Texture effect and oxygen doping dependence of superconducting bulk samples of Bi2Sr2CaCu2O8+x

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Abstract

Superconductors are materials having zero resistivity under a certain value of temperature T, magnetic field H, and current density J. Bi2Sr2CaCu2O8+x is a superconducting material used in industrial applications such as current leads, magnetic screens, or fault current limiters. Bulk materials of Bi2Sr2CaCu2O8+x are synthesized by Nexans SuperConductors using the melt casting process. Despite of almost isotropic grain orientation, critical current densities Jc(77 K) in bulk samples may reach very high values of an order of 4 kA/cm2 comparable with those in well aligned tapes and wires (_˜10 kA/cm2). Such a behavior is difficult to understand within the known models of high-temperature superconductivity. The aim of this work is to study in detail the texture, its effects on Jc, and Jc dependence on the doping state (oxygen contents x in Bi2Sr2CaCu2O8+x). First results show that values of critical temperature as a function of oxygen content in our bulk samples follow the same behavior as single crystals. This behavior demonstrates that bulk annealing process is well implemented and controlled. Maximum values of critical current density and critical temperature are not observed for the same value of oxygen content suggesting that both physical parameters are not linked to the same physical phenomena. Texture path is studied to explain variation of critical current densities between samples differently oxygenated but preliminary results tend to show that texture does not differ much from one sample to another. Deeper texture studies have to be performed to confirm these preliminary results.

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