Supramolecular Bi-functional Conductor (Me-3,5-DIP)[Ni(dmit)$_2$]$_2$

Yosuke Kosaka[1], Hiroshi M. Yamamoto[1], Akiko Nakao[2], Akiko Tajima[1], Masafumi Tamura[1, 3], and Reizo Kato[1]

[1] *Condensed Molecular Materials Lab, RIKEN, Japan*

[2] *High-Energy Accelerator Research Organization, Japan*

[3] *Department of Physics, Faculty of Science and Technology, Tokyo Univ. Science, Japan*

Email: yhiroshi@riken.jp

(Me-3,5-DIP)[Ni(dmit)$_2$]$_2$ comprises two alternating layers of Ni(dmit)$_2$, one of which is a two-dimensional metal (Layer II) and the other of which is a Mott-insulator (Layer I). (Me-3,5-DIP = N-methyl-3,5-diiodopyridinium, dmit = 1,3-dithiole-2-thione-4,5-dithiolate) The origin of the peculiar structure of this material is the supramolecular halogen (I···S) and hydrogen (H···S) bonds formed between Me-3,5-DIP and Ni(dmit)$_2$. As a result, this salt is exhibiting almost all chemical bonds, namely, covalent, coordination, metallic, hydrogen, halogen, and ionic bonds. Firstly, we will discuss the competition and cooperation of these chemical bonds in building this interesting structure.

Having confirmed structural characteristics, we will describe the physical properties of this material. As expected from the band calculation, it exhibits metallic conduction and localized moments at the same time, both derived from the π-electrons on Ni(dmit)$_2$. To understand the interaction between itinerant and localized π-electrons, resistivity under pressure has been measured. These results will be discussed in conjunction with the recent studies on this material by NMR [2], Shubnikov-de Haas oscillation, photoemission spectroscopy, and so on. The possibility of Kondo-state will be also discussed.

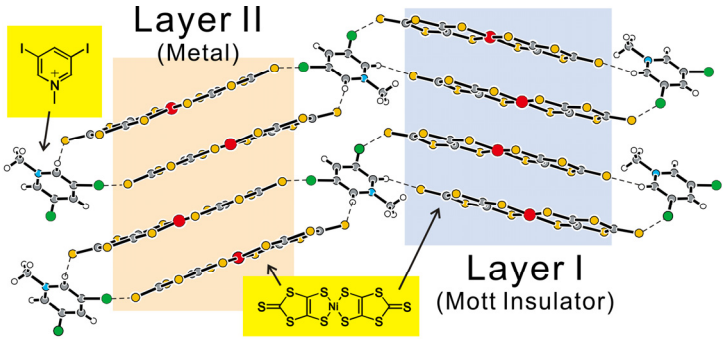

Figure: Crystal structure of (Me-3,5-DIP)[Ni(dmit)$_2$]$_2$.

*This work was partially supported by Grants-in-Aid for Scientific Research (No. 16GS0219, 20681014) from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

[1] Y. Kosaka *et al.*, *J. Amer. Chem. Soc*. **129** (2007) 3054.

[2] S. Fujiyama *et al.*, *Phys. Rev. B* **77** (2008) 060403.