Critical Current Density of Top-Seeded Melt Growth Processed $YBa_2Cu_3O_{7-y}$ Superconductors with Mo additions

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Impurity addition to melt processed $YBa_2Cu_3O_{7-y}$ (Y123) superconductors can increase the flux pinning force via formation of non-superconducting lattices in a superconducting phase. Transition metals such as Zn, Ni and Mo are good candidates for the doping element. To understand the effect of Mo addition to the superconductivity of a Y123 superconductors, YBCO superconductors with Mo additions were fabricated by top-seeded melt growth process. Mo powders of various compositions (0, 0.0025, 0.005, 0.01, 0.1 mol. %) were mixed with an Y123 powder using the ball milling technique. The powder mixtures were made into pellets by uniaxially and subsequent isostatic pressing. Single grain YBCO superconductor containing Mo were made by combined process of top seeding and slow cooling. The samples were oxygenated at 450 ^oC for 70 h in flowing oxygen gas. Microstructure was investigated by an optical microscope and scanning electron microscope (SEM) for the polished/etched surfaces samples. Magnetization curves are obtained by using of a superconducting quantum interference device magnetometer. Critical current density (J_c) was estimated using a Bean Model from the magnetization curves. It was observed that 0.01 mol % Mo added sample showed the peak effect at intermediate magnetic fields. The enhanced J_c due to the peak effect is attributed to the possible substitution of Cu by Mo or microstructure modification which produce fine size second particle phase which improve the flux pinning of an Y123 phase. We report processing parameters for the fabrication of single grain YBCO superconductors, phase formation, interior microstructure regarding flux pinning and the superconducting properties.

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