Thermodynamic Investigation of Organic Conductors under Pressures

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Low-temperature thermodynamic measurements on organic charge transfer salts κ-(BEDT-TTF)$_2$Ag(CN)$_2$H$_2$O, κ-(BEDT-TTF)$_2$Cu(NCS)$_2$ and (DI-DCNQI)$_2$Ag systems were performed under pressures and with magnetic fields. The former two salts are organic superconductors with transition temperature of 5.0 K and 9.6 K, respectively. Two small chip-type sensors of ruthenium oxide are attached to the both sides of single crystals or pellets with typical size of 1.0×1.0×0.4mm^3 . These chips were used as a heater and a thermometer to detect temperature oscillation of the sample [1]. Using the sensitive ac-modulation technique available in the cramp-type pressure cell, we have succeeded to detect thermal anomalies being associated with the superconducting transitions of metal indium under several pressures. The thermal anomaly related to the superconductivity of κ-(BEDT-TTF)$_2$Ag(CN)$_2$H$_2$O was observed around 5 K as a small hump of the heat capacity. [2] The peak shape of the superconducting transition is similar to that has been observed in the thermal relaxation calorimetry technique. The magnitude of heat capacity anomaly was found to be reduced by the external magnetic fields smaller than 1 T. The anomaly disappears under pressure of 0.4 GPa which is consistent with the scenario of Mott-Hubbard physics.

Concerning the superconducting transition of κ–(BEDT-TTF)$_2$Cu(NCS)$_2$, we have detected a board hump-like structure in C_pT^{-1} vs T curvatures under 0.5 and 0.7 GPa. The reduction of the superconductive transition by pressure is consistent with the transport and ac susceptibility measurements. We also discuss the qualitative change of the magnetic contribution in heat capacity of the strongly correlated electrons system of (DI-DCNQI)$_2$Ag using the pressure calorimetry technique.

References

[1] O. Kubota and Y. Nakazawa, Rev. Sci. Instrum. 79 (2008) 053901 1-6.
[2] N. Tokoro *et al. J. Phys. Conf. Series.* 132(2008)012010 1-8.