Conception of organic photovoltaic cells based on bio-sourced precursors

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Research on organic photovoltaic cells (OPVs) has attracted considerable attention in recent years. Advantages, such as flexibility, light-weight, and reduced material and fabrication cost, make them an excellent alternative to inorganic solar cells[1,2]. Conjugated polymers, the key components in the OPV's active layers, have been widely investigated due to their absorption of a wide range of wavelengths and tunable electronic structures[3]. However, their synthesis, for example, Suzuki or Stille cross coupling methods, depends highly on non-renewable petroleum monomers, toxic solvents and transition metal catalysts[4]. Hence, the objective of this Ph.D. work is to obtain new bio-based π-conjugated polymers from renewable ressources and to apply them in the design of OPVs. To achieve this goal, new trimers and polymers have been designed using furan, which is one of the most abundant molecule from renewable resources. The synthesis of these trimers was performed under microwave irradiations[5] to optimize the reaction conditions and the respective conjugated polymers were then produced from the electropolymerization[6] of the synthesized trimers, through deposition on conductive substrates. The potential use of these polymers in organic electronic applications was further tested, calculating their respective HOMO and LUMO energy levels from cyclic voltammetry data. The electron acceptor and donor character of the prepared polymers was also investigated through the design of hole-only and electron-only devices.

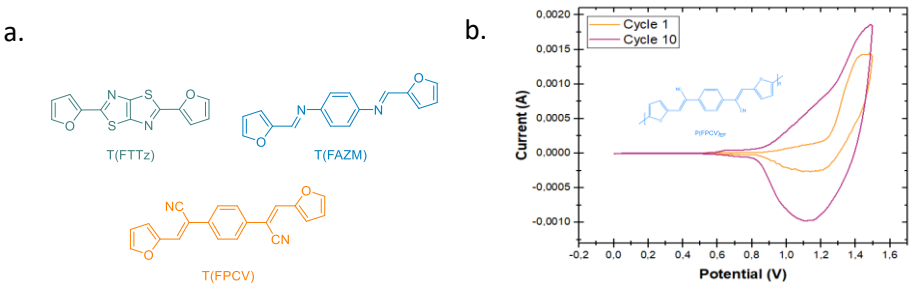

Figure 1. a. Chemical structures of the trimers containing azomethine, thiazolothiazole and cyanovinylenephenelyne subunits. b. Voltammogram of the ectropolymerization of the trimer T(FPCV) (5 mM) : 10 cycles between 0 and + 1.5 V, in a solution of ACN and $TBABF_4$ 0.1 M.

References :

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