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Specific heat study on heavy fermion superconductor $PrOs_4Sb_{12}$

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After the discovery of superconductivity in $PrOs_4Sb_{12}$ [1], which is to date the only known Pr-based heavy-fermion superconductor, much of experimental evidence have been reported suggesting that the superconductivity is unconventional [2,3]. One important aspect is the possibility of the existence of multiphase superconducting (SC) phases suggested from anomalies in specific heat and thermal conductivity measurements [4,5].

Our measurements on several samples suggest that the specific heat anomaly has sample dependence. Such typical examples are shown in Fig. 1. Sample #1 ($RRR = 30 \sim 34$) shows a clear jump at 1.81 K and a kink structure at 1.62 K. Sample #2 ($RRR = 24 \sim 27$) shows a clear double transition structure; two clear jumps at 1.85 K and 1.69 K. Defining the temperatures of T_{c1} and T_{c2} as shown in Fig. 1, we have constructed the magnetic field vs temperature phase diagram.

In the magnetic field vs temperature phase diagram (not shown), T_{c1} and T_{c2} decreases with increasing magnetic field in a way forming two parallel lines; in contrast to the phase diagram obtained from the thermalconductivity measurement [5]. Both temperatures has a slight magnetic anisotropy, being consistent with the anisotropy in H_{c2} determined at lower temperatures.

From the specific heat jump at the transition and the slope of the boundary, GL parameter κ_2 can be obtained, which provides information on whether the paramagnetic limiting effect dominates or not. The resulting κ_2 increases with decreasing temperature for all the field direction of $H//$ [100], [110], and [111]. This observation indicates that H_{c2} is not determined mainly by the paramagnetic limiting effect.

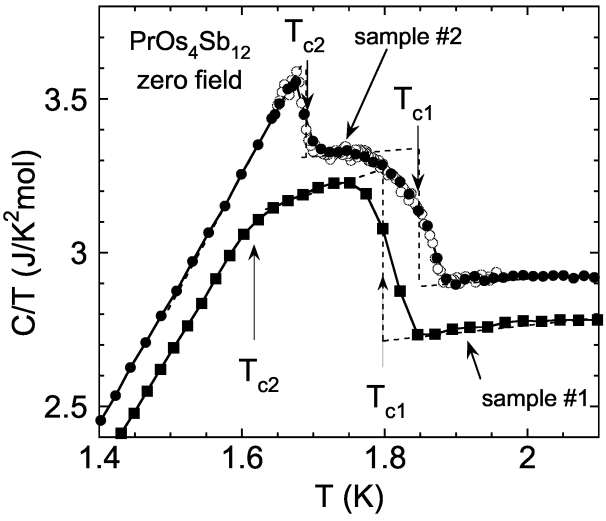

Fig. 1: Temperature dependence of C/T for the samples #1 and #2 in zero field.

[1] E.D. Bauer *et al.*, Phys. Rev. B **65** (2002) 100506(R).
[2] H. Kotegawa *et al.*, Phys. Rev. Lett. **90** (2003) 027001.
[3] Y. Aoki *et al.*, Phys. Rev. Lett. **91** (2003) 067003.
[4] R. Vollmer *et al.*, Phys. Rev. Lett. **90** (2003) 057001.
[5] K. Izawa *et al.*, Phys. Rev. Lett. **90** (2003) 117001.