Abstract Submitted
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Determining the energy gaps of MgB_2 electrodes in all-MgB_2 Josephson junctions using tunneling spectroscopy[1] JOSEPH LAMBERT, University of the Sciences, MASAHITO SAKODA, MICHIO NAITO, Tokyo University of Agriculture and Technology, ROBERTO RAMOS, University of the Sciences — Magnesium diboride (MgB_2) is a novel BCS superconductor, possessing two distinct momentum-dependent gaps. Substructure within the gaps has previously been characterized using tunneling spectroscopy of 1-gap/2-gap heterojunctions, in which the counter electrode is a conventional single-gap superconductor, such as Pb or Sn. Here, we report tunneling spectroscopy measurements of 2-gap/2-gap all-MgB_2 Josephson junctions, with different barrier materials including MgO. The crystal orientations of the two MgB_2 films are mostly c-axis parallel to the tunneling direction, resulting in very small contribution from the larger σ gap. Additionally, due to differences in growth conditions, the two MgB_2 electrodes have different critical temperatures and gap values. We present our analysis of differential conductance measurements using a modified tunneling model in which each electrode is represented as a weighted sum of two BCS densities of states. We observe (1) a transition from SIS to NIS behavior as the temperature increases past the lower T_c electrode, and (2) the presence of multiple quasiparticle peaks due to the sums and differences in various pairwise combinations of disparate π and σ gap values within each electrode.

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