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Synthesis and characteristics of $(Bi_2Ba_3O_{4-\delta})_{b1/b2}CoO_2$ thin films by chemical solution deposition

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Abstract

$(Bi_2Ba_3O_{4-\delta})_{b1/b2}CoO_2$ (BBC) thin films are prepared on $LaAlO_3$ (*001*) single crystal substrates by chemical solution deposition. The annealing temperature effects on the thin film microstructures as well as transport properties are investigated. The results of X-ray diffraction, energy dispersive spectrometry and transmission electron microscopy confirm the formation of stoichiometric BBC thin films with *c*-axis orientation. Annealing temperature plays a very important role in determination of resistivity and Seebeck coefficient due to the variations of grain size, carrier concentration and mobility. The resistivity behaviors for the different temperature-annealed thin films obey different electrical transport mechanisms at low, medium and high measured temperature ranges. The optimized BBC thin film is annealed at 600 °C, showing a metal-insulator transition at about 100 K and the resistivity and Seebeck coefficient at 300 K is of 8.7 mΩ cm, 74.4 μV K^{-1}, respectively. The results will provide an effective route to fabricate BBC thin films as well as a guidance for investigation about its transport properties.