Competing Kondo and RKKY interactions at the presence of crystal field effects in the compound $CeSi_{1.2}Ga_{0.8}$

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We present the thermoelectric power, electrical and thermal conductivity, magnetic and specific heat measurements for the intermetallic compound $CeSi_{1.2}Ga_{0.8}$. This composition belongs to the series $CeSi_{2-x}Ga_x$, which exhibits divers ground states and different crystallographic structures depending on the substitution level x [1-4]. It has been previously suggested that for 0.0<x<1.3 the compounds crystallize in the α-$ThSi_2$ type structure and for 0.7<x<1.3 [1,2] they order ferromagnetically [3,4]. Our complementary studies for x = 0.8 reveal that it is a complex system due to the Kondo scattering competing with the RKKY interactions. Moreover, the Seebeck coefficient shows not only an anomaly related to the magnetic transition, but also a wide maximum at about 100 K related to the crystal field effect. The case of x = 0.8, which has not been studied previously, is of special interest as it is at the crossing of the characteristic temperatures, i.e. $T_{\mathrm{ord}} \approx T_{\mathrm{K}} \approx 10$ K [4]. We provide the analysis of the temperature dependence of the Seebeck coefficient and electrical resistivity within the two band model, moreover the influence of the crystal electric field on the characteristic energy scales is also discussed. Our analysis of the magnetic field dependence of the specific heat and magnetization indicates that the magnetic order is not ferromagnetic but rather ferrimagnetic due to the evident presence of an antiparallel magnetization component.

References:

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