

Superconducting properties of $Y(Ba_{1-x}Ca_x)_2Cu_3O_{7-\delta}$ ($0 \leq x \leq 0.05$) system

ABSTRACT

A series of polycrystalline compounds with a nominal composition of $Y(Ba_{1-x}Ca_x)_2Cu_3O_7$ ($0 \leq x \leq 0.05$) had been synthesized using solid state reaction method. Crystal structure of those samples was characterized by Rietveld refinement on the x-ray powder diffraction data. It was found that the structural parameters were not changed appreciably with Ca content in $Y(Ba_{1-x}Ca_x)_2Cu_3O_7$. While c-axis remained almost unchanged, both a and b axes decreased slightly leading to the decrease in orthorhombicity of Y-123 phase. The superconducting transition temperature, T_c was determined by measuring the change of electrical resistance versus temperature (50 K to 300 K) using a four point probe technique. The T_c was observed to decrease gradually by Ca doping from 91 K for $x=0.00$ to 88 K for $x=0.05$ attributable to oxygen vacancy disorder. In addition, the superconducting transition breadth, ΔT , increased with Ca doping because of degraded crystallinity or inhomogeneity of the samples. Finally, scanning electron micrographs indicated grain growth induced by Ca doping.

Keyword: Grain growth; Orthorhombicity; Superconducting transition temperature; YBCO