(O1-2)

c-f Hybridization State in an f^2 System: Optical Conductivity of $PrFe_4P_{12}$

H. Okamura[1], T. Murakami[1], K. Senoo[1], M. Matsunami[2], T. Nanba[1], H. Sugawara[3] and H. Sato[4]

[1]Graduate School of Science and Technology, Kobe University, Kobe 657-8501.
[2]RIKEN/SPring-8, Sayo 679-5148
[3]Faculty of Integrated Arts and Sciencies, Tokushima University, Tokushima 770-8502
[4]Graduate School of Science, Tokyo Metropolitan University, Hachioji, 192-0397

The microscopic electronic structures of heavy fermion state in an f^1 system such as a Ce or Yb compound is often modeled using the periodic Anderson hamiltonian. The resulting model of c-f hybridized bands has been shown to well reproduce basic features experimentally observed in various physical properties. For the f^1 systems, an important signature of a c-f hybridization state is an energy gap formation in the electronic dispersion even in a metallic compound, which has been actually observed by optical conductivity technique. Compared with the f^1 systems, however, the microscopic c-f hybridizaiton states in f^2 systems such as Pr compounds have been much less studied, both theoretically and experimentally. Recently, it has been reported that $PrFe_4P_{12}$ exhibits a marked heavy fermion properties, such as a $-\log T$ dependence and a broad maximum in the electrical resistivity. Therefore, it is quite interesting to probe the microscopic electronic structures responsible for the heavy fermion propeties in $PrFe_4P_{12}$. In this presentation, we report optical conductivity studies of $PrFe_4P_{12}$. The optical conductivity spectra $\sigma(\omega)$ were obtained from the measured optical reflectivity spectra $R(\omega)$ of $PrFe_4P_{12}$ at temperatures between 6.8 K and 295 K. Fig. 1 shows $\sigma(\omega)$ spectra at several temperatures. It is seen that $\sigma(\omega)$ in the spectral region below ~ 0.15 eV decreases with decreasing temperature. However, no gap-like structures are observed in $\sigma(\omega)$, unlike the typical cases of Ce- and Yb-based compounds.

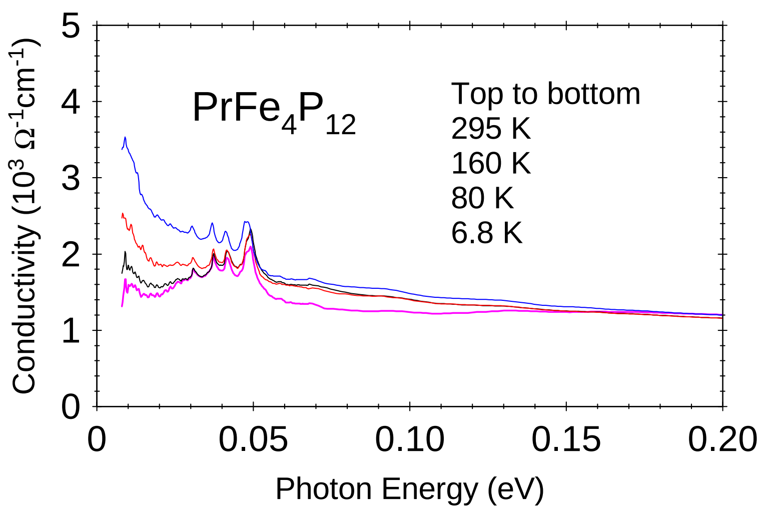

Figure 1: Optical conductivity spectra $[\sigma(\omega)]$ of $PrFe_4P_{12}$.