(P2-20)

Crystaline-electric-field effects in $Pr_3Pd_{20}Ge_6$

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$Pr_3Pd_{20}Ge_6$ is crystallized in the cubic structure with the space group Fm3m ($Cr_{23}C_6$ type). In this compound, Pr ions occupy the two inequivalent crystallographic sites: (4a) and (8c). It is predicted that the ground state of 4f electrons is Γ_3 quadrupole doublet for both the Pr sites [1,2]. However, the results of the elastic constants [3] and the magnetization [4] are in disagreement with this prediction, suggesting that the ground states of the two inequivalent sites are different: the (8c) site Γ_3 (non-magnetic) and the (4a) site Γ_5 (magnetic) (Fig. 1).

In the present study, we have performed inelastic neutron scattering mesurement for the powdered $Pr_3Pd_{20}Ge_6$ sample (made by arc melting) in the extended energy transfer between -2 meV and 14 meV to understand the crystalline-electric-field (CEF) effects of this system. Figure 2 shows the experimental data taken at 2 K. We observed two peaks at 0 and 4 meV but no peaks in the energy range higher than 6 meV. This is in agreement with the previous results obtained by Keller *et al.* [1] for the energy range between -2 meV and 5 meV. The absence of peaks at the high energy range is consistent with their prediction, because there is no probability of excitation from Γ_3 (or Γ_5) to the highest level Γ_1 at this low temperature. In the two-site model, the excitations from Γ_5 to Γ_3 ($\Delta E \sim 0.53$ meV) and Γ_3 to Γ_5 ($\Delta E \sim 0.30$ meV) should exist, but the transfer energies are too low to be detected in the present energy resolution. We also present the inelastic excitation spectra obtained at 2, 20 and 60 K, and compare the results with the CEF models.

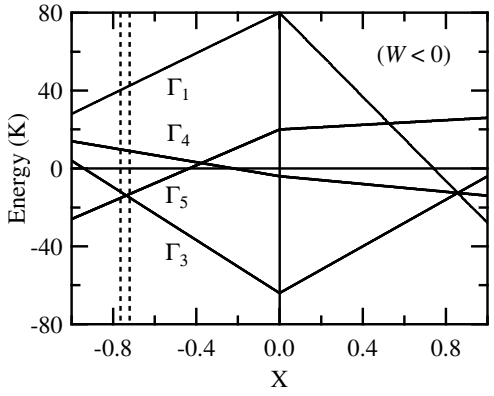

Figure 1: The CEF level scheme for the cubic symmetry. Dashed lines indicate the parameters for the two-site model.

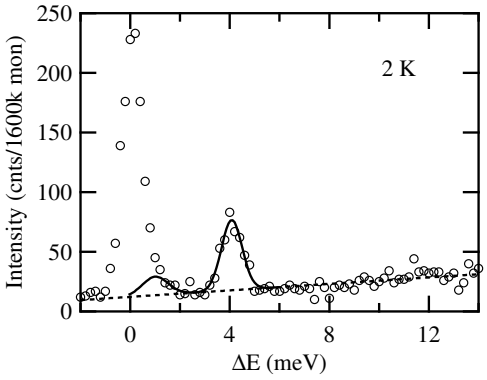

Figure 2: The inelastic neutron scattering profile obtained for $Pr_3Pd_{20}Ge_6$ powdered sample. Solid line indicates the CEF calculations based on the single-Pr-site model [1].

[1] L. Keller *et al.*, Physica B **259-261** (1999) 336.
[2] M. Nakayama *et al.*, Physica B **281&282** (2000) 152.
[3] T. Horino *et al.*, Physica B **281&282** (2000) 576.
[4] H. Amitsuka *et al.*, J. Phys. Soc. Jpn. **71** suppl. (2002) 124.