Conducting Pd(dmit)$_2$ Radical Anion Salts with Fluorinated Onium Cations (dmit = 1,3-dithiol-2-thione-4,5-dithiolate)

R. Kato$^1$, M. Nomura$^1$, A. Tajima$^1$, H-B. Cui$^1$, T. Tsumuraya$^{1,2}$, T. Miyazaki$^2$

$^1$Condensed Molecular Materials Laboratory, RIKEN, Japan
$^2$National Institute for Materials Science, Japan

Presenting author: reizo@riken.jp

Anion radical salts of Pd(dmit)$_2$$_2$ (dmit = 1,3-dithiol-2-thione-4,5-dithiolate; Fig. 1) with onium cations belong to a Mott system with a triangular lattice of [Pd(dmit)$_2$]$_2$-dimers where electron correlation and frustration operate [1]. Band parameters of this system can be tuned by the choice of counter cations [2]. Chemical modifications of the insulating/non-magnetic counter cation allow control of the electronic properties, because the counter cation can affect the geometry of the conducting/magnetic anion site. In this study, we introduced a fluorine atom into the counter cation by the H/F substitution (Fig. 1). An introduction of the slightly larger and electronegative fluorine atom would induce significant effect on the anion arrangement, keeping the pristine crystal structure.

In (FCH$_2$)Me$_3$Z$^+$ (Z = N and P) salts, which are isostructural with the corresponding Me$_4$Z$^+$ salts, the lattice constant along the direction parallel to the side-by-side arrangement of the dimers is reduced. This leads to an enhancement of the corresponding interdimer transfer integral and band width. The (FCH$_2$)Me$_3$Z$^+$ salts show metallic behavior in high temperature region under ambient pressure, whereas Me$_4$Z$^+$ salts are Mott insulators in the whole temperature region. The (FCH$_2$)Me$_3$N$^+$ salt shows superconductivity at 7.4 K under 4.2 kbar.

References