

Josephson Effects in Planar MgB₂/Au/Nb and MgB₂/Nb Junctions

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We have studied fabrication of planar multi-layer MgB₂ Josephson junctions. Base MgB₂ thin films were prepared by rf-magnetron sputter deposition of B precursor film with ex-situ Mg-diffusion annealing. To get a smooth surface the MgB₂ thin film was dry-polished with 1/4 micron diamond polishing powder. The junction contains either a 10 nm thin Au normal barrier layer or no artificial barrier. The Nb counter film was deposited by a dc magnetron sputtering method. The junction area was 4 μm × 4 μm. We measured current-voltage (I-V) curves and modulation of the junction critical current in response to external magnetic fields. The junctions showed typical resistively-shunted-junction characteristics. The junction critical current density measured at 4.2 K was 4.8×10³ A/cm² for the MgB₂/Au(10 nm)/Nb junction and 3.2×10⁴ A/cm² for the MgB₂/Nb junction. We observed a Fraunhofer-like periodic modulation of the junction critical current by applying external magnetic fields at 4.2 K.

Keywords : MgB₂, Josephson junction