Influence of Preparation Conditions on Properties of Superconductor Bi-2223 Thin Films


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From both of scientific and technological points of view, it is important to study the effect of the thickness of film and substrate on the superconducting transition temperature, and to examine thickness for the occurrence of superconducting state. In this case of high-temperature superconducting (HTS), the dimensionality of HTS has also been an interesting subject for understanding the mechanism of superconducting phenomena. Intensive studies on the preparation of high-temperature superconducting thin films have been reported [1]. Several fabrication techniques of Bi-2223 films have been performed, such as pulse laser deposition [2], molecular beam epitaxy [3], co-evaporation [4], metal organic chemical vapor deposition [5] etc.

We report the electrical transport properties of Bi$_2$Sr$_2$CaCu$_2$O$_{8-x}$ (Bi-2223) thin films fabricated by pulsed laser deposition on SrTiO$_3$ substrates. The aim of the study was to investigate the influence of prepared conditions on the properties of the films. Three studied processing parameters which are deposition temperature ($T_d$), annealing time ($t$) and deposition rate ($r$) were investigated. The results show that the optimal results as critical temperature, $T_c=110$K and critical current density, $J_c=2.6 \times 10^6$A/cm$^2$ are obtained at $T_d=700$C, $r=4$h and $t=5$A/s. On the other hand we investigated effect of Li dopant on the Bi-2223 thin films. The resistive transition in the presence of the magnetic field exhibits a broadening induced by the magnetic field and the broadening increases with increasing field. The large broadening of resistivity curve in magnetic field suggests that this phenomenon is directly related to the intrinsic superconducting properties of this kind of oxide superconductors. The sudden drop in $J_c$ as soon as a magnetic field is applied (H=0.5 Tesla) is due to the effect of Josephson weak-links at the grain boundaries.

REFERENCES