

Infrared study on the electronic states of filled skutterudites RT_4X_{12}

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RT_4X_{12} (R = rare earth; T = transition metal; X = pnictogen element) crystallized in the filled skutterudite structure exhibit various interesting properties depending on the components R , T and X [1-3]. Such a change in the physical properties has been recognized to be induced by the change in the electronic states in the vicinity of the Fermi level. The energy scale of such change in the electronic states corresponds to that an infrared spectroscopy covers. This means that an infrared spectroscopic study becomes a very useful tool directly to observe such change in the electronic states, for example, due to metal-insulator transition, magnetic ordering and so on.

In this study, we have investigated the temperature dependence of the optical conductivity of following various kinds of compounds,

1. Metal insulator transition: $\text{PrRu}_4\text{P}_{12}$ and $\text{SmRu}_4\text{P}_{12}$
2. Magnetic order from Pauli paramagnetism to anti-ferromagnetism: $\text{GdRu}_4\text{P}_{12}$
3. Ce-filled skutterudites: $\text{CeRu}_4\text{P}_{12}$ [2], $\text{CeRu}_4\text{Sb}_{12}$ and $\text{CeOs}_4\text{Sb}_{12}$ [3]

Based on these results, the following further research programs on filled skutterudites will be referred,

1. study on newly synthesized materials such as As-based compounds in collaboration with crystal growth group,
2. study on the change electronic state due to the magnetic order and valence fluctuation state: $\text{EuRu}_4\text{P}_{12}$,
3. study the metal-insulator transition by the change in the electronic state under high pressure, and so on.

[1] G. P. Meisner, *Physica B* **108** (1981) 763.

[2] I. Shirotnani et al., *J. Solid State Chemistry* **142** (1999) 146.

[3] H. Sato et al., *Physica B* **328** (2003) 34.