

Metamagnetism in $\text{SmFe}_4\text{P}_{12}$

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$\text{SmFe}_4\text{P}_{12}$ is a novel heavy fermion compound with a ferromagnetic ground state ($T_c=1.6$ K)[1]. The electronic specific heat coefficient attains as large as $370\text{mJ/mole} \cdot \text{K}^2$. In order to confirm the Kondo effect in the magnetic susceptibility (χ), we measured $\chi(T)$ of $\text{La}_{1-x}\text{Sm}_x\text{Fe}_4\text{P}_{12}$. The result is shown in Fig. 1. The ferromagnetic transition is suppressed for $x \leq 0.85$. In the paramagnetic state, for $x \leq 0.60$, $\chi(T)$ is nearly constant below about 20 K. The Kondo temperature is estimated from this result to be about 30 K. Surprisingly, $\chi(T)$ near the ferromagnetic boundary, $x=0.85$, 0.80 and 0.70, exhibits a maximum around 15 K. The peak position does not depend on x . The peak position is too small compared with ordinary intermediate-valence compounds, but rather close to that of CeRu_2Si_2 which shows a crossover from itinerant to localized f-electron state at 78 kOe [2]. Figure 2 shows the high-field magnetization of $\text{SmFe}_4\text{P}_{12}$, which clearly exhibits a metamagnetic transition at 20 T. The transition disappears above 6 K. In analogy with the case of CeRu_2Si_2 , crossover from itinerant to localized state may be responsible to the transition.

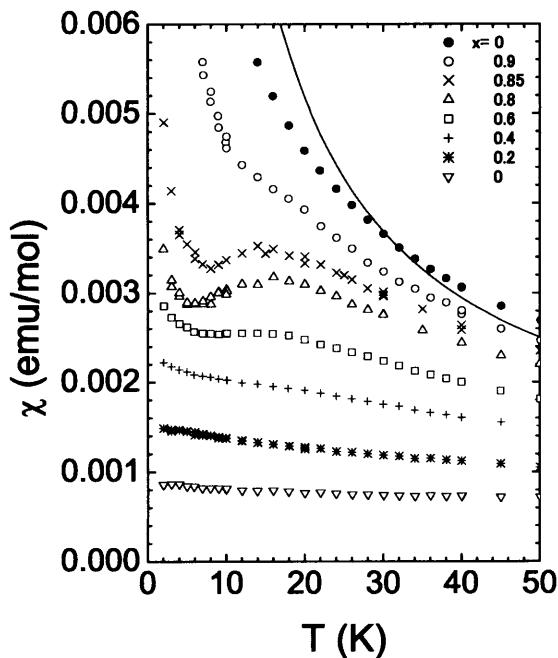


Fig.1 The temperature dependence of the magnetic susceptibility.

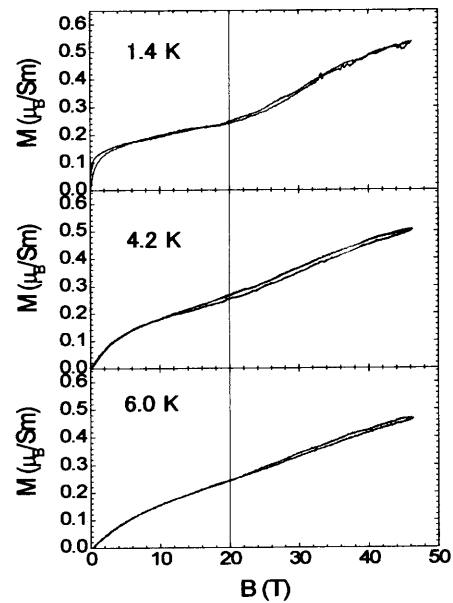


Fig.2 The magnetization of $\text{SmFe}_4\text{P}_{12}$

[1] N.Takeda and M.Ishikawa, J. Phys.: Condens. Matter 15(2003)L229.

[2] H.Aoki et al., Phys. Rev. Lett. 71(1993)2110.