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Diplomas

1983: B. Sc., University of Tokyo, Tokyo, Japan
1985: M. Sc., University of Tokyo, Tokyo, Japan
1988: Ph.D. Sc., University of Tokyo, Tokyo, Japan

Career summary

1988-1992: Assistant Professor, Institute for Molecular Science, Japan
1992-2001: Associate Professor, Tokyo University, Japan
2001-present: Professor, Nagoya University, Japan

Selected publications:

1. "Electron highways into nanochannels of covalent organic frameworks for high electrical conductivity and energy storage" Y. Wu, D. Yan, Z. Zhang, M.M. Matsushita, K. Awaga, (2019) *ACS Appl. Mater. Interfaces*, **11**, 7661.
2. "Towards high-bandwidth organic photodetection based on pure active layer polarization", L. Reissig, S. Dalgleish, K. Awaga, (2019) *Scientific Reports*, **8**, 15415.
3. "An exotic band structure of a supramolecular honeycomb lattice formed by a pancake π–π interaction between triradical trianions of triptycene tribenzoquinone" Y. Shuku, A. Mizuno, R. Ushiroguchi, C. S. Hyun, Y.J. Ryu, B.K. An, J.E. Kwon, S.Y. Park, M. Tsuchiizu, K. Awaga, (2018) *Chem. Commun.*, **54**, 3815.
4. "3D Spin-Liquid State in an Organic Hyperkagome Lattice of Mott Dimers" A. Mizuno, Y. Shuku, M.M. Matsushita, M. Tsuchiizu, Y. Hara, N. Wada, Y. Shimizu, K. Awaga, (2017) *Phys. Rev. Lett.*, **119**, 057201.
5. "Discovery of the K_4 Structure Formed by a Triangular π Radical Anion" A. Mizuno, Y. Shuku, R. Suizu, M.M. Matsushita, M. Tsuchiizu, D. R. Mañeru, F. Illas, V. Robert, K. Awaga, (2015) *J. Am. Chem. Soc.*, **137**, 7612.
6. "Monitoring the solid-state electrochemistry of Cu(2,7-AQDC) (AQDC = Anthraquinone Dicarboxylate) in lithium battery: coexistence of metal and ligand redox activities in a metal-organic framework" Z. Zhang, H. Yoshikawa, K. Awaga, (2014) *J. Am. Chem. Soc.*, **136**, 16112.
7. "In situ seamless magnetic measurements for solid-state electrochemical processes in Prussian blue analogues" T. Yamada, K. Morita, H. Wang, K. Kume, H. Yoshikawa, K. Awaga, (2013) *Angew. Chem. Int. Ed.*, **52**, 6238.

Development of Molecular Mimics of Carbon Allotropes

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Isostructure and isoelectronicity are crucial concepts in chemistry for understanding the chemical and physical properties of atoms, ions, molecules and even solid-state materials. They are also useful in materials research to reproduce and improve the properties and functions of existing materials. As model systems for material design, carbon allotropes are extremely interesting; the electronic structure of graphene has conical bands, so-called Dirac cones. K_4 carbon, which is a theoretically-predicted carbon allotrope consisting of sp^2 carbons, is also predicted to possess the S=1 Dirac cones, and the valence band of diamond has characteristic nodal lines. It is thus clear that these carbon allotropes possess unique band structures due to their highly symmetrical structures. From this perspective, isostructure of the carbon allotropes are promising structures, particularly electron systems of which were delocalized. Although it is difficult to reproduce such structures by using simple non-carbon elements, it is highly possible to realize molecule-based carbon-allotrope structures by means of supramolecular chemistry.

In this presentation, we discuss the rational synthesis of the molecule-based K_4 and honeycomb structures, using polyhedral π-conjugated molecules. It is found that a chiral molecule, (−)-NDI-Δ, forms a K_4 lattice in the crystal structure of $(TBA)_{1.5}$[(−)-NDI-Δ], by an intermolecular π-π overlap between the NDI moieties [1,2]. The spin lattice in this salt is identical to the hyper-kagome lattice of S=1/2 Mott dimers, and the low-temperature magnetic and thermal measurements reveal the presence of a gap-less spin liquid state [3]. We also report molecule-based honeycomb lattices, formed the triptycene analogs [4].

References (Times 10pt)

[1] A. Mizuno, Y. Shuku, K. Awaga, *Bull. Chem. Soc. Japan*, **92**, 1068 (2019). (Invited Review)
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