(PS10)

Small Saturation Moment due to the Crystalline Electric Field Effect for T_h Site Symmetry in the Ferromagnet UFe_4P_{12}

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We have grown a single crystal of UFe_4P_{12} and measured the electrical resistivity, specific heat, magnetic susceptibility and high-field magnetization. The experimental results have been analyzed on the basis of the CEF model for the cubic symmetry of T_h point group. Possible CEF schemes to explain the experimental results, especially the inverse magnetic susceptibility at high temperatures up to 800 K and the magnetization in magnetic fields up to 50 T, are proposed. Figures 1 and 2 show the inverse magnetic susceptibility and high-field magnetization at 1.3 K, respectively. Here, the solid and dashed lines are the calculated results for the CEF schemes with (a) triplet($\Gamma_4^{(2)}$) and (b) singlet(Γ_1) ground state, respectively. The $5f^2$-CEF schemes of the $\Gamma_4^{(2)}$ ground state and the Γ_{23} first excited state, separated by 800 K, and also the Γ_1 ground state and the $\Gamma_4^{(2)}$ first excited state, separated by 6 K, explain well the overall magnetic property in UFe_4P_{12}. From these analyses, the term $O_6^2 - O_6^6$ in the CEF Hamiltonian for T_h site symmetry was found to be essentially important to explain a small saturation moment of 1.3 μ_B/U in UFe_4P_{12}.

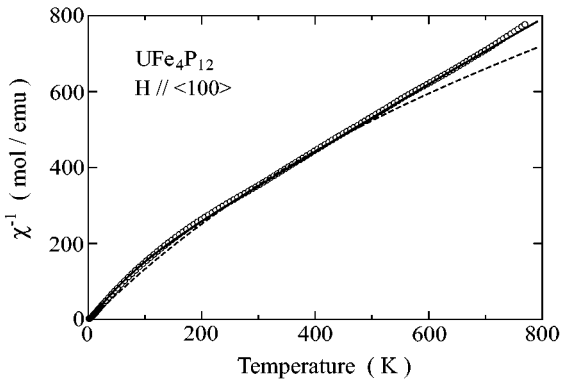

Figure 1: Temperature variation of the inverse magnetic susceptibility for $H \parallel \langle 100 \rangle$ in the magnetic field of 5 T. Solid and dashed lines are the results of the CEF calculations in the configuration for cases (a) and (b), respectively.

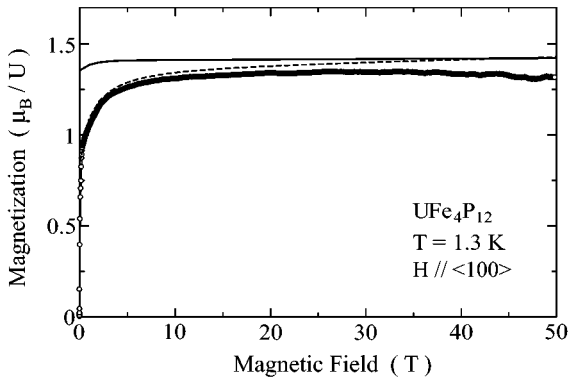

Figure 2: High-field magnetization curve for $H \parallel \langle 100 \rangle$ at 1.3 K in UFe_4P_{12}. Solid and dashed lines are the results of the CEF calculations in the configuration for cases (a) and (b), respectively.