Rare-earth Information Center

Insight

RARVS

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Sapphire-NiAl(Yb) Composite

In a composite material, the reinforcing fibers serve to bridge cracks and relieve stress at the crack tip, thus, restricting crack growth. In order to serve this function, the fibers must resist pulling out of the matrix material. Clearly, a smooth interface between fiber and matrix is going to be less resistant to pull-out than a rough interface. R. Asthana and S. N. Tewari {*J. Mater. Sci. Lett.*, **16**, 406-11 (1997)} have studied the effect of Yb as an alloying agent in NiAl when used with sapphire (Al_2O_3) reinforcing fibers. Both diffusion, bonded and float zone, processed composites were studied. In the absence of Yb, there is very little reaction of the Al_2O_3 with the NiAl. As anyone who has tried to produce rare earth compounds in an alumina crucible might expect, the addition of Yb changes this picture. The clean interface is replaced by a multilayer interfacial zone with layers of oxygen-rich NiAl, Yb_2O_3, and the oxide spinel $Yb_3Al_5O_{12}$. The formation of these layers produces a rough surface on the fibers, which enhances the pull-out resistance of the fibers. The paper presents detailed analysis of the results.

Anisotropic Sintered $Sm_2(Fe,M)_{17}N_x$

Since $Sm_2(Fe,M)_{17}N_x$ decomposes at a temperature well below those at which effective sintering takes place, the production of an anisotropic magnet requires that a texture $Sm_2(Fe,M)_{17}$ compact be sintered and then nitrided. A major problem with this approach is that $Sm_2(Fe,M)_{17}$ has easy plane anisotropy making in hard to align. Jun Yang et al. {*Appl. Phys. Lett.*, **70**, [9], 1176-8 (1997)} have overcome this problem by using rotational alignment to produce the textured compact and then studied the nitriding characteristics of the compacts. (Rotational alignment of Sm_2Fe_{17} has previously been demonstrated by S. Brennan et al. {*J. Magn. Magn. Mater.*, **140-4**, 971-2 (1995)}.) An easy plane material can not be uniaxially aligned in a static field since the unique axis is then only required to be perpendicular to the field direction, resulting in a fiber texture rather than a uniaxial texture. If the direction of the aligning field is rotated more rapidly than the particles can respond to the rotation, a unique direction is established for the unique crystallographic axis perpendicular to the plane of rotation. In practice, it is easier to rotate the sample than the field, so the sample was spun at 100 rpm in a field of 2 T. Compacts of different densities were prepared by varying the sintering parameters. An optimum density was determined by the competition between the requirement for the maximum density of magnetic material and the fact that if the materials were too dense, full nitriding was not achieved and cracking resulted from stress due to the volumetric changes of nitriding.

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Dynamic Alignment of Magnetic Materials

A more general and detailed description of the alignment of magnetic materials using time varying fields is presented by Y. D. Zhang and J. I. Budnick {*Appl. Phys. Lett.*, **70**, [9] 1083-5 (1997)}. The response of a magnetic particle to a time varying magnetic field is determined by the relationship between the time scale of the field and the response time of the particle (assuming that the particle is a single crystal). For a periodically varying field, if the response time of the particle is shorter than the periodicity of the field, the particle will simply follow the field. On the other hand, if the response time is too long, the particle does not move in the field. For intermediate times, the particle responds to lower the time-averaged energy of the particle in the field. In the case of easy plane anisotropy, the easy plane will lie in the plane of rotation of a rotating field as discussed above. A more interesting case is where pulsed fields are applied along more than one axis. If the pulses are sequentially timed, it is possible to fully orient the magnetic material. This process may be quite interesting for shapes which are not suitable for rotating in a fixed field.

Magneto-optical Recording

The January, 1997 issue of *the Japanese Journal of Applied Physics* focuses on high density magneto-optic recording. T. Maeda {*Jpn. J. Appl. Phys.*, **36**, 504-13, (1997)} presents a review of the mechanism for high density recording on magneto-optical disks. Models are presented and the guidelines for predicting performance are discussed. S. Murata et al. {ibid p. 562-7} discussed a magneto-optical disk basked video disk recorder. The 120 mm disk has a user data capacity of 4.1 Gbytes which will hold 125 minutes of MPEG2 moving images. The disk is based on TbFeCo and GdFeCo. Detection schemes and readout functions are discussed in other articles. From the materials viewpoint, the paper of H. Nanto et al. {ibid, p. 421-3} is interesting in that it describes an optical memory system based on photostimulated luminescence. The technique appears to be related to thermoluminescence which has been used in radiation dosimeters for decades. In this case, electrons are excited into high level traps by a writting beam which is scanned across the material. When a read beam is scanned across the material, the electrons are excited over the energy barrier holding them in the traps and luminous as they decay to the ground state. The resulting light is detected to determine the information that was stored spatially. The phosphor used is Eu and Sm codoped strontium sulfide.

Rhône-Poulenc Expands In China

In a press release dated March 27,1997, Rhône-Poulenc announced that it had acquired a major stake in a Chinese rare earth production company. The new joint venture, Baotou Luxi Rare Earths Co. Ltd. is 41% owned by Rhône-Poulenc. The Baotou Rare Earth Development Zone holds a 40% share and the American company West Lake, from whom Rhône-Poulenc acquired its holding, retains a 19% share. The company has a production facility located at Baotou which was constructed in 1994. For further details, contact Veronique Bienayme in Paris at (33) (0) 1 47 68 05 88. In a press release earlier this month, Rhône-Poulenc announced that its French operations have received ISO 9001 certification. This is an enhancement of the ISO 9002 certification held by French and US operations.

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