Electronic structure of iron pnictides in electron and hole doped $BaFe_2As_2$

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One of the mysterious issues in iron pnictides is that superconductivity can appear upon both hole doping by the chemical substitution of Ba^{2+} with K^+ and electron doping by substitution of Fe^{2+} with Co^{3+}. With different substitutions, the electronic structure near the Fermi energy can change dramatically. The unconventional superconductivity in iron pnictides is strongly related to the orbital characters near the Fermi energy. Utilizing polarization and photon energy dependent angle-resolved photoemission measurement, the Fermi crossing, chemical potential and the dispersion of the bands with the $d_{3z^2-r^2}$, d_{xy}, d_{yz}, $d_{x^2-y^2}$ and d_{xz} character have been systemically studied. Compared to parent compound $BaFe_2As_2$, the energy shifts of the bands with $d_{3z^2-r^2}$ character can reach as much as 120 meV in hole doped sample $Ba_{0.6}K_{0.4}Fe_2As_2$, while in the electron doped compound $BaCo_{0.15}Fe_{1.85}As_2$, little shifts of these bands are observed. In both electron and hole doped compounds, the bandwidths of the bands with d_{yz} and d_{xz} characters alter only a little which show rigid-band-like behavior. Moreover, the dispersion, Fermi velocity, and effective mass of the bands with d_{xy} character change in both cases. Our results show that bands with different characters show distinctive behavior in the electron and hole doped compounds and this could help to understand the mechanism of the superconductivity in the iron pnictides.