

## Supplementary Information

### **A Facile Solvent Vapor Fumigation Induced Self-repair Recrystallization of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> Films for High Performance Perovskite Solar Cells**

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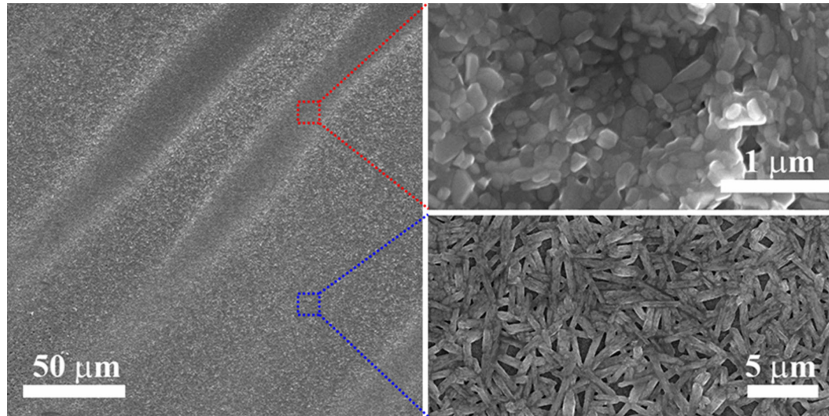
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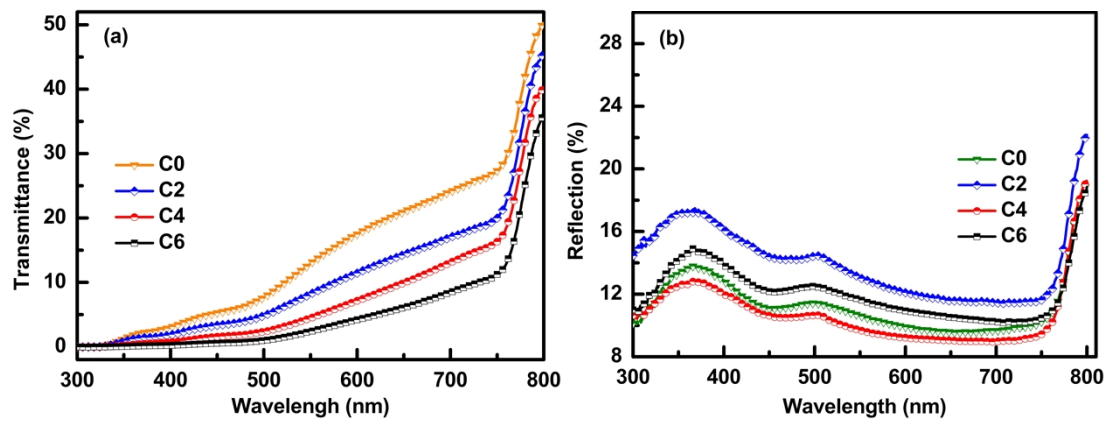
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**Figure S1** Surface SEM images of the  $\text{CH}_3\text{NH}_3\text{PbI}_3$  film after ten cycles of recrystallization treatment (sample C10).



**Figure S2** (a) Transmittance spectra and (b) reflection spectra of the samples C0, C2, C4, and C6, respectively.

**Table S1** Photovoltaic parameters obtained at forward scan (FS) and reverse scan (RS) for the perovskite solar cells based the samples of C0, C2, C4, and C6, respectively.<sup>a</sup>

Sample	Scan	J <sub>sc</sub> (mA cm <sup>-2</sup> )	V <sub>oc</sub> (V)	FF	PCE (%)	HI
C0	RS	12.46	0.83	0.49	5.07	0.29
	FS	13.91	0.78	0.35	3.77	
C2	RS	15.62	0.85	0.54	7.28	0.19
	FS	16.80	0.78	0.43	5.61	
C4	RS	18.38	0.87	0.56	8.93	0.09
	FS	17.52	0.87	0.57	8.70	
C6	RS	19.54	0.91	0.58	10.28	0.03
	FS	20.33	0.88	0.56	10.08	

<sup>a</sup>The I-V hysteresis index (HI) is defined as:  $HI = (J_{RS}(V_{oc}/2) - J_{FS}(V_{oc}/2)) / J_{RS}(V_{oc}/2)$ , where  $J_{RS}(V_{oc}/2)$  and  $J_{FS}(V_{oc}/2)$  represent the photocurrent densities at 50% of  $V_{oc}$  for the RS and FS, respectively.<sup>1,2</sup>

**Table S2** Device photovoltaic parameters based on 20 solar cells based the sample C6 among 4 batches.

Devices	V <sub>oc</sub> (V)	J <sub>sc</sub> (mA cm <sup>-2</sup> )	FF	PCE (%)
1-1#	0.86	18.44	0.60	9.49
1-2#	0.84	18.53	0.58	9.02
1-3#	0.87	18.95	0.58	9.63
1-4#	0.87	19.30	0.66	11.08
1-5#	0.89	19.46	0.64	11.03
2-1#	0.87	19.48	0.63	10.66
2-2#	0.86	19.45	0.64	10.69
2-3#	0.85	19.62	0.66	10.99
2-4#	0.85	18.85	0.67	10.67
2-5#	0.86	18.89	0.66	10.64
3-1#	0.85	18.03	0.66	10.05
3-2#	0.86	19.20	0.62	10.21
3-3#	0.84	19.05	0.65	10.40
3-4#	0.87	19.42	0.66	11.15
3-5#	0.84	19.19	0.62	9.97
4-1#	0.84	19.31	0.63	10.24
4-2#	0.91	19.34	0.54	9.51
4-3#	0.90	20.18	0.55	10.00
4-4#	0.84	20.66	0.55	9.56
4-5#	0.90	20.58	0.57	10.56

## References

1. H. S. Kim and N. G. Park, *The Journal of Physical Chemistry Letters*, 2014, **5**, 2927-2934.
2. R. S. Sanchez, V. Gonzalez Pedro, J. W. Lee, N. G. Park, Y. S. Kang, I. Mora Sero and J. Bisquert, *The Journal of Physical Chemistry Letters*, 2014, **5**, 2357-2363.