In-plane anisotropy of the vortex melting line in $YBa_2Cu_4O_8$

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Abstract

In $YBa_2Cu_4O_8$, the c-axis resistivity $\rho_c(T)$ changes dramatically from metallic to insulating behaviour when a large magnetic field is applied perpendicular to the CuO chains ($B//a$) [Hussey *et al.*, Phys. Rev. Lett. **80**, 2909 (1998)]. Here we report the effect of this field-induced dimensional crossover on the mixed state resistivity of $YBa_2Cu_4O_8$. For all field directions ($B//a, b, c$), a "kink" is observed in the resistive transition, below which, the resistive dissipation show non-Ohmic behaviour. This feature has been observed in several other high-T_c cuprates where it has been shown to correspond to the melting transition of the vortex lattice. This resistive kink shows a distinct dependence on the direction of the magnetic field within the plane, occuring at lower temperatures for $B//a$. Moreover, the in-plane anisotropy of the melting line increases as the magnetic field increases. These observations demonstrate clearly the dominant role of the electronic anisotropy in determining the vortex phase diagram of high-T_c cuprates.

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