Granularity-induced field-hysteresis of transport critical current in patterned coated conductors

A. A. GAPUD, A. KHAN, University of South Alabama, D. K. CHRISTEN, F. A. LIST III, R. FEENSTRA, Oak Ridge National Laboratory — In superconducting coated conductors such as RABiTS and IBAD films, intergranular misorientations have been effectively minimized, but a small number of local, higher-angle misorientations remain. One important effect of such weak links is the hysteresis of the critical current density \( J_c \) with respect to applied field \( H \), brought about when large circulating currents trapped within adjacent grains produce a focused field within the grain boundaries (GB’s) which can partially cancel out \( H \) when applied field is decreasing, thus shifting the maximum \( J_c \) from zero \( H \) to a finite field where the local field at the GB is at minimum. This effect has been seen recently in measurements of magnetization (induced) currents, but has not been documented using transport (applied) current. However, in samples that are patterned into conduits 200 \( \mu \)m wide or less, the hysteretic effect on transport \( J_c \) is clearly seen. This discrepancy between ‘magnetization \( J_c \)’ and ‘transport \( J_c \)’ may be due to differences in voltage criterion between the two types of measurement, as will be discussed. Systematic measurements and analyses will be presented, along with ramifications for applications.

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