

Effect of sol-gel synthesized BiFeO₃ nanoparticle addition in YBa₂Cu₃O_{7-δ} (Y123) superconductor synthesized by standard solid state reaction method

ABSTRACT

The effects of the multiferroic BiFeO₃ nanoparticles addition on the structure and superconducting properties of YBa₂Cu₃O_{7-δ} (Y123) with different concentrations were systematically investigated using X-ray diffraction (XRD), field emission scanning electron micrograph (FESEM), EDX and four point probe measurement. It was found that the added samples were predominant by Y-123 phase beside small amount of Y-211 and unreacted BiFeO₃ secondary phases. Samples with less (wt.%) BFO added YBCO precursor powder preserved the orthorhombic structure similar to the pure YBCO, while samples with higher wt% addition show orthorhombic-to-tetragonal transition tendency. The samples became more porous and their grain size slightly decreased with addition of BiFeO₃. The addition of nanoBiFeO₃ disturbed the grain growth of Y123, thus resulting in the degradation of superconducting properties of the samples. The superconducting transition temperature (T_c onset) of samples decreased from 92 K for x=0.0 to 44 K for x=10.0 wt. %, which could be attributable to oxygen vacancy disorder.

Keyword: BFO; Critical temperature; Multiferroics; Sol-gel; Solid stat; YBCO