Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information - Amino Acid Functionalised Perylene Bisimides for Aqueous Solution-deposited Electron Transporting Interlayers in Organic Photovoltaic Devices

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Table 1. Thickness of ZnO/PBI double layer. Films were slit with a sharp blade and height profiles were obtained by atomic force microscopy scans to measure the thickness of the ZnO/PBI double layer

PBI Layer	Average thickness (nm)
PBI-A	38
PBI-F	26
PBI-H	71
PBI-L	264
PBI-S	38
PBI-V	37
PBI-W	66
PBI-Y	39

Table 2. Electron affinity and ionisation energy values of the PBIs at high pH as previously determined by cyclic voltammetry.[1] The following electrodes were used: a glassy carbon working electrode, a Pt wire counter electrode and an Ag/AgCl reference electrode. The supporting electrolyte was 0.1 M NaCl.

Material	Electron affinity (eV)	Ionisation energy (eV)
PBI-A	-4.07	-5.88
PBI-F	-4.12	-5.90
PBI-H	-4.02	-5.80
PBI-L	-3.98	-5.75
PBI-S	-4.05	-5.88
PBI-V	-4.08	-5.87
PBI-W	-4.07	-5.84
PBI-Y	-4.01	-5.81

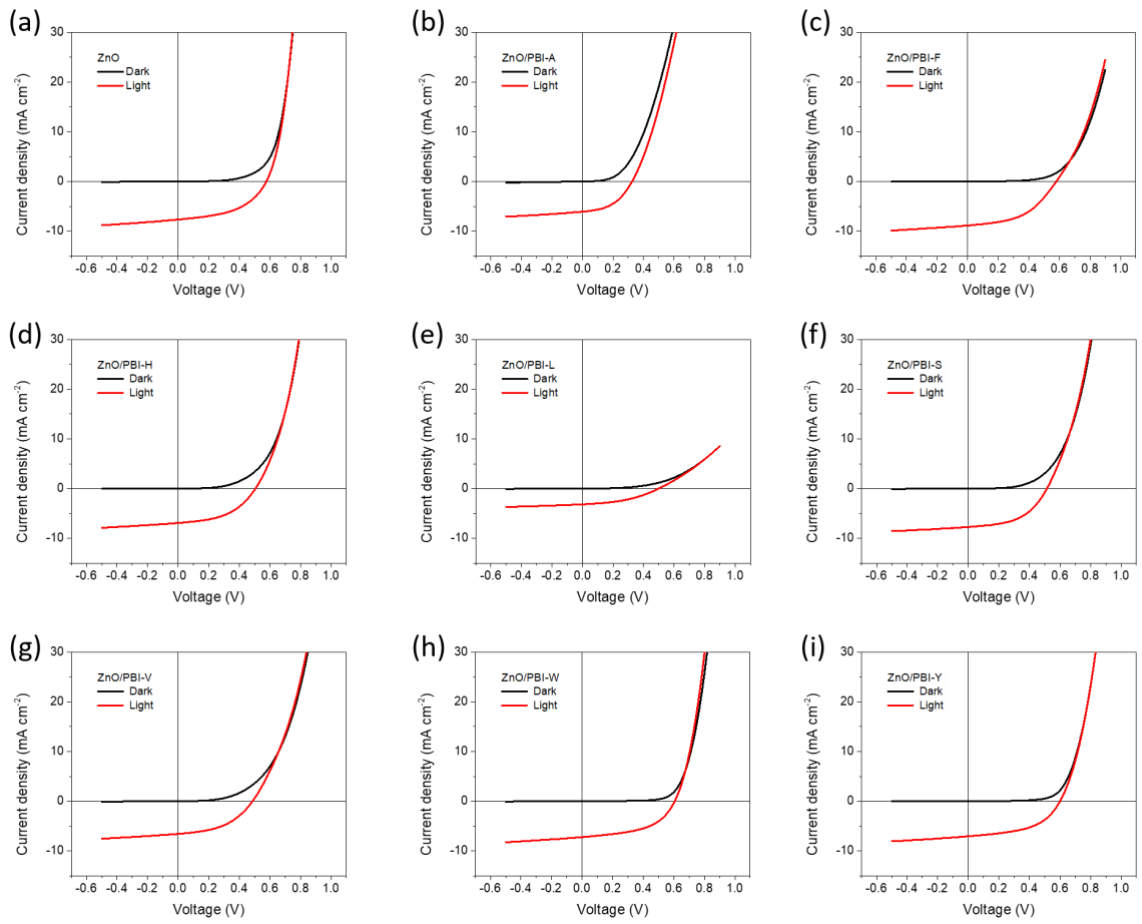

Figure S1. Representative example *J-V* characteristics of OPV devices with structure (a) ITO/ZnO/P3HT:$PC_{61}BM$/MoO_3/Ag or ITO/ZnO/PBI/P3HT:$PC_{61}BM$/MoO_3/Ag where the PBI layer is (b) **PBI-A**, (c) **PBI-F**, (d) **PBI-H**, (e) **PBI-L**, (f) **PBI-S**, (g) **PBI-V**, (h) **PBI-W** and (i) **PBI-Y**. Current and voltage was measured using a Keithley 4200 semiconductor characterisation system. A Newport solar simulator with 150 W Xe lamp was used for AM1.5 irradiation.

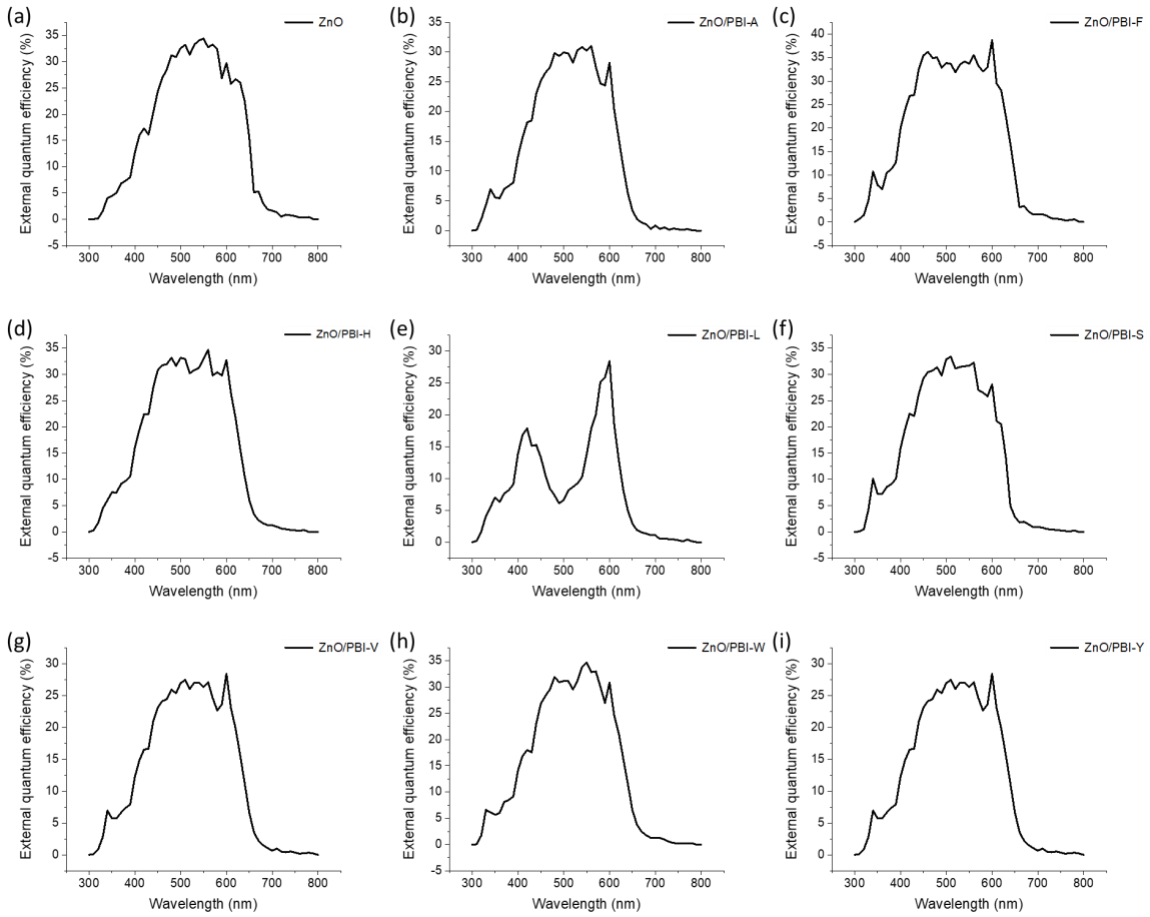

Figure S2. External quantum efficiency plots for OPV devices with structure (a) ITO/ZnO/P3HT:$PC_{61}BM$/MoO_3/Ag or ITO/ZnO/PBI/P3HT:$PC_{61}BM$/MoO_3/Ag where the PBI layer is (b) **PBI-A**, (c) **PBI-F**, (d) **PBI-H**, (e) **PBI-L**, (f) **PBI-S**, (g) **PBI-V**, (h) **PBI-W** and (i) **PBI-Y.** Measured using a Gooch and Housego OL 750 automated spectroradiometric measurement system. The current was measured every 10 nm between 300 – 800 nm, with the irradiation wavelength controlled using the monochromator.

1. E. R. Draper, L. J. Archibald, M. C. Nolan, R. Schweins, M. A. Zwijnenburg, S. Sproules and D. J. Adams, *Chem. Eur. J*, 2018, **24**, 4006-4010.