(PS30)

Magnetic and thermal properties of $YbFe_4Sb_{12}$ single crystal

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Single crystals of $YbFe_4Sb_{12}$ have been prepared by several different methods. The weight of the single crystals was about 1 mg. We measured the magnetic susceptibility $\chi(T)$, magnetization and specific heat $C(T)$ in these single crystals, named as #5 and #7, and the Mössbauer effect in polycrystalline samples, named as #2 and 'pellet', at temperatures from 13 to 300 K.

Above 130 K, the reciprocal magnetic susceptibility $1/\chi(T)$ of both two single crystals coincides each other, and obeys the Curie-Weiss law as shown in Fig. 1. The $\chi(T)$ of $YbFe_4Sb_{12}$ is seemed to be mostly originated from the magnetism of Fe_4Sb_{12} polyanions, by comparing it to $\chi(T)$ of $LaFe_4Sb_{12}$ and alkali earth Fe_4Sb_{12}[1]. The magnetization at low temperatures depends on the samples; one (#5) is paramagnetic, the other (#7) is weak ferromagnetic at 2 K. The Tc of #7 is about 11 K, thought there is not any distinct anomalies around 11 K in $C(T)$ curves as shown in Fig. 2. It is not clear whether this weak ferromagnetism is intrinsic or not. The γ value of two single crystals is about 160 and 140 mJ/mol K^2 for #7 and #5, respectively, which is comparable to that of $LaFe_4Sb_{12}$[2]. In the single crystalline $YbFe_4Sb_{12}$, the valence of Yb is seemed to be close to 2.

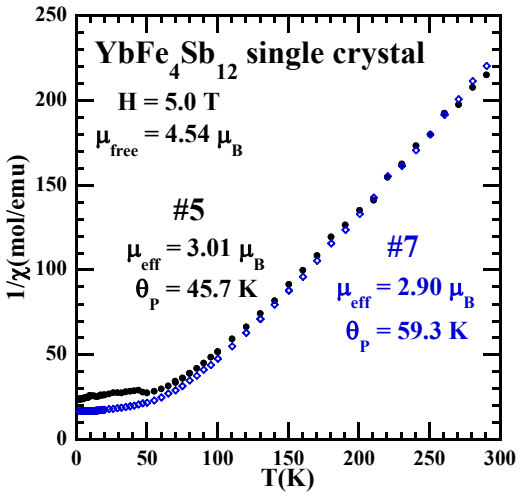

Fig. 1. $1/\chi(T)$.

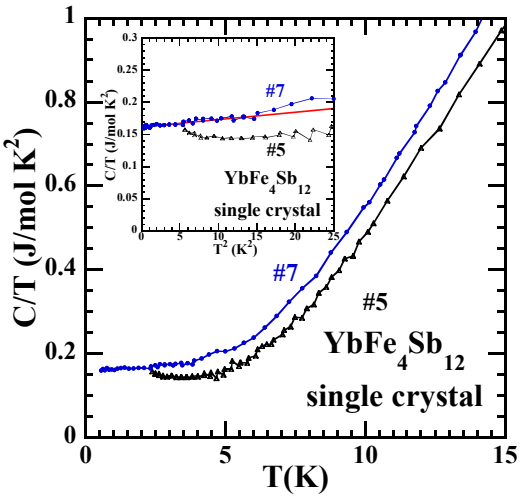

Fig. 2. $C(T)/T$.

Mössbauer spectrum at each temperature consists of a quadrupole doublet with a line width of about 0.24 mm/s. This fact indicates that there is no magnetic order in $YbFe_4Sb_{12}$ above 13 K. Moreover, the center shifts and the quadrupole splittings suggest that Fe atoms in $YbFe_4Sb_{12}$ are in a low spin state between Fe^{2+} and Fe^{3+}.

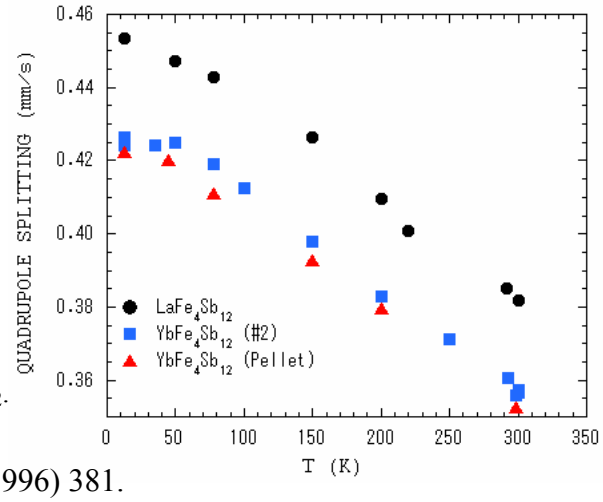

Fig. 3. Quadrupole splitting of $YbFe_4Sb_{12}$ and $LaFe_4Sb_{12}$.

[1] M. E. Danebrock et al., J. Phys. Chem. Solids **57** (1996) 381.

[2] E. Bauer et al., Phys. Rev. B **63** (2001) 224414.