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Effects for the Electronic Structure by Oxygen Deficiency on the double-layer Cuprate High-T_c Superconductor, Bi2212

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Cuprate superconductors have been one of the materials which show the highest superconducting transition temperature (T_c) in superconductors under atmosphere. To elucidate the microscopic mechanism of the high T_c in cuprates; however, it has been unclear so far regardless of a lot of intensive studies [1]. Among Bi-based high-T_c cuprates, a double layer cuprate, $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212) is a representative material which shows high-T_c superconductivity [2]. T_c and the electronic structure of cuprates dramatically changes with carrier doping, and therefore, one needs to understand the mechanism about these trends to achieve a higher T_c in superconductors.

According to the recent experimental study of Bi2212 using angle-resolved photoemission spectroscopy (ARPES), with increasing the hole carrier, the shape of the electronic structure shows a sudden discontinuous change around a hole doping level (p_c) of ~ 0.19 [3]. Therefore, the previous study suggests that the phase transition occurs at $p_c \sim 0.19$, but the origin of the phase transition has not been clear yet.

To investigate the electronic structure change with changing hole carrier, we have performed the temperature dependent ARPES study for two different Bi2212 samples with $p \sim 0.17$ and ~ 0.22. The ARPES spectra shows different shape compared with the previous results [3]. One of the unexpected features is that the peak-dip-hump structure at 20 K and 60 K, which was observed in the previous study, is not observed in the present experiment.

In this poster presentation, we will show the temperature dependent ARPES spectra in details and discuss the origin of the phase transition at $p_c \sim 0.19$.

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