Vortex Phase Diagram of Bi2212 Investigated by Resistivity Measurements

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Abstract

The phase diagram of the vortex matter is investigated by measuring the in-plane resitivity (ρ) of $Bi_2Sr_2CaCu_2O_y$ (Bi2212) single crystals with the magnetic fields applied along the c-axis direction. Crystals with various doping levels from the underdoped to the overdoped regime were prepared by adjusting the oxygen contents through careful heat treatments. The resistivity steps marking the first-order (melting) transition were observed in all of the crystals regardless of the doping level, when the applied field was smaller than the so-called "secondary peak field" (H_{pk}). On the other hand, the ρ-T curves followed the critical scaling of the vortex-glass transition for applied fields larger than H_{pk}. The results indicate that the low-field high-temperature region of the phase diagram is primary determined by the anisotropy parameter, and is rather insensitive to the sample quality. In contrast, the glass-transition tempearture is not scaled (at least solely) by the anisotropy parameter. The dimensionality of the vortex-liquid phase will also be discussed.