Transport critical current density of Bi-Sr-Ca-Cu-O/Ag superconductor tapes with addition of Fe3O4 as flux pinning center

ABSTRACT

This paper reports on the flux pinning capability of micron size Fe3O4 in Bi-Sr-Ca-Cu-O superconductor tapes. Ag sheathed high temperature superconductor tapes with starting compositions (Bi,Pb)2Sr2Ca2Cu3O10 (2223) and(Bi,Pb)2Sr2Ca2Cu3O10-(Fe3O4)0.01 were fabricated using the powder in tube method.The Bi-Sr-Ca-Cu-O powders were prepared by using the co-precipitation technique.The effects of Fe3O4 addition on the microstructure, phase formation, critical temperature and transport critical current density, Jc were studied. The Jc value of the Fe3O4 added tapes is higher (6,090 A/cm2 at 77 K and 24,500 A/cm2 at 30 K, in zero field) than the non-added tapes (3,730 A/cm2 at 77 K and 13,3180 A/cm2 at 30 K, in zero field). A sudden decrease of Jc in low magnetic fields (B < 0.12 T) when applied parallel (B||) and perpendicular (B^) to the tapes surface was observed. The destruction of weak links played an important role in the early Jc suppression. The rate of decrease of Jc was observed to decrease when the magnetic field was increased further. Improvement in the flux pinning was observed in (Bi, Pb)2Sr2Ca2Cu3O10-Fe3O4)0.01 tapes. This study shows that magnetic particles such as Fe3O4 can act as effective pinning centers leading to the enhancement of Jc in the system.

Keyword: superconductor tapes, Fe3O4, flux pinning capability