RARE-EARTH INFORMATION CENTER INSIGHT

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High Strength, Low Density Glassy Alloys

A new class of aluminum-base amorphous (glassy) alloys have been discovered by scientists at the University of Virginia. A series of aluminum-transition metal - rare earth metal alloys were found to have tensile strengths about twice that of the strongest commercial alloys. In addition these amorphous alloys are quite formable (usually glassy alloys containing 70 to 80 at.% Al are brittle).

Another unusual feature of these alloys is that the aluminum content is so high: they contain about 90% Al, 5 to 9% transition metal (Fe, Co, Ni or Rh) and about 5% rare earth metal. The highest strength reported to date was 940 MPa for $Al_{90}Fe_5Ce_5$. The alloys, in the form of ribbons 1 to 2 mm wide by 15 µm thick, were prepared by melt spinning. Upon heating to 250 to 300°C the alloys become crystalline which limits the upper temperature at which they may be used. Because of the low densities, the aerospace industry is expected to be the first to use these new materials. The results were reported in the September 23, 1988 issue of **Science** (**241**, 1567) by Y. He, S. J. Poon and G. J. Shiflet.

High T_c Update — How Do J_c's Stack Up!

David Caplin has summarized the results presented at the "Critical Current in High-temperature Superconductors" Conference held in Snowmass, Colorado, August 16-19, 1988 [**Nature 335**, 204 (15 September 1988)]. Basically the $YBa_2Cu_3O_7$ (1:2:3) high temperature superconductor still leads the critical current (J_c) race for both thin film and bulk materials. The competing non-rare earth materials are the Tl- and Bi-based oxide compounds. The critical current densities at 77 K at magnetic fields up to 1 tesla for the best of the ceramic superconductors are still about two orders of magnitude smaller than that of Nb_3Sn at 4.2 K. If the high T_c superconductors are expected to see extensive use, especially in applications which require high electrical current densities, a 20-fold increase in J_c's are needed.

Part of the problem is the short coherence distance in the high T_c oxide superconductors, which is about 100 times smaller than that of the conventional superconductors. This means that small non-superconducting regions at the grain boundary impede the flow of the superconducting current. (This is known as the weak-link problem.) Another major problem is that the imperfections in the oxide solids are not nearly as effective in

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pinning the flux motion at 77 K as they are in the normal superconductors, which operate at 4.2 K, because of thermal activation of flux motion.

Rhone-Poulenc to Acquire Research Chemicals

Rhone-Poulenc Inc. and Nucor Corp. (parent company of Research Chemicals) have signed a letter of intent for Rhone-Poulenc Inc. to purchase Research Chemicals from Nucor Corp. This purchase will give Rhone-Poulenc a larger role in the metallurgical and magnetic markets.

S.X. to Treat Rare Earths

In early October the South Australia Government announced that a new plant for treating rare earths is to be established at Port Pirie by S.X. Holdings, Ltd. The project is to be phased in over five years. Initial feedstock and some technology will be imported from the People's Republic of China. After the plant has been established the feedstock will come from Australia. S.X. Holdings, Ltd. is owned by Muswellbrook Energy and Minerals, Ltd. and Lanthanide Technology, Pty. Ltd.

Nuclemon to Separate Rare Earths

Nuclemon announced that they are building a plant to separate rare earths in Sãn Paulo, Brazil. They will receive technical assistance from Santoku Metal Industries of Kobe, Japan and financial help from the trading company Nissho Iwai Corp. of Osaka, Japan. The plant is expected to become operational in the latter half of 1989.

HIGHLIGHTS FROM THE 18TH RARE EARTH RESEARCH CONFERENCE

September 12-16, 1988, Lake Geneva, Wisconsin

Mid-infrared Laser Diode - continued

In the last issue of **RIC Insight** we described the new quantum well PbEuSeTe/PbTe laser device. One of the exciting possible uses of this laser is in the medical field, where the laser may be used to detect isotopes of elements which do not have appropriate half-lives (e.g oxygen and nitrogen) or where the use of radioisotopes is precluded by biomedical applications (e.g. carbon). In these cases, tunable diode laser spectroscopy has a much higher sensitivity and selectivity than the standard techniques (e.g. mass spectrometry) and can be used to easily detect $^{13}C^{16}O$ in exhaled human breath, which is naturally present at 1 to 10 parts per 100 million.

This low detectability limit has much potential in carrying out clinical tests for a variety of medical problems, such as bacterial infections, cirrhosis of the liver, diabetes, etc. For example, by feeding a patient sugar with a high ^{13}C content and monitoring the patient's breath for $^{13}C^{16}O$ one can diagnose whether or not the subject is diabetic, depending on how quickly the patient assimilated the sugar, relative to a normal person.

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