Effect of Spin-polarized Current Injection on Pair Tunneling Properties of $Bi_2Sr_2CaCu_2O_{8+x}$ Intrinsic Josephson Junctions

Ho-Seop Shin, Hu-Jong Lee, Do Bang

Department of Physics, Pohang University of Science and Technology, Pohang 790-784, Republic of Korea

We studied the tunneling conduction properties of intrinsic Josephson junctions (IJJs) formed in $Bi_2Sr_2CaCu_2O_{8+x}$ single crystals for the injection of spin-polarized bias currents. Properties of an identical stack ($10\times5.0\times0.030$ m^3) of IJJs were compared for the bias current injected through Au and Co electrodes. Clear quasiparticle branches in tunneling current-voltage (*I-V*) curves from the IJJs in the stack were observed for an unpolarized bias current through the Au electrode. On the other hand, spin injection through the Co electrode to the same stack caused pair breaking in the CuO_2 double layers, which led to reduction of the Josephson critical current and the superconducting gap revealed in the tunneling *I-V* curves. This result may provide valuable information on clarifying the mechanism of high-T_c superconductivity, where the interlayer coupling characteristics are considered to play a crucial role. It can also be utilized to develop spin-dependent high- T_c active devices.

keywords : spin-dependent tunneling properties, pair breaking, intrinsic Josephson junctions