Doping Dependence of The Electronic Structure in Triple-layer Cuprate Bi2223

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The energy gap seen in the superconducting (SC) and normal states has been believed to be an important piece of evidence for the mechanism of high SC transition temperature in cuprate superconductors. Bi-based high-T_c cuprate superconductors can be classified by the number of the neighboring CuO_2 planes (n): single-layer (n = 1) $Bi_2Sr_2CuO_{4+\delta}$ (Bi2201), double-layer (n = 2) $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212), triple-layer (n = 3) $Bi_2Sr_2Ca_2Cu_3O_{10+\delta}$ (Bi2223). In going from n = 1 to 3, the maximum T_c increases and shows 35 K and 95 K for Bi2201 and Bi2212, respectively. Bi2223 shows 110 K, which is the highest T_c among the Bi family of cuprates [1]. However, the microscopic origin of this trend has not been clear yet.

For optimally doped Bi2223, we have revealed the electronic structure using angle-resolved photoemission spectroscopy (ARPES) [2-5]. However, it has been known that the sample fabrication with different doping is very difficult and the doping dependence of the electronic structure could not be investigated so far. Recently, high quality underdoped and overdoped single crystals of Bi2223 has been successfully synthesized [6,7]. We have performed a high-resolution ARPES study using synchrotron radiation, and revealed the doping dependent electronic structure in Bi2223. In this presentation, we will show the electronic structure of underdoped, optimally doped, and overdoped Bi2223 and discuss the origin of the high T_c in Bi2223.

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