PRESSURE-TEMPERATURE PHASE DIAGRAM OF β-(BDA-TTP)$_2$FeCl$_4$ INVESTIGATED BY THE MAGNETIZATION MEASUREMENT UNDER HIGH PRESSURE

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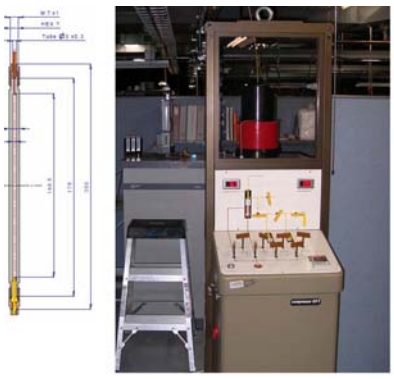
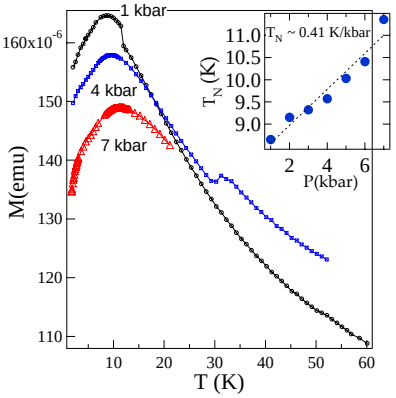
The existence of local magnetic moments as magnetic anions in charge transfer salts induces dramatic changes in the ground state of some organic conductors. In some weak interaction cases, the magnetotransport properties show distinct behaviors between magnetic and non-magnetic compounds even when they show similar ground states. We previously obtained a pressure-temperature (*PT*) phase diagram of a weak πd interaction system β-(BDA-TTP)$_2$FeCl$_4$ [1] from the magnetoresistance (MR) measurement under pressure. Since β-(BDA-TTP)$_2$FeCl$_4$ undergoes a metal-insulator (MI) transition at high temperature (~120 K), we were unable to access the AFM transition (T_N~ 8.5K at ambient pressure) from the transport method. We recently integrated a gas pressure system with the Quantum Design MPMS SQUID magnetometer to investigate the pressure dependence the AFM ordering temperature.

Fig. 1 shows the measurement system and the gas pressure cell. Several single crystals with total mass of ~0.4 mg were attached on a quartz rod and placed inside the pressure cell. The pressure was changed at ~ 100K to ensure the helium is in the gas phase at high pressure. Fig. 2 shows the M(T) curves at several different pressures, where the AFM transitions are seen as decrease of the magnetization with decreased temperature. The AFM ordering temperature increases with pressure with rate of ~0.41K/kbar in the measured pressure range. The resulting phase diagram along with the result from the previous transport experiment is shown in Fig. 3. It is notable that the superconductivity and AFM phase coexist at low temperature and high pressure. The coexistence was predicted from the MR measurement [1], where a MR anomaly associated with metamagnetic transition was observed.





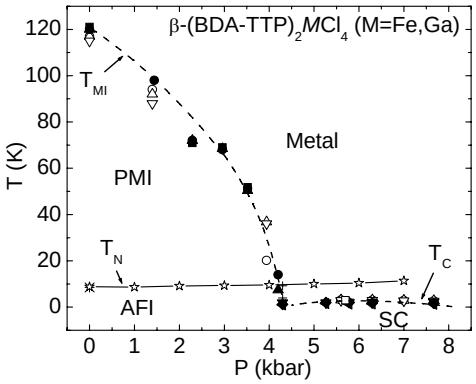


Fig. 1. The pressure cell and the measurement system (the gas press system and MPMS).

Fig. 2. M(T) curves at different pressures. Inset : Néel temperature as a function of pressure. The anomaly in the magnetization curve is associated with the solid-gas phase transition of helium.

Fig. 3. The pressure-temperature phase diagram of β-(BDA-TTP)$_2$FeCl$_4$ from the transport and magnetization measurement. The transition temperatures for the non-magnetic analogue β-(BDA-TTP)$_2$GaCl$_4$ is also shown as open symbols.

Acknowledgements

This work is supported by NSF-DMR 0203532.

References

[1] Choi, E.S., *et al.*, Phys. Rev. B, **70**, 024517 (2004).