Electrospinning Synthesis of Bi-2223 Superconducting Nanowires

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ABSTRACT

This paper presents the synthesis and characterization of Bi2Sr2Ca2Cu3O8+x superconducting nanowires. Bi2Sr2Ca2Cu3O8+x nanowires with *T*c = 68 K were synthesized using the electrospinning process employing sol–gel precursors. A sol–gel methodology was used to obtain a homogeneous PVP solution containing Bi, Sr, Ca, and Cu oxalates. Samples were heattreated at 120 °C to remove excess moisture, and then at 850 °C in box furnace. Bulk sample was also prepared using coprecipitation method for comparison. Based on XRD, the nanowire sample showed minimal Bi-2223 phases and apparent Bi-2212 phases. The morphology, microstructure, and crystal structure of these nanowires were examined using field emission scanning electron microscopy (FESEM) to reveal a rectangular morphology having typical wire thickness in the range of 150–1000 nm. Electrospun Bi-2223 were grinded and pressed at 0.9 GPa into pellets. DC measurements were conducted to investigate the critical transition temperature (*T*c) of Bi-2223 nanowires and to compare their magnetic properties to those of coprecipitated Bi-2223 pellets. The *T*c for the bulk sample is observed at 101 K and electrospun Bi-2223 at 68 K. Coprecipitated Bi-2223 was added with Pb whereas electrospun Bi-2223 does not employ Pb. These results point to the existence of utilizing of the substitution of Pb with Bi; Bi-2223 phases in pressed nanowire are less, and the potential of using electrospinning to synthesis functional Bi-2233 superconductors.

KEYWORDS: High temperature superconductors, BSCCO, Electrospinning, Nanowires.

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