Phase Formation and Superconducting Properties of $Y_{1-x}Ca_xBa_2Cu_3O_{7-y}$ Superconductor

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Impurity doping has been attempted to enhance the electrical and magnetic properties of high-T_c superconductors. Some doping elements were known to be effective in improving current properties of $YBa_2Cu_3O_{7-y}$ (Y123) superconductor. Calcium is known to substitute for yttrium or barium to an appropriate doping level. The effect of calcium doping for yttrium site on the microstructure and the critical current density of a sintered $YBa_2Cu_3O_{7-y}$ sample was investigated. $Y_{1-x}Ca_xBa_2Cu_3O_{y-7}$ (x=0, 0.01, 0.04, 0.05, 0.1, 0.2) samples were synthesized by solid state reaction method using powders. Powder mixtures of Y_2O_3, $BaCO_3$ and CuO of appropriate compositions were clacined at 900°C for 10 h, crushed thoroughly and then calcined at 920°C for 10 h again. $Y_{1-x}Ca_xBa_2Cu_3O_{y-7}$ powders were uniaxially pressed in a steel mold into pellets, isostatically pressed in a water chamber again for densification. The pellets were sintered at 920°C for 10 h in air and annealed in flowing oxygen for oxygen embedding to an $Y_{1-x}Ca_xBa_2Cu_3O_{y-7}$ lattice. Microstructure was investigated by using of scanning electron micrograph and the phase formation was identified by powder x-ray diffraction. Superconducting transition temperature and critical current density at 77 K were estimated by a superconducting quantum interference device (SQUID) magnetometer. We report the effect of calcium doping on phase formation, crystal structure, grain morphology, superconducting properties associated with flux pinning.

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