On the mechanism of conductivity enhancement and work function control in PEDOT:PSS film through UV-light treatment

In this work, we study the effect of UV light on the work function of PEDOT:PSS films. The authors found that UV irradiation lead to an increase in the work function. Several devices with UV exposed and unexposed PEDOT:PSS were fabricated and measured. The current–voltage characteristics have been obtained for ITO/PEDOT:PSS/InZnO samples. We found that UV irradiated devices show better electrical characteristics and lead to Ohmic contact. The trend in device performance was explained by the observed changes in the work function of the PEDOT:PSS layer. The change in the work function was measured by ultraviolet photoelectron spectroscopy. The structural and morphological properties of PEDOT:PSS films with and without UV treatment were investigated by X-ray photoelectron spectroscopy and atomic force microscopy techniques. The change in the work function of PEDOT:PSS is mainly due to the surface conformational change. The stability of devices with and without UV treatment has been investigated under normal environmental conditions. Electrical properties of the devices have been studied over a period of 30 and 60 days. The stability tests show that devices with UV treatment are more stable that those without UV treatment.

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A comparison of Fig. 4a and b shows that the reverse current across the PEDOT:PSS/InZnO junction without UV treatment is lower than that across the junction fabricated on the sample with UV treatment. This is attributed to the difference that may appear at the interface quality. The absorption and accumulation of oxygen or moisture in the film during measurements is more pronounced in the untreated films. After 60 days of storage, the untreated devices were
found to exhibit weak rectifying properties originated mainly from the bulk of the PEDOT:PSS layer. The phenomenon is believed to be associated with a change of PEDOT:PSS work function as result of O₂ or moisture adsorption on the PEDOT:PSS layer.

**Keywords**

Effect of UV irradiation; Electrical conductivity; Organic films; Work function

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