(PS27)

Pressure-induced Metal-Insulator transition in the filled skutterudite $PrFe_4P_{12}$

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We have studied the electrical resistivity in the filled skutterudite compound $PrFe_4P_{12}$ under high pressure. An antiferro-quadrupolar ordering temperature ($=T_Q$) decreases monotonously with increasing pressure up to 2.4 GPa. However at 2.4 GPa, the increase of the resistivity appears below T_Q. T_{MI}, where rapid resistivity starts to increase, moves to higher temperature with increasing pressure; the metal-insulator (M-I) transition appears under high pressure. Above 2.4 GPa, T_{MI} and an activation energy E_g/k_B estimated from Arrhenius plot increase with increasing pressure. The Kondo like behavior at high temperature remains even in high pressure range. By applying the magnetic field, M-I transition is suppressed easily and finally fermi liquid state with large coefficient A appears.

Harima *et al.* have calculated a band structure of $PrFe_4P_{12}$, suggesting that this compound has good nesting property in the main conduction band. $PrFe_4P_{12}$, however, has an extra hole-like band crossing the Fermi surface, which prevents from a perfect nesting effect[1]. Therefore $PrFe_4P_{12}$ is considered to be an uncompensated metal even at high pressure unless a structural phase transition and/or a magnetic ordering are induced by applying pressure. In this stage, it is not clear what induces M-I transition. The observed Kondo like behavior and the field-induced heavy-fermion state suggest that the quadrupolar interactions of the f electrons of Pr^{3+} survive even in the insulator phase and the quadrupolar interactions might play an essential role in the M-I transition.

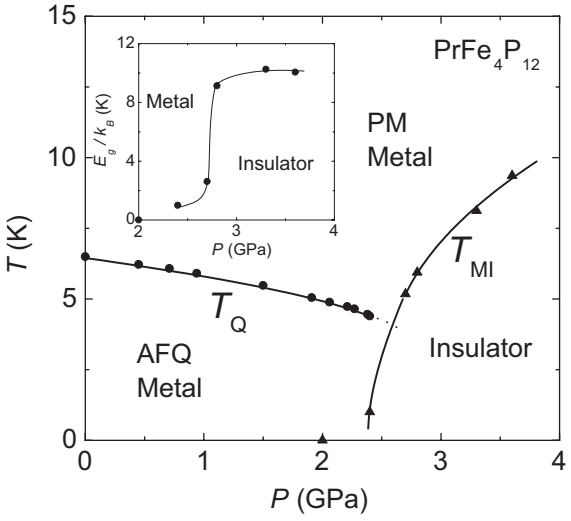

Figure 1: P - T phase diagram. Inset shows the pressure dependence of E_g / k_B.

[1] H. Harima *et al.*, J. Phys. Soc. Jpn. **71** Suppl. 70 (2002).