明志科技大學材料工程系107學年四技專題製作競賽

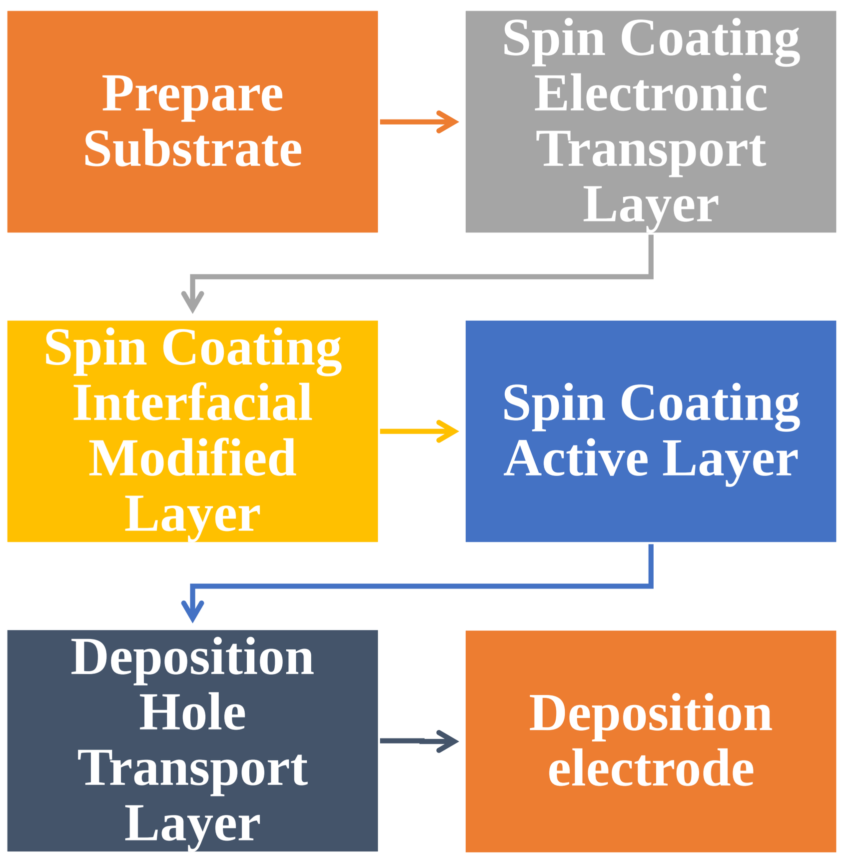
Embedding interfacial layer enhances the performance of organic photovoltaics

班級/學生:材四甲/彭雅絹 指導教授:陳志平 教授

Introduction

Organic interface layers have proven to be effective ways to improve component performance, affecting electrode energy levels and affecting the morphology of the interface and active layer as well as charge selection and transmission. The inverted component interface work function is better modified, which is beneficial to carrier transmission. The change of surface energy is used to control the wettability of the active layer blending membrane, and then the active layer coating pattern is modified. The active layer type can be controlled in this way to obtain high efficiency components.

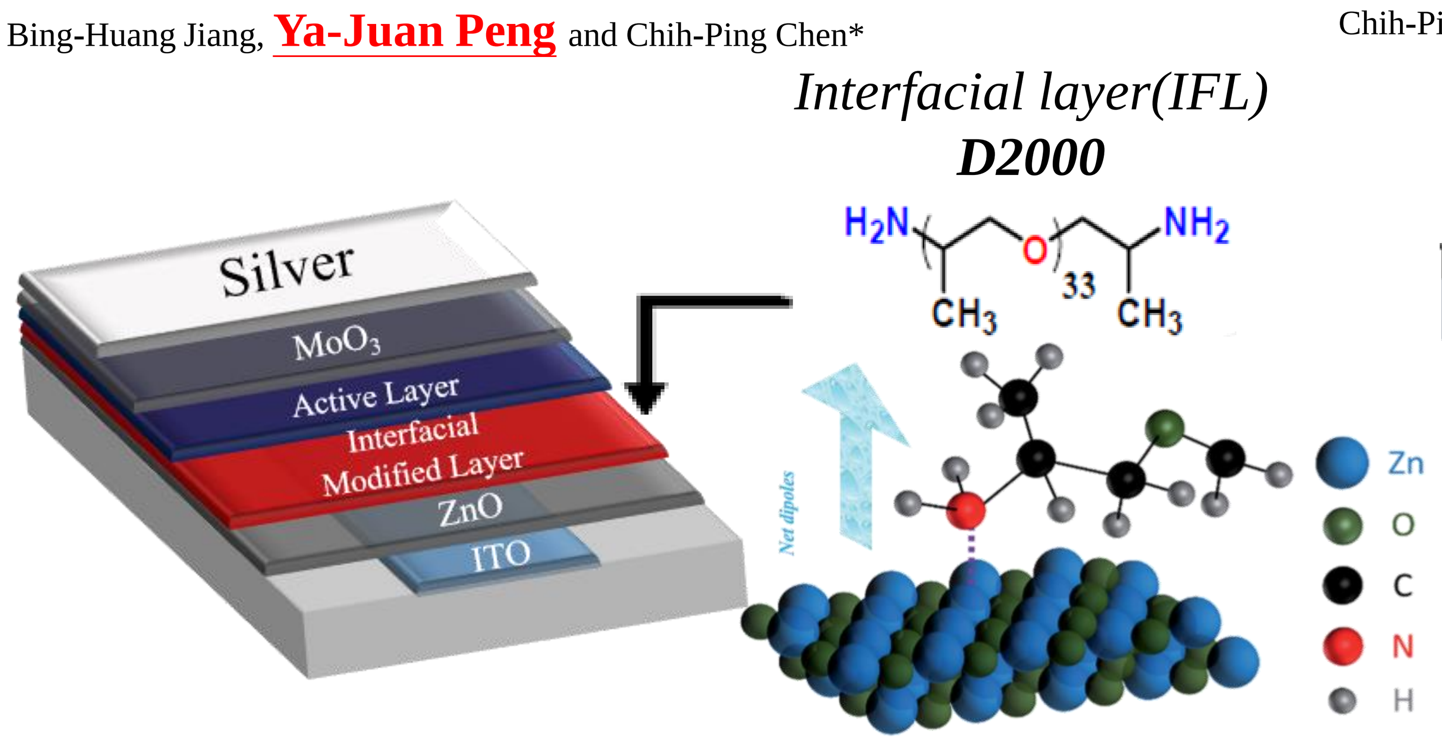
Experimental



Journal of Materials Chemistry A Impact factor: 9.931*

Simple structured polyetheramines, Jeffamines, as efficient cathode interfacial layers for organic photovoltaics providing power conversion efficiencies up to 9.1%

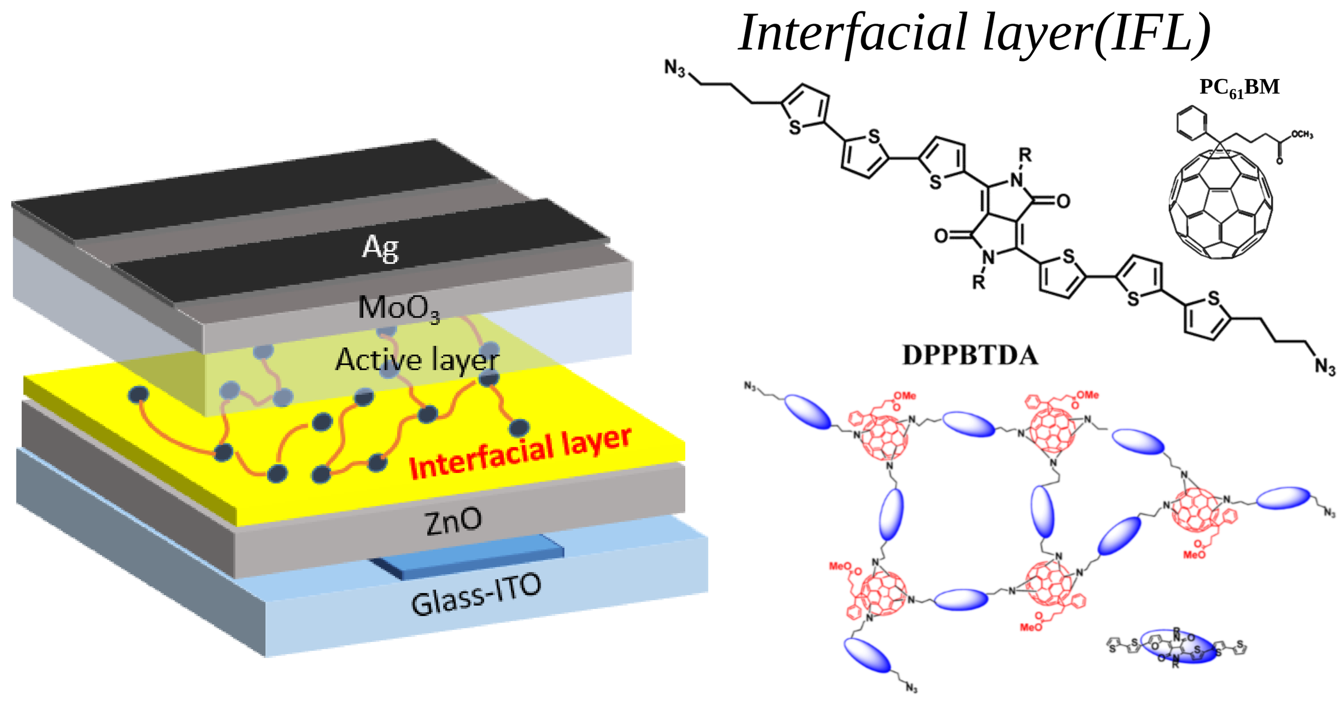
Bing-Huang Jiang, Ya-Juan Peng and Chih-Ping Chen*



ACS APPLIED MATERIALS & INTERFACES Impact Factor=8.097*

Diketopyrrolopyrrole-Based Cross-linking Interfacial Layer on Organic Photovoltaics.

Hsiang-Lin Hsu, Ying-Chieh Chao, Yu-Hua Liao, Chung-Lin Chung, Ya-Juan Peng, Chih-Ping Chen,* and Ru-Jong Jeng*



D2000

Fig1. UPS spectrum for ZnO with/without D2000

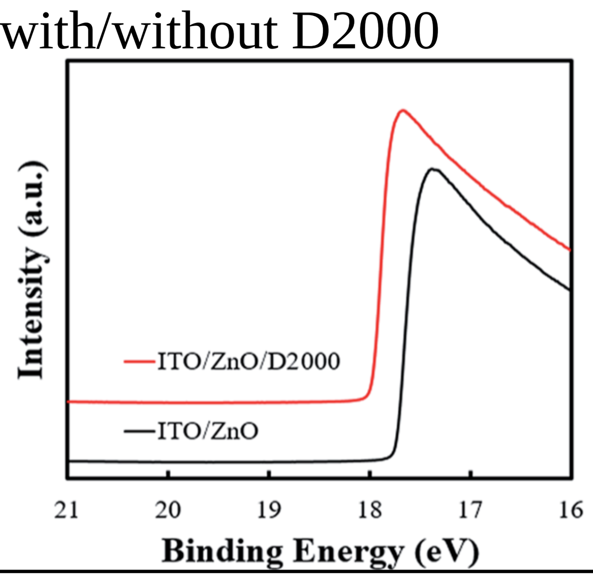


Table 1. SCLC mobility

Devices	Electron mobility ($cm^2V^{-1}s^{-1}$)
ZnO/ PTB7:PC$_{71}$BM	1.24 x10^{-8} (±1.86x10^{-9})
ZnO/D2000/ PTB7:PC$_{71}$BM	**3.06 x10^{-8} (±1.07x10^{-9})**

Morphology of blends

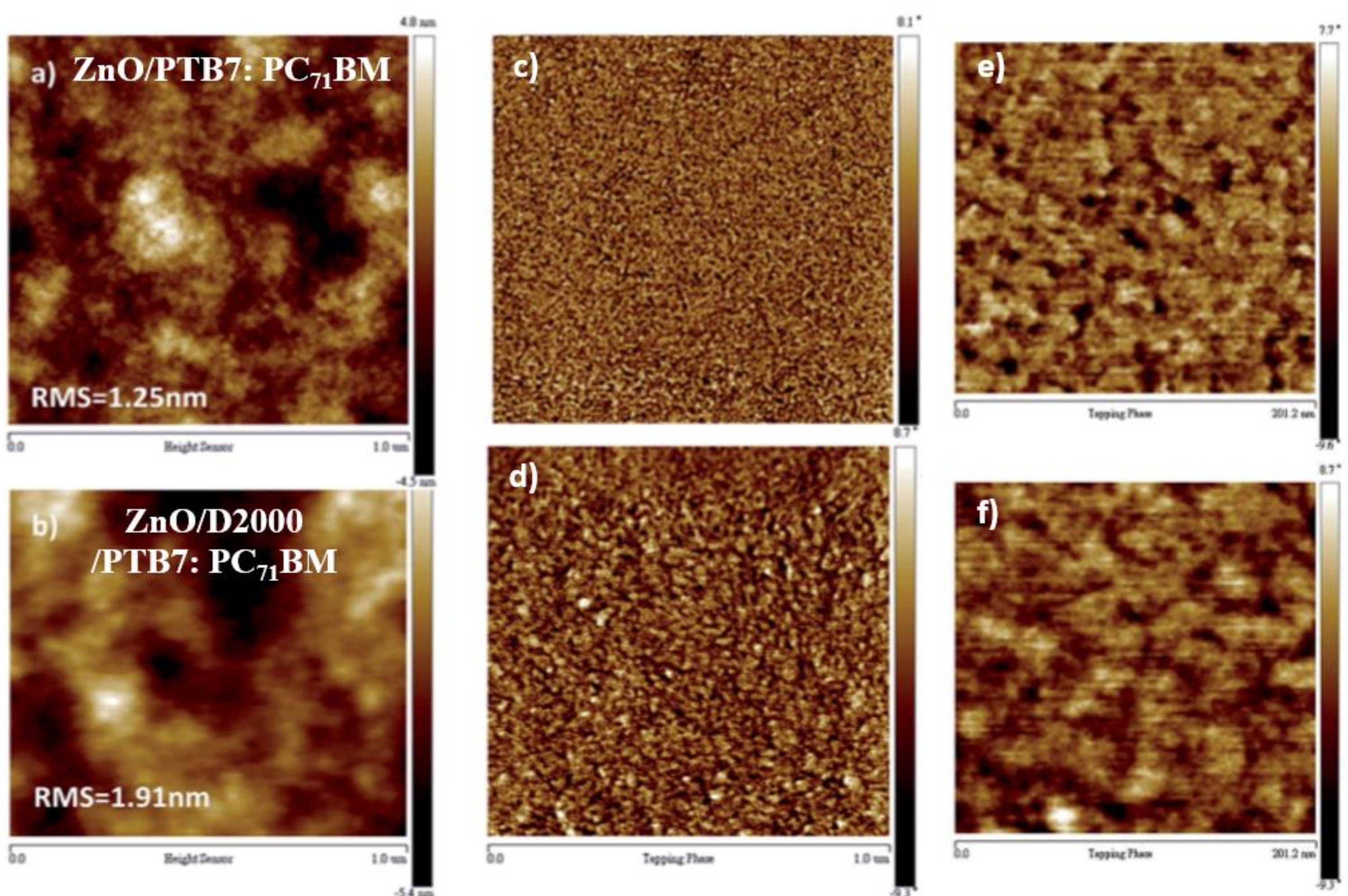


Fig2. AFM topographic (1 mm x 1 mm), phase (1 mm x 1 mm), and enlarge phase images (200 nm x 200 nm) of (a,c,e)ZnO/PTB7: PC$_{71}$BM (b,d,f)ZnO/D2000/ PTB7: PC$_{71}$BM

Devices performance

Fig3. I–V curve

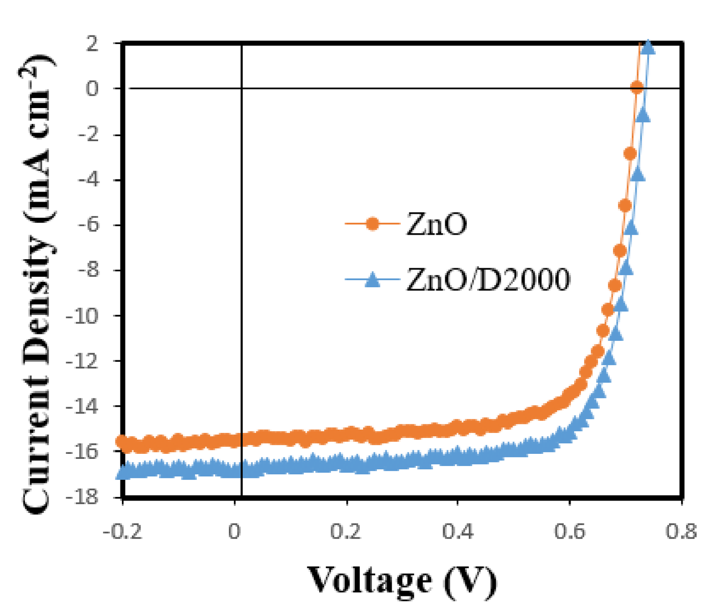


Fig4. IPCE

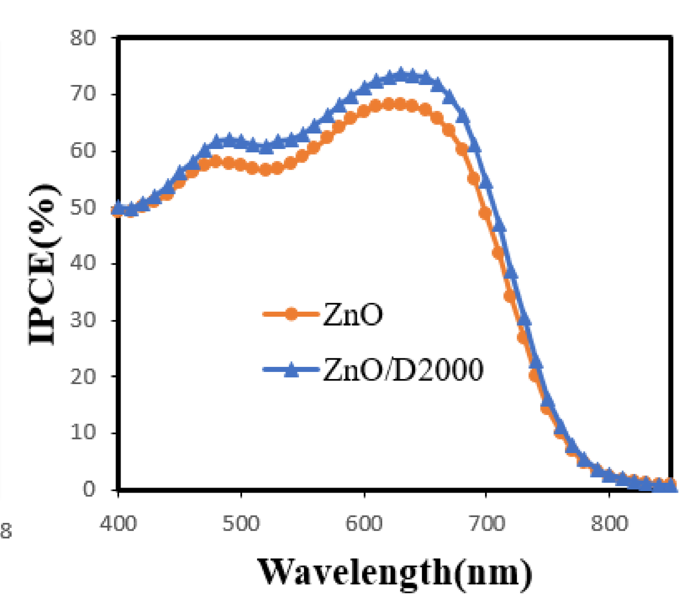


Table 2. J–V properties of the OPV devices

Devices	J_{sc} (mA cm^{-2})	V_{oc} (V)	FF (%)	PCE (%)	best PCE (%)
ZnO	15.7±0.33	0.72±0.01	71.6±2.28	8.1±0.11	8.2
ZnO/ D2000	**15.9±0.89**	**0.73±0.01**	**74.6±0.99**	**8.6±0.37**	**9.1**

DPPBTDA-PC$_{61}$BM

Fig5. Depth profiles of the PTB7-Th:PC$_{71}$BM blended films.

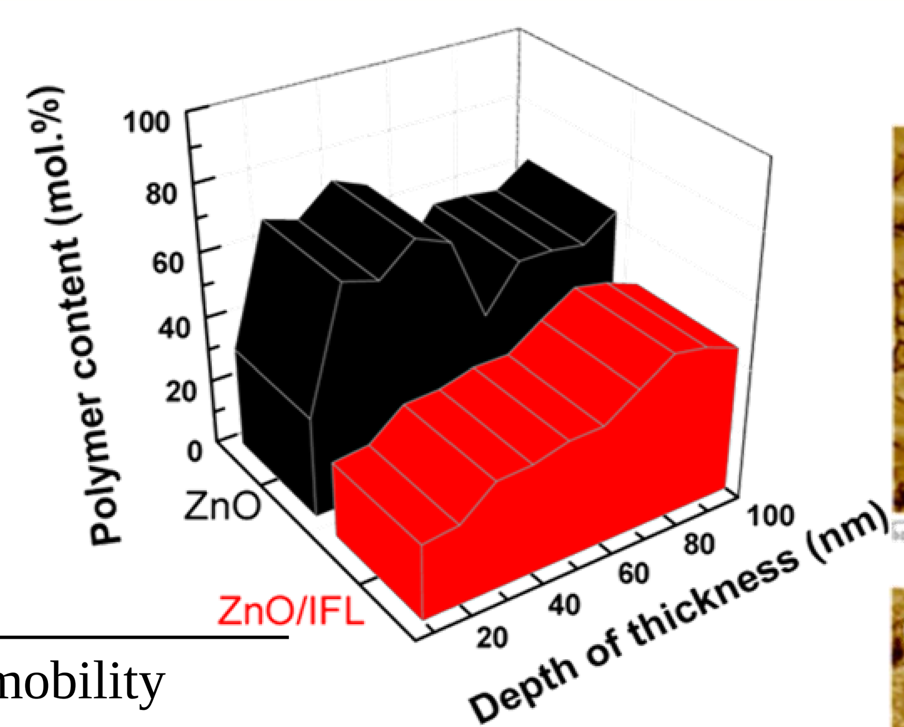


Table 3. SCLC mobility

Devices	Electron mobility ($cm^2V^{-1}s^{-1}$)
ZnO/ PTB7-th:PC$_{71}$BM	5.67x10^{-5} (±1.73x10^{-5})
ZnO/DPPBTDA-PC$_{61}$BM /PTB7-th:PC$_{71}$BM	**1.44x10^{-4} (±4.38x10^{-5})**

Morphology of blends

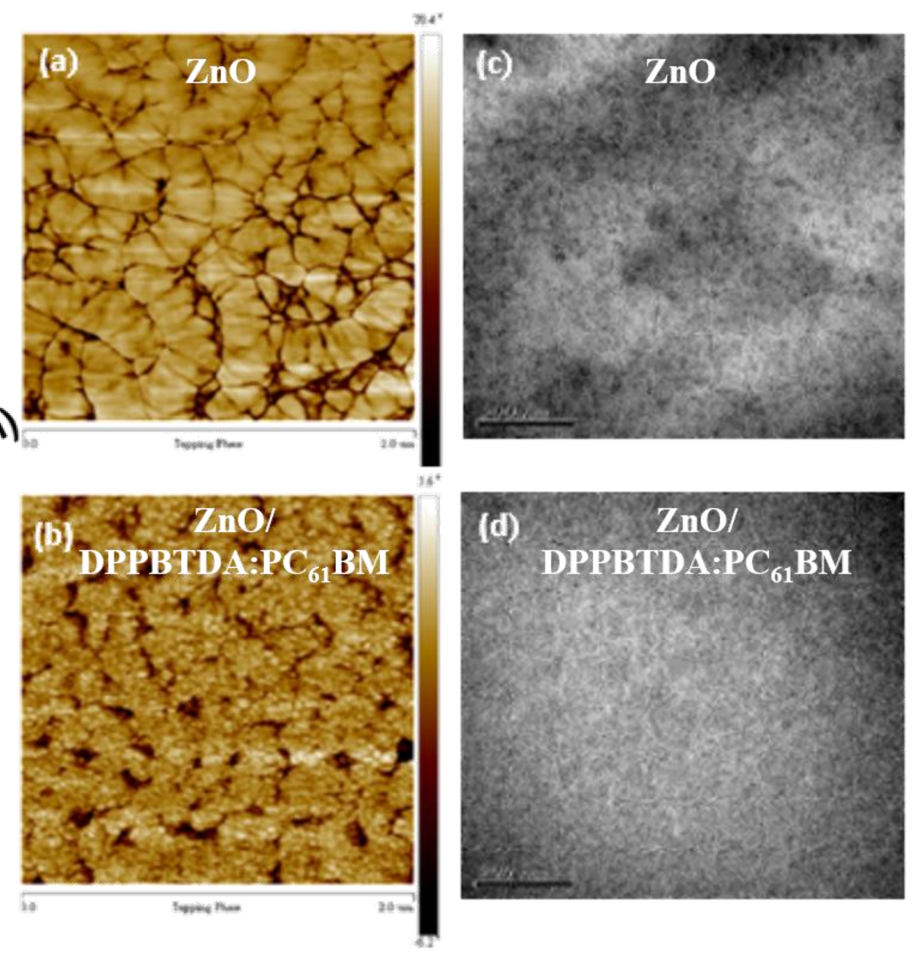


Fig6. (a,b) AFM phase images (2 x 2 μm) of the ZnO with/without IFLs and (c,d)TEM images of the BHJ blend films

Devices performance

Fig7. I–V curve

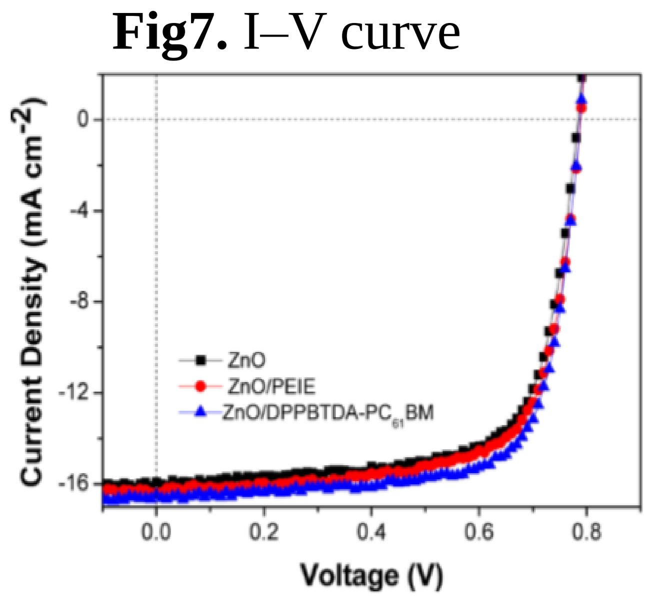


Fig8. IPCE

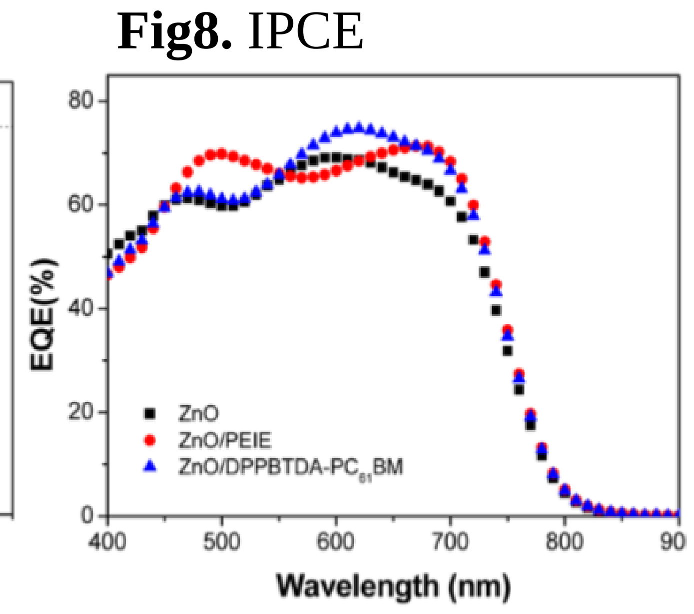


Table 4. J–V properties of the OPV devices

Devices	J_{sc} (mA cm^{-2})	V_{oc} (V)	FF (%)	PCE (%)	best PCE (%)
ZnO	15.9±0.22	0.77±0.01	68.7±1.1	8.5±0.15	8.7
ZnO/DPPBTDA-PC$_{61}$BM	**16.6±0.17**	**0.78±0.01**	**72.1±0.8**	**9.4±0.11**	**9.6**

Conclusions

- The embedded interfacial layer modified the work function of the ZnO by the interface dipole, changes the morphology of the blended film, and enhances electron transport and better cathode selectivity.
- Cross-linked small molecule modification layer exhibits nano phase separation and uniform dispersion of conjugated polymer and fullerene, resulting in higher electron mobility and higher efficiency of components.