Material design and synthesis of heteroarene-based organic semiconductors for organic transistors and solar cells

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The filed of organic electronics has emerged as a potential technology enabling to realize low cost, ubiquitous, and soft electronics applications. One of the key materials in the technology is organic semiconductors that act as the active material in the electronic devices such as organic field-effect transistors (OFETs) and organic photovoltaic cells (OPVs).

Our research group in Hiroshima University has tried to contribute to the developments of organic semiconductors including small molecular- and conjugated polymer-based materials. In particular, we have focused on fused-heterarene structures as the key building unit. Such heteroarenes are [1]benzothieno[3,2-*b*][1]benzothiophene (BTBT) [1], dinaphtho[2,3-*b*:2',3'-*f*]thieno[3,2-*b*]thiophene (DNTT) [2], dianthra[2,3-*b*:2',3'-*f*]thieno[3,2-*b*]thiophene (DATT) [3], isomeric naphthodithiophenes (NDTs) [4], anthra[2,3-*b*;6,7-*b*']dichalcogenophenes (ADXs) [5], benzo[1,2-*b*;4,5-*b*']dichalcogenophenes (BDXs) [6], naphtho[1,2-*c*:5,6-*c*']bis[1,2,5]thiadiazole (NTz) [7], naphthodithiophene diimide (NDTI) [8] (Fig. 1).

These heteroarenes can be efficiently synthesized and modified to afford superior molecular semiconductors, or incorporated into conjugated chains to provide new semiconducting polymers. In this presentation, synthetic chemistry and design strategy of these materials are discussed together with their device characteristics.

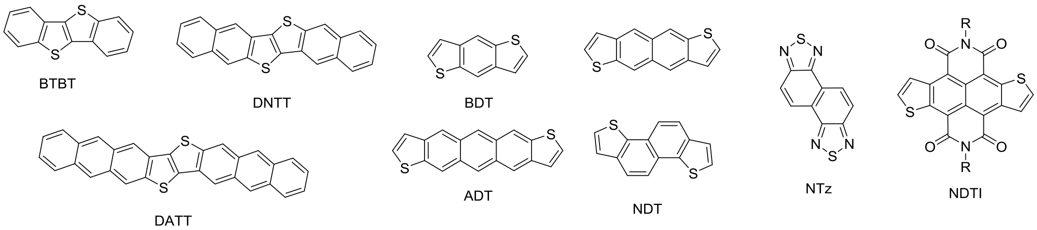

Fig. 1. Heteroarens for molecular and polymer semiconductors

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