Rare-earth Information Center INSIGHT

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Volume 6 November 1, 1993 No.11

1.4 Megabytes per Second

A new design of the rewritable magneto-optical drive makes magneto-optical disks much more competitive with conventional magnetic hard disk drives. Although the magneto-optic disks can store considerably more information than a hard disk, access to this information is quite slow compared to that for ordinary magnetic disks. This has limited the use of the magneto-optic technology to applications which required the large storage capacity and where the time to access the data was not essential. All of this has now been changed by redesigning the drive which is used to access the stored information or to rewrite it. A small computer company, Pinnacle Micro, made the read/write head smaller and more maneuverable than the conventional method. This was primarily accomplished by putting the laser light source off to the side and placing a prism mirror on a moving pickup. The Pinnacle Micro disk drive moves the information from a disk to the computer at a rate of 1.4 megabytes per second, which is faster than some hard drives. This advance will help to increase the sales of rewritable magneto-optic storage disks which contain (Gd,Tb)-(Co,Fe) amorphous alloys as the active magneto-optic material.

Line Defects Improve High T_c Superconductors

A few years ago theorists suggested that the best way to improve the current carrying capacity of the high temperature ceramic superconductors was to use a line of normal (non-superconducting) material (i.e. a microscopic hole) in the superconductor such that the vortex cores could sit in it and not move. One of the first studies used a heavy ion accelerator to shoot tin ions at extremely high energies (600 million electron volts) to form 60Å diameter holes in the $YBa_2Cu_3O_7$ (1:2:3) superconductor. After irradiation this material had a current capacity of 100,000 A/cm^2 at 77 K in a field of 4 T.

Other researchers have used different approaches to see if they can achieve the same type of line defects. These include: the addition of extra yttrium to $YBa_2Cu_3O_7$, in which the yttrium precipitates to form thread-like defects which serve the same purpose as the ion tracks. Another method was to compress the 1:2:3 material at 950°C, which caused the grains to slip past one another to create microscopic deformations resembling line defects. However, in both cases, the 1:2:3 samples had a smaller current carrying capacity than the ion bombarded material.

More recently, the 1:2:3 material was doped with U^{235} and then placed in a nuclear reactor. The neutrons are absorbed by the U^{235} causing it to fission and give off two energetic charged ions which leave columnar defects. In this case the line defects are randomly orientated and thus not as effective as the material bombarded by tin ions which has more or less parallel rows of defects. The neutron irradiated high temperature superconducting 1:2:3 ceramic had a current carrying capacity of 85,000 A/cm^2 at 77 K in a field of 2 T. The challenge will be to

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improve on these techniques or to develop new approaches to put line defects into the $YBa_2Cu_3O_7$ superconductors. *But read on.*

High T_c Tapes

Recently, researchers at the Lawrence Berkeley National Laboratory have developed a process for making $YBa_2Cu_3O_7$ films which can carry a current of 600,000 A/cm^2 at 77 K, which is about ten times higher than drawn wires containing the 1:2:3 material. The first step in making these tapes is to deposit a buffer layer of Y_2O_3-stabilized ZrO_2 (YSZ) on a nickel alloy substrate using a pulsed laser. As this layer is grown, an ion beam bombards the YSZ at an oblique angle, causing an in-plan orientation of the growing crystallites. Then the 1:2:3 material is deposited on the YSZ layer. No ion beam is used in this step. To date, only short lengths have been made, but the technique shows considerable promise.

ETREMA Dedicates New Terfenol Facility

In mid-October, ETREMA of Ames, Iowa held a grand opening of their new 1000 m^2 (10,800 ft.^{2}) facility for production of terfenol-D, an intermetallic compound of the composition $(Tb_{0.3}Dy_{0.7})Fe_2$, which exhibits large magnetostrictive effect at room temperature. The new facility was named the McMasters Systems and Research Center, after O. D. McMasters who was the prime mover in developing the technical processes for the manufacture of single crystals and directionally solidified polycrystalline terfenol-D. The new plant is highly automated with the latest quality control techniques and manufacturing processes. Research and engineering facilities, including an application laboratory, is also housed in this building.

Semiconductors

A new book, **Rare Earth Doped Semiconductors**, has just been published by the Materials Research Society (MRS). This book is based on a symposium held in San Francisco at the 1993 MRS Spring meeting. It is the first extensive book on this emerging field, which shows considerable promise for a number of new high technological applications. The proceedings contain nearly 60 papers, which discuss (1) techniques of incorporating the rare earth elements into the various semiconducting materials (primarily Si); (2) the optical and electrical properties of primarily GaAs-based materials, but also InP, GaP, PbTe and Ge; (3) excitation mechanisms for optical luminescence; (4) novel structures and devices; and (5) theory and models. This book is highly recommended to bring one's knowledge to the forefront of this rapidly developing and exciting field which promises to merge our current semiconductor base computers with the photonic revolution. The rare earths will play an increasingly important role. High purity rare earths are generally required in these semiconductor applications, but the amount of the individual lanthanide used is extremely small. Erbium and ytterbium are the two most important dopants, but Sm, Dy and Tm are also used. The 400 plus page proceedings was edited by G. S. Pomrenke, P. B. Klein and D. W. Langer and is available from the Materials Research Society, Publications Dept., 9800 McKnight Road, Pittsburgh, PA 15237, USA; phone: 412-367-3012, and fax: 412-367-4373. The cost of this hardcover book is $65.00 U.S. and $70.00 foreign (for MRS members it is $55.00).

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