Rare-earth Information Center INSIGHT

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Commercially Available 54 MGOe Permanent Magnets

Sumitomo Special Metals America, Inc. (Torrance, California, USA) announced that they are putting into commercial production one of the highest energy product Nd-Fe-B based materials on a mass production basis. This material surpasses their previous best material (NEOMAX-46) by 18%. The new material has a remanence of 14.95 kG, a coercivity of 10.6 kOe ($_{b}H_{c}$ = 10.57 and $_{i}H_{c}$ = 10.62 kOe), and an energy product [$(BH)_{max}$] of 54.2MGOe. The new permanent magnet material is expected to be available in April 1994.

New Joint Ventures in China

Advanced Material Resources Ltd. (AMR) of Toronto, Canada announce that they have raised funds, subject to final regulatory approval, to finance several joint ventures in China. The first of these joint ventures is a 60% interest by AMR of a 300 ton rare earth oxide facility in Jiangyin, Jiangsu Province, PRC. The feedstock of this plant is the ion absorption clays found in this region of the PRC. This facility produces high-value separated rare earth products. AMR plans to improve this factory's product quality and to reduce operating costs through capital and operating improvements.

The second joint venture is between AMR (60% interest) and Beijing New Precision Alloy Company, a wholly owned subsidiary of Central Iron and Steel Research Institute, which is part of the Chinese Ministry of Metallurgical Industry. This joint venture is still subject to approval from the Chinese government. A new production facility, which is to be constructed, will be an extension of an existing pilot plant, which will produce rare earth permanent magnets for electric motors. The pilot plant has a current production capacity of 10 tons.

The third joint venture by AMR involves a 70% interest in a facility in Yixing, Jiangsu Province. This plant is the largest rare earth plant in China using the ion absorption clays. As in the case of the Jiangyin plant (above), AMR will purchase 100% of the production of the Yixing facility. According to Peter V. Gundy, Chairman, AMR plans to become a major international low-cost producer of separated rare earth products, as it becomes an important company in the Chinese natural resource sector. Indeed, they are undergoing preliminary discussions for AMR to acquire an 80% interest in another facility in Shandong Province.

Role of La and Y in Superalloys

In an electron microscopy study of two nickel-based superalloys, H. M. Tawancy and N. M. Abbas [**Scripta Met. Mater. 29**, 689 (1993)] concluded that the rare earth metal segregates

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to the grain boundaries of the protective oxide to improve their high temperature oxidation resistance. They studied Haynes alloys: numbers 214 and 230. The former contains 16 Cr, 4.5 Al, 4 Fe, 0.04 C and 0.01 Y, while the latter contains 22 Cr, 0.3 Al, 14 W, 5 Co, 3 Fe, 2 Mo plus four other elements (all <0.5) and 0.03 Y (all concentrations are in wt.%). The authors postulate that in alloy 214 the yttrium segregates to the α-Al_2O_3 scale and thus improves its high temperature strength and reduces its growth rate. For the alloy 230 the lanthanum segregates to the α-Cr_2O_3 scale and serves the same functions as yttrium did for the Al_2O_3. But in addition, the authors believe that the other beneficial effects found in alloy 230 could be due to the formation of $LaCrO_3$ particles which could block the chromium transport and thus reduce the growth rate of the scale.

Chalcogenide Glasses

Non-oxide, chalcogenide glasses have a great deal of promise for many infrared applications, including mirrors, filters and waveguides. Because of the low vibrational frequencies of the bonds formed by the chalcogenide atoms, these glasses can transmit electromagnetic radiation out to the infrared region, typically between 0.5 and 10 μm. This low maximum phonon energy also ensures low nonradiative relaxation rates, and this property makes them ideal laser host candidates. Earlier studies on photoinduced and waveguide properties of chalcogenide glasses had been carried out on the As-S, Ge-As-Se and Ge-Sb-Se systems. But there are major problems with these materials - toxicity, low devitrification temperature, and are difficult to work with mechanically. Because of these problems and the high potential need for chalcogenide glasses, K. E. Youden *et al.*, University of Southampton, United Kingdom [**Appl. Phys. Lett. 63**, 1601 (1993)], studied some of the properties of Ga-La-S system glasses. The Ga-La-S glasses are non-toxic, hard, easy to polish, and have recrystallization temperatures of 600 to 700°C. Thin films of $7Ga_2S_3 \cdot 3La_2S_3$ ($LaGa_{2.3}S_5$) were prepared by reacting Ga_2S_3 and La_2S_3 in the proper proportions at 1150°C and quenching in H_2O at room temperature. The $LaGa_{2.3}S_5$ material was deposited on a CaF_2 substrate by ablation using a KrF excimer laser. Reversible photobleaching, photoinduced refractive index changes and photodoping effects were demonstrated in the $LaGa_{2.3}S_5$ films. The results obtained to date indicate that these films have a great promise for optical applications and warrant further studies. The authors suggested that it should be possible to construct channel waveguides and integral Bragg mirrors in doped materials (which would most likely be other lanthanide elements, such as neodymium and erbium) in order to construct a fully integrated miniature laser.

One of the main challenges with lanthanide-chalcogenide glasses, just as for the heavy metal fluoride glasses, will be the ability of the rare earth industry to produce eight to nine nines purity rare earth materials consistently, especially lanthanum-based materials for the host. In addition, high-purity lanthanide elements with unpaired 4*f* electrons will be required as dopants in many of the optical devices, but the quantities will be much, much smaller than for lanthanum. It is also possible the yttrium may find important niches in these non-oxide glass applications as part of the basic host materials.

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