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Critical currents, magnetic relaxation and pinning in Nd$Ba_2Cu_3O_{7-\delta}$ films with BaZrO_3 generated columnar defects[1] A.O. IJADUOLA, Department of Physics, North Georgia College and State University, S.H. WEE, A. GOYAL, P.M. MARTIN, J. LI, Oak Ridge National Laboratory, J.R. THOMPSON, Department of Physics, University of Tennessee, D.K. CHRISTEN, Oak Ridge National Laboratory — The critical current density J_c and the magnetic relaxation (creep) properties have been studied for a set of $NdBa_2Cu_3O_{7-\delta}$(NdBCO) films doped with $BaZrO_3$ (BZO) nanoparticles to form columnar defects. The dependence of J_c on the magnitude and orientation of the applied magnetic field H_{app} (0-6.5 T) and temperature T (5 K-T_c) was investigated. The normalized flux-creep rate $S = -dln(J)/dln(t)$ was determined as a function of T. The current dependence of the effective activation energy $U_{eff}(J)$ was derived using the formalism developed by Maley. The results are well described by an inverse power law type barrier of the form $U_{eff}(J) \sim U_0(J_0/J)^{\mu}$ with fitted values for the pinning energy scale U_0 and the glassy exponent μ. When comparing values for these parameters in the BZO-doped samples with those for their undoped control counterparts, the most striking difference is the larger scale of current density J_0 in the doped samples (a factor of 2.4 higher), while the other pinning parameters do not differ strongly. In the BZO-doped materials, the pinning energy scale U_0 increases with vortex density and J_0 decreases, with both following simple power law dependences on the field.

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