Rare-earth Information Center INSIGHT

Ames Laboratory
Institute for Physical Research and Technology
Iowa State University / Ames, Iowa 50011-3020 / U.S.A.

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New Record for NdFeB Energy Product

The latest China Rare Earth Information newsletter (November 1990, No. 19) has a brief announcement concerning a record value for the energy product of a NdFeB permanent magnet. They report that scientists at the Baotou Research Institute of Rare Earth, Baotou, Inner Mongolia used a powder metallurgy technique to prepare a magnet which has an energy product of 52.2 MGOe, a remance of 1.47T and coercivity of 8.36 kOe. Congratulations to the Baotou scientists.

CeO_2 Buffer Layers for High T_c Superconductors

One of the major problems for using high temperature superconductors in microwave devices is that the best substrates for epitaxial high T_c superconducting thin films are not satisfactory, while those which have satisfactory microwave properties (silicon and sapphire) react with the high T_c materials. One solution to the problem is to use a buffer layer to prevent the chemical reaction between the superconductor and substrate, but will still have an epitaxial film of the superconductor on the substrate. Scientists (X. D. Wu and co-workers) at the Los Alamos National Laboratory have found that CeO_2 thin films on $LaAlO_3$, sapphire, and yttria-stabilized zirconia (YSZ) form excellent buffer layers which are chemically and structurally compatible with the $YBa_2Cu_3O_{7-x}$ (1:2:3) high temperature superconductor. The (100) planes of CeO_2 have a lattice mismatch of 0.16% with the a lattice parameter of the 1:2:3 phase and a 1.7% difference with the b lattice parameter. The (100) CeO_2 and 1:2:3 films were deposited epitaxially on (100) $LaAlO_3$, (100) YSZ, and $(1\bar{1}02)$ sapphire (R-cut sapphire) by using a pulsed laser deposition technique. The CeO_2 film thickness varied from 1000 to 2000Å. The 1:2:3 phase was then deposited on the CeO_2 buffer layer. The epitaxial 1:2:3 films had a zero resistance temperature of 90K and a critical current density of 5.9×10^6 A/cm^2 at 75K, both of which are state-of-the-art values.

Superconductor Sandwiches

University of Stanford researchers have been able to grow a multi-layered thin-film sandwich of the $YBa_2Cu_3O_7$ superconductor (Y:1:2:3) in which the optimum current-carrying CuO_2 planes are oriented perpendicular to the surface of the film. Here-to-fore scientists were only able to grow films with the CuO_2 plane oriented parallel to the film surface. But for

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Telephone: (515) 294-2272
Facsimile: (515) 294-3226
Telex: 269266
BITNET: RIC@ALISUVAX