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High Field Magnetism of Filled Skutterudite Compounds

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We measured the high-field magnetization for skutterudite compounds of a paramagnet $PrFe_4Sb_{12}$ and a ferromagnet $SmOs_4Sb_{12}$ to investigate the characteristic magnetic properties.

In the right of figure shows the typical magnetization curve of $PrFe_4Sb_{12}$ at 1.3 K, together with the curve of a reference non-4f compound $LaFe_4Sb_{12}$. The magnetization of $LaFe_4Sb_{12}$ is large, 0.6-0.7 μ_B/f.u. at 48 T, which is due to the moment of the paramagnetic Fe ion. In $PrFe_4Sb_{12}$, the magnetization increases steeply at low fields, increases linearly up to 15 T and indicates a slow increases as a function of the field, with a characteristic shoulder-like feature around 20 T. We remark the shoulder-like feature in magnetization. This is more clearly reflected in the differential magnetization dM/dH curve, as shown in right hand side of the figure. A peak structure appears around a critical field H_c=16 T at 1.3 K, which is observed up to 7.8 K and disppears completely above the temperature of 10 K where the susceptibility indicates a maximum.

In $SmOs_4Sb_{12}$, the anisotropy of magnetization for H//[100] and [110] was not observed, which is inconsistent with the quartet ground state in the CEF scheme. The linear magnetization is found above 10 T with the tangent of 3.3×10^{-3} emu/mol. It is noted that the magnetization reaches 0.4 μ_B/Sm at 45 T, although it is smaller than 0.7 μ_B/Sm expected for the Sm^{3+} ion.

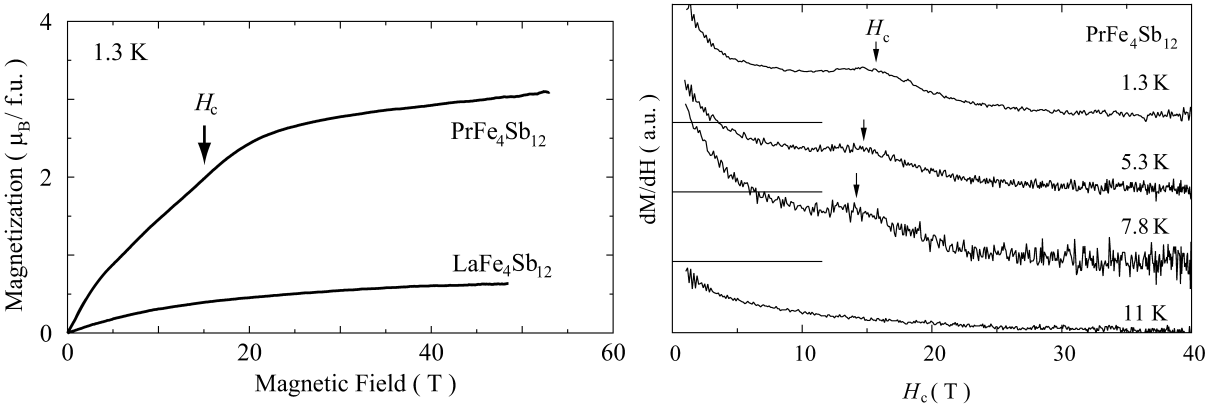

Figure 1: Magnetization and dM/dH curves in $PrFe_4Sb_{12}$.