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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