



Irreversibility Line and Enhancement of Magnetic Flux Pinning in Sm-Doped Y123 Superconductor with CuO Nanoparticles

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Abstract

$Y_{1-x}Sm_xBa_2Cu_3O_{7-\delta}$ ($x=0.00, 0.01, 0.02$ and 0.05 wt.%) samples with Nano-CuO have been prepared by the solid-state reaction method. The effects of Sm doped in the YBCO system with Nano-CuO (40 nm) on structural, critical temperature (T_c), irreversibility line (IL), critical current density, J_c and flux line pinning force are investigated. We also measured magnetization as a function of temperature (M–T) and magnetic loops (M–H) at constant temperatures of 10, 20, 30, 40, 50 and 60 K up to 10 kG. XRD measurements show that all the sintered samples have orthorhombic structure. The sample with $x=0.01$ wt.% Sm substituted for Y on YBCO superconductor improves the critical temperature more than that of the pure Y123 and the other samples. For this sample, the zero field-cooled and field-cooled magnetization as a function of temperature measurements reveals the shift of IL to higher temperatures and magnetic fields. The critical current density and flux pinning force calculated using the Bean's critical state model indicate an enhancement of J_c and F_p for the Sm-doped $x=0.01$ sample compared with the sample with $x=0.02$ and even the pure Y123.

Keywords High- T_c superconductors · Scanning electron microscopy · X-ray scattering · Irreversibility line · Critical current density