(27a6)

Raman scattering of filled skutterudite

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Raman scattering spectra of filled skutterudite $Ln\mathrm{Fe_4P_{12}}$(Ln=La, Ce, Pr and Nd), $Ln\mathrm{Os_4Sb_{12}}$ (Ln=Ce, Pr and Nd) and $\mathrm{PrRu_4P_{12}}$ have been measured. In the skutterudite family with cubic symmetry of $Im\bar{3}$ (T_h^5), Raman active mode is 2Ag + 2Eg + 4Tg. All Raman active modes are the vibrations of pnictogens; P or Sb.

Figure 1(a) shows the representative polarization dependence of Raman spectra of $\mathrm{CeFe_4P_{12}}$ measured at room temperature. All observed phonons, denoted by $A_g^{1,2}$, $E_g^{1,2}$, and $T_g^{1\sim4}$ shown in Fig. 1(a), completely satisfy the polarization selection rule in the cubic symmetry. This full assignment of the phonon modes for the filled skutterudite compounds is the first.

Fig. 1(b) shows the observed phonon energy as a function of lattice parameter. The energy decrease for $Ln\mathrm{Os_4Sb_{12}}$ is explained by the increase of the mass (P→Sb) and the lattice parameter. However, the energy increase for $\mathrm{PrRu_4P_{12}}$ is anomalous. To discuss details about the interatomic interactions, firstly, we have performed the normal mode analysis by a GF matrix method for $Ln\mathrm{Fe_4P_{12}}$. We have found the strong interaction between rare earth and the surrounding pnictogens for $Ln\mathrm{Fe_4P_{12}}$, compared with rare-earth hexaboride materials.

In this talk, the results of the temperature dependence will be also presented.

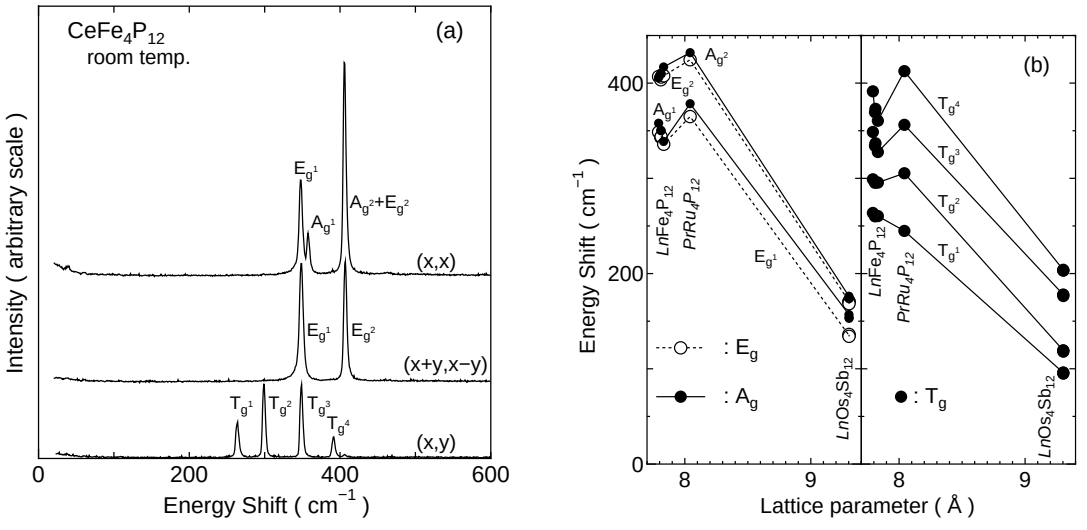

Figure 1: (a)Polarization dependence of Raman spectra of $\mathrm{CeFe_4P_{12}}$ measured at room temperature. (x,y) denotes the polarization direction of incident(x) and scattered(y) light. (b) Observed phonon energy vs. lattice parameter. The left graph is for A_g and E_g and the right is for T_g.