Study of the photoluminescent and the electrical properties of nanostructured MEH-PPV/TiO_2 hybrid films

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Abstract: Thin nanostructured TiO_2 layers prepared by using a thermal treatment have been spin-coated and embedded in poly-[2-methoxy, 5-(2′ -ethyl-hexyloxy) phenylene vinylene] (MEH-PPV) films. Scaning electron microscopy (SEM) studies showed that a nc-TiO_2 layer grown at 700 °C for 1.5 hour (PON2 sample) was very porous whereas nc-TiO_2 layers grown at the same temperature for, respectively, 1 hour and 2 hours (PON1 and PON3 samples) were quite dense. Study of the photoluminescence (PL) spectra of pure MEH-PPV and nanohybrid films has shown that excitation with a 325-nm-wavelength laser leads to the largest enhancement in photoluminescent intensity, as observed in the PON2 sample and that excitation with a 470-nm-wavelength laser leads to the strongest fluorescence quenching. Current-voltage (I-V) characteristics of laminar- layer devices with a structure of Ti/nc-TiO_2/MEH-PPV/Al-Ag in comparison with those of Ti/MEH-PPV/Al-Ag showed that the turn-on voltage of the first type of devices was as low as 4 V whereas for the second type, of the current going through the thin layer of MEH-PPV depended linearly on the voltage. Combining the I-V characteristics with the SEM and the PL results, the PON2 hybrid film is seen to be a good candidate for photovoltaic solar cell applications whereas the PON1 and PON3 are suitable for organic light-emitting diodes.
Author Keywords: Fluorescence quenching; Hybrid layer; I-V characteristics; Nc-TiO_2; Photoluminescence

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