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Pressure effect for Metal-Insulator Transition in RRu$_4$P$_{12}$ (R = Pr, Sm)

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The metal-to-insulator (M-I) transition was observed in filled skutterudite PrRu$_4$P$_{12}$ and SmRu$_4$P$_{12}$, which have transition temperature T_{MI} = 62 K and 16 K, respectively [1, 2]. We measured the temperature dependence of the electrical resistance, R, of PrRu$_4$P$_{12}$ and SmRu$_4$P$_{12}$ at temperature 0.1 to 300 K under high pressure up to 15 GPa. The semiconductor-like resistivity in PrRu$_4$P$_{12}$ below T_{MI} was suppressed with pressure, and this behavior is consistent with previous report [3]. The superconducting transition and some anomalies in the resistance were observed [4]. With increasing pressure, the R below T_{MI} of SmRu$_4$P$_{12}$ was markedly suppressed as shown in Fig. 1. Above 3.5 GPa, a peak and a kink of the R were observed at around T_1 = 15 K and T_2 = 2 K. Below T_2, an increment of the R was observed. Pressure dependence of T_{MI}, T_1 and T_2 is shown in Fig. 2. These temperatures are very sensitive with pressure. With increasing pressure, T_2 decreased and the increment of R was suppressed. It is unclear that the origin of anomaly of R below T_2, however it may be suppressed with pressure. At higher pressure, we expect that SmRu$_4$P$_{12}$ shows superconducting transition.

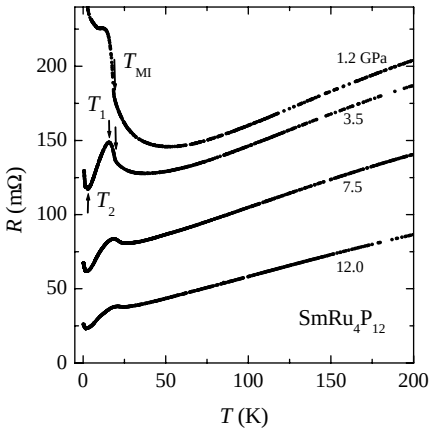

Fig. 1 Temperature dependence of the R at several pressures.

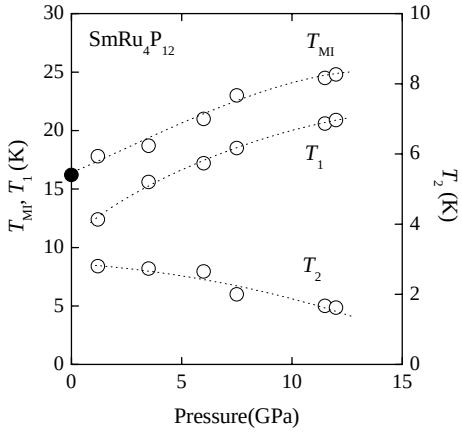

Fig. 2 Pressure dependence of T_{MI}, T_1 and T_2.

[1] C. Sekine *et al*., Phys. Rev. Lett. **79** (1997) 3218.

[2] C. Sekine *et al.*, *Science and Technology of High Pressure*, Universities Press, Hyderabad, India 2000, p.826.

[3] I. Shirotani *et al*., Physica B **322** (2002) 408.

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