

Two-dimensional superconductivity of ultrathin Bi films on cleaved GaAs surfaces

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We have performed magnetotransport measurements on ultrathin Bi films on GaAs (110) surfaces. To reduce disorder arising from the substrate, we used cleaved surfaces of insulating GaAs. Based on the technique of the previous works on InAs inversion layers^{1 2}, our experimental procedure is as follows: (1) A GaAs crystal was cleaved at liquid helium temperatures in an ultrahigh vacuum chamber. (2) An amorphous Bi films was produced by quench-condensation. (3) Four-probe transport measurements were performed using Au electrodes on noncleaved surfaces. The critical film thickness for superconductivity was obtained to be 4.2Å, which is thinner than the previous data for different kinds of substrates³.

In the study of I - V characteristics, we observed discontinuous jump in the temperature dependence of the power α in $V \propto I^\alpha$, which is associated with “universal jump” of the Kosterlitz-Thouless transition. This indicates that the KT transition can occur in amorphous films as well as Josephson-coupled arrays. We also observed the anisotropy of the parallel and perpendicular magnetic dependence of the resistance.

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