science news®

A Science Service Publication
Vol. 104/Sept. 22, 1973/No. 12
Incorporating Science News Letter

OF THE WEEK

RESEARCH NOTES

ARTICLES

DEPARTMENTS

COVER: Looking for particles within particles is an old game for physicists. Lately they have found partons within the proton. Now they are looking for whatever is inside the parton with the aid of the detector shown in breakaway schematic. See p. 188. (Illustration: SLAC.)

Publisher E. G. Sherburne Jr.
Editor Kendrick Frazier
Aerospace Everly Driscoll
Behavioral Sciences Robert J. Trotter
Medical Sciences Joan Arehart-Treichel
Natural Sciences Jonathan Eberhart
Physical Sciences Dietrick E. Thomsen
Science and Society John H. Douglas
Copy Editor Nadine Clement
Assistant to the Editor Esther Gilgoff
Production Manager Davida Daemon
Books Margit Friedrich
Circulation Manager Lawrence Cope
Advertising Scherago Associates, Inc.
11 W. 42nd St., New York, N.Y. 10036
Fred W. Dieffenback
Sales Director

Subscription Department
231 West Center Street
Marion, Ohio 43302

Subscription rate: 1 yr., $10; 2 yrs., $18; 3 yrs., $25. (Add $2 a year for Canada and Mexico, $3 for all other countries.) Change of address: Four to six weeks' notice is required. Please state exactly how magazine is to be addressed. Include zip code.

Printed in U.S.A. Second class postage paid at Washington, D.C. Established as Science News Letter ® in mimeograph form March 13, 1922. Title registered as trademark U.S. and Canadian Patent Offices.

Published every Saturday by SCIENCE SERVICE, Inc., 1719 N St., N.W., Washington, D.C. 20036. (202-785-2255). Cable SCIENSERV.

science news
OF THE WEEK

Warming up superconductivity

A newly developed compound has the highest temperature yet recorded for the onset of superconductivity

Superconductivity, the property by which certain metals lose all electrical resistance at very low temperatures, has been gradually inching its way up the temperature scale. As new superconducting materials are discovered, occasionally one of them has a critical temperature (the temperature at which it becomes superconducting) higher than any other.

A new record has just been set, and although it does not represent the staggering breakthrough (such as room-temperature superconductivity) that some physicists hope for, it could point the way to a significant technological and economical improvement.

The new superconductor is a crystalline compound of niobium and germanium with the formula Nb_3Ge. It has a critical temperature of 22.3 degrees K. (The previous record holder was an alloy of niobium, aluminum and germanium with a critical temperature of 20.8 K.) The new substance was prepared by John R. Gavaler of the Westinghouse Research Laboratories in Pittsburgh and reported at a symposium in Gatlinburg, Tenn., last week. It is the first superconductor to have a critical temperature substantially above the freezing point of liquid hydrogen, and it raises the possibility that liquid hydrogen may be used as a refrigerant for superconducting electric-circuit elements instead of liquid helium. Hydrogen is much more abundant and cheaper than helium.

Gavaler says that his work is based heavily on the work of J. K. Hulm, B. T. Matthias, T. H. Geballe and their collaborators. Hulm showed that substances that crystallize in the particular form that Nb_3Ge has were very promising for high-temperature superconductivity. Matthias and Geballe showed how important it is for superconductivity that the materials be exactly stoichiometric—formed in exactly the proportions of the formula without any stray extra atoms of one element or the other.

To achieve the stoichiometry, Gavaler used a method of high-pressure sputtering to form the Nb_3Ge rather than bulk methods. Sputtering is a technique in which ionized argon molecules are made to collide with a target material (in this case a composite niobium-germanium target) and remove portions of it, depositing them as a thin film on a substrate prepared nearby. Gavaler used a much higher argon pressure than is usual, and he concludes that the large amount of argon caused a mixing of the niobium and germanium to allow formation of a nearly perfectly stoichiometric compound.

Efforts to develop large-scale applications of superconductivity are currently under way in laboratories around the world. Among the applications that would benefit tremendously from a successful superconducting technology are power transmission lines, high-speed trains, ship propulsion systems, electric generators and a variety of low-power electrical devices.

Before the new material developed by Gavaler can be used technologically, a process will have to be found to make it into wire. Gavaler is confident that this can be done and that the resulting wire will have important functional and economic advantages over any other existing superconducting material. □