

Supplementary Information

**Efficient Additive-free FAPbI₃ Perovskite Solar Cells Achieved by
Promoting Homogeneity**

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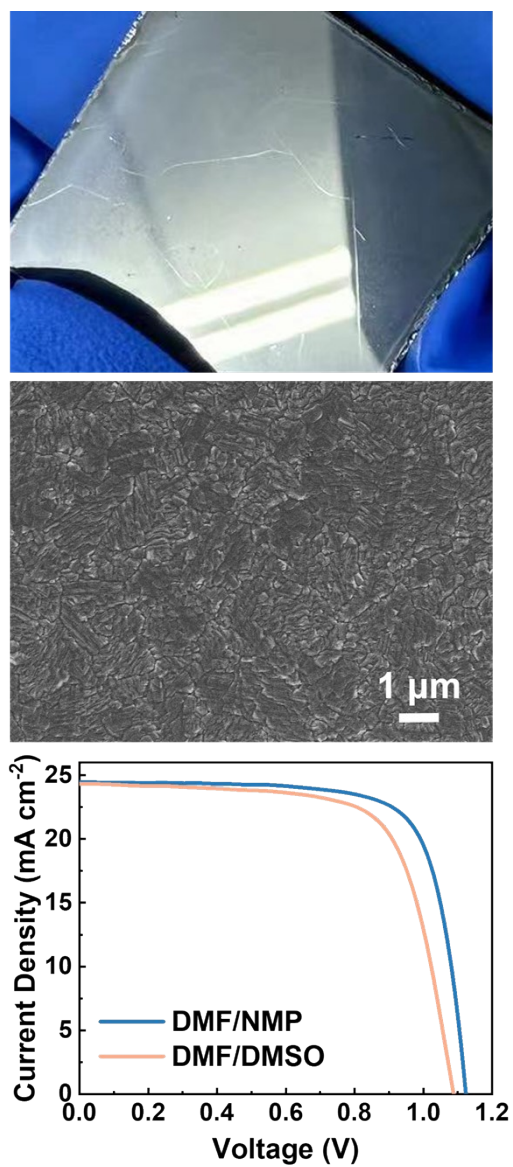


Figure S1. Photograph and SEM image of the perovskite films prepared by LPA using a DMF–DMSO cosolvent. J – V characteristics of PSCs using different solvent system.

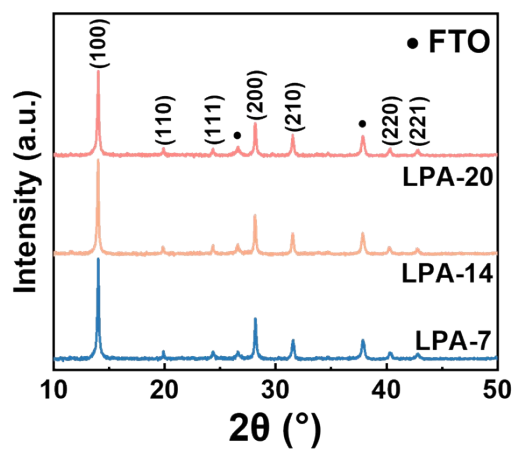


Figure S2. XRD patterns of three different perovskite films.

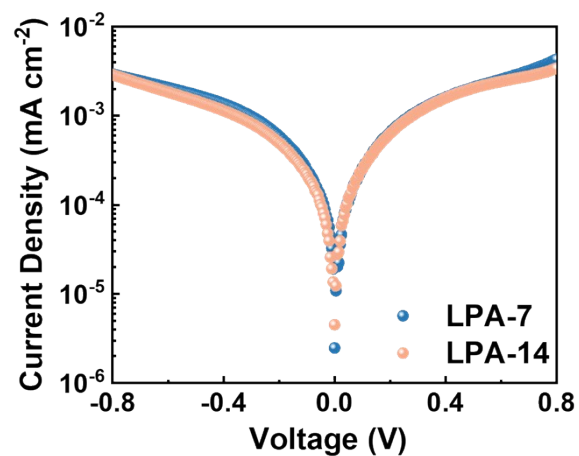


Figure S3. Dark J - V curves for PSCs fabricated with LPA-7 and LPA-14 films.

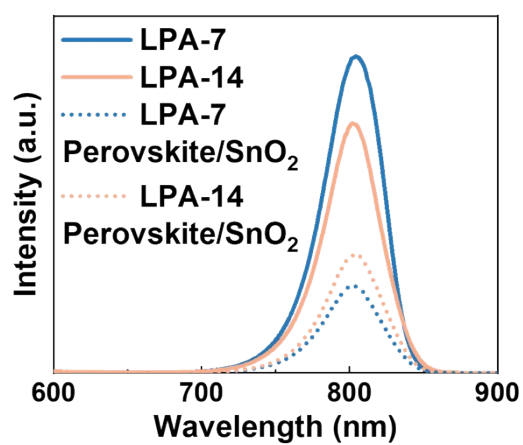


Figure S4. PL spectrum of the bare perovskite films and perovskite/SnO₂ films.

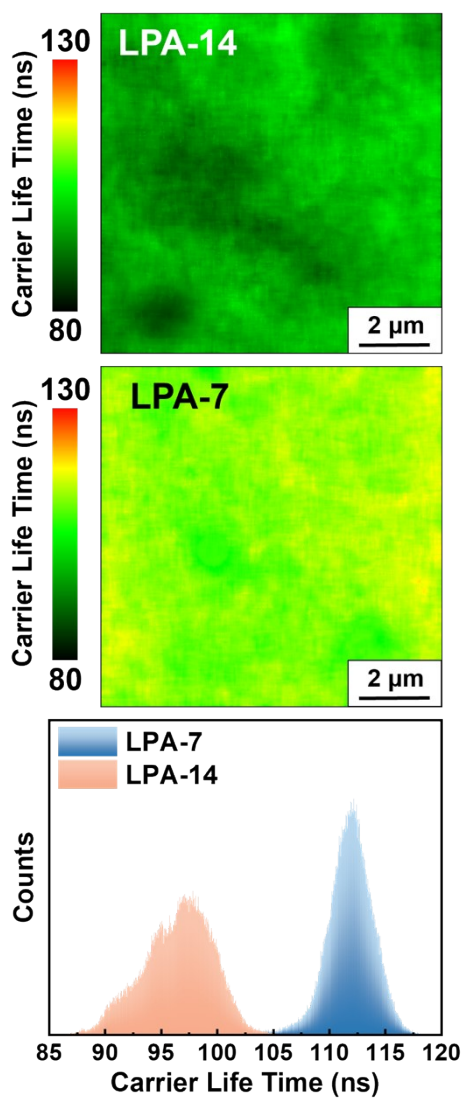


Figure S5. PL mapping images (carrier lifetime) of buried interface of LPA-14 and LPA-7 films, as well as the corresponding carrier lifetime distribution.

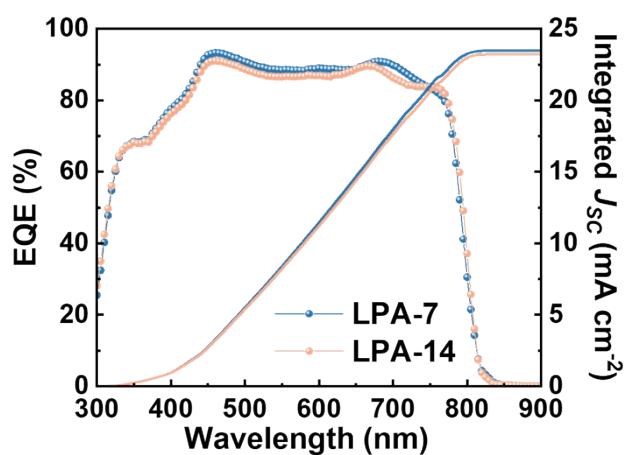


Figure S6. EQE spectrum and integrated current density for PSCs fabricated with LPA-7 and LPA-14 films.

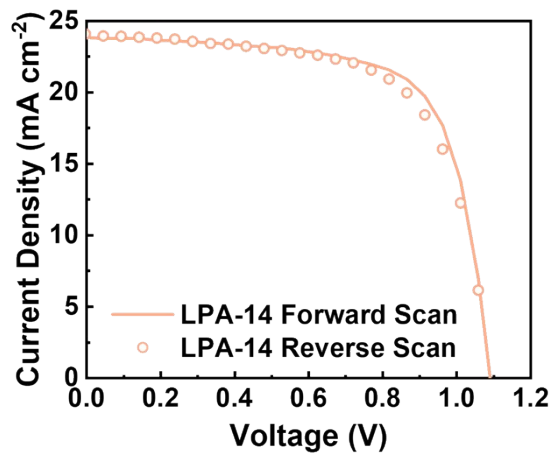
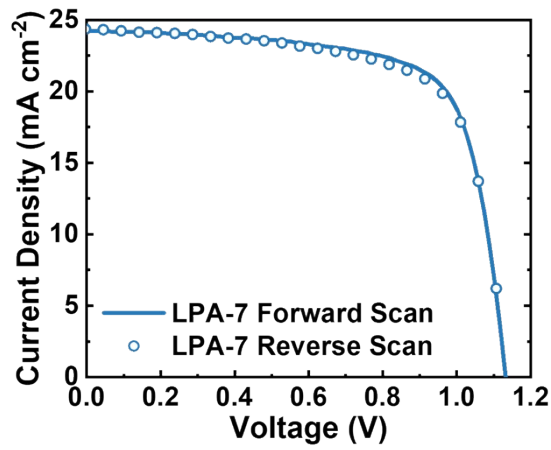


Figure S7. J - V curves of PSCs fabricated with LPA-7 and LPA-14 films measured in forward and reverse scans.

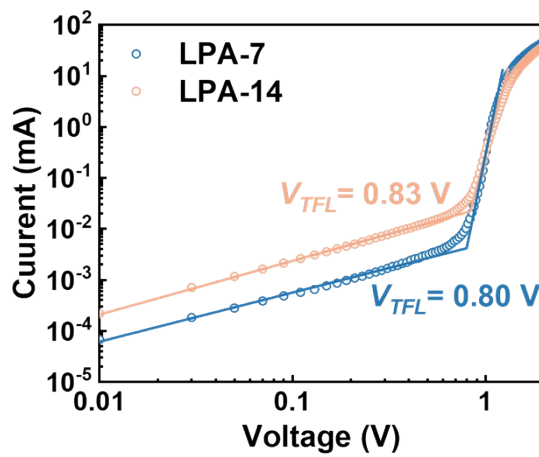


Figure S8. SCLC measurements of hole-only devices based on LPA-14 and LPA-7 films.

Table S1. RMS roughness of LPA-7, LPA-14 and LPA-20 samples.

Sample	RMS (nm)
LPA-7	13.57
LPA-14	32.74
LPA-20	42.56

Table S2. Previously report photovoltaic parameters of compositionally pure FAPbI₃ PSCs.

V_{OC} (V)	J_{SC} (mA/cm ²)	FF (%)	PCE (%)	Year	Reference
0.94	23.3	65	14.2	2014	Eperon et al. ¹
0.991	20.94	69	14.32	2014	Lee et al. ²
1.11	21.43	70	16.59	2015	Wozny et al. ³
1.048	21.84	73.6	16.84	2016	Aguiar et al. ⁴
0.951	24.1	67.7	15.5	2017	Fu et al. ⁵
1.048	24.23	64.6	16.41	2018	Lee et al. ⁶
1.011	23.63	63.5	15.16	2019	Yang et al. ⁷
1.027	24.84	77.08	19.66	2019	Kim et al. ⁸
1.04	23.00	69	16.55	2020	Lyu & Park ⁹
0.99	23.28	74	17.1	2020	Akin et al. ¹⁰
1.04	24.8	74.6	19.3	2020	Yadavalli et al. ¹¹
1.08	22.13	72.8	17.39	2021	Zhang et al. ¹²
1.074	24.90	75.4	20.19	2022	Lin et al. ¹³
Not available	Not available	Not available	21.6	2022	Du et al. ¹⁴
1.131	24.58	76.0	21.1	2023	This work

Table S3. Fitted values of different electronic parameters from dark Nyquist plots of LPA-7 and LPA-14 devices.

Device	R_s (Ω)	R_{ct} (Ω)	C_1 (F)	R_{rec} (Ω)	CPE_1 (F)
LPA-7	0.916	2573	1.098×10^{-8}	1.269×10^{20}	8.220×10^{-7}
LPA-14	2.804	3797	1.283×10^{-8}	9.239×10^{19}	5.593×10^{-7}

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