Effects of rare earth nanoparticles (M= Sm2O3, Ho2O3, Nd2O3) addition on the microstructure and superconducting transition of Bi 1. 6Pb0. 4Sr2Ca2Cu3O10 ceramics

ABSTRACT

The effect of rare earth nanoparticles, M=Sm_2O_3, Nd_2O_3 and Ho_2O_3 added to $(Bi_{1.6}Pb_{0.4}Sr_2Ca_2Cu_3O_{10+\delta})$1-x(M)x, where x = 0.00 - 0.05, superconductor were studied by X-ray diffraction technique (XRD), resistivity (R), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDX). The volume fraction of high-Tc phase, Bi-2223, decreased from 84% for pure sample to 48, 30 and 23% at x = 0.05 for Sm_2O_3, Ho_2O_3 and Nd_2O_3 additions, respectively. The critical temperature Tc(R=0) that is 102 K for the pure sample decreased to 78, 73 and 69 K at x = 0.05 for samples with Sm_2O_3, Nd_2O_3 and Ho_2O_3 nanoparticles additions, respectively. The additions of rare earth nanoparticles decreased the grain size and increased the random orientation of the grains. The results showed that the phases' formations, variations of lattice parameters and electrical properties are sensitive to the size of nanoparticles and magnetic properties of its ions.

Keyword: High Tc phase (Bi-2223); Hole concentration; Pairing mechanism; Sm_2O_3, Ho_2O_3 and Nd_2O_3 rare earth nanoparticles