Supporting Information

Spectroscopic Study on the Impact of Methylammonium iodide Loading Time on the Electronic Properties in Perovskite Thin Films

*Yuanhang Cheng[1], Ho-Wa Li[1], Jinfeng Zhang[1,2], Qing-Dan Yang[1], Taili Liu[1], Zhiqiang Guan[1,2], Jian Qing[1,2], Chun-Sing Lee[1,2], Sai-Wing Tsang[1]**

[1]Department of Physics and Materials Science, City University of Hong Kong, Hong Kong SAR, P. R. China.

[2] Center of Super-Diamond and Advanced Films (COSDAF), City University of Hong Kong, Hong Kong SAR, P. R. China.

*Corresponding author.

E-mail: saitsang@cityu.edu.hk (S-W Tsang)

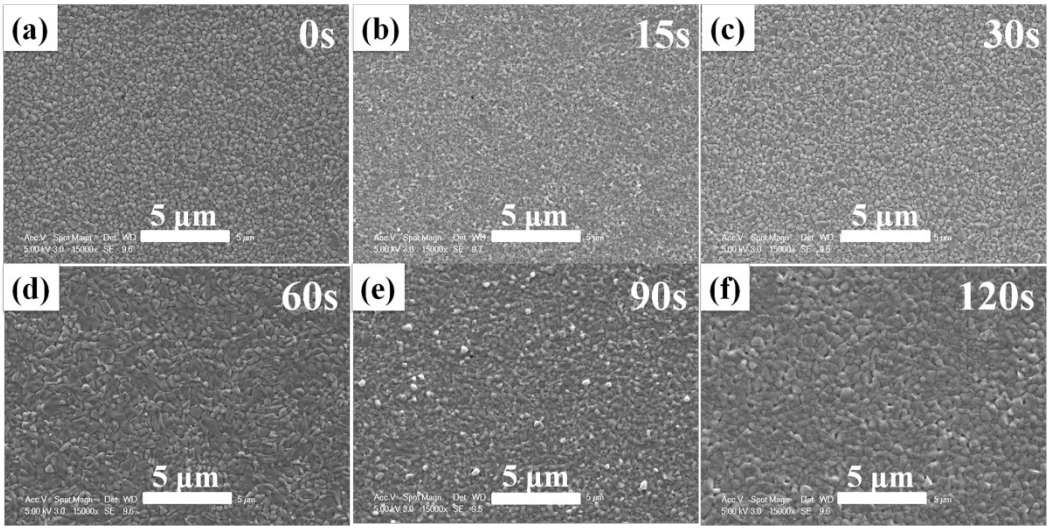

Figure S1 SEM images of $CH_3NH_3PbI_3$ films grown with loading MAI on PbI_2 films for 0 s (a), 15 s (b), 30 s (c), 60 s (d), 90 s (e) and 120 s (f). The scale bar is 5 µm.

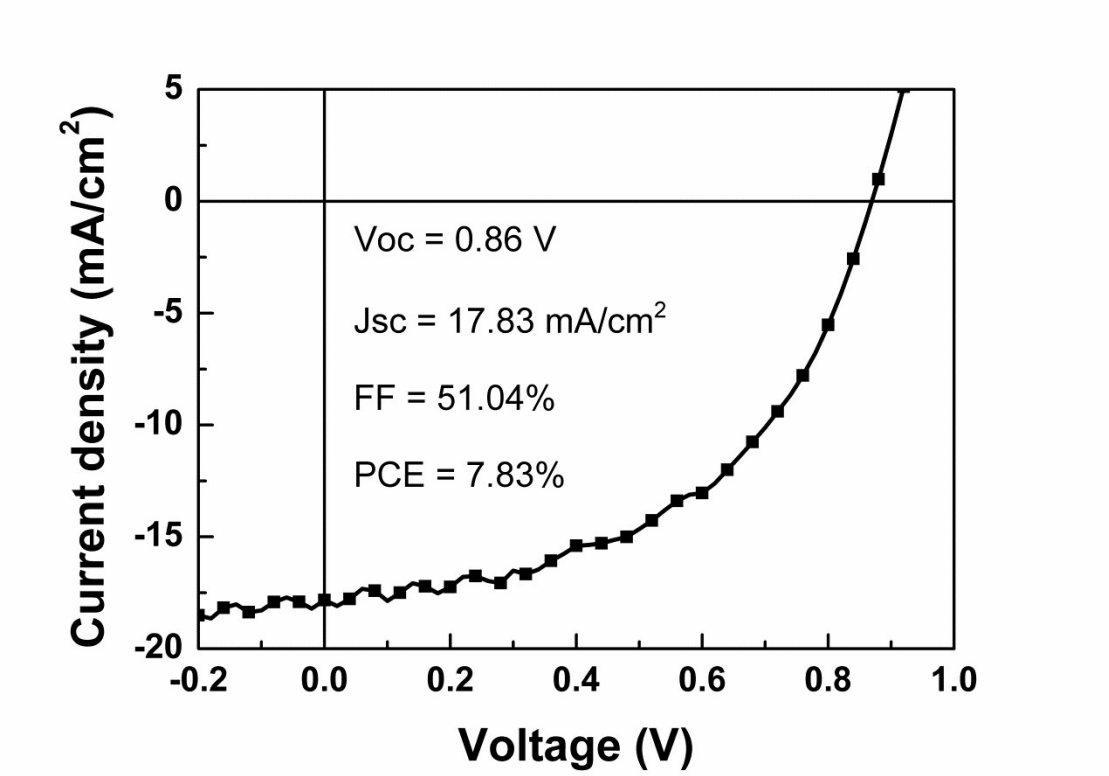

Figure S2 Current density-voltage (*J-V*) characteristics of $CH_3NH_3PbI_3$ perovskite device without BCP as cathode buffer layer (perovskite film was prepared with 60 s as MAI loading time).

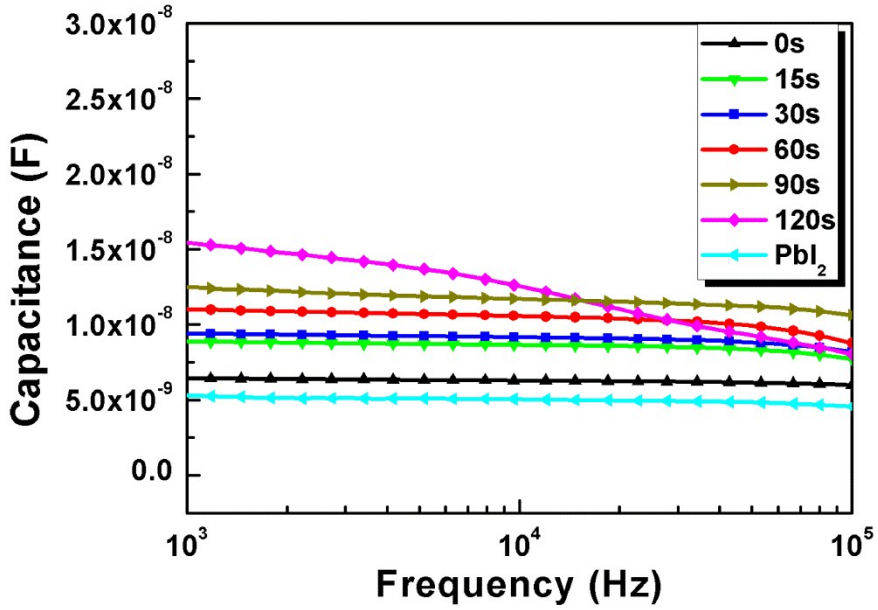

Figure S3 Frequency dependent capacitance of $CH_3NH_3PbI_3$ perovskite films prepared with different MAI loading times.

Table S1 Summary of photovoltaic parameters of devices with reverse and forward scan directions prepared with different MAI loading times.

Loading time (s)	Scan direction	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)
0	Reverse	0.74	9.54	27.4	1.94
	Forward	0.82	9.51	40.2	3.14
15	Reverse	0.72	15.27	25.2	2.77
	Forward	0.86	14.72	35.1	4.45
30	Reverse	0.92	16.11	43.8	6.51
	Forward	0.94	16.03	50.7	7.64
60	Reverse	0.96	21.82	74.3	15.58
	Forward	0.98	21.62	73.2	15.51
90	Reverse	0.92	15.40	55.1	7.81
	Forward	0.94	16.47	60.0	9.14
120	Reverse	0.90	15.65	49.79	7.05
	Forward	0.95	16.70	51.83	8.24

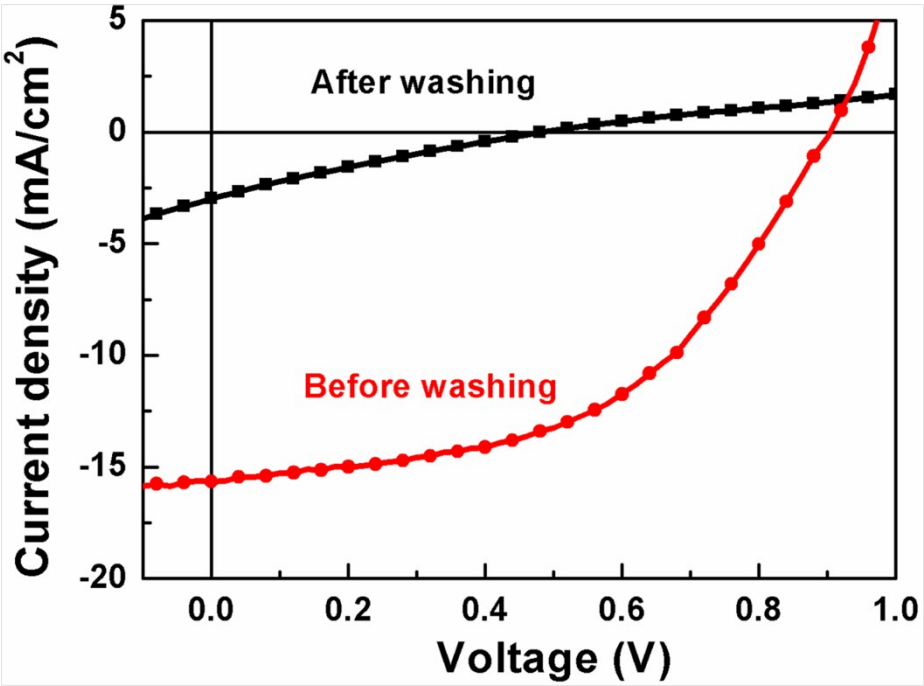

Figure S4. Current density-voltage (*J-V*) characteristics of $CH_3NH_3PbI_3$ perovskite solar cells prepared with 120 s MAI loading time before and after washing with IPA.