Rare-earth Information Center INSIGHT

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Laser Markets Expand

The European laser market is expected to grow 7.5% per year over the next five years and be worth $1.8 billion by 1997. Growth is expected to be strongest for Nd:YAG, tunable solid-state lasers (some of which employ other lanthanide ions) and excimer systems. Similar growth patterns can be expected in the USA and Japan. Germany is expected to be the dominant country for purchases of laser equipment.

Neodymium Cuts Diamond

Over the last ten years the diamond processing industry has adapted laser technology for cutting, sawing and kerfing diamonds. But mechanical methods have been preferred for cutting diamonds because about five percent of the diamond weight is lost during laser cutting, which is about twice that of mechanical techniques. Recent research by Prof. Yehiam Prior and colleagues of the Weizman Institute of Science in Rehovot, Israel, has led to optimizing the laser sawing process, whereby only two percent of the diamond is lost. The cutting process involves graphitization of the diamond by the laser pulses which enables efficient ablation of the carbon. Nd:YAG lasers are the primary laser of choice of the diamond industry. Currently, a single mode Nd:YAG laser is used. But when the new generation of miniature diode-pumped Nd:YAG lasers, which have power levels of a few millijoules per pulse operating at a frequency of several kilohertz, are commercially available, the diamond cutting process will be much more efficient and will increase the Nd:YAG laser's share of the diamond cutting market.

In addition, the lasers can be used to create diamond shapes never seen before, making it possible to design and produce customized diamonds. The beauty of using lasers is that laser cutting does not cause internal damage. Clearly the laser, in particular Nd:YAG, has revolutionized the diamond shaping industry.

A New Record for $YBa_2Cu_3O_{7-x}$ Superconductor

The critical current capacity, J_c, is slowly creeping up for the $YBa_2Cu_3O_{7-x}$ (1:2:3) high temperature superconductor, and thus coming closer to commercialization. Recently Kobe Steel Ltd. announced that they had set a new record for the J_c of a thick film of the 1:2:3 material, 12,000 A/cm^2. The previous record according to a company official, was 7,500 A/cm^2. The Kobe Steel scientists used a sol-gel process to form the 1:2:3 phase on a silver substrate. However, as far as we are aware, at the present time the $Bi_2Sr_2CaCu_2O_{8-x}$ (BSCCO) phase is less affected by magnetic fields than the 1:2:3 material (i.e. J_c falls off slower with increasing magnetic field for

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BSCCO than for the 1:2:3 compound) and thus BSCCO has a slight advantage over $YBa_2Cu_3O_{7-x}$ with respect to applications which involve environments in which the superconductor is subject to high magnetic fields.

New Magazine Launched

Concord Trading Corporation has introduced a new magazine which they claim to be "the most authoritative newsmonthly ever produced for buyers and sellers of rare earths and specialty metals". The new magazine, which is called **Elements**, is geared to bring its readers the latest global market and pricing trends. In addition it will include: current industry news and market activity; a listing of international events important to technical and commercial specialists; in-depth feature profiles on companies and industrial personalities; and technological advances. Subscription to **Elements** is $495 per year. To place a subscription order or to obtain a complimentary copy write or call: Ms. Amy Lightner, Concord Trading Corp., Three Park Central, Suite 1000, 1515 Arapahoe Street, Denver, CO 80202, USA; telephone: 303-899-4400; fax: 303-899-4555; telex: 450202.

Are Rare Earths Caged-in?

A recent study on the YC_{82} metal fullerene molecule, commonly known as "buckyballs", by L. Soderholm et al. [**J. Phys. Chem. 96**, 7153-56 (1992)] strongly suggested that the yttrium atom is not inside the fullerene C_{82} cage as is commonly believed [see **RIC Insight, 5**, [4] (April 1, 1992)}. The scientists from Argonne National Laboratory and the Boeing Company used time-of-flight mass spectroscopy (TOFMS) and extended x-ray absorption fine structure (EXAFS) to characterize their samples. The TOFMS measurements indicated that the fullerene metal complex had the formula of YC_{82} while the EXAFS studies indicated that the yttrium atom has 7 ± 1 near-neighbor carbon atoms at a distance of 2.35 ± 0.02Å and an yttrium atom neighbor at 4.05 ± 0.05Å. These observations are inconsistent with a model which places a metal atom inside the C_{82} cage. The authors instead proposed that the experimental data can be explained by a dimer of the form YC_{82}-X-YC_{82} where the bridging atom (X) is either a carbon or an oxygen atom. Furthermore, they note that yttrium is trivalent in this molecule. Clearly, our ideas on the nature and structure of this exciting and interesting class of new materials need to be modified and broadened.

Heavy Lanthanide Magnesium Alloy Developed

Two new magnesium-based alloys, one containing gadolinium and the other terbium, have been jointly developed by scientists at Nagaoka Technical University (Niigata Prefecture) and Mitsui Mining and Smelting Company, Ltd. The Tb-Mg alloys are said to be 33% stronger than the standard Y-Nd-Mg alloy used for high temperature applications between 200 and 300°C, while the Gd-Mg alloy had a 200°C hardness, 40% larger than the Y-Nd-Mg alloy. Because of these improved properties the heavy lanthanide magnesium alloys are said to be suitable for use in pistons and other high temperature applications.

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