Development of Novel Heterocyclic Compounds and Their Molecular Assemblies for Advanced Materials

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Heterocycles containing sulfur and/or nitrogen atoms are useful as components of functional organic materials since heteroatoms in their rings are helpful to stabilize ions or ion-radical species. In addition, intermolecular interactions caused by heteroatom contacts can be expected to form unique molecular assemblies. In this project, novel functional organic materials based on various heterocycles were synthesized and their physical and structural properties were investigated.

1. A Novel Synthesis of Halogenated Oxa[9]helicenes and Dibromo Spiro-Lactone Derivative[1)]

A new class of halogenated oxa[9]helicene derivatives along with dibromo spiro-lactone were synthesized in excellent yields, and the compounds were successfully characterized by ^{1}H and ^{13}C NMR, high resolution mass spectroscopy and X-ray crystallographic analysis.

2. X-Ray Crystallographic Analyses of Heterocyclic and Organometallic Compounds[2,3)]

The X-ray crystallographic analyses of two heterocyclic and organometallic compounds have revealed their interesting structural natures and unique molecular aggregations.

References

1) M. Shahabuddin, M. Salim, M. Tomura, T. Kimura and M. Karikomi, *Tetrahedron Lett.* **57**, 5902–5906 (2016).
2) M. Tomura, *IUCrData* **2**, x171023 (2017).
3) M. Tomura, *IUCrData* **2**, x171059 (2017).

Multifunction Integrated Macromolecules for Molecular-Scale Electronics

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Recently a single electron tunnel device (**SET**) has attracted much attention as an ultra-low-power device. In this project, to establish an innovative fabrication process for **SET** systems, we have been developing step-wise synthetic protocols for mono-molecular single-electron tunnel devices and their integrated circuits (**MOSET IC**).

1. Development of Rigid-Rod Linkers for Mono-Molecular Integration of Quantum-Effect Device Modules

We have established the synthetic methods for typical **SET** modules based on building blocks (**1**). In this study, we developed rigid-rod linkers (**2-9**) for precise alignment of the device modules in single molecular skeleton. Figure 1 illustrates our synthetic strategy.

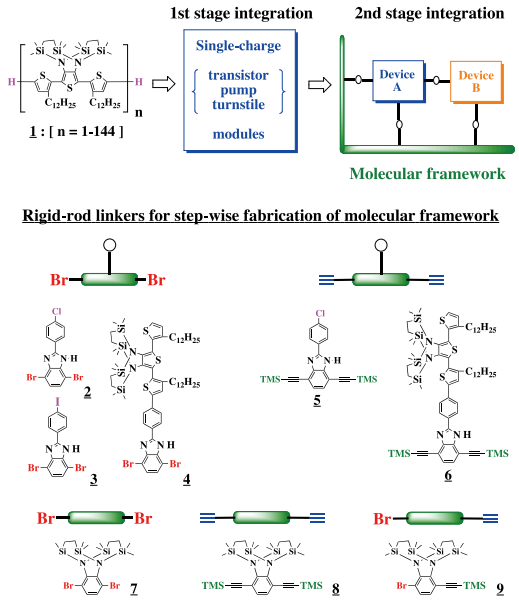

Figure 1. Synthetic strategy for precise integration of device modules.