(6a1)

Ferromagnetic Kondo compound $SmFe_4P_{12}$

N. Takeda[1], H. Mitamura[2], T. Goto[2], M. Ishikawa[2]

[1]Faculty of Engineering, Niigata University, Niigata, 950-2181
[2]Institute for Solid State Physics, University of Tokyo, Kashiwa, 277-8581

Pr-based skutterudites have been attracted much attention because of their novel heavy fermion (HF) state and superconductivity. Valence fluctuations in Sm-compounds, on the other hand, have been investigated for a last few decades, but only a few compounds are known as HF systems. $SmFe_4P_{12}$ is a novel HF compound (γ =370 mJ/mol K^2) with a ferromagnetic ground state. The magnetic susceptibility (χ) indicates that Sm-ions are in nearly trivalent state. The J=5/2 multiplet of 4f-state splits into a doublet and a quartet. The magnetic entropy estimated from the specific heat measurement is much less than Rln2 at T_c, but this result does not necessarily mean the ground state doublet. It is known that the CEF ground state of $SmRu_4P_{12}$ and $SmOs_4P_{12}$ is a quartet. The CEF ground state of $SmFe_4P_{12}$ is not established at present. $La_{1-x}Sm_xFe_4P_{12}$ ($x \leq 0.4$) is a Pauli paramagnet at low temperatures, which suggests that the magnetic moment of Sm-ions is screened by the Kondo effect. Samples for $0.7 \leq x \leq 0.85$, which are paramagnetic, show a broad maximum in the magnetic susceptibility around 15 K. It is well known that such a maximum in χ is observed in nearly ferromagnetic metals or intermediate-valence(IV) compounds. In the present case, the temperature of maximum is much lower than that of IV compounds. $CeRu_2Si_2$ shows a broad maxmum in χ around 10K. The matamagnetism occurs in this compound at 8T, which is conjectured to be a crossover from itenerant to localized 4f-electron state. We measured the magnetization of $SmFe_4P_{12}$ up 46 T. As can be seen in Fig.1, metamagnetism occurs at 20T. The metamagnetism disappears with increasing temparature or substitution of La. In analogy with $CeRu_2Si_2$, itenerant character of 4f-state in Sm-ion is not roled out at present.

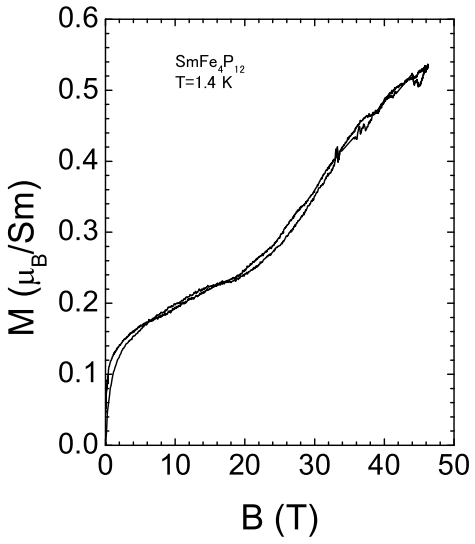

Figure 1: The magnetization up to 46 T. Metamagnetism occurs at 20 T.