

Superconducting properties of bulk $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_{2-x}\text{Cd}_x\text{Cu}_3\text{O}_{10}$ system prepared via conventional solid state and coprecipitation methods

ABSTRACT

The effect of Cd doping on the superconducting properties of BSCCO system with nominal starting compositions of $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_{2-x}\text{Cd}_x\text{Cu}_3\text{O}_{10}$ ($x = 0.00\text{--}0.10$) was studied. The preparation methods used to prepare the samples are the conventional solid-state oxide powder (SSR) and the coprecipitation (COP) techniques. Resistivity versus temperature measurements ($R\text{--}T$) showed that all doped samples exhibited metallic behaviour. For the SSR samples, existence of a two step feature was observed at $x = 0.07$ indicating the presence a lower temperature 2212 phase together with the higher temperature 2223 phase. This behaviour resulted in the shifting of the $\text{TC}(R=0)$ towards lower temperature. However, the COP samples showed better superconducting properties probably due to higher homogeneity resulted from mixing of sub-micron particles during sintering. The $R\text{--}T$ curve did not display any two step features due to the single phase nature of the samples. This is confirmed by the XRD data where Bi-2212 phase was minor. In addition, small amount of doping ($x = 0.02$ in COP and SSR samples) enhanced the phase formation and $\text{TC}(R=0)$.

Keyword: Superconductor, Cd substitution, Phase formation