Composition Effects on the Critical Current of MOCVD-processed Zr:GdYBCO Coated Conductors in an Applied Magnetic Field

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Abstract - Zr:GdYBCO films were grown by reel-to-reel metal organic chemical vapor deposition (MOCVD) on hastelloy tapes with IBAD-MgO-based buffer. The composition was varied systematically to investigate the effects of changes in (Gd+Y)/Ba, (Gd+Y)/Cu and Gd/Y ratios and Zr-doping concentration on the critical current density (J_c) of the films in an applied magnetic field (B). The magnetic-field-angle dependence of J_c measured at 77K and 1T showed that (1) for Gd+Y content ranging from 1.2 to 1.5, the minimum J_c for any angle did not vary significantly with the Gd+Y content; while the J_c at B//c varied significantly and took its maximum value at Gd+Y content of 1.2; (2) increasing Gd+Y could suppress or level off the J_c peak at B//c which was associated with the pinning from $BaZrO_3$ nano-columns; (3) the optimum Zr-concentration for the highest J_c(77K, 1T) is in the range of 0.04 – 0.07 in the film; in this range under certain growth condition, the c-peak in the angular dependence of J_c could be higher than the ab-peak; (4) increasing Gd/Y ratio increased J_{c_min}(77K, 1T); (5) in self-field or low field, however, the optimized Gd/Y ratio was about 1.

Index Terms - Composition effects, MOCVD, YBCO, 2G HTS, Coated conductor

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