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Fermi surface of iron-based superconductor $Ba(Fe_{2-x}Ni_x)As_2$ observed by angle-resolved photoemission spectroscopy

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Introduction

Recently, the iron-based superconductor $LaFeAsO_{1-x}F_x$ (T_c = 26 K) has been discovered [1] and the highest T_c of this system is ~ 55 K. The electronic structures of these compounds have been investigated by angle-resolved photoemission spectroscopy (ARPES) to elucidate the mechanism of superconductivity [2, 3].

$Ba(Fe_{2-x}Ni_x)As_2$ which is electron doped iron-based superconductor shows superconductivity below T_c ~ 18 K [4] at the optimally doping region. Recently, photon-energy dependence of ARPES spectra has been reported and revealed strong k_z dispersion of the electronic structure [5].

Here, we report the results of ARPES measurements of underdoped $Ba(Fe_{2-x}Ni_x)As_2$, x = 0.075 and shows Fermi surfaces (FSs) taken at $h\nu$ = 78 and 60 eV, corresponding to the Γ and Z points.

Experimental Condition

Single crystals of underdoped $Ba(Fe_{1.925}Ni_{0.075})As_2$, ($T_c$ ~ 16 K) were prepared by by a self-flux method. ARPES experiments were carried out using a SES-2002 analyzer at BL 28A. Measurements were performed at T ~ 9 K and photon-energy was set at $h\nu$ = 78 and 60 eV.

Results and Discussion

Figure 1 shows FSs of $Ba(Fe_{1.925}Ni_{0.075})As_2$ using $h\nu$= 78 and 60 eV and T ~ 9 K. The observed FSs around the Γ (Z) and X points show hole and electron FSs, respectively. FS area of hole FS taken at different photon energies shows large difference between them. This means that Ni-doped $BaFe_2As_2$ also has strong three dimensionality as reported in previous work [5].

References

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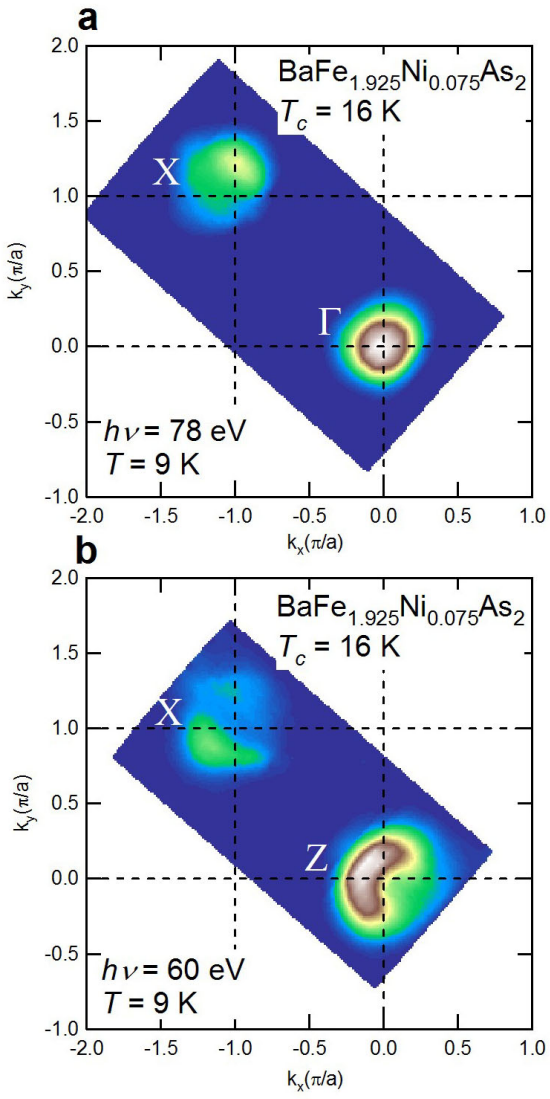

Figure 1: ARPES-intensity plots of $BaFe_{1.925}Ni_{0.075}As_2$ (T_c = 16 K) taken at $h\nu$ = 78 and 60 eV and T = 9 K. (**a**), (**b**): Hole and electron Fermi surfaces have been observed around the Γ (Z) and X points, respectively. Hole Fermi surface taken at $h\nu$ = 78 eV almost disappears due to the k_z dispersion of the hole band.