Resistivity hysteresis in moving vortex lattice phase of $YBa_2Cu_3O_y$ single crystal

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Abstract

Effect of probing current on the first-order vortex lattice melting transition have been investigated for untwinned $YBa_2Cu_3O_y$ single crystal. The transition temperature T_m is slightly affected by applying current: for example, it is lowered by ca. 50 mK for the current density of 5 A/cm^2. The hysteretic behavior of the electrical resistivity ρ is observed in the vicinity of the transition line. For current densities below 1 A/cm^2, the resistive transition temperature on cooling is independent of applying current, while it on warming decreases gradually with increasing current. The V/I values on warming and cooling measured from I-V characteristics coincide with each other at high current densities above 5 A/cm^2. This is consistent with the result that the hysteretic behavior of the resistive transition almost disappears in this current region. Moreover, just below the resistive transition, the flow resistance with small hysteresis accompanied by a small dip is observed in this current region. These behaviors are discussed on the basis of the melting of the moving vortex lattice.