Supporting Information

Improving performance of lead acetrate-based perovskite solar cells via solvent vapor annealing control perovskite grain size

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1. Supporting Figures

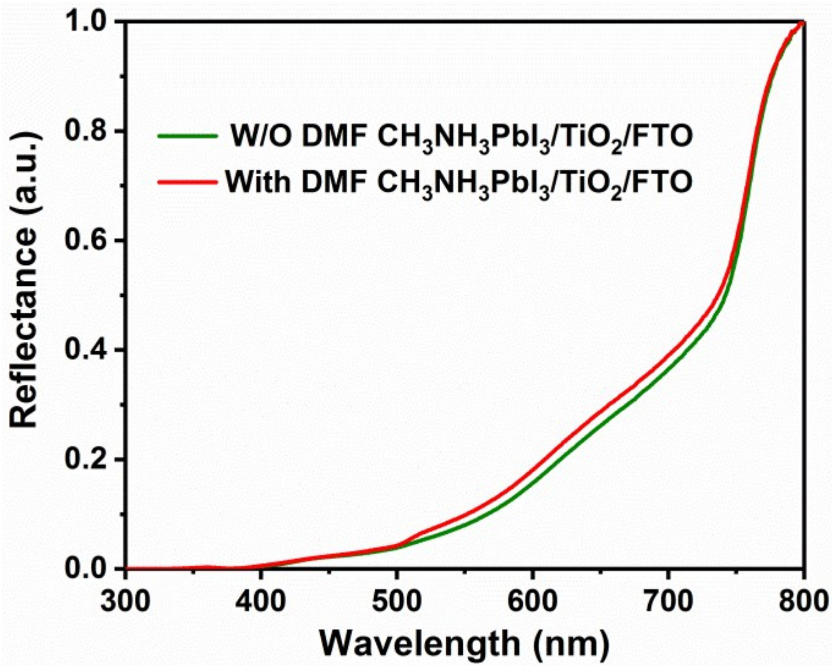

Fig. S1 UV–vis diffuses reflectance spectra of perovskite/TiO_2/FTO (with and without DMF vapor treated) film.

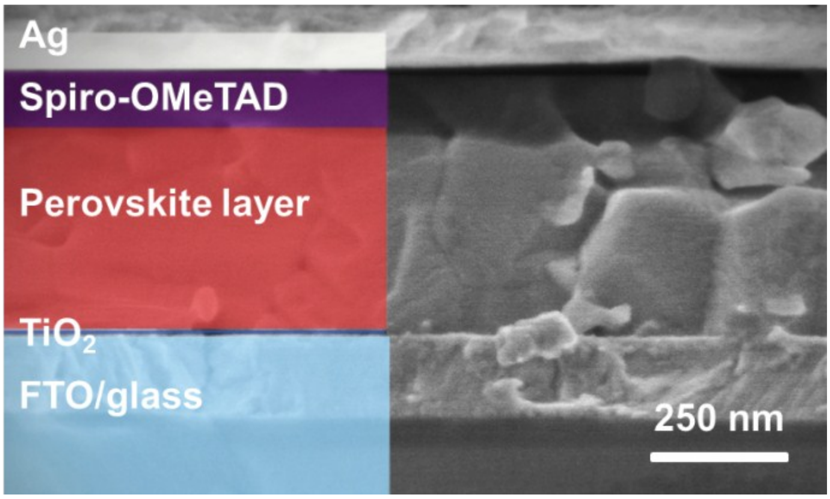

Fig.S2 Cross-sectional SEM image for the planar perovskite solar cell.

2. Supporting Tables

Table S1 Photovoltaic parameters of planar PSCs are prepared by DMF (15μL) solvent vapor annealing.

Device number	Scan direction	Voc (V)	Jsc (mA/cm^2)	PCE (%)	FF (%)	H-index (%)
1	Reverse	1.006	21.75	13.57	62.00	1.7
	Forward	1.004	21.6	13.33	61.50	
2	Reverse	1.011	21	12.55	59.10	3.7
	Forward	0.992	20.69	12.09	58.90	
3	Reverse	0.999	20.68	11.73	56.80	2.9
	Forward	0.969	20.7	11.61	57.90	
4	Reverse	0.998	21.24	13.47	63.60	6.3
	Forward	0.993	20.79	12.62	61.10	
5	Reverse	0.949	20.6	11.99	61.30	4.3
	Forward	0.979	20.09	11.48	58.40	
6	Reverse	0.981	19.63	12.07	62.70	1.6
	Forward	0.994	18.99	11.87	62.90	
7	Reverse	1.004	20.7	13.24	63.70	1.5
	Forward	0.992	20.84	13.04	63.10	
8	Reverse	0.93	20.68	11.79	61.30	0.4
	Forward	0.984	19.84	11.74	60.10	
9	Reverse	0.96	19.85	11.95	62.70	0.9
	Forward	0.982	19.41	11.84	62.10	
10	Reverse	0.955	20.26	11.91	61.60	1.6
	Forward	0.972	19.95	11.72	60.40	
11	Reverse	1.01	20.84	12.43	59.10	6.8
	Forward	1.002	19.85	11.58	58.20	
12	Reverse	1.012	20.8	13.33	63.30	1.1
	Forward	1.012	20.29	13.18	64.00	

13	Reverse	0.969	20.74	12.36	61.50	5.2
	Forward	0.992	19.86	11.71	59.40	
14	Reverse	1.001	20.49	12.76	62.20	2.8
	Forward	1.001	19.8	12.40	62.10	
15	Reverse	1.002	20.02	12.44	62.00	5.8
	Forward	0.995	19.64	11.72	60.00	
16	Reverse	0.955	20.26	11.91	61.60	1.6
	Forward	0.972	19.95	11.72	60.40	
17	Reverse	1.01	20.84	12.43	59.10	6.8
	Forward	1.002	19.85	11.58	58.20	
18	Reverse	1.036	21.26	13.71	62.20	6.5
	Forward	1.011	20.75	12.81	61.00	
19	Reverse	1.029	20.36	13.20	63.00	2.9
	Forward	1.012	20.17	12.82	62.80	
20	Reverse	1.013	20.38	12.14	58.80	4.2
	Forward	1.028	20.39	11.63	55.50	

We use a hysteresis index "H-index" to show the hysteresis: H-index = ($PCE_{reverse}$-$PCE_{forward}$)/$PCE_{reverse}$. $PCE_{reverse}$ and $PCE_{forward}$ are power conversion efficiency from reverse and forward scan, respectively. The hysteresis for each condition was calculated and summarized in Table S1.

It is find that there is the phenomenon that the forward scan showed higher Voc than that of reverse scan in these 20 devices. After investigating and analyzing the previous literature, the specific reasons for this phenomenon that the forward scan showed higher *Voc* than that of reverse scan are as follows. This phenomenon is essentially a manifestation of the hysteresis effect. There are currently four accepted interpretations: (1) The dynamic slow process of the capacitor current was one important reason for hysteresis;[1] (2) ion movement caused by excessive ion deposition at the interface affect the hysteresis;[2] (3) charge transfer at the interfaces or internal defects of the material affect the hysteresis;[3] (4) Dipole changes caused by material polarization and ferroelectricity affect the hysteresis.[4]

According to Rong and co-workers report, this such unique trends of tunable hysteresis are analyzed by considering the polarization of the TiO_2/perovskite interface, which can attributed to accumulate positive charges reversibly[5]. Besides, from the report of You and co-workers, this phenomenon due to ion movement, charge transfer at the interfaces and imbalance charge transfer and hole accumulation at perovskite/hole transport layer.[3]

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