J. R. Thompson, Department of Physics, University of Tennessee,
Knoxville, Tennessee and Solid State Division

"Quantum Constraints on Technological Superconductors: Vortex Tunneling in Bi-2212/Ag Tapes with Randomly Oriented Columnar Defects," 9th US-Japan Workshop on High-T_c Superconductors (Yamanashi, Japan, October 13-15, 1999)

Abstract- Vortex pinning in textured Bi-2212/Ag superconducting tapes was enhanced by irradiation with 0.8 GeV protons, creating randomly oriented columnar defects via a fission process. As shown previously, these strong pins enhance the persistent current density J and expand the irreversible region (the region of finite-J) by 20-30 K. To understand the constraints on attainable performance of the material at low temperatures, we have studied the time dependence of J in the range 2 - 40 K. This work shows that thermally activated current decay was greatly decreased, compared with unirradiated tapes. However, temperature-independent quantum tunneling of vortices considerably limits J and its temporal stability for a significant fraction of the finite-J_c region. These studies were conducted for a range of magnetic fields H = 0.25 - 2 tesla applied perpendicular to the tapes.