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

Supporting Information

Engineering the underlying surface to manipulate the growth of 2D perovskites for highly efficient solar cells

Shuoxun Tian [a], Jiehuan Chen [a], Xiaomei Lian [a], Yaqin Wang [a], Yingzhu Zhang [a], Weitao Yang [a], Gang Wu [a]* ,Weiming Qiu [b]* and Hongzheng Chen [a]*

[a]State Key Laboratory of Silicon Materials, MOE Key Laboratory of Macromolecular Synthesis and Functionalization, Department of Polymer Science and Engineering, Zhejiang University, Hangzhou 310027, P. R. China. E-mails: samy@zju.edu.cn, hzchen@zju.edu.cn

[b] IMEC, KU Leuven, Kapeldreef 75, Heverlee B-3001, Belgium. E-mails: weiming.qiu@imec.be

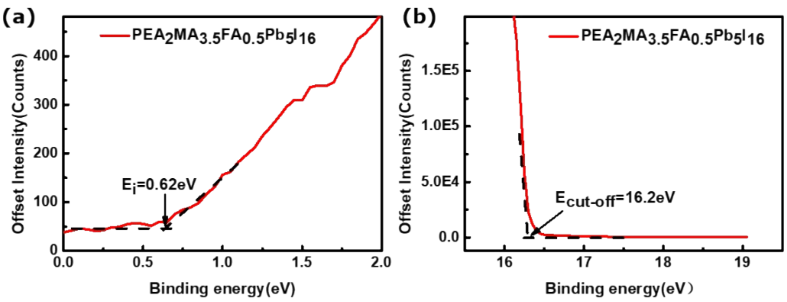

Fig. S1 UPS in the onset (E_i) (a) and the cutoff ($E_{cut-off}$) (b) energy regions of the surface measurement for $PEA_2MA_{3.5}FA_{0.5}Pb_5I_{16}$ perovskite films.

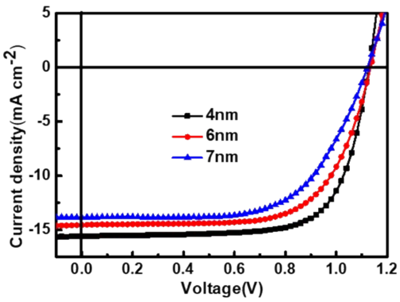

Fig. S2 *J-V* curves of the PVSCs with different thicknesses of PFN layer.

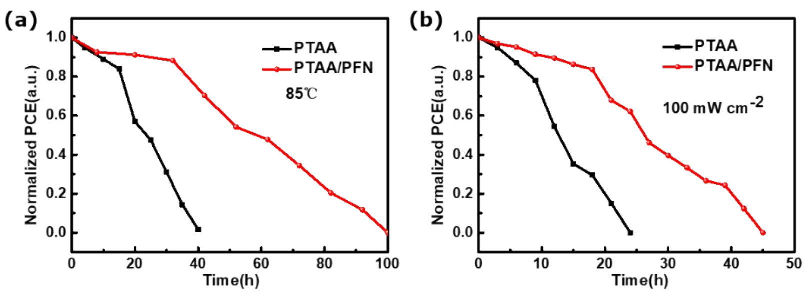

Fig. S3 Thermal stability (a) and light stability (b) curves of the devices with and without PFN.

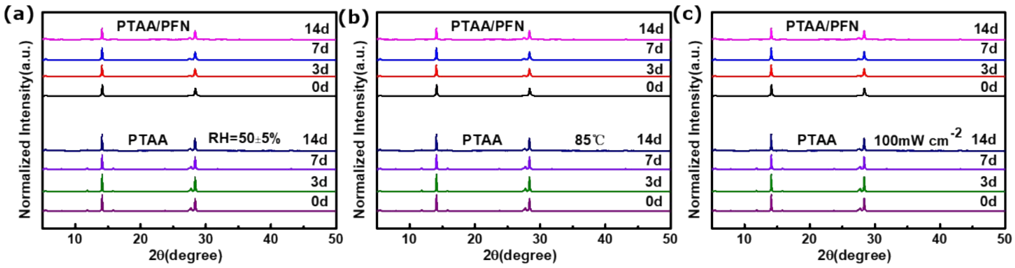

Fig. S4 The XRD patterns of perovskite films before and after humidity (a), heat (b) and light (c) aging test.

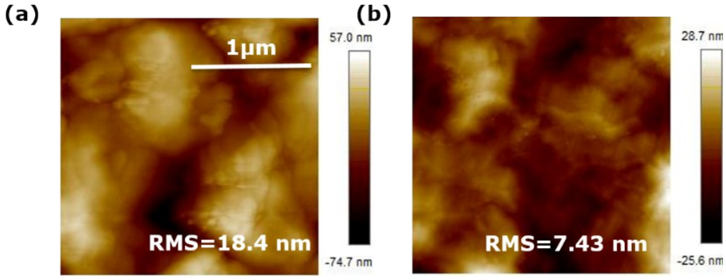

Fig. S5 Atomic force microscopy (AFM) images of perovskite films based on PTAA (a) and PTAA/PFN (b). The root-mean-square roughness (RMS) of perovskite films on the PTAA and PTAA/PFN are 18.4 nm and 7.43 nm, respectively, indicating the film on PTAA/PFN has a smoother surface, which is agreed well with the SEM images (**Fig. 3a** and **Fig. 3b**).

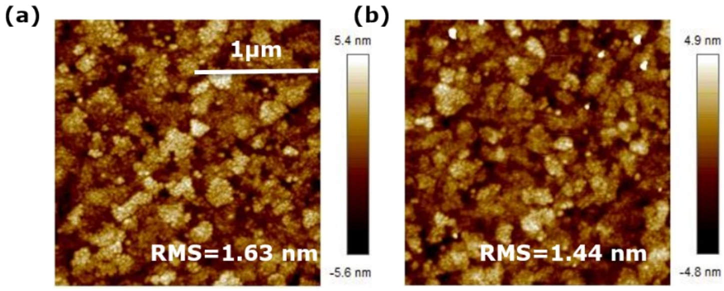

Fig. S6 Atomic force microscopy (AFM) images of PTAA and PTAA/PFN substrates.

Table S1 XRD pattern parameters of the perovskite films on PTAA and PTAA/PFN substrates.

Peak	（**111**）		（**222**）	
	Intensity (cps)	**FWHM (°)**	**Intensity (cps)**	**FWHM (°)**
PTAA	1.75×10^7	0.24	1.38×10^7	0.29
PTAA/PFN	9.89×10^6	0.25	5.25×10^6	0.31