Fluorescence and Electroluminescence Quenching Evidences of Interfacial Charge Transfer in Poly (3-hexylthiopene):Graphene oxide Bulk Heterojunction Organic Photovoltaic Device

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We present electrochemistry of graphene oxide (GO) nanosheets and fluorescence and electrogenerated chemiluminescence quenching capability of GO that are transferred into chloroform from aqueous solution utilizing a novel, surfactant-assisted method. Electrochemical studies indicate that GO can be reduced upon charge injection. Fluorescence quenching of the conjugate polymer poly(3-hexylthiopene) (P3HT) in both solution and solid films is demonstrated to show that GO can be used as an electron acceptor in a bulk heterojunction organic photovoltaic device (OPV). OPV devices were then fabricated with an ITO/PEDOT:PSS/P_3HT-GO/Al structure. Devices containing GO exhibited an increase in short-circuit current (I_{sc}) and conductivity but a decrease in open circuit potential (V_{oc}). These results display the potential for non-organically functionalized GO to be used as an acceptor material in future OPV devices. The results also indicate that GO can increase the conductivity of the nanocomposite film so that charge recombination is an issue in such a device. The increased conductivity and fluorescence quenching are also supported by electrogenerated chemiluminescence (ECL) measurements of P3HT/GO composite films.