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Magnetization, Creep, and Flux Pinning in $YBa_2Cu_3O_{7-x}$ Thin Films with Nanoscale Pinning M.D. SUMPTION, Ohio State University, T.J. HAUGAN, P.N. BARNES, Air Force Research Laboratory, C. VARANASI, University of Dayton Research Inst. — Critical current and flux pinning have been studied for $YBa_2Cu_3O_{7-x}$ (YBCO) thin films with Y_2BaCuO_5 (211) precipitates introduced as layers and as random distributions. Magnetically determined critical current density (J_c) was fit to $J_c \propto B^{-\alpha}$ and values of α were suppressed from the control sample values of $\alpha = 0.5$ to lower values for pinned samples, reaching as low as $\alpha = 0.2$ for the layer pinned 211 sample at low temperatures. $U(J)$ vs J curves were extracted from M-H measurements with various ramp rates, at temperatures from 4.2 K to 77 K for pinned and control samples. Direct magnetization decay measurements were made for the 211 layer pinned sample and good agreement was seen with ramp rate derived results. Values of $\mu \cong 0.6$-0.8 were seen for all samples, while $\nu \cong 0.4$ for control samples, 0.1 for layer pinned samples, and 0.2-0.4 for the random pinned samples. The values of μ and ν extracted were inconsistent with 2-D pinning behavior in all cases, even though the layer spacing in the layer pinned sample is smaller than the calculated collective correlation length. While the layer pinned sample is clearly in the collective pinning regime, the artificial defects in the random pinned sample may be in the isolated strong pinning regime.

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