Suppression of the Superconductivity in $Bi_2Sr_2CaCu_2O_{8+\delta}$ Single Crystals by *C*-axis Spin Injection into a Small Stack of Intrinsic Junctions

Ho-Seop Shin and Hu-Jong Lee

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

We studied the effect of spin injection along the *c*-axis direction of $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi-2212) single crystals. To that end, we fabricated mesa structure (40 x 10 x 0.02μm^3) on the surface of Bi-2212 single crystals. About 80-nm-thick Co contact electrode of lateral dimension 100 x 10 x 0.08μm^3 and 300-nm-thick Au electrode were then deposited in a four-terminal configuration on the mesa with predeposited 20-nm-thick Au layer. This structure was used to inject either an unpolarized or a spin-polarized current into the mesa of layered CuO_2 double layers. For an ordinary unpolarized-current injection through the Au electrode clear quasiparticle branch splitting from each intrinsic Josephson junction in the mesa was observed. In contrast, spin-polarized current injection through Co electrode caused pair breaking in the CuO_2 double layers and thus led to vanishing of the Josephson critical current density and consequently the quasiparticle branches as well. The latter effect indicates that the junction of Co/(20nm thick)Au/Bi-2212 structure was highly effective for the spin injection into Bi-2212 material. We will present the sample fabrication process and the spin diffusion characteristics along the *c*-axis direction.

keywords : *c*-axis spin injection to high-T_c superconductors; suppression of superconductivity by spin injection; intrinsic Josephson junctions; spin-relaxation length