

Cyclic Voltammetry Studies of n-Type Polymers with non-Alternant Fluoranthene Units.

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Short description of the institute

The IChF-PAN is involved in research and development in nearly all fields of physical chemistry including investigation of light/matter interactions (mostly realized in Department of Photochemistry and Spectroscopy – DP&S). The group of “Electrochemiluminescence - ECL” (as part of the DP&S) investigate the electron transfer processes leading to generation and annihilation of the electronically excited species in intramolecular as well as intermolecular reactions. Both, organic (intramolecular donor-acceptor A–D compounds) and inorganic systems (transition metal, Ru(II), Re(I) and Ir(III), complexes) are objects under investigations. In the field of A–D compounds current investigations are devoted to the description and prediction of the excited intramolecular charge-transfer (singlet and triplet) state properties. Investigations on transition metal complexes involve electron transfer generation and annihilation of the excited metal-to-ligand charge transfer states (MLCT) with an attempt to unify the kinetic description of the both processes. The performed works involve also synthesis (with general chemical and physicochemical characterization – structure/properties relationships) of new, organic and inorganic compounds applied in the carried investigations. The main goal of the performed studies is the search of new materials for efficient electricity-to-light conversion in the electron transfer reactions. Until yet our best ECL systems (based on the cyclometalated Ir(III) chelates) are characterized by efficiencies approaching 70% (in numbers of photon emitted per number of the electron transferred in an ECL event). Recently, the group has started investigations of materials for light-to-electricity conversion.

Current work within SolarNtype project (MRTN-CT-2006-035533)

The present work is done in the frame of the search for a stable polymer able to substitute fullerenes - poly(*p*-fluoranthenevinylenes) straightforwardly affordable by heating up their dithiocarbamate precursors. We have investigated these materials electro- and photo-chemically by means of cyclic voltammetry and fluorescence spectroscopy. Four derivatives (with different pending alkyl chains) have been deposited on ITO plates and tested under different preparation (curing temperature, film thickness) and measuring conditions. We have found that the electrochemical conversion of the dithiocarbamate precursors results in the generation of new non-conjugated fluoranthene polymers in which electroactive units are connected by –CH₂–CH₂– groups. The obtained materials show very similar redox properties as its formally conjugated version in which the electroactive units are bounded through –CH=CH– bridges. Reversible electrochemical reduction of poly(*p*-fluoranthethanes) occurs at potentials only somewhat (*ca.* 0.1 V) more negative as found for their poly(*p*-fluoranthenevinylenes) analogues suggesting relatively weak coupling between fluoranthene kernels in both kinds of investigated polymers. Most probably the described electrochemical route may be also applicable for other dithiocarbamate precursors of polymeric materials allowing simple preparation of stable electroactive layers at ambient conditions. It may be of interest if the high-temperature conversion route should be avoided for any reasons.