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Antiferromagnetically ordered insulating phase under high pressure in PrFe4P12

H. Hidaka[1], N. Wada[1], H. Kotegawa[1], T. C. Kobayashi[1], D. Kikuchi[2], H. Sato[2] and H. Sugawara[3]

[1]Graduate School of Natural Science and Technology, Okayama University, Okayama 700-8530

[2]Graduate School of Science, Tokyo Metropolitan University, Hachioji 192-0397

[3]Faculty of Integrated Arts and Sciencies, Tokushima University, Tokushima 770-8502

In the electrical resistivity measurement under high pressure using Daphne oil 7373 as a pressure–transmitting medium, we have found a pressure–induced transition from metal to insulator above 2.4 GPa in $PrFe_4P_{12}$. [1] It is revealed from NMR, magnetization and neutron diffraction measurements that an antiferromagnetic ordered state is realized in the insulating phase. Furthermore, the metal–insulator (M–I) transition is of first order, and a phase separation exists near M–I transition temperature T_{MI} owing to the distribution of pressure. Recently, Kawana *et al.* found a structural phase transition from cubic structure to tetragonal one at T_{MI} by x–ray diffraction measurement under high pressure.

In this study, we have performed the electrical resistivity measurement under high pressure using other pressure-transmitting mediums in order to investigate the effect of the uniaxial stress to the M–I transition. Figure shows a obtained pressure–temperature phase diagram. In the uniaxial stress measurement using a polymerized Stycast, the M–I transition appears at lower pressures than the case of quasi-hydrostatic pressure, indicating that the uniaxial stress is favorable to the M–I transition. It is considered that the uniaxial stress assists the occurrence of the structural phase transition from cubic to tetragonal at T_{MI}. On the other hand, the M–I transition appears suddenly with finite T_{MI} between 2.55 and 2.66 GPa in the measurement using a petroleum ether, where the better hydrostaticity is expected than Daphne oil 7373. It is suggested that the transition from the antiferroquadrupolar metallic phase to the insulating phase is of first order and its critical pressure P_C is about 2.6 GPa. .

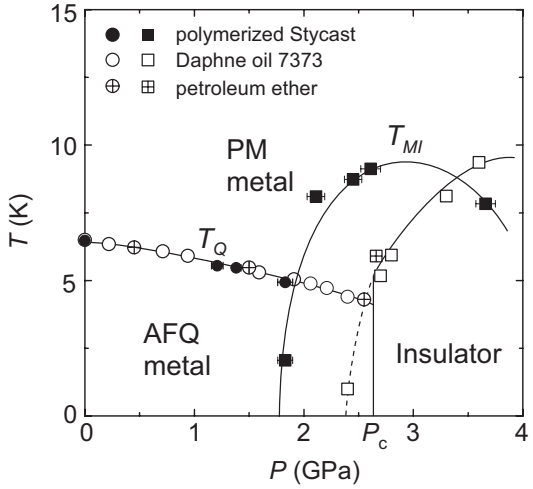

Figure 1: Pressure–temperature phase diagram obtained from the resistivity measurements using Daphne oil 7373[1], polymerized Stycast, and petroleum ether.

[1] H. Hidaka *et al.*, Phys. Rev. B **71** (2005) 073102.