Magnetoresistance Study of Organic Conductor HMTSF-TCNQ

Woun Kang,[1] Keizo Murata[2], Reizo Kato[3]

[1] *Department of Physics, Ewha Womans University, Seoul 03760, Korea, e-mail: wkang@ewha.ac.kr*
[2] *Osaka Metropolitan University (previously Osaka City University) Osaka 558-8585, Japan*
[3] *RIKEN, Wako, Saitama 351-0198, Japan*

We have studied field- and angular dependence of magnetoresistance of the organic conductor, HMTSF–TCNQ under high pressure. HMTSF–TCNQ is a charge transfer salt with charge transfer ratio of 0.74. HMTSF donor molecules and TCNQ acceptor molecules in a crystal aligns to construct a sheet in such a way that the HMTSF stacks surround the TCNQ stacks like a checkerboard. The proposed Fermi surface consists of a pair ($+k_F$ and $-k_F$) of 1-dimensional sheets of electrons and another pair of holes, in the similar way as TTF–TCNQ. High quality single crystals were found to be indispensable to study magnetoresistance in a reproducible manner. [1-6] Field dependent magnetoresistance above 1.47 GPa when the magnetic field is aligned parallel to the least conducting c* axis of the sample is reminiscent of the magnetoresistance observed in the organic Dirac material, α-(BEDT-TTF)$_2$I$_3$, in which the magnetoresistance increases at low field, but is soon followed with a broad region of negative magnetoresistance and finally increases again. [7] Angular magnetoresistance for a magnetic field rotating in the crystallographic *bc*-plane is also reminiscent of what was observed in α-(BEDT-TTF)$_2$I$_3$, but becomes significantly different when the rotation plane of magnetic field departs away from the *bc*-plane. Resemblance of magnetoresistance data to those of α-(BEDT-TTF)$_2$I$_3$ suggests a possible appearance of linear dispersion in the title compound above 1.47 GPa. In fact, a recent first-principles calculation and tight-binding analysis showed that HMTSF-TCNQ can be a new candidate material for the nodal-line semimetal, [8] similarly to the single-component molecular conductor [Pt(dmdt)2]. [9-10] It also showed that the CDW occurring below 30 K deforms open nodal lines into closed ones.

References

[1] K. Murata *et al*., *Physica B* **405**, S111 (2010).
[2] K. Murata *et al*., *J. Phys. Soc. Jpn.* **79**, 103702 (2010).
[3] K. Murata *et al*., *Physica B* **407**, 1927 (2012).
[4] K. Murata *et al*., *Physica B* **460**, 241 (2015).
[5] K. Murata *et al*., *Jap. J. Appl. Phys.* **56**, 05FA12 (2017).
[6] K. Murata *et al*., *J. Mod. Phys.* **5**, 673 (2014).
[7] T. Osada *et al*., *J. Phys. Soc. Jpn.* **77**, 084711 (2008).
[8] S. Ozaki *et al*., *Phys. Rev. B* **104**, 155202 (2021).
[9] B. Zhou *et al*., *Chem. Commun.* **55**, 3327 (2019).
[10] R. Kato *et al*., *J. Phys. Soc. Jpn.* **89**, 044713 (2020).