Electronic Supplementary Information for

Novel hole extraction layer enhancing performance of inverted organic solar cells

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Table S1. The photovoltaic parameters for inverted devices with structure of ITO/PEIE/PTB7-Th:$PC_{71}BM$/composite anode. The average values and standard deviations are obtained based on 12 devices.

Composite anode	V_{OC} (V)	J_{SC} (mA cm^{-2})	FF	PCE (%)	R_S (Ω cm^2)
MoO_3 4 nm/Ag	0.782±0.002	15.42±0.10	0.639±0.010	7.69±0.20	270
MoO_3 5.5 nm/Ag	0.784±0.007	15.40±0.15	0.657±0.012	7.93±0.15	287
MoO_3 7 nm/Ag	0.798±0.012	14.57±0.22	0.626±0.013	7.28±0.16	301
MoO_3 8.5 nm/Ag	0.774±0.015	14.91±0.28	0.628±0.027	7.25±0.19	312
MoO_3 10 nm/Ag	0.798±0.005	14.47±0.18	0.662±0.007	7.64±0.19	317
MoO_3 11.5 nm/Ag	0.796±0.006	15.30±0.15	0.653±0.017	7.95±0.18	300
MoO_3 13 nm/Ag	0.791±0.003	15.22±0.20	0.648±0.020	7.84±0.20	312
MoO_3 4 nm/PEIE 5 nm/Ag	0.799±0.001	15.27±0.23	0.666±0.017	8.14±0.20	262
MoO_3 5.5 nm/PEIE 5 nm/Ag	0.797±0.003	15.50±0.21	0.674±0.009	8.34±0.18	284
MoO_3 7 nm/PEIE 5 nm/Ag	0.803±0.009	14.97±0.15	0.665±0.020	7.98±0.19	293
MoO_3 8.5 nm/PEIE 5 nm/Ag	0.800±0.004	15.58±0.16	0.675±0.015	8.42±0.20	259
MoO_3 10 nm//PEIE 5 nm/Ag	0.801±0.002	14.89±0.20	0.665±0.011	7.92±0.15	278
MoO_3 11.5 nm/PEIE 5 nm/Ag	0.801±0.007	15.01±0.17	0.671±0.006	8.06±0.14	293
MoO_3 13 nm/PEIE 5 nm/Ag	0.796±0.003	15.19±0.18	0.673±0.020	8.12±0.12	305

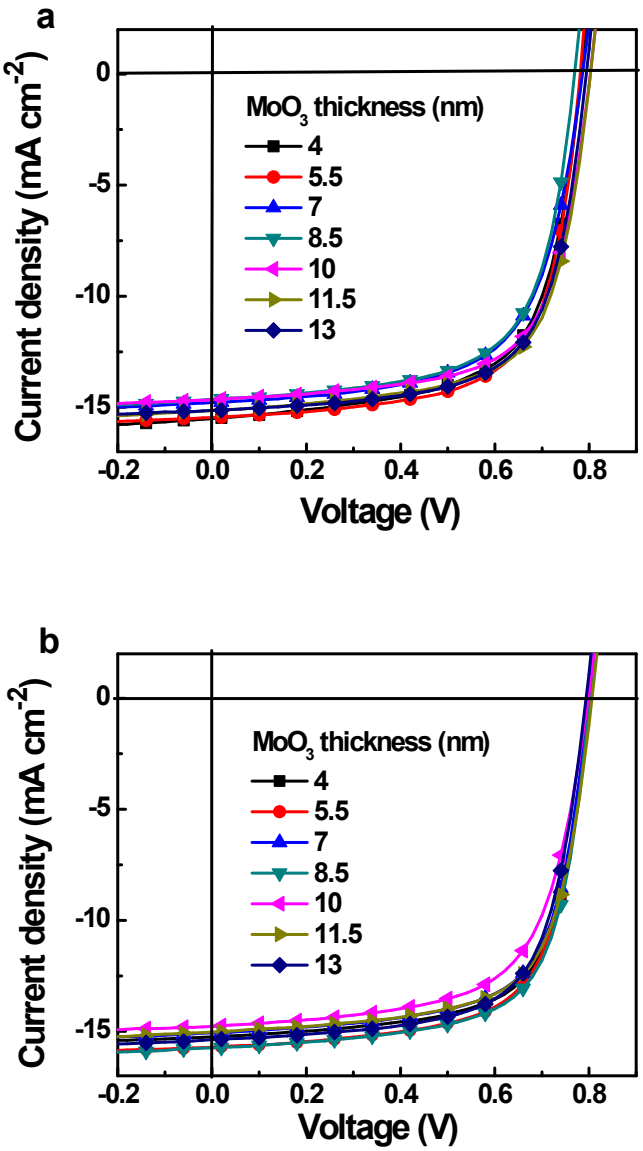

Fig. S1 The *J-V* characteristics of inverted OSCs with structure of ITO/PEIE/PTB7-Th:$PC_{71}BM$/AC at various MoO_3 thicknesses under illumination, where AC = MoO_3/Ag (a) or MoO_3/PEIE 5 nm/Ag (b).

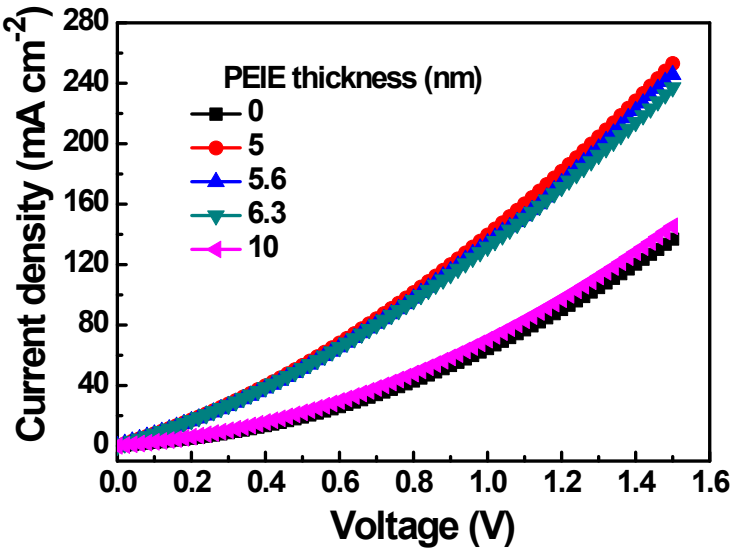

Fig. S2 The dark *J-V* characteristics of hole-only devices with structure of ITO/PEDOT:PSS/PTB7-Th:$PC_{71}BM$/MoO_3 10 nm/PEIE/Ag at various PEIE thicknesses.

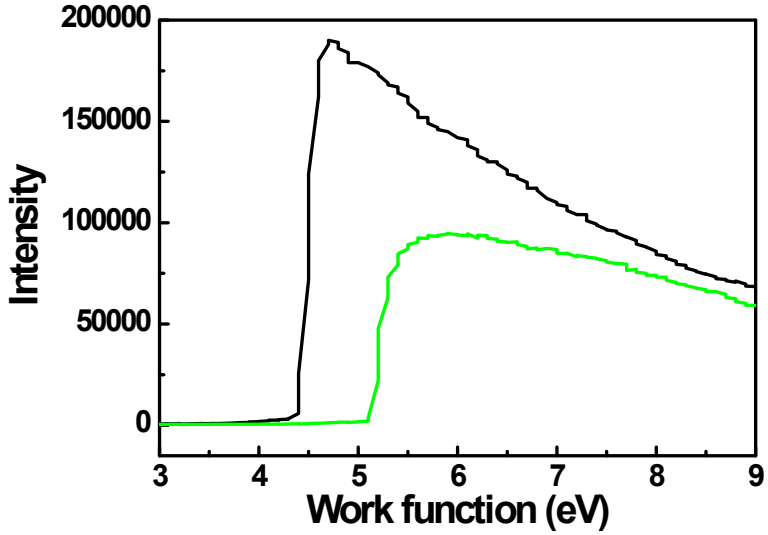

Fig. S3 UPS spectra of the secondary cutoff regions for the glass/ITO/MoO_3 10 nm (green line) and glass/ITO/MoO_3 10 nm/PEIE 5 nm (black line).