Rare-earth Information Center INSIGHT

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New Techniques for Preparing Coatings and Thin Films

Sievers Research, Inc., Boulder, Colorado announced that they have been allowed a U.S. patent for a new process to form metal or metal compound coatings or thin films. Their process is called Supercritical Fluid Transport-Chemical Deposition (SFT-CD), and it consists of dissolving a metal compound (or mixture of compounds) in a supercritical fluid, spraying this solution on the item to be coated, and inducing a chemical reaction to occur at or near the surface. In the patent application, R. E. Sievers and B. N. Hansen of the University of Colorado, described the preparation of a mirror-like film of the Y-Ba-Cu-O superconductor on a silicon substrate, and metallic yttrium also on silicon. An yttrium chelate, $Y(thd)_3$ - yttrium tri(2,2,6,6-tetramethyl-3-5-heptanedione) - was dissolved in n-pentane along with Ba and Cu thd, then pressurized to 10MPa (1400 psi) and heated to 210°C to make the solution supercritical. This solution was discharged into the deposition region, which is maintained at a pressure of $2x10^{-4}$ torr, and the chelates were decomposed at the substrate surface which was maintained at 700°C. For the yttrium metal deposit, the $Y(thd)_3$ was dissolved in supercritical N_2O and decomposed on the silicon substrate at 690°C. This new technique offers advantages over other coating techniques because a wider range of precursors can be used. The SFT-CD process can be employed to make superconducting thin films, protective coatings, reflective coatings, catalytic surfaces, thin film capacitors, etc.

Who, What, and Why in European Permanent Magnetism

Do you want to know what is going on in research on rare earth permanent magnets in the European Common Market countries? If so, see the July issue of the **Materials Research Bulletin** (**15**, [7], pp. 54-60), which arrived in RIC offices about the time the August issue of **RIC Insight** went to press. The story was written by I. V. Mitchell, who is the scientific project director for the Concerted European Action on Magnets (CEAM), which is one of the European Commission's research projects on Advanced Materials.

CEAM was started in 1985 as a interdisciplinary collaborative research and development effort involving more than 120 scientists and engineers from 58 European institutions. CEAM is divided into four groups -- two materials groups headed by D. Givord at CNRS, Grenoble, France and by J. M. D. Coey at Trinity College, Dublin, Ireland; a materials processing group headed by I. R. Harris, University of Birmingham, England; and an applications group led

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by R. Hantisch, Technische Universität Berlin, West Germany. A list of the institutions involved, their principal investigators and subject groups is given. Although most of the institutions are universities, several companies and government laboratories are also involved.

Mitchell gives a brief overview of the activities and the accomplishments since 1985. The main emphasis is on $Nd_2Fe_{14}B$, but other materials are also being investigated, including alloy substitutions for the basic components of the $Nd_2Fe_{14}B$ base material. Research in the Material Groups involves: studies of the magnetic properties of the $R_2Fe_{14}B$ series of compounds, phase relations, microstructure, atomic scale magnetism, coercivity, and crystal growth. The Magnet Processing Group studied powder metallurgical sintering, rapid quenching and hydrogen decrepitation processes, and also corrosion protection. The Application Group worked on the design and construction of electric machines and static devices.

Water Vapor Detector

Researchers at the Department of Electronics, Tokyo Engineering University have found a novel way of detecting water vapor by using mid-range infrared emitting rare earth activated phosphors. Y. Mita and co-workers [Jap. J. Appl. Phys. 29, L798 (1990)] excited Er-doped YF_3 or BaY_2F_8 phosphor materials using a GaAs:Si light emitting diode. The emissions at 2.6 to 2.8 μm were detected using a PbS photoconductive cell. Of the various rare earth activated phosphors studied, the BaY_2F_8:Er phosphor worked best for determining the amount of water vapor in air by the absorption of light.

Thermoluminescence Dosimeter

A new Eu activated phosphor was found to be five times more sensitive than one of the standard phosphors ($CaSO_4$:Dy) used for dosimetry of ionizing radiations. P. D. Sahare and S. V. Moharil of Nagpur University, Nagpur, India report on the preparation and properties of $K_2Ca_2(SO_4)_3$ doped with 0.1 mol% Eu as a new high-sensitivity phosphor for thermoluminescence dosimetry. The compound was prepared by a solid state diffusion reaction followed by melting, slow cooling and crushing. This phosphor had a linear response to the amount of radiation, and exhibited a simple glow curve with an emission peak at 415 nm, with negligible fading. The phosphor can be readily reused. This new material should replace the $CaSO_4$:Dy phosphor, and perhaps some of the LiF doped phosphors which are used as radiation dosimeters.

A Mitsubishi/Mitsubishi Merger

Mitsubishi Metal Corp. and Mitsubishi Mining & Cement Corp. will merge in December 1990 to form a new company known as Mitsubishi Materials Corp. The new company is expected to have annual sales totaling over 6 billion dollars.

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