Development of β-linked Quaterthiophene and Tetrathiafulvalene Dimers as New Organic Semiconductors

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High performance organic semiconductors have been widely developed in recent years because of their industrial use for flexible, low-cost, and large-aria coverage electronic devices. As for twisted-form molecules, solution processable organic field-effect transistors (OFETs) utilizing swivel cruciform oligothiophenes have been reported [1]. To tune molecular packing motif and environmental stability, we focus on twisted molecular geometry of β-linked quaterthiophene dimers, which are thought to be less conjugated π-system than linear octithiophenes indicative of stable lowered HOMO level under environmental condition, and are expected to maintain side-by-side intermolecular interactions through sulfur-sulfur short contacts.

As an active component of OFETs or molecular conductors, we present here the synthesis and properties of new β-linked quaterthiophene dimers of **1** and **2**, where the central bithiophene unit is linked at β-position of thiophene ring, and tetrathiafulvalene (TTF) dimer of **3**, where TTF is linked with ethyne spacer for the planarity to make conduction path (Fig.1). As expected, redox and optical properties of **1** and **2** are similar to that of the parent α-α'-butylquaterthiophene. This demonstrates that two quaterthiophene units of **1** and **2** have no electronic interaction. Compound **3** shows similar trend. Both **1** and **2** are moderately soluble in common organic solvents. The crystal structure and FET fabrication of the present compounds are also investigated.

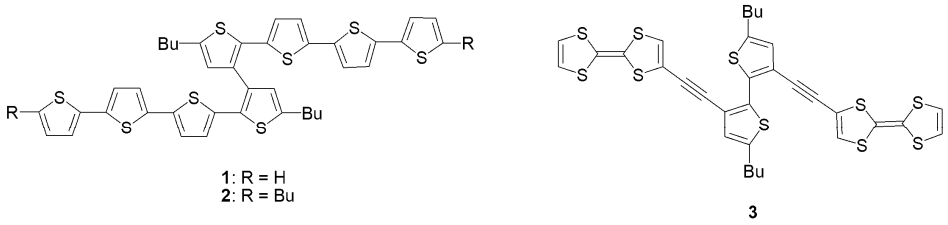

Figure 1. Chemical structures of the investigated dimers.

[1] (a) Achmad Zen *et al.*, J. Am. Chem. Soc. 128 (2006) 3914. (b) Achmad Zen *et al*., Chem. Mat. 19 (2007) 1267. (c) Askin Bilge et al., J. Mater. Chem., 16 (2006) 3177.