

whereas a relatively large orbital component

remains in CrPt_3 . The spin component always shows a positive moment in spite of the small amplitude on the Cr-rich side, as a result, the total moment increases linearly with the Mn content. In $(\text{Cr}_{0.5}\text{Mn}_{0.5})\text{Pt}_3$, the total moment is, however, almost cancelled out due to the opposite contribution between the orbital and spin characters, so that this sample has a relatively low Curie temperature.

The Pt L edge XMCD provides the evidence that the Pt $5d$ magnetic states sensitively depend on the neighboring TM atom and local environment. The magnetic properties of the $(\text{Cr}_{1-x}\text{Mn}_x)\text{Pt}_3$ system can be explained by taking the average over the volume fractions of ferromagnetic MnPt_3 and ferrimagnetic

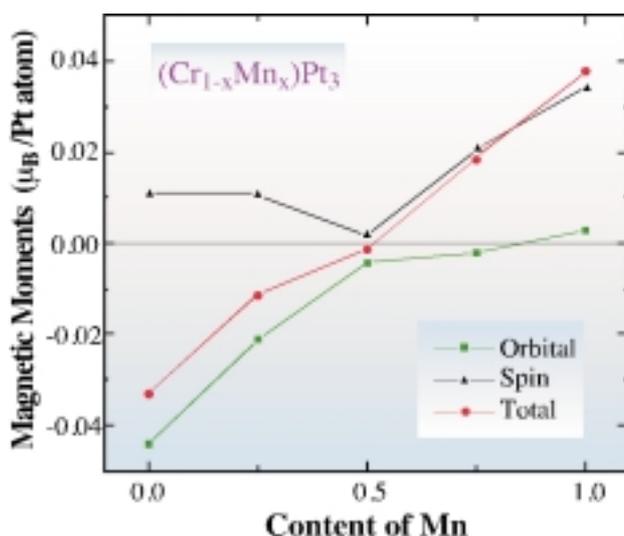


Fig.4: Orbital, spin and total magnetic moments of Pt atom estimated from the sum rules. These data are subjected to no correction for the saturation magnetization.

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HIGH RESOLUTION Ce $3d$ - $4f$ RESONANT PHOTOEMISSION STUDY OF CeNiSn and CePdSn

Many Ce compounds have attracted interest widely due to their strongly correlated Ce $4f$ states hybridized with valence band states. High resolution photoemission spectroscopy is a useful technique to experimentally reveal the electronic states. It is known, however, that rare-earth $4f$ electronic states on the surface are remarkably different from those in bulk. Measurements at low $h\nu$ (< 200 eV) cannot faithfully probe the bulk Ce $4f$ states due to their surface-sensitivity.

In order to study such bulk electronic states using high energy excitations ($h\nu > 500$ eV), a high resolution photoemission station has been constructed at the twin-helical undulator beamline **BL25SU** [1]. Here, we report high resolution Ce $3d$ resonant photoemission spectra of CeNiSn and CePdSn measured at this station.

CeNiSn is a so-called "Kondo semiconductor" where the Kondo temperature (T_K) is of the order of ~ 40 K and the Ce $4f$ electrons are valence-fluctuating [2]. For CePdSn, on the other hand, the Ce $4f$ electrons are more localized and T_K is thought to be lower than 7 K [3]. A Ce $3d$ resonant photoemission study was performed with the total energy resolution of ~ 0.22 eV, as shown in Figure 1(b). The sample temperature was about 20 K.

Figure 1(a) shows Ce $3d$ resonant valence band spectra of CeNiSn and CePdSn together with the Ce $4d$ resonance spectra. The Ce $4f$ contributions are obtained by subtracting the Ce $3d$ off resonance ($h\nu \leq 875$ eV) spectra from the on resonance ($h\nu \sim 882$ eV) ones (" $3d$ - $4f$ spectra"). In the $3d$ - $4f$ spectra of CeNiSn, one can see a strong peak due to the f^1 final states near E_F and the shoulder structure of the f^0 final states at ~ 2.4 eV. For CePdSn, the f^0 peak at about 1.9 eV and the f^1 peak near E_F , which is comparable to slightly stronger than the f^0 peak, are observed.

The Ce $4f$ contributions obtained by the same procedure in the Ce $4d$ resonance region ($h\nu \sim 120$ eV, " $4d$ - $4f$ spectra") are also displayed. They were measured at beamline BL-3B of the Photon Factory. One can notice that the $4d$ - $4f$ spectral shapes are

remarkably different from those of the $3d-4f$ ones. These striking differences are thought to originate from the differences of the $c-f$ mixings in the bulk and surface, where c stands for the valence bands. Details of the resonant spectra near E_F are shown in Figure 1(b). In the Ce $3d$ on resonance spectrum

CeNiSn, the binding energy of the maximum intensity is located at <0.2 eV. A further remarkable finding is that the mid-point of the leading edge in the Ce $3d$ and $4d$ resonance spectra is unambiguously located above E_F , suggesting the existence of a narrow and strong Kondo peak above E_F .

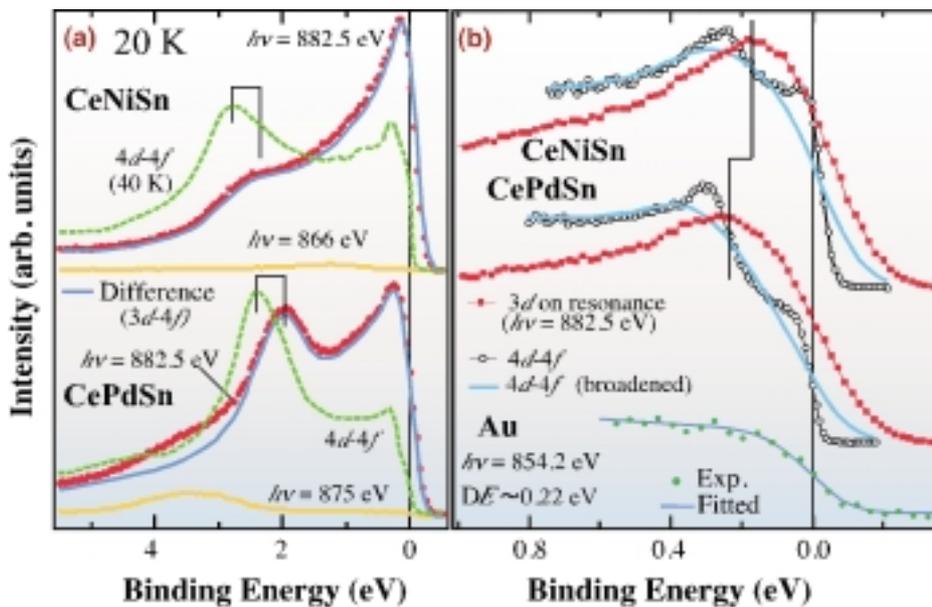


Fig. 1: (a) High resolution Ce 3d resonant photoemission spectra: (on: $h\nu \sim 882$ eV, off: $h\nu \leq 875$ eV) of CeNiSn and CePdSn compared with the Ce 4f contributions obtained from the Ce 4d resonant photoemission. (b) Spectra near E_F .

In the Ce $3d$ and $4d$ resonance spectra of CePdSn, on the other hand, the point at half-intensity of the edge is located fairly close to E_F . The point of the maximum intensity in the Ce $3d$ on resonance spectrum of CePdSn is positioned at ~ 0.25 eV, which is deeper than that for CeNiSn. This is considered to be reflected in the differences of the $c-f$ mixings, and therefore, that of T_K between weakly hybridized CePdSn and more strongly hybridized CeNiSn. We also show the $4d-4f$ spectra near E_F , broadened by the resolution of the Ce $3d$ resonant spectra in Figure 1(b). The broadened $4d-4f$ spectra do not coincide with the Ce $3d$ on resonance spectra for both materials, indicating that the different line shapes cannot be explained by the resolution effect only. In order to understand the bulk Ce $4f$ contributions,

we have performed spectral calculations using a non-crossing approximation (NCA) based on the single impurity Anderson model (SIAM) [4]. The properly fitted results of the calculations are compared with the bulk-sensitive $3d-4f$ spectra in Figure 2, in which the NCA-calculated spectra semi-quantitatively reproduce the experimental ones for both compounds. The estimated T_K 's from the calculations are comparable to those mentioned above. For reference, we also show a properly broadened Ce $4f$ partial density of states (PDOS) obtained by a band-structure calculation for CeNiSn [5] in Figures 2 (a). According to an improvement of the beamline monochromator, the third resonant photoemission study is nowadays done at a total resolution of 100 meV.

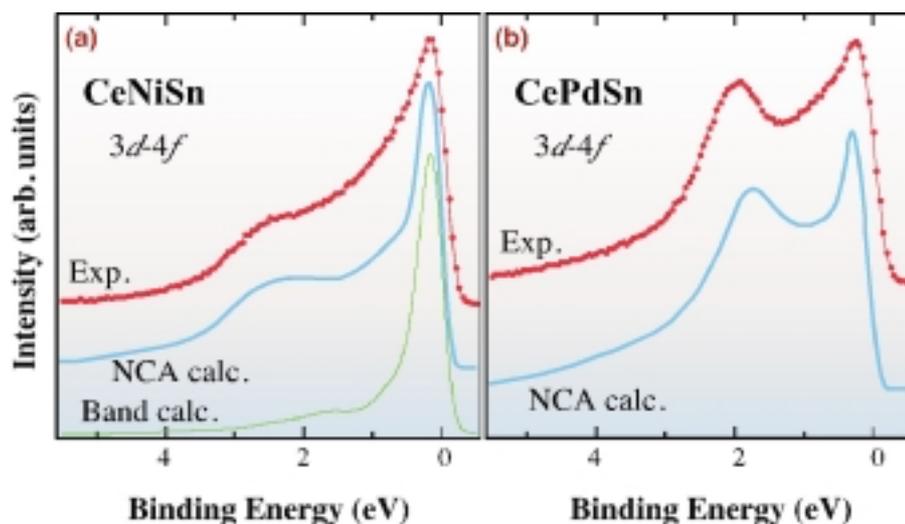


Fig. 2: Comparison of the 3d-4f spectra with theoretical calculations for (a) CeNiSn and (b) CePdSn. For the experimental 3d-4f spectra, the secondary electron backgrounds of the integration type were properly subtracted from those in Fig. 1 (a).

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