engineering sciences

SUPERCONDUCTORS

Commercial multifilament

A new superconductor suitable for commercial applications employing continuous filaments of niobium-tin (Nb_3Sn) distributed in a copper matrix has been developed by the Nuclear Metals Division of Whittaker Corp.

Superconducting metals (SN: 6/20, p. 602) conduct electricity without resistance when cooled to temperatures close to absolute zero. For commercial purposes, the problem becomes one of balancing the cost of cooling the system against the gain from no-resistance circuits. Thus the temperature at which the metal becomes superconducting is critical. Broad use of the new wire is predicted by its developers because it remains superconductive at a higher than usual range, 10 to 16.6 degrees K.

Also, Nuclear Metals engineers anticipate industry acceptance of the wire because of its filament construction, its high-current capacity (the critical current is three to five times greater than the broadly used niobium-titanium alloy) and its ability to carry either form of commercially available current, alternating or direct. Further, researchers claim that the wire will operate in magnetic fields of 100,000 gauss and with improvements, to 200,000 gauss.

NONDESTRUCTIVE TESTING

Test for molybdenum in steel

The Trent Tube Division of Colt Industries has come up with a simple way to identify the presence of molybdenum in stainless steel (alloys of about two percent) without damage to the material.

In the process, the positive terminal of a six-volt, steady-voltage battery is connected to the test specimen and the other terminal is connected to a carbon rod. A drop of electrolyte is applied to the metal and the rod is placed in it, but not on the metal, for two seconds. The solution changes to a pink color, and if the hue persists, molybdenum is present.

The electrolyte is a solution of potassium thiocyanate, stannous chloride and hydrochloric acid. In the reaction, the pink reflects the formation of red cyanide salts of each metal present; all normally fade rapidly except molybdenum thiocyanate. Both material suppliers and steel-tube buyers have shown interest in the test, says a Trent metallurgist, W. C. Christianson.

MANMADE ISOTOPE

Interest growing in californium 252

Effective promotion by the Atomic Energy Commission of its manmade radioisotope, californium 252, as a high neutron source for laboratory and field studies may assure a future market for the unstable element. The technique used by the Savannah River Operations Office of the AEC is a market evaluation program in which potential users may obtain small quantities of Cf-252 on a loan basis. Since its inception in June 1969, the program has generated 1,500 information requests and 20 loan recipients.

Indicative of the miniscule amounts of material involved is a current effort by the manufacturer of Cf-252, the Savannah River Laboratory operated by the DuPont Co., to produce one full gram within the next seven months. It also reflects the degree of difficulty in making the element—a tedious irradiation sequence during which 14 neutrons are added to one atom of uranium 238. Allotments to-date vary from 5 to 5.000 micrograms. Total production in 1969 was 33 milligrams, and less than 70 milligrams will be made this year. However, a single gram of Cf-252, having a half-life of 2.65 years, will emit 2.34 trillion neutrons a second.

Although it is presently made from spent uranium fuel, a simpler and less costly process using spent americium 243 and curium 244 will be tried later this year. This could ultimately drop the cost to $10 per microgram. At that time, broad use of Cf-252 is anticipated by industry for process-control applications and neutron radiography and by the medical field for radiation therapy and radiography.

ELECTROCHEMISTRY

Reverse approach to electrolysis

For years the electrochemical industry has produced elemental gases, chemicals and metals through the application of an electric current to electrodes immersed in a suitable electrolyte. Electroplating is similarly accomplished. Two conditions were common in all processes: an external electric source and a stationary electrolyte.

They were, that is, until Richard L. Davies conceived a new approach and turned the whole process around. Davies, president of the Washington consulting firm of Klein & Saks, Inc., has devised a process in which the electrolyte and its container are moved through a magnetic field to generate a current. The field typically is radial and the container is moved perpendicularly to it to develop a potential across the electrolyte closing the circuit between electrodes at each end of the container.

Both the process and equipment design are covered in a patent (United States No. 3,522,162) newly issued to Davies. A major advantage of his approach, says the inventor, is avoidance of any build-up of products about the electrodes that interfere with the electrolytic action.

RADIOISOTOPES

Erosion clues from gold

Government engineers are salting coastal waters of the United States with minute quantities of radioactive gold 198 or gold 199 in a study of the effects of ocean currents on coastline erosion and sediment flow. The study, called RIST, for Radioisotope Sand Tracer, is a joint effort by the Atomic Energy Commission and the Army Corps of Engineers.

Only a quart of gold-tagged sand enables researchers to investigate an area exceeding 500,000 square feet of water-borne sediments, AEC officials report. The sand is dumped a short distance off shore and underwater radiation detectors trace its movement outward to 1,500 feet and along the coastline more than 3,000 feet. Measurements can be made for up to one week at a sampling rate of 1,500 points an hour before dilution and decay render the radiation undetectable, says the AEC.