Electronic Supplementary Information

Solution processable high-performance infrared organic photodetector by iodine doping †

Pin Tian,[a] Libin Tang,*[a,b] Jinzhong Xiang,*[a] Zhenhua Sun,[c] Rongbin Ji,*[b] Sin Ki Lai,[d] Shu Ping Lau,[d] Jincheng Kong ,[b] Jun Zhao, [b] Chunzhang Yang [b] and Yanhui Li [b]

[a] *School of Materials Science and Engineering, Yunnan University, Kunming 650091, P.R. China.*

[b] *Kunming Institute of Physics, Kunming 650223, P.R. China.*

[c] *College of Optoelectronic Engineering, Shenzhen University, Shenzhen, 518000, P.R. China.*

[d] *Department of Applied Physics, The Hong Kong Polytechnic University, Hong Kong SAP, P.R. China.*

·Optical parameters of the undoped and doped films

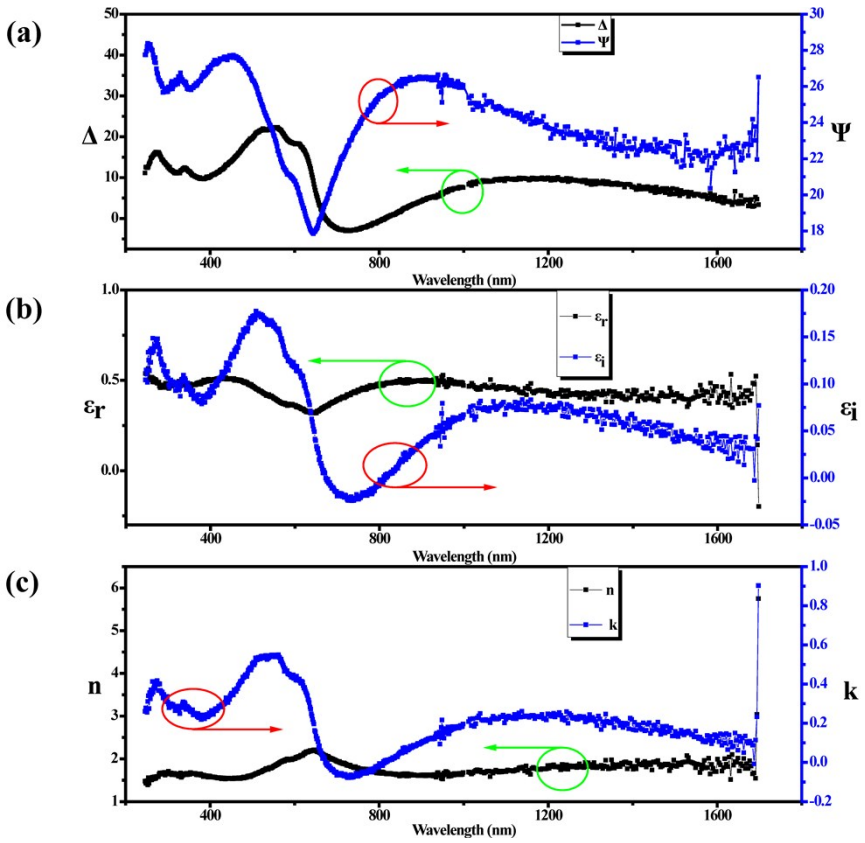

Fig. S1. The ellipsometric spectra of the active layer (P3HT:PCBM) without iodine doping. (a) The λ dependent Δ and Ψ spectra, (b) The λ dependent ε_r and ε_i spectra, (c) The λ dependent n and k spectra.

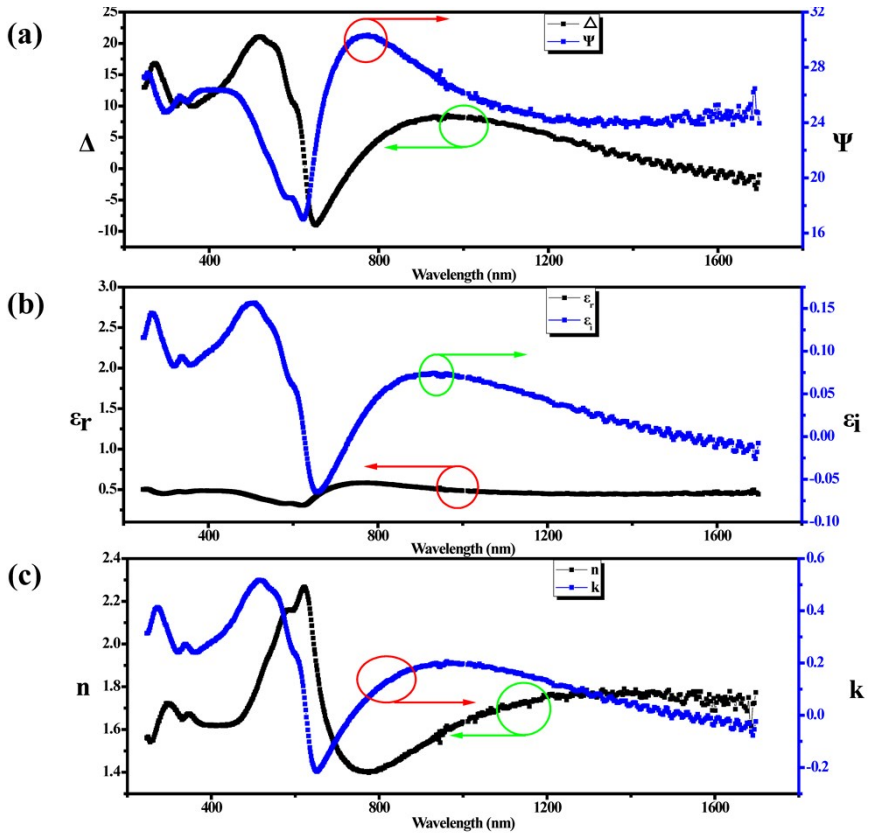

Fig. S2. The ellipsometric spectra of the doped active layer (P3HT:PCBM:I_2). (a) The λ dependent Δ and Ψ spectra, (b) The λ dependent ε_r and ε_i spectra, (c) The λ dependent n and k spectra.

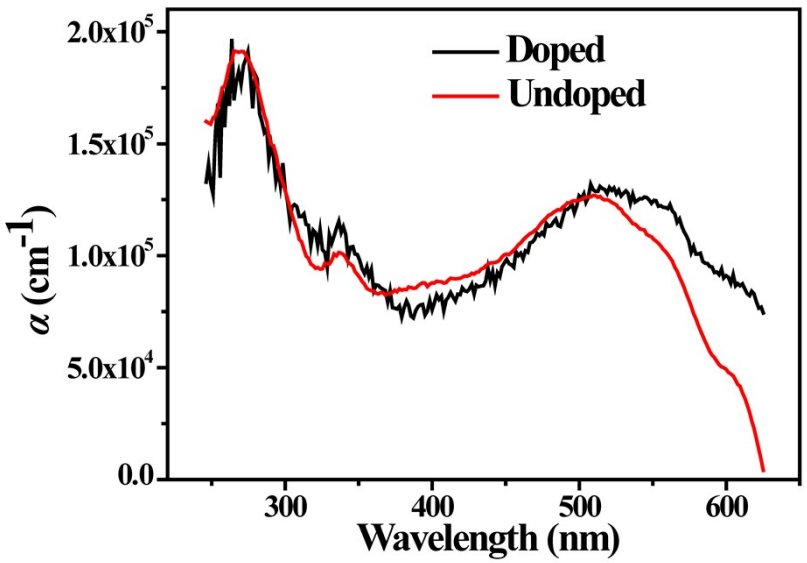

Fig. S3. The absorption coefficient (α) spectra for the doped and undoped films, α is calculated using the equation $\alpha = \frac{4k\pi}{\lambda}$.

·Effects of iodine doping concentration on device performance

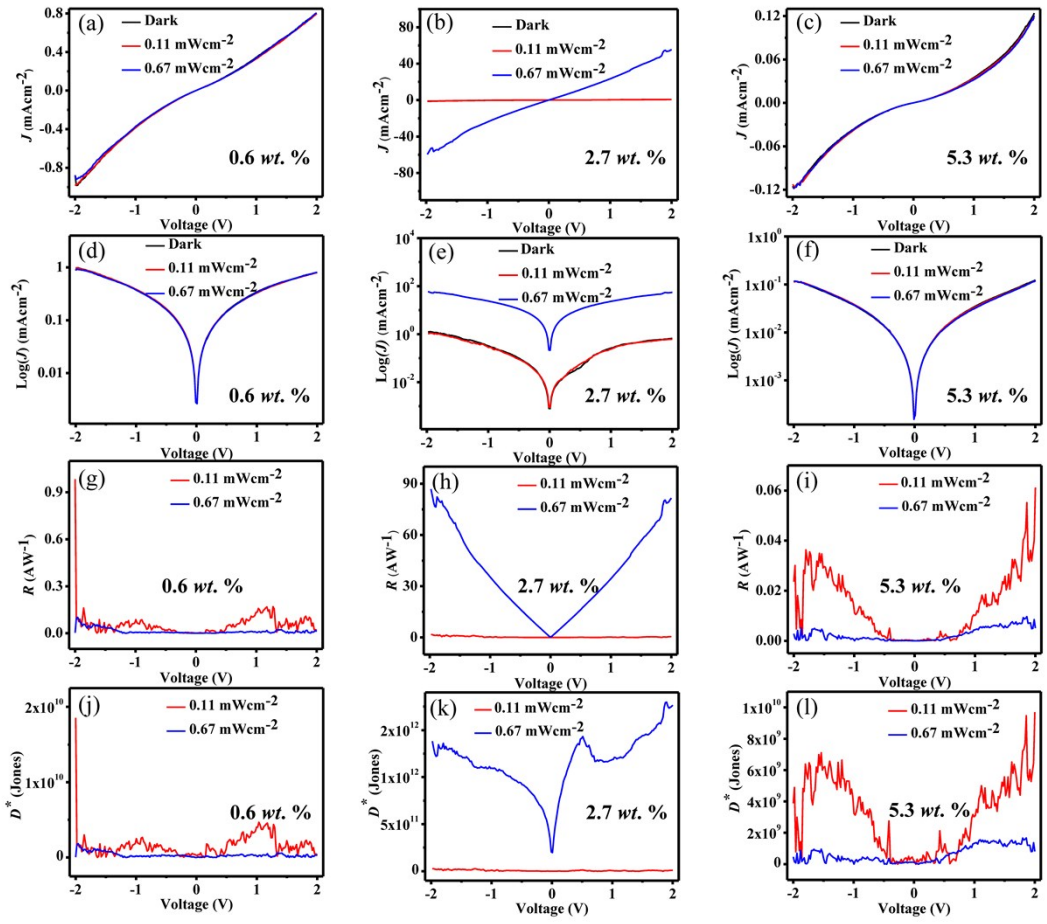

Fig. S4.The effect of iodine concentration on device performance. Devices A ((a),(d),(g) and (j)), B ((b),(e),(h) and (k)) and C ((c),(f),(i) and (l)) were doped with 0.6 *wt*.%, 2.7 *wt*.%, 5.3 *wt*. % iodine, respectively.

The effect of iodine doping concentrations (0.6 *wt*.%, 2.7 *wt*.%, 5.3 *wt*.%) on device performance has been investigated, the responsivity (R) and detectivity (D^*) of device A (0.6 *wt*. %) are larger than device C (5.3 *wt*. %),but smaller than device B (2.7 *wt*. %), indicating that only an optimized (a proper concentration) may get the best performance (device B).

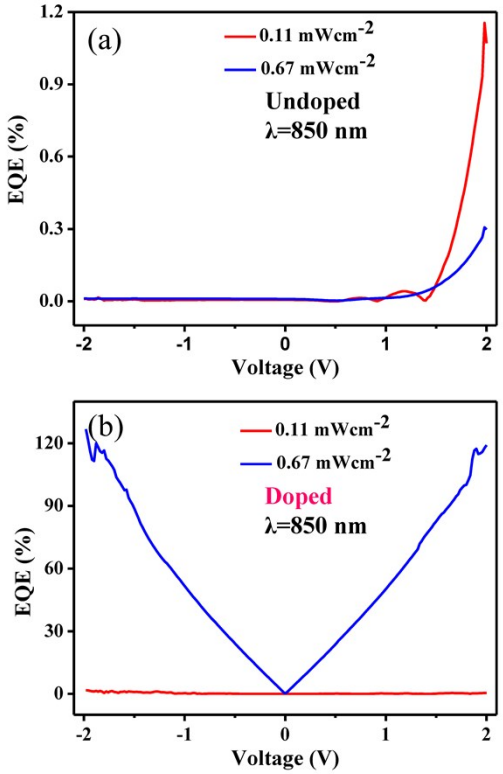

Fig. S5. The EQE for the undoped (a) and doped (b) devices.

EQE is calculated using $EQE = \frac{1240}{\lambda} R$, where λ is wavelength, R is responsivity. For the undoped device, only ~0.3% EQE has been got (0.67 mW cm^{-2}, λ=850nm). After doping with 2.3 *wt*.% iodine, however, EQE is increased to 120%, meaning a proper iodine doping concentration may drastically increase the device performance because of the increased photo-generated carriers under illumination.