Intrinsic Pinning of the Josephson Vortex in a Layered Superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ Studied by the Conversion between Ultrasonic and Electromagntic Waves

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Abstract

Through the measurement of the mutual conversion between ultrasonic and electromagnetic waves via vortex pinning, the pinning of vortex in $Bi_2Sr_2CaCu_2O_{8+\delta}$ has been investigated. The interaction with the longitudinal ultrasonic wave is dramatically enhaced due to the intrinsic pinning of the Josephson vortex, when the magnetic field is applied nearly parallel to the superconducting plane. In high temperature region, both the angle region and strength of intrinsic pinning are reduced by thermal fluctuation. On the other hand, in the region of irreversible pancake pinning, the intrinsic pinning is weakened due to folded vortex structure, in which Josephson vortex cannot develop along the superconducting plane. The strengh of intrinsic pinning was found to be reduced above Josephson core overlapping field, which decreases with increase of anisotropy parameter.