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Inkjet-printed complementary inverters based on Organic Electrochemical Transistors

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Inkjet-printed complementary inverters based on Organic Electrochemical Transistors (OECT) are the device of choice for building logical, sophisticated and smart electronic devices. Typically, a complementary inverter comprises a n-type and a p-type transistor. While p-type organic transistors are already well established in the literature, n-type devices still face a lack of publications and studies due to its poor stability and electronic conductivity. (1) Therefore, to achieve logical, sophisticated and smart devices, these challenges must be overcome. Among them, this project will investigate the mechanisms of operation of these devices, the physics of the interfaces involved, stability and optimization. Particularly, the OECTs operation is based on electrochemical doping of the organic semiconductor by ionic species coming from electrolyte. The volumetric capacitance (C^*) is the fundamental physical parameter that gives information about this phenomenon. Usually, C^* is extracted with Electrochemical Impedance Spectroscopy (EIS) in a capacitor-like structure. Recent studies, however, have reported a pulsed voltage technique for calculating impedances parameter, directly from the transistor structure (three terminal device). (2) Therefore, the first goal of this project is to confront these two correlated, yet, completely different techniques for characterizing OECTs. The materials choice for the OECTs here in explored are: P3HT, PBTTT, PTB7-Th and PEDOT:PSS as p-type and P (NDI2OD-T2) and NDI-2Tz as n-type organic semiconductors. As for the electrolytes, standard aqueous 100 mM KCl solution shall be used. This topic is quite recent in the literature and, therefore, its study constitutes opportunities to contribute to the understanding of fundamental aspects of the area, as well as the possibility of publications with high scientific and technological impact.

Palavras-chave: Organic electrochemical transistors. Volumetric capacitance. Electrochemical impedance spectroscopy.

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