Josephson junction between two high T_c superconductors with arbitrary transparency of interface

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Abstract

In this paper, a dc Josephson junction between two singlet superconductors (d-wave and s-wave) with arbitrary reflection coefficient has been investigated theoretically. For the case of high T_c superconductors, the c-axes are parallel to an interface with finite transparency and their ab-planes have a mis-orientation. The physics of potential barrier will be demonstrated by a transparency coefficient via which the tunneling will occur. We have solved the nonlocal Eilenberger equations and obtained the corresponding and suitable Green functions analytically. Then, using the obtained Green functions, the current-phase diagrams have been calculated. The effect of the potential barrier and mis-orientation on the currents is studied analytically and numerically. It is observed that, the current phase relations are totally different from the case of ideal transparent Josephson junctions between d-wave superconductors and two s-wave superconductors. This apparatus can be used to demonstrate d-wave order parameter in high T_c superconductors.

Keywords: Josephson junction, high T_c superconductor, d-wave, transparency

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