Transport Properties of Flux Motion in High-Tc Superconducting YBCO Films

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ABSTRACT

The mixed-state longitudinal (ρ xx) and transverse (ρ xy) resistivities were examined in order to study the effect of flux pinning in a YBa2Cu3Oy (YBCO) thin films with an artificial anti-dot lattice. The antidotes were arranged in a rectangular array with lattices parameters of a = 1 μ m and b = 1.6 μ m, and extend over 20 μ m × 20 μ m areas by e-beam lithography process. The activation energy U, ρ xx , Hall coefficient RH, and ρ xy were measured with currents applied along the a-axis and b-axis directions of the rectangular array, respectively. It was observed that the sign reversal of the Hall coefficient RH diminishes within the measured configuration with current applied along the a axis of the rectangular array, accompanying an observed decrease of U. This implies that the mechanism of flux flow may be the most important origin of the anomalous Hall effect and the sign reversal of RH is sensitive to the flux pinning. In addition, the exponent β in scaling behavior ρ xy~ ρ xx β is magnetic field dependent and becomes smaller when the current is applied along the a axis of the rectangular array. The experimental results are discussed within the framework of vortex-dynamics theories.

Keywords : High-Tc superconductor ; Hall effect ; Pinning potential energy ; Negative Hall resistivity

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