Structure and electronic properties of bilayer type molecular conductors based on ETTM-STF

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We synthesized asymmetrical donor molecules for searching unique crystal structures and electronic properties. For example, an ambient-pressure molecular superconductor (TMET-STF)$_2$BF$_4$ ($T_c = 4.1$ K) has two crystallographically independent cation radical layers, which is called bilayer structure. The band structure calculation indicates that the one conduction layer has a quasi-one-dimensional Fermi surface and the other layer a cylindrical two-dimensional Fermi surface.\(^1\)\(^2\)

In order to develop molecular conductors and new superconductors with bilayer structure induced by asymmetry of molecule, we have newly synthesized asymmetrical donor molecules, ETTM-STF, and prepared their cation radical salts. X-ray structure analysis revealed that BF$_4$ and ClO$_4$ salts have bilayer structure similar to that of (TMET-STF)$_2$BF$_4$ (Fig. 1). When the temperature dependence of resistivity was measured under pressure by using a diamond anvil cell, the resistivity decreased sharply at 6.8 K (onset) under 8 kbar, which corresponds to the superconducting transition. We will present crystal and electronic structures, and physical properties of (ETTM-STF)$_2$X (X = BF$_4$, ClO$_4$).

Fig. 1 Crystal structure and temperature dependence of resistivity for (ETTM-STF)$_2$BF$_4$.


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