Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Current density in YBCO-based Tapes Studied over 8 Decades of Dissipation[1] J.R. THOMPSON, Univ Tennessee & Oak Ridge Natl Lab, OZGUR POLAT, Univ. Tennessee, D.K. CHRISTEN, ORNL, D. KUMAR, NC A&T Univ., P.M. MARTIN, ORNL, J.W. SINCLAIR, Univ. Tennessee — Many applications of superconductors require conduction of high density electric currents in a magnetic field, with minimal dissipation. We investigated the dependence of current density J on electric field E due to motion of depinned vortices, over a range of $\sim 10^8$ in E. The materials are pre-commercial $YBa_2Cu_3O_{\sim 7}$ coated conductors (3.5μm) on buffered Hastelloy substrates prepared by SuperPower, Inc. Experimental methods include conventional 4-probe electrical transport at the highest E fields; inductive measurements of magnetic moment $m \sim J$ using a swept magnetic field $\mathrm{d}H/\mathrm{d}t \sim E$ at lower E fields; and time dependent "flux creep" measurement where $\mathrm{d}m/\mathrm{d}t \sim E$. At $T = 77$ K, a power law variation $E \sim J^n$ is found. The resulting $E(J)$ dependencies become steeper, i.e., the characteristic n-value increases, as J is reduced, reflecting a diverging activation energy for vortex movement. The inductive studies are easily extended to lower temperatures and a wide range of magnetic fields. Implications for applications will be discussed.

[1]Research sponsored by DOE, Division of Materials Sciences and Engineering, and Office of Electricity Delivery and Energy Reliability.

J.R. Thompson
Univ Tennessee

Date submitted: 29 Nov 2007 Electronic form version 1.4