

Thermodynamics and vortex pinning by columnar defects in HTS single crystals

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Abstract

Measurements of the equilibrium magnetisation of heavy-ion irradiated high temperature superconductors reveal important information on the pinning potential and the fraction of vortices trapped by a columnar defect. Such measurements are complementary to those of the Josephson plasma resonance and c -axis resistivity, which are sensitive to pancake vortex alignment but not to the fraction of trapped vortices. A correlation with the irreversible magnetisation gives clues as to the nature of vortex dynamics. We will present reversible magnetisation data on BSCCO 2122 single crystals irradiated with 6 GeV Pb ions at various angles with respect to the c -axis; these yield the value of the pinning energy and show that core pinning is predominant. An analysis of the field and temperature dependence of the reversible magnetisation sheds light on the origin of the different parts of the irreversibility line, while angular-dependent torque measurements are used to elucidate the origin of the directional pinning effect of the columnar defects.