Effect of Co0.5Ni0.5Fe2O4 Nanoparticles Addition in Ag-Sheathed Bi-2223 Superconductor Tapes Prepared by Co-Precipitation Method

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Abstract:
Effect of complex magnetic oxide Co0.5Ni0.5Fe2O4 (CNFO) nanoparticles addition in (Bi1.6Pb0.4)Sr2Ca2Cu3O10 (Bi-2223) superconductor tapes was investigated. Ultrafine Bi-2223 powder precursor was prepared via co-precipitation method and was added with 0.01 – 0.05 wt.% Co0.5Ni0.5Fe2O4 nanoparticles during the final heating stage. The sample with 0.01 wt.% addition, Bi-2223(CNFO)0.01 was found to have the highest critical current density, Jc. This sample were then chosen to be fabricated into Ag-sheathed superconductor tapes using the powder-in-tube (PIT) method. The tapes were sintered for 50 and 100 h at 845 °C. The phase, microstructure and Jc of the samples were determined by powder X-ray diffraction (XRD), scanning electron microscopy (SEM) and four point probe, respectively. Jc of Ag-sheathed Bi-2223(CNFO)0.01 tapes sintered for 100 h was 19830 A/cm2 at 30 K and 3970 A/cm2 at 77 K compared to tapes without addition which showed a much lower Jc (6370 A/cm2 at 30 K). This study showed that CNFO nanoparticles could act as an effective flux pinning centers to enhance the critical current density in the Bi-2223 superconductor.

Keywords: Critical Current Density; Flux Pinning Centers; High Temperature Superconductor; Nanoparticles

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