IX-G Development of Multi-Function Integrated Macromolecules and Their Organization on Substrate Surfaces for Planar Molecular-Scale Electronics Circuits

The concept of molecular-scale electronics is now realized for individual components such as wire, diode, switch, and memory cell, but the fabrication of complete molecular-scale circuits remains challenging because of the difficulty of connecting molecular modules to one another. Molecular monolithic technology, which integrates the wiring, transistors and the required passive elements on a single macromolecule, has been proposed as a promising solution to this problem. In this project we have been trying to establish both the architecture of this novel class of macromolecules and the protocols for their purposive organization on metal/semiconductor substrate surfaces.

IX-G-1 Step-Wised Synthesis of Multifunctional Molecular Wires for Planar Metal-Molecule-Metal Junctions

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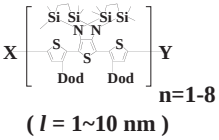
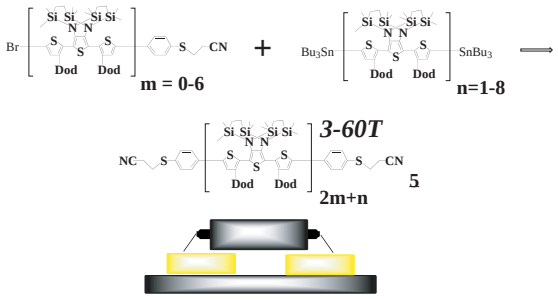
A series of 1–10 nm long building blocks (**1-4**) have been prepared. We have already developed i) "insulated molecular modules," ii) "energy-gap tuning modules," iii) "molecule-anchor modules," and iv) "molecular junction modules" as the basic elements for multi-function integrated π-conjugated macromolecules. The building blocks **1-4** are widely applicable to assemble these functional modules in a single molecule. For example, a series of linear macromolecules (**5**–**6**), specifically designed for the systematic investigation of electron conduction in molecular wires, have been prepared easily from these blocks and modules in a few steps.



1: X = Br, Y = Br
2: X = Br, Y = H
3: X = $SnBu_3$, Y = $SnBu_3$
4: X = $SnBu_3$, Y = H

Figure 1. Molecular structure of 1–10 nm long building blocks.



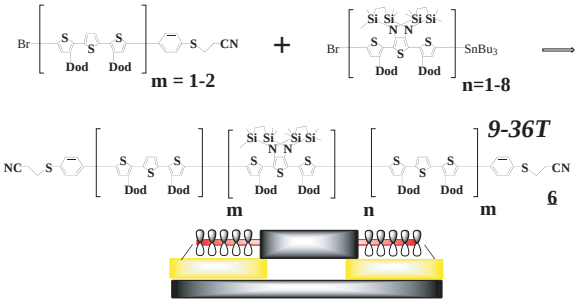


Figure 2. Molecular structure of insulated molecular wires with anchor units.