Interaction between $BaZrO_3$ Nano-rods and RE_2O_3 Nano-dots and Its Effects on the Flux Pinning in Zr:REBCO Tapes

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Abstract - The effects of Zr content and rare-earth content on the micro-structural and superconducting properties of Zr:GdYBCO coated superconducting tapes were systematically studied. At a lower temperature, the Zr content required for optimum pinning increases. At a temperature below 40K and magnetic field of 3T, the Zr content for optimum pinning is 15% or higher. The effects of rare earth composition on the microstructure and superconducting properties were studied for 15% Zr-added (Gd,Y)BCO superconducting tapes. It is found that the Gd+Y content of 1.2 is the optimized (Gd,Y) composition for the growth of long BZO nanorods. It is also the optimum (Gd,Y) content for the 15% Zr-added (Gd,Y)BCO achieving the best in-field performance. The Zr:(Gd,Y)BCO films with long BZO nanorods, exhibit better in-field performance at low temperature than the short nanorods. Long BZO nanorods growing through the entire thickness of the film were seen only in the (Gd,Y)1.2 tapes. The composition effects are more significant at low temperature than at 77K. In fact, the minimum critical current for all magnetic-field-angle at 30K and 3T, I_c(30K,3T), as a function of Gd+Y content showed a sharp peak at Gd+Y=1.2; while I_c(77K,1T) varies not much with the variation of Gd+Y in the range from 1.1 to 1.5.

Keywords - YBCO, Flux pinning, Coated conductor, MOCVD

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