04a

Advisor: Dr. José Luis Maldonado Rivera

Committee Members:

Dr. Salvador Fernández Tavizón
(Secretary - CIQA)

Dr. Bernardo A. Frontana Uribe
(Evaluator - IQ-UNAM y CCIQS-UAEMex)

Dr. José Luis Maldonado Rivera
(Chairperson)

Thesis: "GRAPHENE DERIVATIVE BASED ELECTRODES TO BE USED IN ORGANIC OPTOELECTRONIC DEVICES"

Summary:

In this work, a semi-transparent, low-cost and easy processable graphene derivative and PH1000 (conductive PEDOT:PSS polymer) based bilayer anode, is presented as a sustainable potential alternative to ITO (Indium Tin Oxide). The simple mechanical-synthesized graphene derivative was in aqueous-suspension processed (SPG), drop-coated onto a common glass substrate and treated with hydriodic acid (HI). The SPG film presented a Raman intensity ratio (ID/IG) of 0.56 and a number of 7 sheets theoretically estimated. Modified PH1000 with dimethyl sulfoxide (DMSO) was spin-coated onto SPG layer. The bilayer anode (SPG/PH1000) exhibited a transmittance, roughness and resistance of 82 % (550 nm), 9 nm and 226 Ω/sq, respectively. The bilayer alternative electrode was used in the manufacture of organic solar cells (OSCs) based on the non-fullerene PBDB-T:ITIC active layer. Average power conversion efficiency (PCE) of 8.3 % (best 8.6 %) was attained for control devices (using ITO as anode) and 4.0 % (best 4.2 %) for devices with the alternative SPG/PH1000 bilayer anode. In addition, preliminary work was carried out modifying the bilayer anode into a three-layer one (SPG/PH1000/PH1000) by adding another PH1000 film onto the bilayer structure, O2 plasma treatment to the SPG film was implemented to activate it. Its transmittance and resistance parameters were 75 % (550 nm) and 82 Ω/sq, respectively. Also, preliminary OSCs based on the non-fullerene PM6:Y7 active layer were manufactured, under regular atmosphere conditions and with direct architecture, whose average PCE was 7.2 % (best 7.7 %). For OSCs fabrication, a vacuum free deposited top electrode Field's metal (FM, an eutectic alloy of Bi 32.5 %, In 51 % and Sn 16.5 %, with a melting point above 62°C) was used. This graphenic electrode could be used in other organic electronic devices such as OLEDs, PSCs and OFETs.