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

Supporting Information for

Dimethyl-sulfoxide-assisted improvement in the crystallization of lead-acetate-based perovskite for high-performance solar cells

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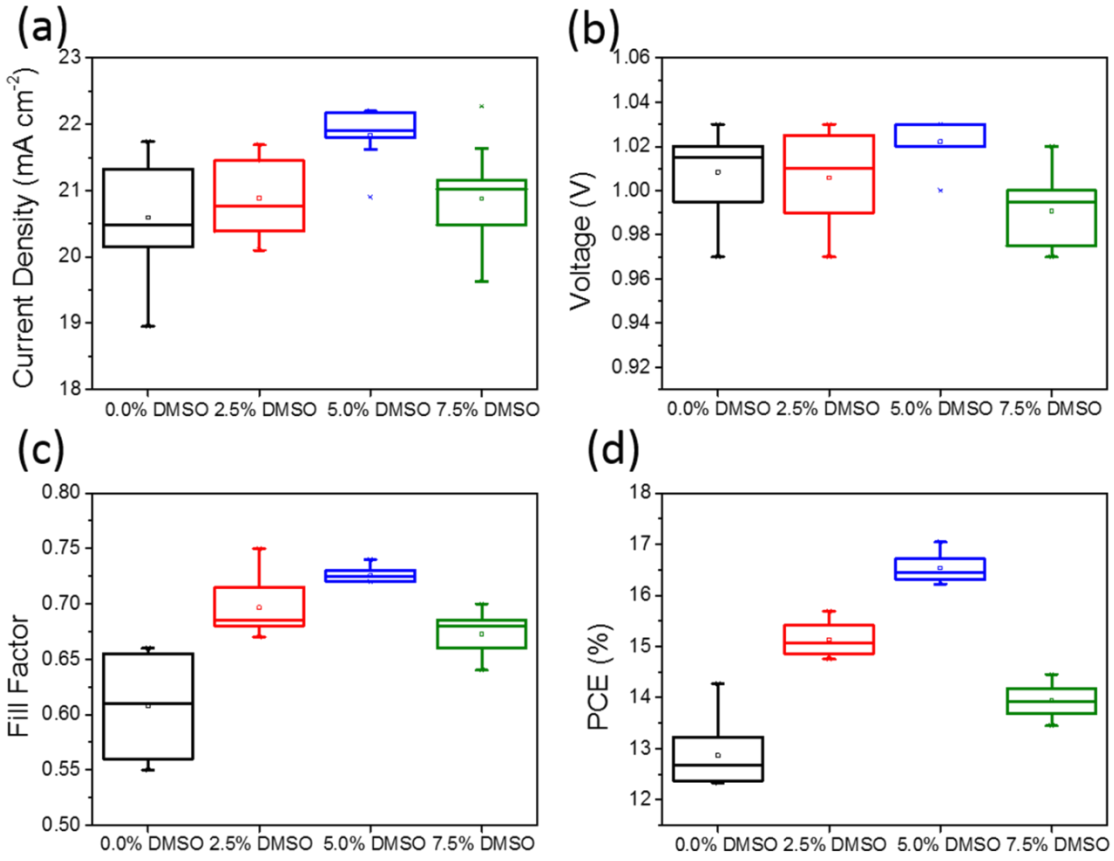


Fig. S1. Statistical photovoltaic parameters of (a) J_{sc}, (b) V_{sc}, (c) FF, and (d) PCE for PSCs based on perovskite films processed using precursors without (0.0%) and with 2.5, 5.0, and 7.5% DMSO as the solvent additive. The parameters were obtained under AM 1.5G (100 mW cm^{-2}) at the scan rate of 0.1 V s^{-1}.

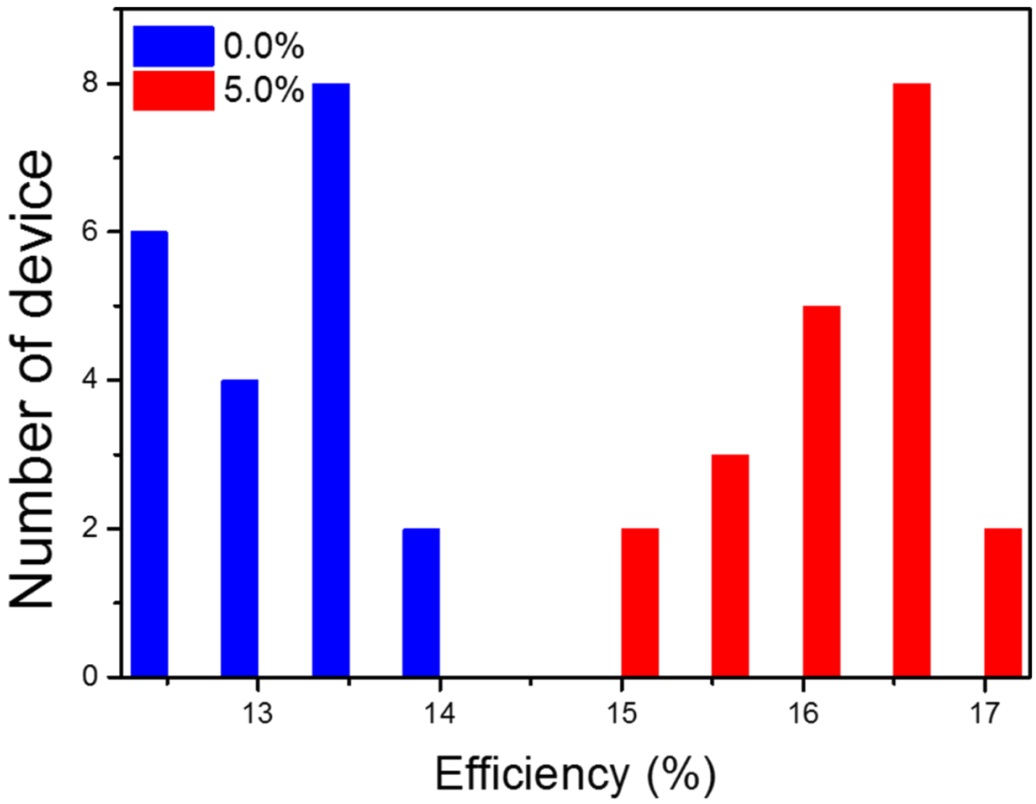


Fig. S2. Histogram of device parameters: PCE for two batches of PSCs based on perovskite films processed using precursors without (0.0%) and with 5.0% DMSO as the solvent additive.

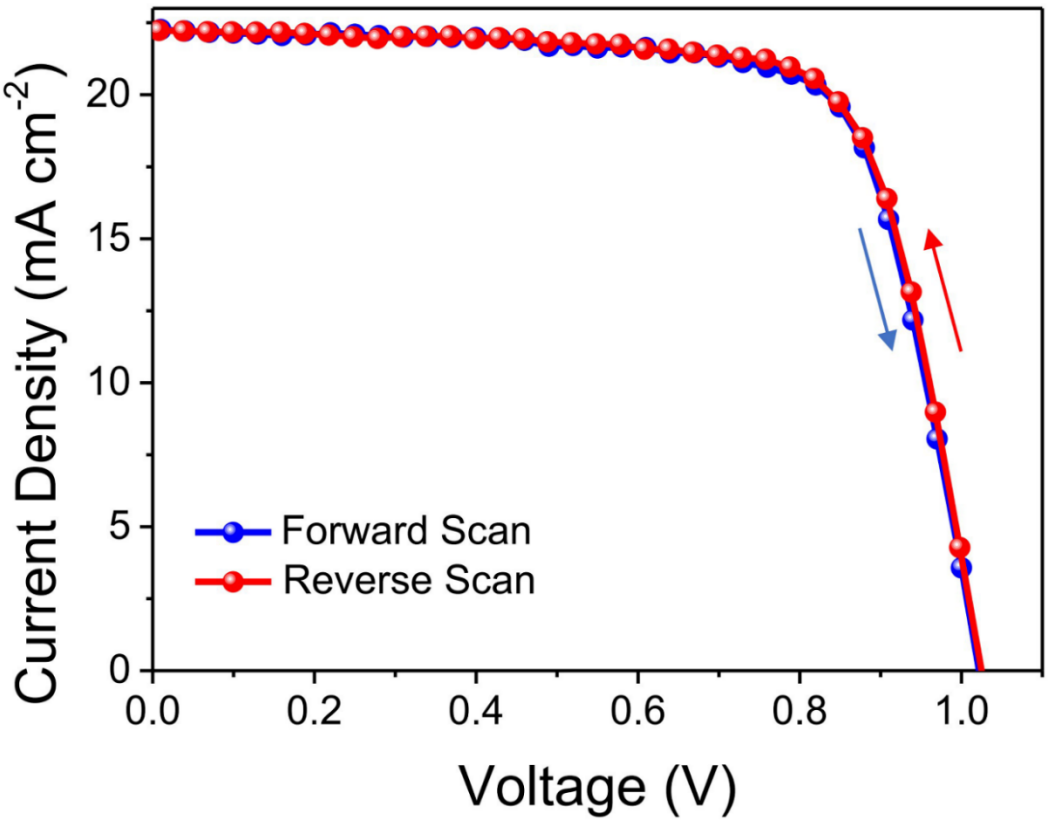


Fig. S3. *J–V* characteristics under forward and reverse scans of the PSCs based on $CH_3NH_3PbI_3$ processed using a precursor with 5.0% DMSO as the solvent additive.

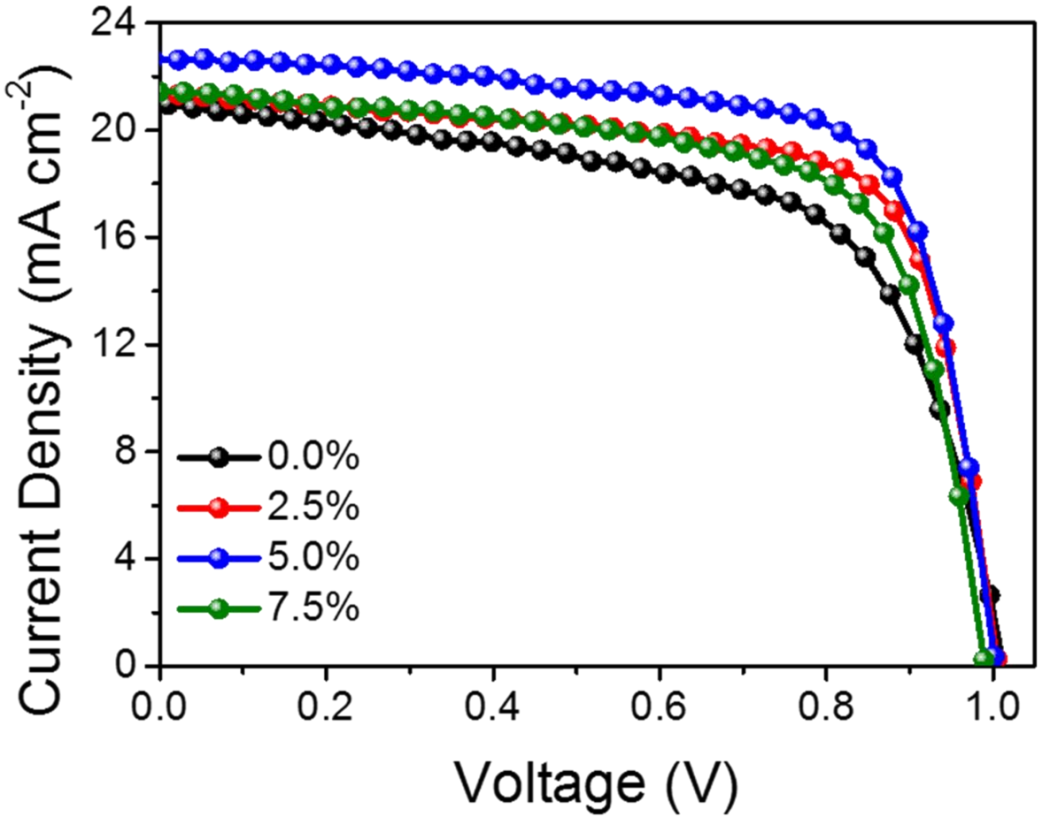


Fig. S4. *J*–*V* characteristics of the PSCs without (0.0%) and with 2.5, 5.0, or 7.5% DMSO as the solvent additive under illumination of 100 mW·cm^{-2} (AM 1.5G) and the effective device area was 0.12 cm^2 (0.3 cm × 0.4 cm).

Table S1. Device parameters for PSCs based on perovskite films processed using precursors without (0.0%) and with 2.5, 5.0, and 7.5% DMSO as the solvent additive under illumination of 100 mW·cm^{-2} (AM 1.5G) and the effective device area was 0.12 cm^2 (0.3 cm × 0.4 cm).

DMSO Concentration (vol. %)	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF	PCE (%)
0.0%	1.01	20.85	0.62	13.18
2.5%	1.01	21.38	0.71	15.38
5.0%	1.01	22.18	0.73	16.35
7.5%	0.99	21.33	0.67	14.13

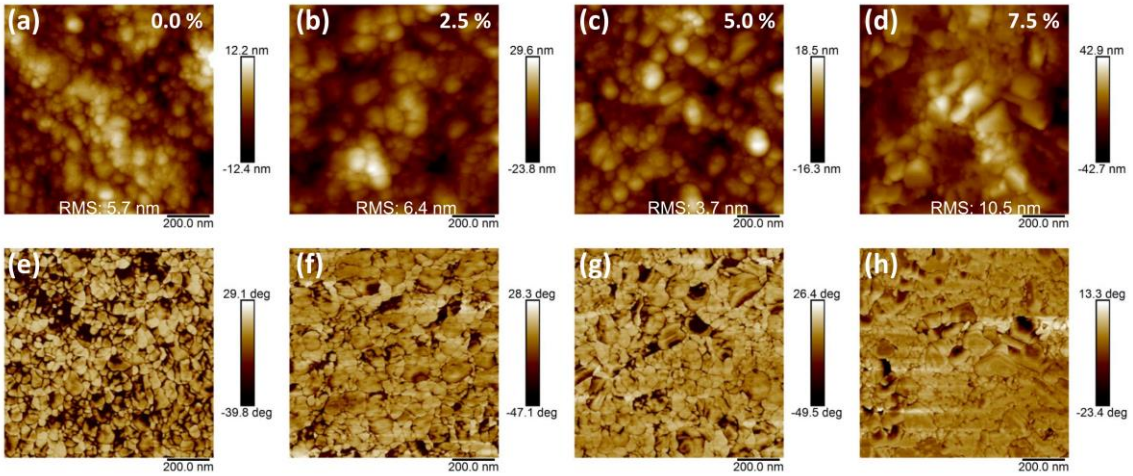


Fig. S5. AFM height and phase images of $CH_3NH_3PbI_3$ perovskite films processed using precursors without (0.0%) and with 2.5, 5.0, and 7.5% DMSO as the solvent additive. (a)-(d) and (e)-(h) are the height and phase images, respectively.

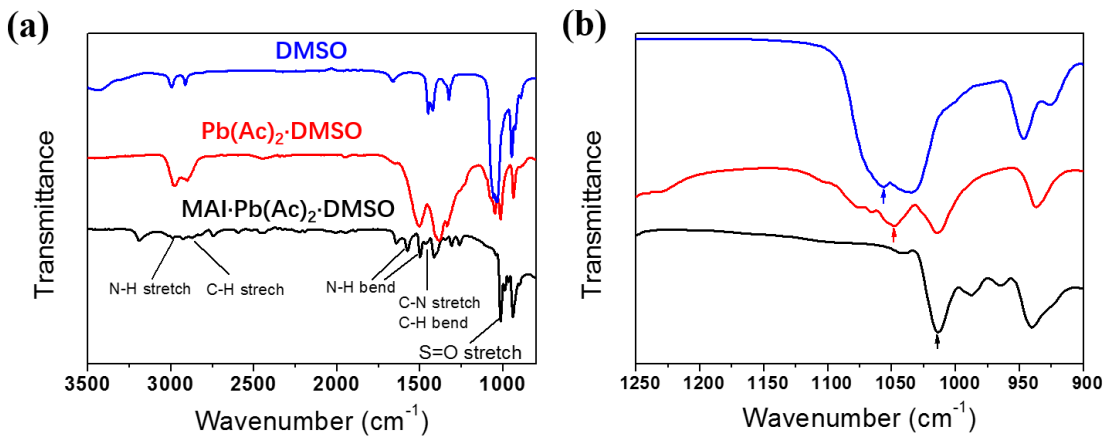
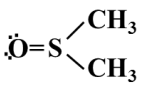
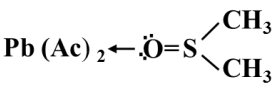
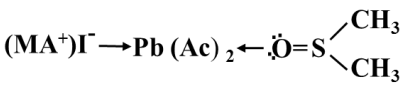


Fig. S6. (a) FTIR spectra of DMSO, $Pb(Ac)_2$·DMSO, and MAI·$Pb(Ac)_2$·DMSO intermediate phase. (b) Magnified view for S=O stretching mode in the spectra.

Table S2. Stretching frequency of S=O in DMSO, $Pb(Ac)_2$·DMSO, and MAI·$Pb(Ac)_2$·DMSO, along with their chemical structures.

Material			
	[DMSO]	[$Pb(Ac)_2$·DMSO]	[MAI·$Pb(Ac)_2$·DMSO]
S=O wavenumber (cm^{-1})	1058	1047	1013

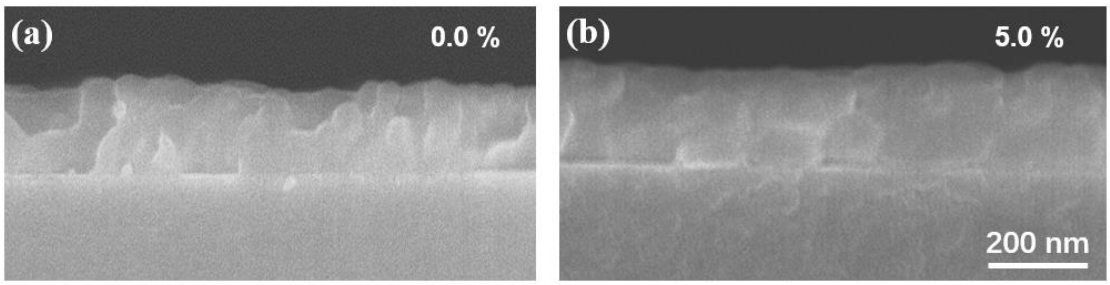


Fig. S7. Cross-sectional SEM images of the perovskite films prepared from precursors without (1.0%) and with 5.0% DMSO.

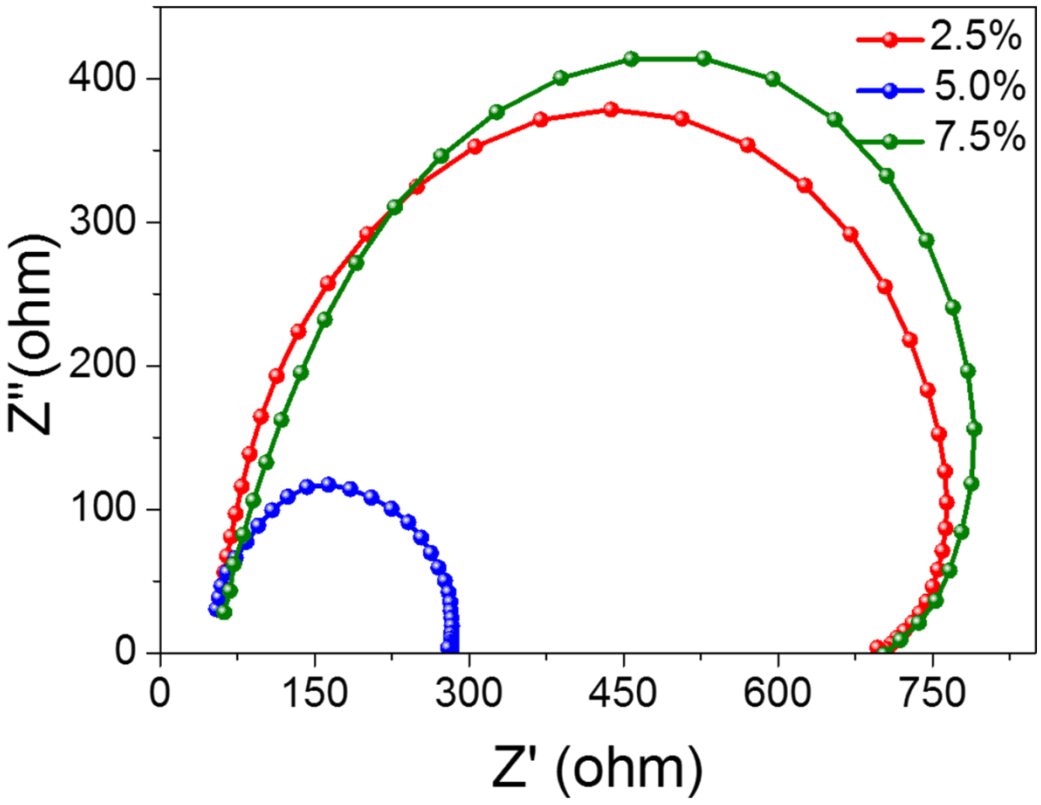


Fig. S8. Magnified Nyquist plots (under sun illumination with a bias of 1 V) for PSCs based on perovskite films processed using precursors with 2.5, 5.0, and 7.5% DMSO as the solvent additive.

Table S3. EIS parameters of planar heterojunction $CH_3NH_3PbI_3$ perovskite solar cells fabricated using lead acetate with DMSO.

DMSO Concentration (vol. %)	*Rs* (Ω)	R_{ct} (Ω)	C_{ct} (F)
0.0%	36	2981	1.5×10^{-8}
2.5%	31	483	5.3×10^{-9}
5.0%	27	217	3.1×10^{-9}
7.5%	32	490	5.8×10^{-9}