Magnetism and electronic transport properties in Ce_5CuPb_3: the role of two crystallographically inequivalent Ce atoms

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The intermetallic Ce_5CuPb_3 compound was reported to crystallize in the Ti_5Ga_4-type structure (space group $P6_3/mcm$) [1]. In this contribution we show the results of magnetization (M), electrical resistivity (ρ) and thermoelectric power (TEP) measurements. We observed two successive magnetic phase transitions at T_{C1} = 46.0 ± 0.5 K and T_{C2} = 5.0 ± 0.5 K (Fig. 1). The double magnetic phase transition may be explained due to two inequivalent magnetic sublattices of the Ce^{3+} ions. An analysis of the magnetic data suggests that the transition at T_{C1} is of a ferromagnetic origin and at T_{C2} is of ferrimagnetic one. Both the magnetic susceptibility, $\chi \equiv M/H$, and electrical resistivity data imply the localized character of the Ce 4f – electron. Above T > 150 K, χ follows the Curie – Weiss law with the effective moment of 2.69 μ_B/Ce and the paramagnetic Curie temperature of θ_p ~ -21.8 K. The electrical resistivity exhibits clear anomaly at T_{C1}, indicative of the reduction in the spin – disorder scattering. Besides, ρ is characterized by an upturn below ~ 13 K. A possible mechanism for this phenomenon could be the Kondo-type scattering of the conduction electrons. The thermoelectric power of Ce_5CuPb_3 is negative over the temperature range measured. At room temperature, TEP reaches a value of ~ -12 μV/K (Fig. 2) and weakly varies with decreasing temperature down to T_C. A pronounced change in TEP occurs below 25 K, where the slope S/T attains a value of ~ – 0.27 μV/K^2. Such a huge slope is often accompanied to an enhancement of the electronic contribution to the low-temperature specific heat and is presumably due to a lowering of the charge-carry density and/or a Kondo-like effect.

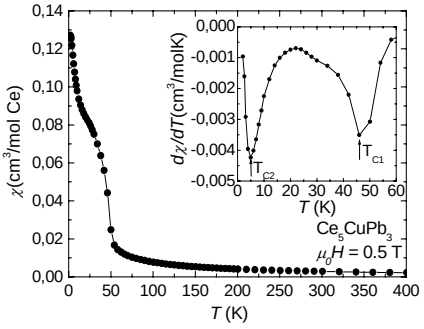

Fig. 1. Magnetic susceptibility as a function of temperature of Ce_5CuPb_3. The inset shows the derivative $d\chi/dT$.

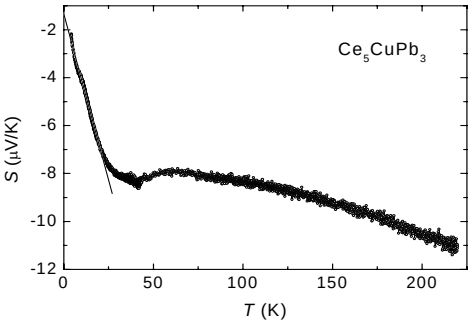

Fig. 2. Temperature dependences of the thermoelectric power of Ce_5CuPb_3. The solid line illustrates a diffusion contribution.

[1] L.D. Gulay, J. Stępień-Damm, M. Wołcyrz, J. Alloys Compd. **319** (2001) 148.

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