

Co substitution effect of Kondo semiconductor $\text{CeFe}_2\text{Al}_{10}$

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We have performed the measurements of electrical resistivity ρ , magnetic susceptibility χ and specific heat C for single crystalline $\text{Ce}(\text{Fe}_{1-x}\text{Co}_x)_2\text{Al}_{10}$ ($0 \leq x \leq 0.17$), which is the Co substituted system for Fe site in a recently discovered Kondo semiconductor $\text{CeFe}_2\text{Al}_{10}$.¹ The $\chi(T)$ for $\text{CeFe}_2\text{Al}_{10}$ shows a broad peak centered at $T_{\text{max}} \sim 70$ K, which is typical of valence fluctuation compounds. The T_{max} decreases with increasing x , and disappears for $x \sim 0.17$, indicating decrease in T_K with increasing x , which is also supported by decrease in $\chi(0)$ with increasing x . The $\rho(T)$ for $\text{CeFe}_2\text{Al}_{10}$ shows two negative temperature coefficient region at high and low temperatures accompanied with a broad peak centered at ~ 70 K. Only 5% Co substitution vanishes the low temperature increase. The high temperature negative slope decreases gradually with x , and turns into metallic behavior for $x \sim 0.17$. The $C(T)$ of $\text{CeFe}_2\text{Al}_{10}$ indicates a small electronic specific heat coefficient $\gamma \sim 5$ mJ/K²mol. The γ value strongly increases with x , and attains $\gamma \sim 150$ mJ/K²mol for $x \sim 0.17$. These results indicate that the Co substitution destroys the gap rapidly and $\text{CeFe}_2\text{Al}_{10}$ turns from valence fluctuation regime into heavy fermion one.

¹Y. Muro, K. Motoya, Y. Saiga, and T. Takabatake, J. Phys. Soc. Jpn. **78**, 083707 (2009).