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Specific heat study on the filled skutterudite $SmOs_4Sb_{12}$

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Recently, a single crystal of the filled skutterudite $SmOs_4Sb_{12}$ has been grown, of which physical properties has not been reported yet. Here, we report the thermodynamical properties of $SmOs_4Sb_{12}$ by means of low-temperature specific heat measurement in magnetic fields.

Figure 1(a) shows the temperature dependence of the specific heat C/T in $SmOs_4Sb_{12}$ for $H \parallel [100]$. The increase of the specific heat above $\sim$4K is due to the lattice contribution, while the upturn below $\sim$0.4K is attributed mainly to the Sb nuclear contribution. Extremely large electronic specific heat is clearly seen. It is most characteristic that this component does not much vary according to temperature and magnetic field. The electronic specific heat coefficient γ is estimated below $\sim$1K to be 0.80J/K^{2}mol, which is about 14 times larger than that of the reference compound $LaOs_4Sb_{12}$(γ=0.057J/K^{2}mol). This indicates the existence of mass-enhanced quasiparticle excitations related to $4f$ electrons of Sm ions at low temperatures. Figure 1(b) shows the field dependence of the γ value. Interestingly, the γ value is independent of the magnetic field below 8T, implying the heavy fermion state insensitive to magnetic field. The electronic entropy (not shown) goes exceeding Rln2, and has no tendency to be saturated at least up to 9K. From this result, it is likely that the crystalline-electrical-field ground state of Sm ion is not doublet, but quartet or the both lying closely each other.

In Figure 1(a), a small kink appears about 2K in zero field, which is suppressed and shifts to higher temperature with increasing magnetic field. This is consistent with the results of the magnetization measurement; a weak spontaneous magnetization is observed below $\sim$5K. This result suggests that the kink is an appearance of some magnetic character. However, we cannot conclude whether this is intrinsic or not at this moment.

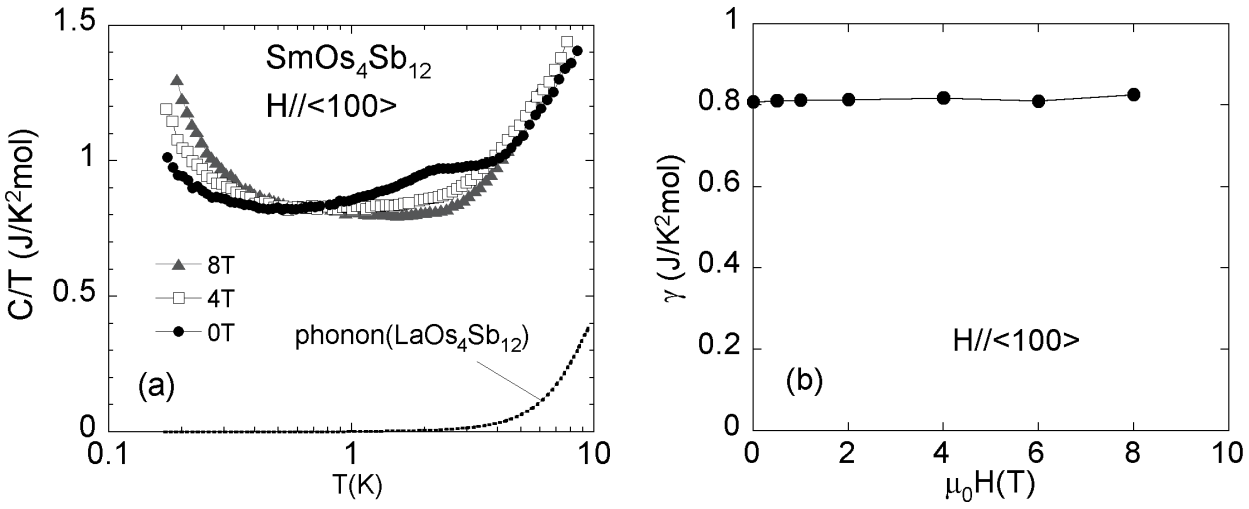

Figure 1: (a) Temperature dependence of the specific heat in $SmOs_4Sb_{12}$ for H $\parallel$ [100], and (b) Field dependence of the electronic specific heat coefficient.