TTF & extended TTF based coordination networks

Nicokas Zigon,[1] Federica Solano,[1] Yohan Cheret,[1] Narcis Avarvari [1]

[1] *Univ Angers, CNRS, MOLTECH-ANJOU, SFR MATRIX, F-49000 Angers, France,*
e-mail: nicolas.zigon@univ-angers.fr

Developed since the end of the eighties, MOFs – formed by the controlled self-assembly of inorganic and organic moieties – offer limitless possibilities to develop new materials for precise purposes, depending not only on the properties of the organic/inorganic moieties used, but also on the 3-D structural organization of the building blocks within the material.[1] MOFs are well-known for their high and tunable porosity, making them good candidates for gas storage and capture, or heterogeneous catalysis. However, MOFs showing both excellent electron conduction and porosity are scarce in the literature, despite the fact that the development of materials combining these two properties would lead to cutting-edge functionalities and applications, e.g. as sensors or battery electrodes.[2,3]

On the other hand, in the field of organic conductors, the synthesis of organic metals or organic superconductors based on TTF scaffolds sprung a tremendous enthusiasm since the 70s with the discovery of the first organic superconductors, commonly called Bechgaard's salts.[4] The crystals obtained are typically extremely stable and highly conducting ($\sigma >> 0.1$ S/cm), but, due to the tight packing observed in organic crystals they do not display long-range porosity.

Most of the literature reported conducting MOFs are based on Tetrathiafulvalene (TTF), benzene hexathiolate or phenolates.[5] We propose herein to explore the structural diversity of organic conductors in the field of conducting MOFs. Scaffolds bearing additional S-atoms, based on bis(vinyldithio)-tetrathiafulvalene (BVDT-TTF) have been developed and associated with various metal ions to constitute a library of coordination networks. Post-synthetic oxidation reactions with I_2 have been performed to increase the conductivity of the frameworks, and followed by single-crystal X-ray diffraction or Raman spectroscopy.

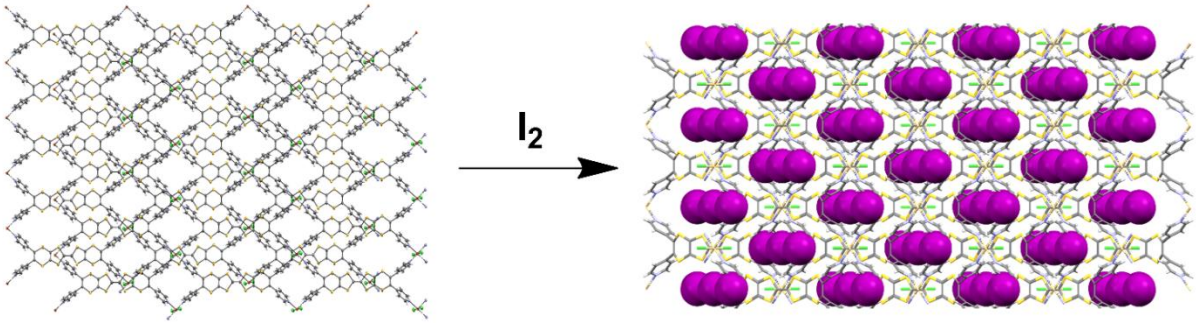

Figure 1. X-ray structures of the post-suynthetic oxydation of an extended-TTF based coordination network (solvent molecules omitted for clarity)

References

1 H. C. Zhou and S. Kitagawa, *Chem. Soc. Rev.*, 2014, **43**, 5403–6176.
2 I. Stassen, N. Burtch, A. Talin, P. Falcaro, M. Allendorf and R. Ameloot, *Chem. Soc. Rev.*, 2017, **46**, 3185–3241.
3 Y.-G. Weng, W.-Y. Yin, M. Jiang, J.-L. Hou, J. Shao, Q.-Y. Zhu and J. Dai, *ACS Appl. Mater. Interfaces*, 2020, **12**, 52615–52623.
4 Jérome, D., Mazaud, A., Ribault, M., and Bechgaard, K., *J. Physique Lett.*, 1980, **41**, 95–98.

5 L. S. Xie, G. Skorupskii and M. Dincă, *Chem. Rev.*, 2020, **120**, 8536–8580.