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Matching field effects in high- T_c superconductors with self-assembled columnar defects J.W. SINCLAIR, University of Tennessee, Y.L. ZUEV, Oak Ridge National Laboratory, J.R. THOMPSON, University of Tennessee, Knoxville, D.K. CHRISTEN, C. CANTONI, S.-H. WEE, A. GOYAL, Oak Ridge National Laboratory, C. VARANASI, Univ of Dayton/Air Force Research Lab — Columnar defects (CDs) in a superconductor provide angularly selective vortex pinning, where the density of CDs provides a natural scale for the magnetic field, the “matching field.” While dramatic changes in the critical current density J_c might be expected when the vortex density exceeds the CD density, observations of this phenomena has been elusive in systems with chemically produced, self-assembled CDs of BaSnO₃, BaZrO₃, SrZrO₃, etc. Here we describe studies of two RBa₂Cu₃O_{~7} systems containing these self-avoiding CDs, using either contact free magnetic or transport measurements. In magnetic measurements on a material with measured areal CD of ~ 2.5 T, the J_c decreased abruptly when the applied field H exceeded this level; this feature was observed over a wide temperature range, from 77 to ~ 40 K. All these features disappeared when the field was tilted away from the CD orientation. Research at ORNL sponsored by US DOE.

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