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Abstract
Surface Ni-doped ITO (Indium Tin Oxide, ITO) thin films were deposited on ARTON plastic substrates at low temperatures by a Ni-ITO co-sputter method. The optimal process parameters with substrate temperature of 45 ℃, sputter pressure of 2.35 mtorr and DC sputter power of 80 W were obtained for the ITO deposition. The properties of the ITO film such as sheet resistance, optical transmittance, surface morphology and work function in dependence of the Ni concentration were revealed. The changes in opto-electrical properties of the ITO films after annealed at 155 ℃ 12 hr in vacuum were investigated. The influence of the Ni-doped ITO anode on the performances of OLED devices was also studied.

Results show that the at substrate temperature of 45 ℃ un-doped ITO film has a sheet resistance of 72 Ω/sq, optical transmittance of 89.33 %, surface morphology of 1.53 nm and work function of 4.73 eV. The Al/Alq3/NPB/ITO/Arton OLED device performs a turn-on voltage of 8.7 V with such an ITO anode. For Ni-doped ITO film with Ni sputter power of 90 W, the sheet resistance is 59.2 Ω /sq, optical transmittance 86.15 %, surface morphology 1. 3 nm and work function 5.09 eV. The turn-on voltage of the OLED device with the Ni (90 W)-doped ITO anode can be reduced to 7 V. The efficiency at 100 cd/m2 can be increased from1.53 lm/W to 2.06 lm/W. However the Ni(90 W)-doped ITO device shows a slightly lower luminance efficiency (1.34 lm/W) than the un-doped ITO device (1.39 lm/W) when calculated at 5000 cd/m2. This indicates that the electron-hole recombination rate is low at high current.

This study evidently demonstrates that a Ni-doped ITO film deposited using a Ni-ITO co-sputter scheme can provide high quality anode to enhance the performances of flexible organic light-emitting diode (FOLED).
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