

Bulk Ce 4f electronic structure in the weakly hybridized regime

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We have performed Ce 3d-4f resonant angle-resolved photoemission spectroscopy (ARPES) on CeNiGe₂ to clarify the bulk electronic structure of Ce 4f-electrons which weakly hybridized with conduction electrons. The results reveal that Ce 4f-states form the Fermi surface (FS) and the intensity of Kondo resonance (KR) peaks show the momentum-dependence. This indicates that Ce 4f-electrons in the weakly hybridized regime contribute to FS and has itinerant character.

キーワード : Photoemission, bulk electronic structure, strongly correlated f-electrons

1. 目的

Manifestation of the bulk electronic structure of Ce 4f electrons, weakly hybridized with conduction electrons, around the Fermi level (E_F) through the direct observation of FS topology and KR peaks.

2. 方法

We carried out Ce 3d-4f resonant ARPES on CeNiGe₂ using photon energies from 870 to 890 eV. Sample surfaces are prepared by in situ cleaving. Measurement temperature and energy resolution are about 20 K and 100 meV at 890 eV, respectively. First, we determined photon energies of Ce 3d-4f on- and off-resonance by XAS experiment. Secondly, the FS topology of f-electron was investigated at on-resonance with changing the azimuthal angle from -5 to 10 by 0.3 degree step, which covers the 1st and 2nd Brillouin zones. Finally, the f- and conduction bands were observed at the high symmetry points with high energy-resolution and good S/N, respectively.

3. 研究成果

In Ce 3d-4f resonant ARPES, we observed that Ce 4f-states form FSs and the intensity of KR peaks varies as a function of the momentum. This indicates that Ce 4f-electrons in the weakly hybridized regime contribute to the FS and has periodicity in lattices.

4. 結論・考察

Strongly correlated Ce 4f-electrons in weakly hybridized regime are considered as very localized state due to large repulsive Coulomb interactions between f-electrons and weak hybridization with conduction electrons. Particularly, the FS involvement and character of Ce 4f-electrons are important keys to understand the quantum criticality in heavy-fermion systems [1]. Here, we found that Ce 4f-electrons in the weakly hybridized regime contribute to the FS and has itinerant character through the formation of Ce 4f-FSs and the momentum-dependence of KR peaks.

5. 引用(参照)文献等

[1] H. J. Im et al., Phys. Rev. B 72, 220405(R)