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

Supporting Information

Highly Efficient Perovskite Solar Cells with Crosslinked PCBM Interlayers

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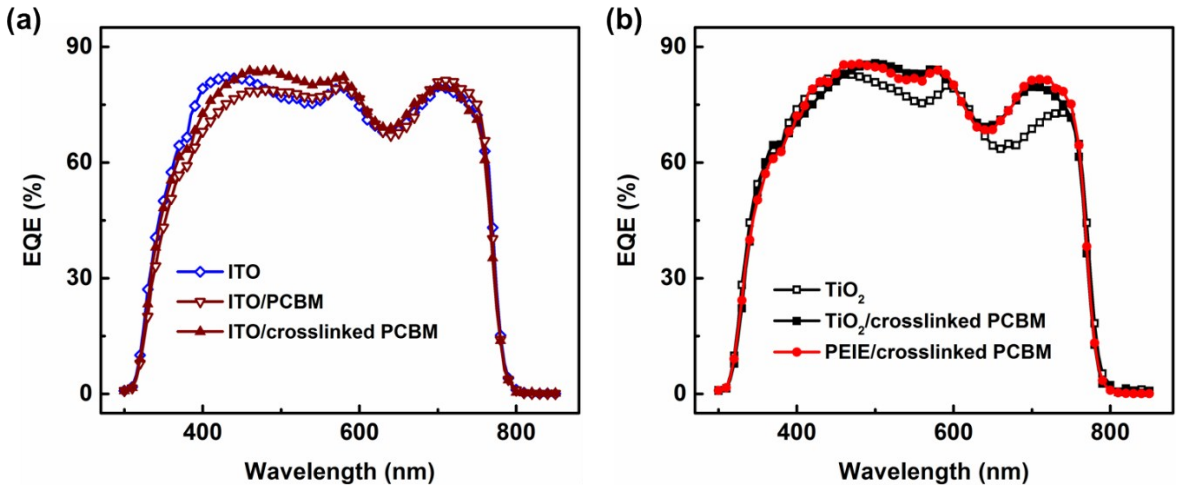

Fig. S1 (a) the EQE curves of of the PSCs without ETL, with pristine PCBM and with crosslinked PCBM as ETL; (b) The EQE curves of PSCs with TiO_2, TiO_2/crosslinked PCBM, PEIE, PEIE/crosslinked PCBM as ETL.

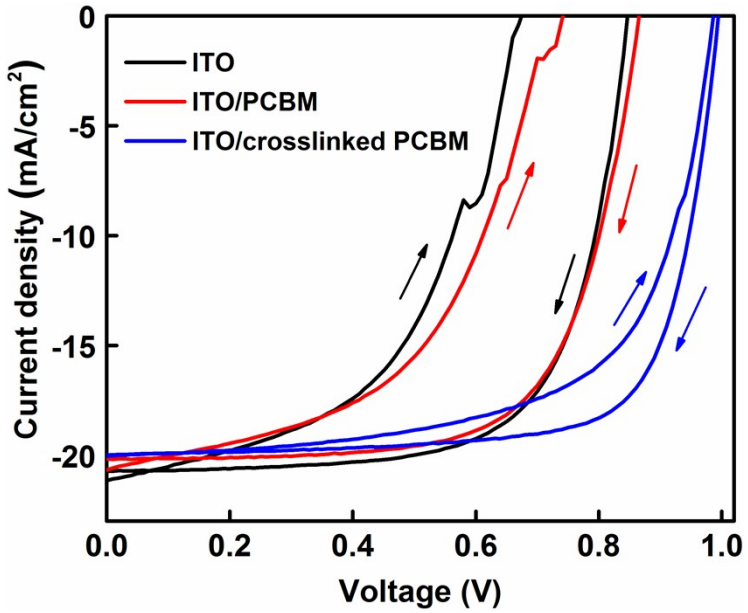

Fig. S2 The *J-V* curves from both reverse and forward sweep of perovskite solar cells with different ETLs.

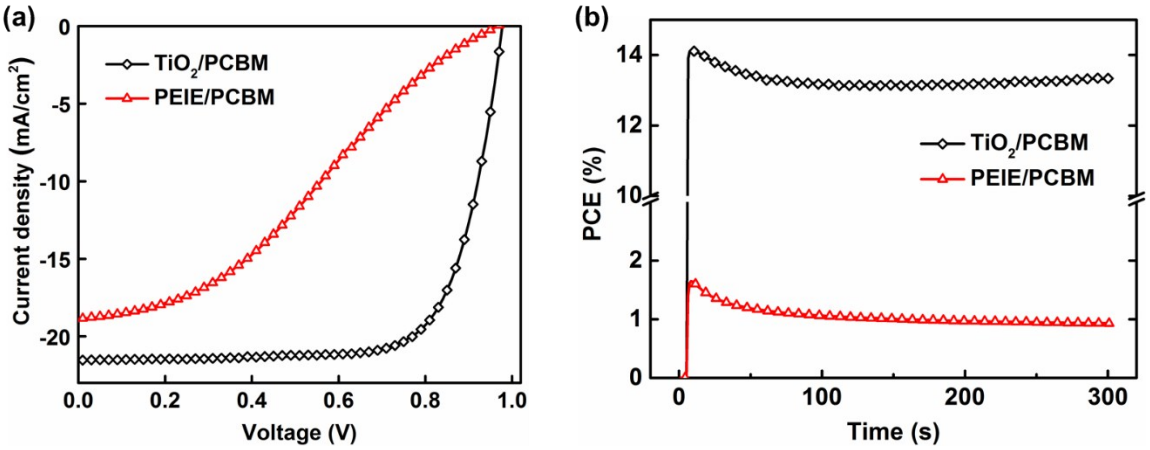

Fig. S3 (a) The *J-V* curves and (b) the steady-state PCEs of PSCs with TiO_2/PCBM and PEIE/PCBM as the ETL, respectively

Table S1. The detailed photovoltaic parameters of the perovskite solar cells using TiO_2/PCBM and PEIE/PCBM as the ETL, respectively, with the data extracted from Fig. S3.

ETLs	J_{sc} (mA/cm^2)	V_{oc} (V)	FF (%)	PCE_{jv} (%)	PCE_{bias} (%)	Irradiance (mW/cm^2)
TiO_2/PCBM	21.5	0.98	73.2	15.4	13.3	100
PEIE/PCBM	18.9	0.97	33.0	6.0	0.9	100

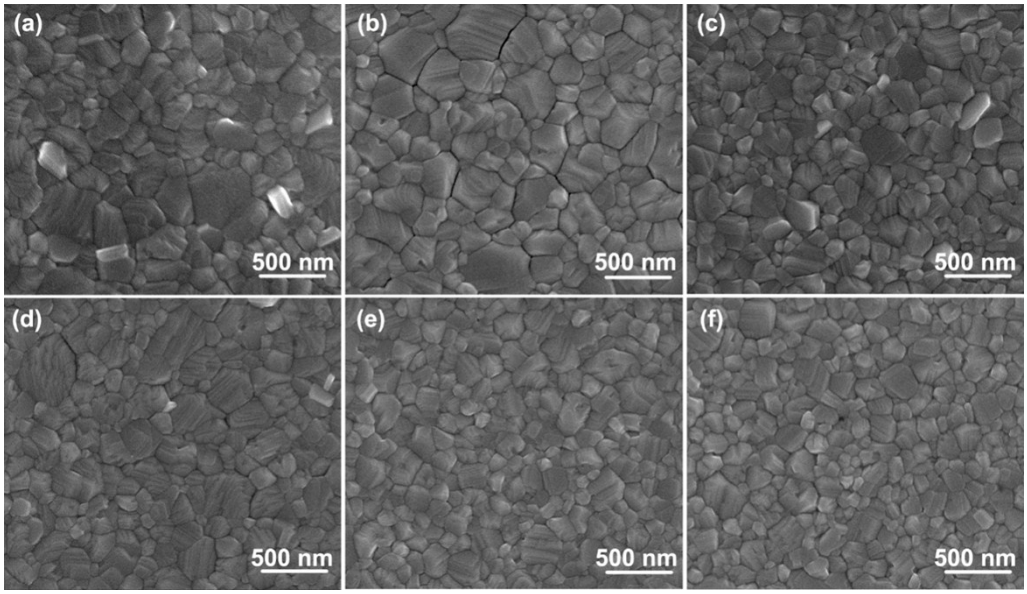

Fig. S4 Top-view SEM images of $CH_3NH_3PbI_3$ films deposited on (a) ITO, (b) TiO_2, (c) PEIE, (d) crosslinked PCBM, (e) TiO_2/crosslinked PCBM, (f) PEIE/crosslinked PCBM.

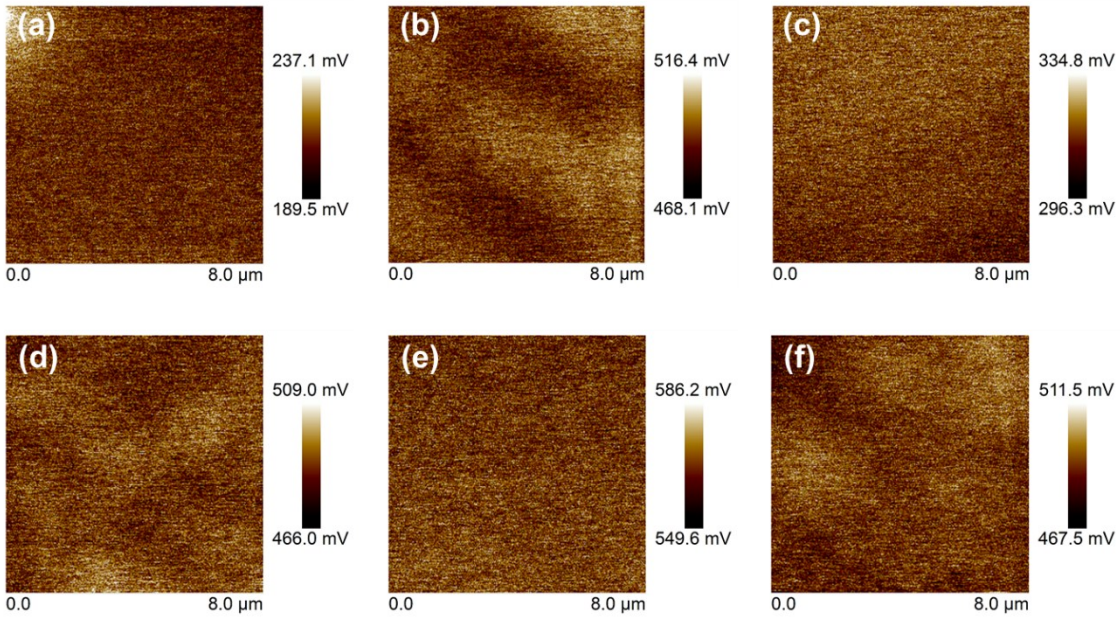

Fig. S5 Difference between the tip work function and that of different ETLs on ITO substrates: (a) ITO; (b) Crosslinked PCBM; (c) TiO_2; (d) TiO_2/crosslinked PCBM; (e) PEIE; (f) PEIE/crosslinked PCBM. The work function of the different tips used was not perfectly matching, therefore whenever the tip needed to be changed, we would re-acquire the potential for the last measured layer, as to be able to fix the offsets to the same scale. This explains eventual incongruences between the data in **Fig. 3d** and that in the scan images.

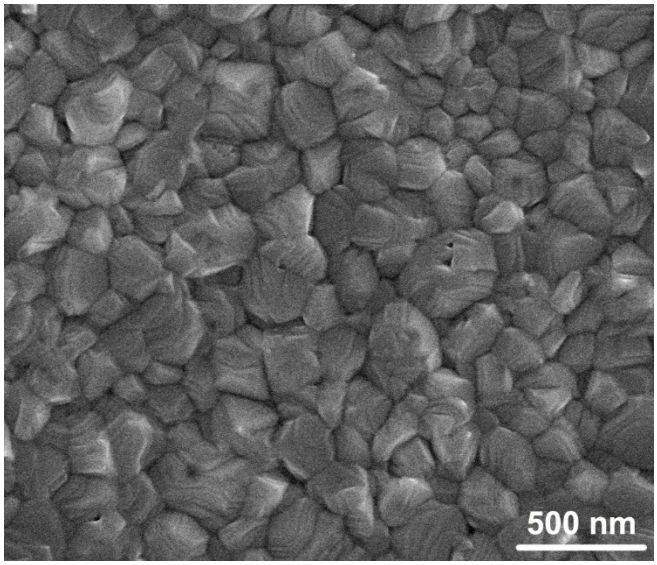

Fig. S6 Top-view SEM images of the $(HC(NH_2)_2)_{0.66}(CH_3NH_3)_{0.34}PbI_{2.85}Br_{0.15}$ film deposited on TiO_2/crosslinked PCBM ETL.

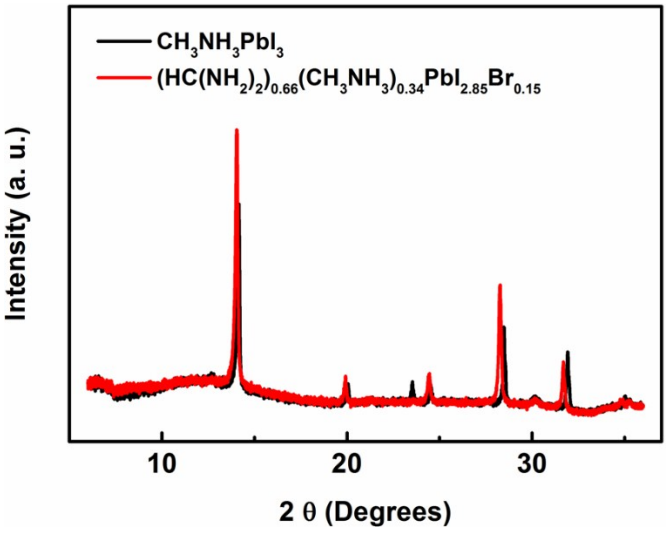

Fig. S7 XRD patterns of the $CH_3NH_3PbI_3$ and $(HC(NH_2)_2)_{0.66}(CH_3NH_3)_{0.34}PbI_{2.85}Br_{0.15}$ films deposited on TiO_2/crosslinked PCBM ETL

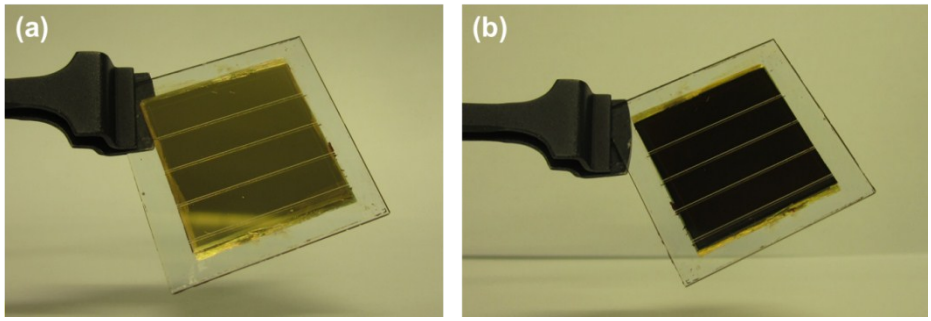

Fig. S8 Digital images of our perovskite module taken from (a) the metal electrode side and (b) the ITO side. It has a total aperture area of 4 cm^2, with 4 sub-cells.

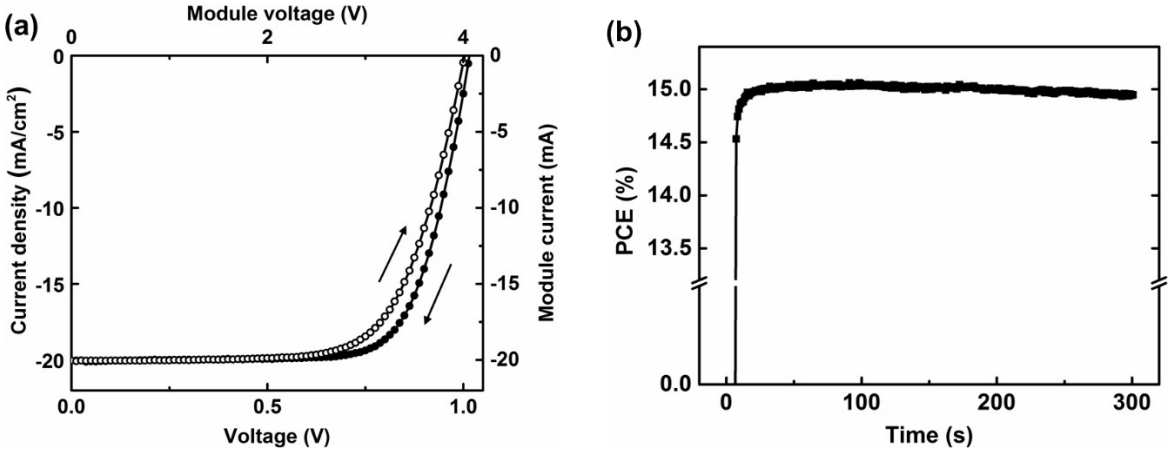

Fig. S9 (a) the J-V curves and (b) the steady-state PCE of the perovskite solar module.