LN-1-INV

Enhanced Vortex-Pinning in Superconducting Wires

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Engineered nanoscale defects within $REBa_2Cu_3O_{7-\delta}$ (REBCO) based coated conductors are of great interest for enhancing vortex-pinning, especially in high-applied magnetic fields. We have conducted extensive research to optimize vortex-pinning and enhance *Jc* via controlled introduction of various types of nanoscale defects ranging from simple rare-earth oxides and Ba-based perovskites to double perovskite rare-earth tantalates and niobates (Ba_2RETaO_6 and Ba_2RENbO_6). This talk will provide an overview on how density, morphology, and composition of these engineered nanoscale defects affects vortex-pinning in different temperature, field and angular regimes. Detailed microstructural and superconducting properties coated conductors with these engineered defects will be presented. It will be shown that certain nanodefect configurations that provide the best performance at high-operating temperatures also provide the optimal properties at low operating temperatures out to high-applied magnetic fields. The talk will discuss vortex-pinning in both PLD films with self-assembled nanodefects as well as ex-situ MOD films with irradiation produced defects.

LN-2-INV

A novel route to prepare bulk superconductors: Spark Plasma Sintering and Texturing

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The unconventional sintering process called Spark Plasma Sintering (SPS) was used to prepare superconducting MgB_2 cryo-magnets. The role of the starting powder on the superconducting properties of MgB_2 has been investigated. Three sets of bulk MgB_2 material were processed from: (i) commercial available powder, (ii) a mixture of Mg metal and amorphous B using a single-step solid-state reaction process and (iii) a mixture of amorphous boron coated with carbon and Mg metal. The samples were prepared by varying different SPS processing conditions such as temperature, dwell time, applied pressure and atmosphere. The structural, microstructures of the samples were investigated by SEM and TEM and correlated to their superconducting properties. The best sample was prepared at 850°C. At 20K its critical current density was $J_c = 500\ kA/cm^2$, while the trapped field measured at the surface of a 20 mm diameter disk was equal to 3.9 T. The dependence on temperature of the levitation force was investigated on MgB_2 disks with various diameters and thicknesses. On the same samples, the levitation force took the same values from 17 to 32 K, as could be expected from the expression of the magnetic moment of the currents flowing in a superconducting cylinder proposed by E.H. Brandt [1]. Otherwise, the T_c determined from these measurements was equal to 38 K, in good agreement with measurements by other techniques. Overall these results suggest that bulk MgB_2 superconductors could be a viable variant for magnetic levitation and cryo-magnet applications.
The measurement of the properties of single phase $Bi_2Ca_2Sr_2CuO_8$ superconductor ceramics consolidated using new route referred as “Spark Plasma Texturing” (SPT) is in progress and will be also discussed.
[1] E.H.Brandt, Phys.Rev.58, 6506 (1998)

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