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

Safety Office

TOMURA, Masaaki
Assistant Professor

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. Synthesis, Structure and Physical Properties of *N*-Boc-Pyrrole Derivatives for Organic Semiconductors

Planar π-conjugated molecules have been attracted much attention from the viewpoints of development of organic semiconductor devices.[1)] To improve their low solubility, we synthesized several *N-tert*-butoxycarbonyl (Boc)-2,5- diarylpyrrole derivatives as precursors of organic semiconductors for the fabrication of solution-processed field-effect transistors. These compounds have nonplanar structures due to a steric hindrance between Boc group and aryl ones. Elimination of Boc group from the soluble precursors by annealing quantitatively afforded insoluble *N*-H-2,5-diarylpyrroles with planar structures. We investigated their spectral and electrochemical changes toward a film fabrication technology.

Reference

1) K. Ono, J. Hashizume, H. Yamaguchi, M. Tomura, J. Nishida and Y. Yamashita, *Org. Lett.* **11**, 4326–4329 (2009).

Multifunction Integrated Macromolecules for Molecular-Scale Electronics

Safety Office

TANAKA, Shoji
Assistant Professor

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 (**MOSET**) and their integrated circuits.

1. Systematic Chemical Modulation of Molecular Wires

We have already elucidated the details of steady-state long-distance molecular conduction through a series of molecular wires **1**. As a next step, we have planed to develop the design principle for precise and wide-range control of electron-transport characteristics of single molecular wires. For this purpose, we have modulated the electronic structure of the wires **1** by systematic chemical modifications. Figure 1 shows the typical examples. The measurement of single molecular conductance of these wires is still in progress.

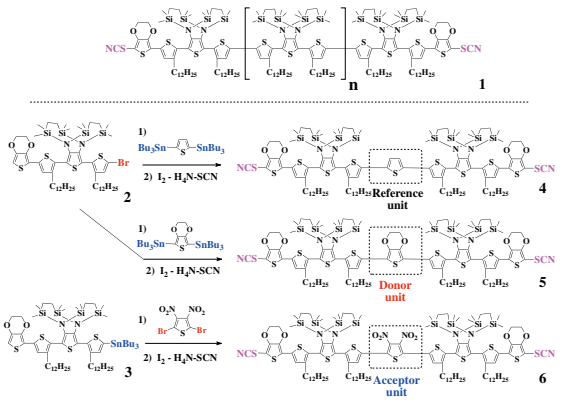

Figure 1. Synthetic scheme for molecular wires with modified electronic structure.