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Magnetic and strong correlation effect in CeT2Al8 (T=Fe,Co)

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Content :

We present specific heat, electrical resistivity, susceptibility, and thermopower measurements on the two novel intermetallic compounds $CeFe_2Al_8$ and $CeCo_2Al_8$. They form in an orthorhombic crystal structure of space group Pbam. In the unit cell representation Ce atom occupies only one lattice site,having Ce-Ce interatomic distance of 4.03Å. Magnetic susceptibility of $CeFe_2Al_8$ in the range of 1.9K - 400K yields an effective paramagnetic moment value of $3.89\mu_B$ together with prevailing antiferromagnetic interaction through Weiss temperature Θ=-745.8K. The overall temperature dependence suggests valence instability in this compound and we model the appearance of broad peak around T=230K in the susceptibility to a T^2lnT dependence attributed to an intermediate valent state. On the other hand for $CeCo_2Al_8$ the local moment state is depicted through an effective moment close to the free Ce^{3+} ion value. No long-range magnetic ordering is found in either of the two compounds down to 1.9K. The magnetic contribution of electrical resistivity on $CeFe_2Al_8$ and $CeCo_2Al_8$ compounds follows −lnT behavior at intermediate temperatures which is typical of incoherent Kondo interactions between conduction electrons and magnetic Ce ions. A Fermi liquid behavior in resistivity measurement is observed in $CeFe_2Al_8$ compound towards the ground state,whereas clear deviations from standard Fermi liquid behavior are indicative of strong electronic correlation effects in $CeCo_2Al_8$. At 2K the electronic specific heat of this compound reaches γ =0.106J/mol-K^2,and exhibits a −lnT divergence towards T⟶0. We explain this behavior in terms of quantum criticality that stems from low-lying magnetic ordering effects. In studies of the thermoelectric power,a maximum is reached at T=140K(S=24μV/K) and T=30K(S=23μV/K) for $CeFe_2Al_8$ and $CeCo_2Al_8$ compounds respectively. We propose a description for this behavior in terms of formation of fine structure in the electronic density of states near the Fermi energy(E_F).

Level (Hons, MSc, PhD, other)? :

PhD Physics

Consider for a student award (Yes / No)? :

yes

Short Paper :

yes

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