

# Intra- and Inter-Granular Critical Currents of Coated Conductors from Field-Hysteretic Transport $J_c$

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**Intra- and inter-granular critical currents of coated conductors from field-hysteretic transport  $J_c$**  A.A. GAPUD\*, \*Oak Ridge Natl Lab, Oak Ridge, TN, J. R. THOMPSON\*,<sup>+</sup>, <sup>+</sup>Dept Physics, Univ. Tennessee, Knoxville, TN, D.K. CHRISTEN\*, H.J. KIM<sup>+</sup>, R. FEENSTRA\*, D.M. FELDMANN, Dept Physics, Univ. Wisconsin, Madison WI — Supercurrent flow through grain/grain-boundary (GB) networks in superconductors is both interesting and important for applications like coated conductors (CCs). In such systems, the critical current density  $J_c(H)$  can be hysteretic in applied magnetic field  $H$ . Particularly interesting is the peak in  $J_c(H)$  at low and *decreasing*  $H$ , which arises from cancellation of  $H$  in the GBs by a return field due to currents in the grains. For CCs, the peak in magnetization has been analyzed by Palau et al. However, the percolative currents in CCs mean that no hysteresis in the *transport*  $J_c(H)$  has been seen until now. Films on RABiTS and IBAD-YSZ-Hastelloy were progressively narrowed to eliminate most percolation around GBs. Transport measurements then revealed hysteresis peaks in  $J_c(H)$ . Comparative studies were conducted on YBCO films on SrTiO<sub>3</sub> bicrystals having a single [001] grain boundary of angle 2–14°. For linear-strip and ring samples, transport and magnetic studies showed a hysteretic  $J_c$  with a large field-cancellation peak in decreasing  $H$ . Modeling yields good agreement with observed intra- and GB  $J_c$ 's. ORNL is managed by UT-Battelle for USDOE.

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