percent.

COMPUTER MEMORY

Quality orthoferrite crystal

An 8-by-50-millimeter single-crystal orthoferrite capable of storing up to several million digital data bits has been developed by Nippon Electric Co., Tokyo. The material used is an oxide of iron and yttrium, erbium and terbium. The advance is an improvement over similar crystalline devices first developed in 1967 by Bell Telephone Laboratories, Murray Hill, N.J., and called bubble-domain memory elements.

The problem in the past with manufacture of these potentially high-density storage units has been high cost and persistent defects in the crystal structure—air-bubble formation, pinholes and sub-grains resulting from production by the floating-zone method.

NEC claims it can now mass produce very-high quality crystals. Its new technique: the ferrite is liquefied on a rotating rod under the exposure of intense infrared radiation and then crystalized. The 8-by-50-millimeter crystal can be formed in eight hours.