Microstructural Development in High-J_c (I_C) $YBa_2Cu_3O_7$ Coated Conductors Based on *Ex-Situ* YBCO Conversion Processes

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Abstract – The ex-situ conversion of BaF_2-based, $YBa_2Cu_3O_y$ precursors has been shown to be an efficient and economically attractive process for adding the superconducting layer to a coated conductor template. Recently, J_c's and I_c's exceeding 3 MA/cm^2 and 250 A/cm-width at liquid nitrogen temperatures and self-field have been reported for long length coated conductors containing 0.8 μm thick YBCO films. Understanding the phase conversion process and final microstructural assemblage is crucial to maximizing the superconducting properties. Detrimental defects in the coated conductor composite can arise from substrate imperfections, interfacial reactions, buffer layer defects, and certain aspects of the *ex-situ* conversion process of the YBCO precursors. With the recent advances in template and buffer layer processes, the focus has shifted to understanding in greater detail and optimizing a conversion process in which partial melts play a role that is not fully understood in the phase development. This work examines the growth mode, porosity distributions, connectivity, long-length uniformity, through-thickness film uniformity, and flux pinning properties of these wires. In particular, a detailed microstructural review of small-angle grain boundaries, coherent and non-coherent secondary phases, planar defects, and porosity in the YBCO films is presented and discussed with respect to their effects on transport critical currents in self and applied fields.

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