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The Penetration Depth of MgB_2 as measured by DC SQUIDs
DANIEL CUNNANE, KE CHEN, X.X. XI, Temple University — High-speed superconducting circuits may benefit from the high T_c and large superconducting gap of MgB_2. Nb remains the state of the art for superconducting electronics partly because of its small penetration depth and its isotropic nature. A microscopic theory on the penetration depth of multiband superconductors states that a clean MgB_2 sample is nearly isotropic while a sample in the dirty limit is anisotropic. We have made and measured DC SQUIDs using MgB_2 Josephson junctions to determine the inductance of an MgB_2 microstrip. The penetration depth along the c-axis, λ_c, was calculated using the inductance value and dimensions of the microstrip. We have previously reported the absolute value of the penetration depth of our MgB_2 films to be around 40 nm. Now we have made devices with film ranging from the clean limit to the dirty limit by adding defects during the deposition. The absolute value of λ_c at low temperature is compared to the cleanliness of the film. The temperature dependence was also measured which is non-trivial due to the two-gap nature of MgB_2. These results are compared with theory that confirmed our previous results.

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