DONOR–ACCEPTOR DOUBLE CABLE POLYMER FILMS PREPARED BY ELECTROCHEMICAL POLYMERIZATION. INVESTIGATION OF THE PHOTOINDUCED CHARGE TRANSFER AS THE BASIC PROCESS FOR OPTOELECTRONIC DEVICES

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Usually, the active layer in organic polymeric optoelectronic devices (e.g. photovoltaic devices, plastic solar cells) consists of a mixture of electron donor and acceptor materials (*bulk heterojunction* solar cells). However, a limited miscibility of the components often gives rise to phase separation within the active composite layer, which in turn affects the overall device's efficiency. The covalent grafting of electron acceptor moieties to polyconjugated backbones appears an interesting route towards non-composite donor-acceptor polymeric materials in which phase separation cannot occur. The structure of such double-cable polymers should force defined electron-donor interaction and should provide continuous conducting pathways for charge carriers of both signs.

A first significant step is the preparation of double-cable polymers where both the donor and the acceptor moieties retain their individual optoelectronic properties and undergo photoinduced electron transfer upon illumination. In this paper, we show the electrochemical synthesis and the investigation of double cable materials consisting of a polythiophene backbone bearing, via covalent bonds, either fullerene derivatives or tetracyanoanthraquinodimethane (TCAQ) moieties as electron acceptors. Thin films of this double-cable materials have been studied by means of cyclic voltammetry, in-situ IR spectroelectrochemistry and photoexcited spectroscopy (photoinduced absorption, light induced ESR). The results show that the materials meet the necessary conditions for photovoltaic applications.