

Growth of Y-123 Thick Film with Modified Ultrasonic Spray Pyrolysis method and effects of post-annealing on the critical current density

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Abstract

Y-123 material was fabricated by solid state reaction technique. After appropriate heat treatment, Y-123 powders were inserted in to the ball-milling system for 2 h to decrease grain size. The nano sized powders obtained were then mixed in ethanol to obtain colloidal system. Mixture was atomized with 2.4 MHz ultrasonic nebulizer system on to the polished MgO and SrTiO₃ single crystal substrates at room temperature for fabrication of thick films. After nebulization a suitable heat treatment was applied to the films and ~1 µm thick films were obtained. Microstructural, Electrical and I-V properties were investigated by using XRD, SEM-EDX and PPMS analysis. The superconducting transition temperatures, T_c, was obtained to be 92 K and the T_{zero} was obtained to be 85 K for MgO single crystal substrates. But the films produced on the SrTiO₃ single crystal substrates showed slightly better result than the MgO substrates. The critical current density was obtained to be 3.2x10³ A/cm² for the best sample. However after post annealing microstructural formation and critical current density increased largely. We also describe largely the modification on the ultrasonic spraying method and its effect on the film production and the properties. We also discussed the large scale fabrication using ultrasonic spraying method.

Keywords: Y-123, Modified USP, Thick Film