RARVS
Gd Eu Tb Sm Dy Pm Ho Nd Er Pr Tm Ce Yb La Sc Y Lu

Rare-earth Information Center INSIGHT

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Magnequench International

Last fall, General Motors Corporation sold its Magnequench plant to Magnequench International Inc. (MQI), whose shareholders are Sextant MQI Equity Holdings, a Delaware corporation owned by US investors and MQ Holdings (USA), another Delaware corporation owned by San Huan and CNIEC, two Chinese companies. In the keynote address at the Gorham conference on polymer bonded magnets held in Atlanta, April 22-24, Archibald Cox, Jr., President of MQI, detailed the structure and plans of the new company. While the agreements between the holding companies call for a board with five members appointed by MQ Holdings and four by Sextant, Sextant has only appointed three board members at this time. Dr. John J. Croat, whose work at the General Motors Research Laboratory formed the basis for the Magnequench process, is a member of the board. Cox listed a number of items as MQI focus areas. These include a concentration on the magnetics business with improved customer focus. He outlined steps taken to improve access to raw materials including the opening of an office in Beijing with the sole responsibility of interfacing with suppliers. Considerable emphasis was placed on MQI's resolution to defend its patent position. MQI has recently acquired the rights to all Kollmorgen patents with regard to NdFeB. Cox reported increased capital investment to significantly increase MQI's ability to meet isotropic powder demand. MQI will more than double its capacity in 1996 and has a goal of having 20 to 25% excess capacity at any time to meet subsequent market demand in 1997. Cox indicated that the allocation of powder should end by mid year. This expansion will take place at the Anderson, Indiana plant. In a separate talk, Dr. Hong Zhang, Chairman and CEO of MQI, outlined the rare earth supply in China as it impacts MQI.

Advanced Ceramics

Si_3N_4 is a high temperature material which is of considerable interest in the advanced ceramics field. As with most ceramics, in order to obtain high strength, it is necessary to produce a material which has a uniform fine grained microstructure by sintering fine powder. Due to the strong covalent bonding in Si_3N_4, the pure material is difficult to sinter and a variety of sintering additives have been investigated. The sintering additives determine the grain boundary characteristics and, hence, the high-temperature properties such as flexural strength, creep behavior and oxidation resistance. When RE_2O_3 and Si_3N_4 are combined, $RE_2Si_2O_7$ is formed, as well as a highly refractory glassy grain boundary phase. Two recent papers, Choi *et al.*, **J. Mat. Sci. Let., 15,** 282-284 (1996) and Sun *et al.*, **Mat. Let., 26,** 9-16 (1996) have investigated different aspects of RE additions to Si_3N_4. Choi studied the high temperature strength and oxidation behavior of $Er_2Si_2O_7$ - Si_3N_4 ceramics and found that the highly refractory glassy grain boundary phase resulted in high strength at 1200°C and good oxidation resistance to 1400°C. Sun focused on the phase transformation in Ln-(α-β) - sialon ceramics where the α material has the composition $Si_{6-z}Al_zO_zN_{8-z}$ and the β phase has the general formula $M_xSi_{12-(m+n)}O_nN_{16-n}$, where M is a metal ion such as Y, Ln, Li, Ca, Mg,... While the α phase usually develops into a prismatic or acicular morphology with high aspect ratios which result in higher

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strength and fracture toughness, the β phase has an equiaxed morphology and possesses superior hardness and thermal shock resistance. Thus, optimum properties are obtained for multi-phase ceramics. Sun *et al.* have studied the (α-β) transition in detail and found it to be controlled by the Ln content of the intergranular liquid during sintering.

Optical Properties

Huiberts *et al.*, **Nature, 380**, 231-234 (1996) have presented a rather graphical demonstration of the change in optical properties, which occur when metallic YH_2 or LaH_2 is converted to semiconducting YH_3 or LaH_3 during continuous absorption of hydrogen. The mirror-like properties of a YH_2 are demonstrated with a chess piece whose reflection masks a chess board pattern. When the hydrogen content is raised to YH_3, the film becomes transparent. While the visual impact of the paper is dominated by the photographs of this process, the technical interest is the method by which the transition was studied. For bulk samples, the strain associated with the transition from the di- to tri-hydride usually causes the material to fall apart making the measurement of optical properties difficult for high H content. On the other hand, the reactive nature of the material makes it extremely difficult to prevent significant oxidation of thin films during cycling. The authors have overcome this problem by overlaying a thin (5-20 nm) Pd film. This layer protects the RE hydride from oxidation but allows H to diffuse readily. There is a minor correction to the optical properties which must be made.

Polymer Wave Guides

The optical transitions of RE ions are of great importance commercially in applications ranging from phosphors for color TV to Nd:YAG lasers. The RE are attractive in these applications since the wavelength of the inner 4*f* shell metastable transitions are fairly insensitive to the host. Recently, Lin *et al.*, **J. Appl. Phys., 79,** 2868-2874 (1996) have studied the doping of optical quality polymers with chelated Nd^{3+}. In order to develop electro-optic polymeric devices, means of overcoming losses in the devices must be developed. Amplifiers based on the same principles as lasers are possible using Nd doping of the polymers but problems of low solubility of the RE materials in the polymer must be overcome. The chemistry investigated by Lin *et al.* appears favorable for such applications.

Conferences, Short Courses, etc.

Magnetic Materials, Measurements and Modeling Symposium, May 16-17, Ames, Iowa, contact Janet Gardner, Iowa State University FAX: 515 294-6223. 14th Technology Short course and Workshop on Permanent Magnet Design, May 20-22 ,1996. The Bay Area, California, Contact Princeton Electro-Technology, Inc. Tel: 407 998-4249. 41st Magnetism and Magnetic Materials Conference, Atlanta, Georgia, November 12-15, 1996, contact Courtesy Associates 202 639-5088. China: "Opportunities for the Magnetic Materials Industry" Guilin, China October 7-9, 1996. Contact Gorham/Intertec 207 781-9800.

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