(PS11)

Inelastic Neutron Scattering from $CeOs_4Sb_{12}$

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The filled skutterudite compound $CeOs_4Sb_{12}$ is interesting because it shows Kondo-semiconducting properties in the transport and magnetic measurements at low temperatures due to the various kinds of interactions between Ce^{3+} and its surroundings. In this work, inelastic neutron scattering measurements were performed on both poly and single crystals for $CeOs_4Sb_{12}$ in order to study the magnetic response from this system. No crystal electrical field excitation was detected for the compound within the experimental error. However the evidence of quasielastic scattering is found below 5 meV for the powder samples at low temperatures. This fact contradicts the simple localized 4f electron picture with the crystal field splitting of about 300 K proposed for $CeOs_4Sb_{12}$ to explain the temperature dependence of the magnetic susceptibility. Figure 1 shows the neutron scattering spectra measured by INC spectrometer for powder $CeOs_4Sb_{12}$ and there was no clear CEF excitations found. The phonon peak at around 4 meV exhibiting in the spectra at high scattering angles measured by LAMD spectrometer for powder samples indicates that there is a very low-energy phonon branch around this energy. Such peaks in the phonon density of states of La or Tl filled skutterudite compounds were discussed as the evidence for the rattling motion of the rare-earth atom in the compounds. However, our preliminary measurements on a single crystal sample shows that there is no clear evidence for the localized Einstein mode along the principal axes although there are low-energy phonon branches whose energies at the zone boundaries are at around 4-6 meV.

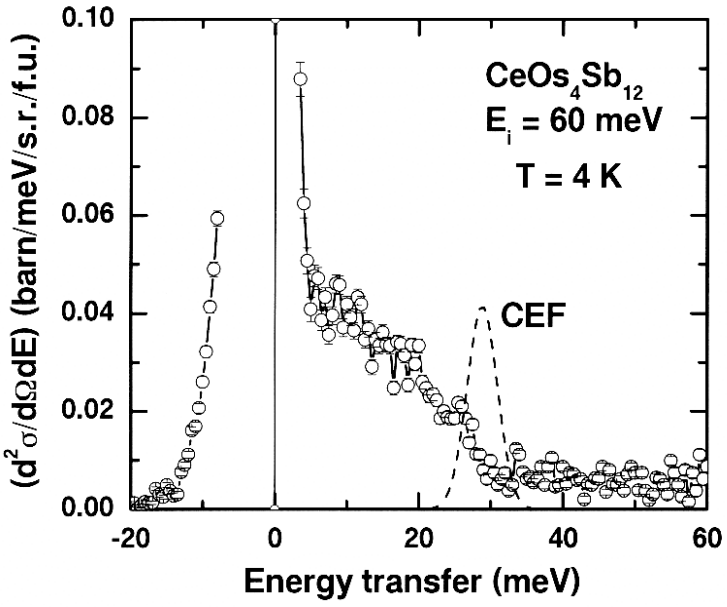

Figure 1: Neutron spectra of $CeOs_4Sb_{12}$ measured by INC for powder samples with a constant incident energy of 60 meV. The dot line is the calculated value of cross section for the crystal field excitation of $CeOs_4Sb_{12}$.