# Rattling motion in PrOs4Sb12

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The filled skutterudite compounds RT4X12 (R: rare earth or actinide, T: transition metal, X: pnictogen) crystallize in the body-centered cubic space group Im-3, in which R ion is surrounded by a cage of X-icosahedron. This characteristic "cage" structure provides a wide variety of thermal, magnetic and transport properties. Among the filled skutterudite compounds, PrOs4Sb12 received much attention because it is the first Pr-based heavy-fermion superconductor and a field-induced antiferro-quadrupolar (AFQ) ordered phase exists near the superconducting phase. In addition to the relation between the AFQ fluctuations and the superconductivity, interestingly, the possibility that the heavy-fermion superconductivity is related to a rattling motion due to a weakly bounded Pr-ion in the Sb cage has been argued. Especially, a Debye-type dispersion in the elastic constants observed by high resolution ultrasonic measurements (T. Goto et al.: Phys. Rev. B 69 (2004) 180511R) shows the importance of the rattling motion in this system. In order to microscopically study the dynamical property of the rattling motion, we started doing inelastic neutorn scattering experiments with high energy resolution.

The powder sample of PrOs4Sb12 was grown by Sb-self-flux method. The total mass is about 39 g. The inelastic neutorn scattering experiments were done by using the Angle Focusing Cold Neutron Spectrometer (AGNES) at JRR-3M in JAEA.

Figure 1 shows inelastic spectra at 10 K and 100 K. The difference between spectrum at 10 K and that at 100 K has been observed below around 0.2 meV. The observed excitation might be due to the rattling motion of Pr-ion. To clarify this possibility, further studies, such as measurements of Q-dependence of the excitation, are needed.

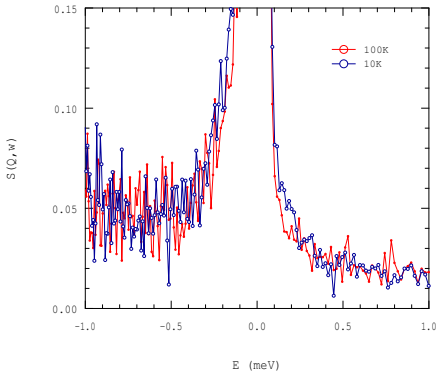


Fig. 1. Inelastic spectra of PrOs4Sb12 at 10 K and 100 K.