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Electrochemistry of New Thiophene Containing Organic Sensitizers for Dye-Sensitized Solar Cells

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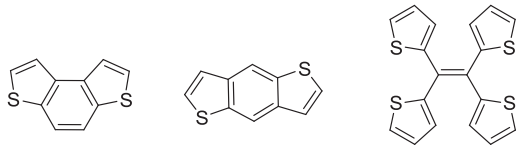
Metal-based photosensitizers (*e.g.* Ru complexes) have been used over the last 20 years as the key components for Dye Sensitized Solar Cells (DSSC).[1] Although transition metal dyes exhibit high performances, challenging synthesis and trick purification steps are often required. For these reasons, in recent years alternative DSSC chromophores have been investigated. In particular, metal-free organic dyes have attracted great attention because of some advantages they have with respect to the metal based ones. The development of innovative, stable organic dyes with optical absorptions extending into red and near-IR region of the solar spectrum is, at present, a "hot topic" of the chemistry research in this field.

We have synthesized a series of novel benzo[1,2-b:4,3-b']dithiophene, (BDT), benzo[1,2-b:4,5-b']dithiophene, (BDT1) and tetrakis(2-thienyl)ethene (TTE) based metal-free dyes in which the donor and the acceptor fragments are constituted by the classical triarylamino and cyanoacrylic groups, respectively, and the linker is either a double or a triple bond.

The novel chromophore series have been the object of a detailed molecular electrochemistry study. We have determined: HOMO-LUMO gaps and the electron transfer properties of the electron rich and electron poor terminal redox sites as a function of the conjugation efficiency, of the linker-spacer system and of the substituent effects. The electrochemical results have been also compared with spectroscopic evidences.



[1] "*Dye-Sensitized Solar Cells*" Ed. by K. Kalyanasundaram, EPFL press **2010**.
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