

technology notes

CIVIL ENGINEERING

Soil freezing studied for tunnel building

A more efficient way to dig deep holes and long tunnels is being sought in a method of surrounding the excavation with a retaining wall of frozen soil.

Dr. O. B. Andersland, civil engineering professor at the the University of Michigan, reports that the method requires no braces or pilings, and so would be useful in cases where an excavation is so wide or deep that costly systems of steel supports would normally be required. Freeze pipes sunk in the ground maintain the low temperature.

Dr. Andersland reports that the strength of clays can be increased up to 10 times by the freezing technique.

METALLURGY

Recipe for superplastic metals

Mathematical recipes for mixing the correct ingredients of just about any fine-grained metal alloy have been worked out by Drs. Charles M. Packer and Oleg D. Sherby of Stanford University. Some of the samples tested have been stretched 20 times their original length without breaking.

Various steels, titanium alloys, brasses and aluminum alloys are among the important industrial metals known to be superplastic. The ability to tailor-make superplastic metals could open up new techniques of metal manufacturing.

Key to achieving superplasticity is in the compounding of proper metals, neither of which can have crystals more than a few millionths of an inch in diameter. Each metal must also have approximately the same melting point.

Microscopic photos taken by Dr. Packer show that new metal crystals form as the old crystals are deformed by stretching. The formula tells how fast the various alloys can be stretched and at what temperatures.

MATERIALS RESEARCH

Copper alloy corrosion rate investigated

The mechanism that controls the corrosion rate of copper-nickel alloys has been investigated by L. H. Bennett and L. J. Swartzendruber of the National Bureau of Standards institute for material research.

The problem in using these alloys for condensers is that a small admixture of iron decreases corrosion, while too much iron increases it. The NBS scientists found that only the iron dissolved in the copper-nickel alloy is effective in increasing its corrosion resistance.

This evidence was obtained in studies made for the Interior Department's Office of Saline Water, which is interested in reducing corrosion in desalination plants. Using Mossbauer spectroscopy to examine the atomic structure of the alloys, the team learned that when the concentration of dissolved iron is more than 1.5 percent, the corrosion rate goes up.

The NBS scientists conclude that, in addition to the amount of iron present, the heat treatment and composition of the alloy must be known before accurate prediction of corrosive behavior can be made.

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MICROWAVE

Oscillations in germanium

Microwave oscillations in current at room temperatures from a germanium crystal under stress have been observed by Dr. J. E. Smith Jr. of IBM. The oscillations, similar to the Gunn effect in gallium arsenide and other compound semiconductors, occur when the germanium sample is stressed at pressures of 10,000 to 20,000 times that of sea level.

The finding is of interest because germanium is the semiconductor material whose behavior is best understood, making the production of reproducible oscillators easier than it would be from such compounds as gallium arsenide.

The stress necessary to initiate the oscillations is easily produced by a small vise and, in applications where low temperatures are not an obstacle, such as in satellite communications systems, germanium crystals could prove to be a suitable source of microwave power. Oscillations so far observed have been in the megacycle range.

ANALYTICAL CHEMISTRY

Trace elements determined

A method for determining trace elements in organic and inorganic materials has been developed at Bell Telephone Laboratories. The accuracy and convenience of the new method makes it possible to analyze bulk samples in less than 15 minutes.

Trace amounts of 68 of the 72 elements normally determined with a conventional X-ray spectrograph can be detected using Coprex, an acronym for co-precipitation X-ray fluorescence spectroscopy.

As little as 20-billionths of a gram of nickel, titanium and scandium, a 10-millionth of a gram of calcium, copper, iron, cobalt and zinc, and one-millionth of a gram of most other elements can be separated and determined by the method.

Coprex procedures are now lacking only for osmium, protactinium, promethium and krypton. As described by C. L. Luke of Bell Laboratories in the May *ANALYTICA CHIMICA ACTA*, the Coprex method overcomes shortcomings of X-ray spectroscopy by virtually eliminating errors caused by interfering elements.

MARINE ENGINEERING

Inflatable masts beat ice peril

British scientists believe they have found a way to stop the severe icing that can sink fishing boats.

Bill Rawcliffe, skipper of the trawler *Boston Phantom*, reports that tests with new equipment this past season were successful; an inflatable cover on the main mast stay cracked ice three inches thick.

Simultaneous experiments using an inflatable rubber cover on a dummy mast cracked ice six inches thick in the climatic chamber of the British Aircraft Corp. at Weybridge, Surrey. The equipment was made by the Palmer Aero Products subsidiary of BTR Industries at Leyland, Lancashire, which plans to market the de-icers for Arctic fishing vessels.