(13)

Pressure–induced metal–insulator transition in $PrFe_4P_{12}$

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The filled skutterudite $PrFe_4P_{12}$ exhibits a nonmagnetic phase transition at $T_A = 6.5$ K, which is proposed to be a multipolar transition with a scalar order parameter with Γ_1 symmetry. In this project, we have studied pressure effect on this compound, and found unusual metal–insulator (M–I) transition above 2.6 GPa.[1,2] It is characteristic that the application of magnetic field suppresses easily the insulating phase and induces the heavy fermion state similar to that at ambient pressure. The pressure–temperature phase diagram obtained from electrical resistivity measurements is shown in Fig. 1. Hall effect measurement revealed a marked reduction of the number of carriers in the insulating phase, indicating that a band gap opens. In addition, we argued from NMR and magnetization measurements that an antiferromagnetic (AFM) transition occurs in the insulating phase and the M–I transition is of first order. In fact, the AFM transition has been confirmed from the neutron diffraction measurement by Osakabe *et al*. Furthermore, Kawana *et al*. revealed that the M–I transition is accompanied with a tiny structural phase transition from the cubic to the orthorhombic by X–ray diffraction measurement.[3] The relation between the AFM ordering and the opening gap in the main conduction band has been discussed theoretically.[4]

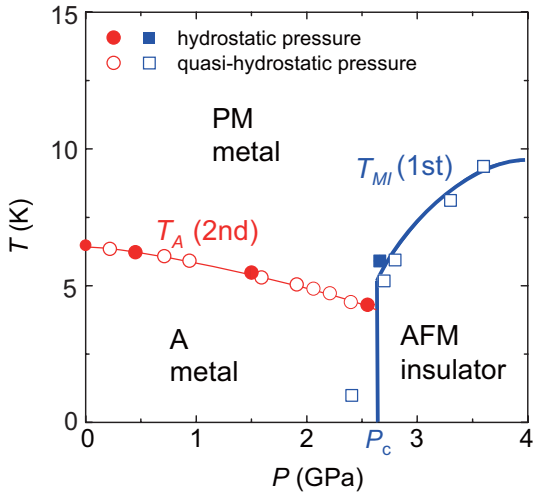

Figure 1: pressure–temperature phase diagram obtained from the electrical resistivity measurements using petroleum ether (hydrostatic pressure) and Daphne oil 7373 (quasi-hydrostatic pressure).

[1] H. Hidaka *et al*., Phys. Rev. B **71**, (2005) 073102.
[2] H. Hidaka *et al*., J. Phys. Soc. Jpn. **75** (2006) 094709.
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