Rare-earth Information Center

Insight

Center for Rare Earths and Magnetics
Ames Laboratory
Institute for Physical Research and Technology
Iowa State University, Ames, Iowa 50011-3020 U.S.A.

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More Aluminum-Scandium

Last month I commented on a technical article on Sc additions to Al. This month an interesting article by Bob Irving {*Welding J.*, 53-7 (July 1997)} crossed my desk. The article reports on the production of Al-Sc welding wire. Ashurst Technology Ltd. of Hamilton Bermuda is developing the product at two laboratories: one in Baltimore, Maryland and the other in Kiev, Ukraine. The Ukraine connection is a result of Ashurst interest in the Zhovti Vody mine, which the article states is the only known primary scandium mine. The mine is said to have sufficient proven reserves for 2 billion lb. of Al-Sc end use alloy. There is reported to be a stockpile of alloys, as a result of the collapse of the soviet defense industry. The article discusses a variety of uses on the Al-Sc alloys, including baseball bats.

d-wave Superconductivity

Since the discovery of high-temperature superconductivity more than 10 years ago, there has been considerable discussion, or perhaps controversy, as to the symmetry of the wavefunction of the superconducting electron pairs in these novel materials. Conventional superconductors have a spherical *s*-state wavefunction, but measurements in high-temperature superconductors have pointed toward a lower symmetry. Both *s*- and *d*-wave have had strong supporters over the years with each side claiming to have produced the definitive measurement in various experiments. The preponderance of evidence in the last few years has been for *d*-wave, and it appears that the controversy has finally been resolved. K. A. Kouznetsov et al. {*Phys. Rev. Lett.*, **79**, 3050 (1997)} report that nature appears to have reached a compromise with the true wavefunction being the sum of pure *s*- and *d*-waves. B. G. Levi {*Phys. Today,* 50, [11], 19-20, (1997)} summarizes these recent developments, so that they are accessible to the non-specialist.

High T_c Crystal Growth

A recent review by Y. Shiohara and A. Endo {*Mater. Sci. Eng.*, **R19**, [1-2], 1-86 (1997)} provides a detailed discussion of the factors that control crystal growth in high-temperature superconductivity oxides. The article also provides a brief introduction to the problems inherent in using high-temperature superconductors, as well as discussion of the methods for producing large oriented poly-grained materials. Single crystal growth processes and mechanisms are discussed. While the focus of the article is of interest to a relatively small group of specialists, the introductory material provides a good overview for a general audience.

Yb Excited State with 10-Year Lifetime

Usually, when we talk about the excited state of a rare earth ion, the lifetime's involved are extremely short. In fact, we usually count on this short lifetime, which is typically milliseconds or less. After all,

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the time resolution of our televisions would be rather poor if the phosphors gave off their light over several seconds. On the other hand, since the Heisenberg uncertainty principle states that the uncertainty in energy of a state is inversely proportional to the lifetime of the state, a state with a long lifetime will have a very well-defined energy. This results in a very sharply defined frequency for the photon emitted when the exited state decays. Recently, M. Roberts et al. {*Phys. Rev. Lett.*, **78**, 1876-9 (1997)} have observed the $^2F_{7/2}$ lifetime in $^{172}Yb^+$. (Note: it is Yb^+ not Yb^{+3}.) The $^2F_{7/2}$ state decays to a $^2S_{1/2}$ state by an octupole transition. The lifetime is found to be 3700 days. Do not feel bad if you have not observed this transition, these measurements were made on a single ion trapped in a magnetic field. The ion is then laser cooled to less than 1mK. The lifetime is inferred from a number of measurements of other transitions.

Optical Pressure Gauge

The shift of the fluorescence line of ruby has been used for years, as a means of determining the pressure obtained in diamond anvil cells for high-pressure experiments. Since the diamond anvil cell may be designed so that there is a clear optical path through the diamonds, this type of measurement does not require the introduction of leads into the cell, allowing much higher pressures than are possible if pressure seals must be made around electrical leads. Recently, F. Datchi et al. {*J. Appl. Phys.*, **81**, 3333-9, (1997)} have performed an improved calibration of $SrB_4O_7{:}Sm^{2+}$. This compound exhibits a fluorescence line in the same spectral range as the commonly used ruby line, but the line is more intense. In addition, the ruby line is a doublet, which splits at high temperature or extremely high pressure limiting its application in these regimes. The Sm^{2+} line, on the other hand, is a singlet which allows its use above 100 GPa and at temperatures to 800K.

RE Beijing '98

From October 4-9, 1998, '98 Beijing International Exhibition on Rare Earth Development and Applications will be held in Beijing, China. While the conference announcement will be reproduced in the next *RIC News*, you may contact Mr. Tian Yonghong, Sub-Council of Metallurgy Industry, CCPIT, 46 Dongsi Xidajie, Beijing, 100711, China; Tel: 86-10-65220753, FAX: 86-10-65233861.

Rhône-Poulenc Changes to RHODIA

On January 1, 1998, the specialty chemical activities of Rhône-Poulenc were incorporated in a new company called RHODIA that employs 38,000 people. As Rare Earths and Gallium Enterprise are part of the new company, this change will certainly be noticed in the rare earth community. Among the activities of the new company will be Baotou Luxi Rhone Rare Earths Co. Ltd. Located in Baotou, China, this joint venture between RHODIA, the BRDZ (Baotou Rare Earth Development Zone), and the Westlake American Company has recently announced plans for a production unit for rare earth alloys and metal hydride powder for rechargeable batteries. The unit will have a capacity of 500 tons/year and is scheduled to be operational in July 1998.

R. W. McCallum
Director CREM/RIC