

Supplementary Information

Potassium Thiocyanate Additive for Hysteresis Elimination in Highly Efficient Perovskite Solar Cells

Ruxiao Zhang,^a # Minghua Li,^a # Yahuan Huan,^a Jiahao Xi,^a Suicai Zhang,^a Xiaoqin

Cheng,^a Hailin Wu,^a Wencai Peng,^a Zhiming Bai,^{b}, Xiaoqin Yan^{a*}*

The two authors made equal contributions

* Corresponding author

R. Zhang, M. Li, Y. Huan, J. Xi, S. Zhang, X. Cheng, H. Wu, W. Peng, Z. Bai, Prof. X.
Yan

a State Key Laboratory for Advanced Metals and Materials, School of Materials
Science and Engineering, University of Science and Technology Beijing, Beijing
100083, China

E-mail: xqyan@mater.ustb.edu.cn

Z. Bai

b School of Civil and Resource Engineering, University of Science and Technology
Beijing, Beijing 100083, China

E-mail: baizhiming2008@126.com

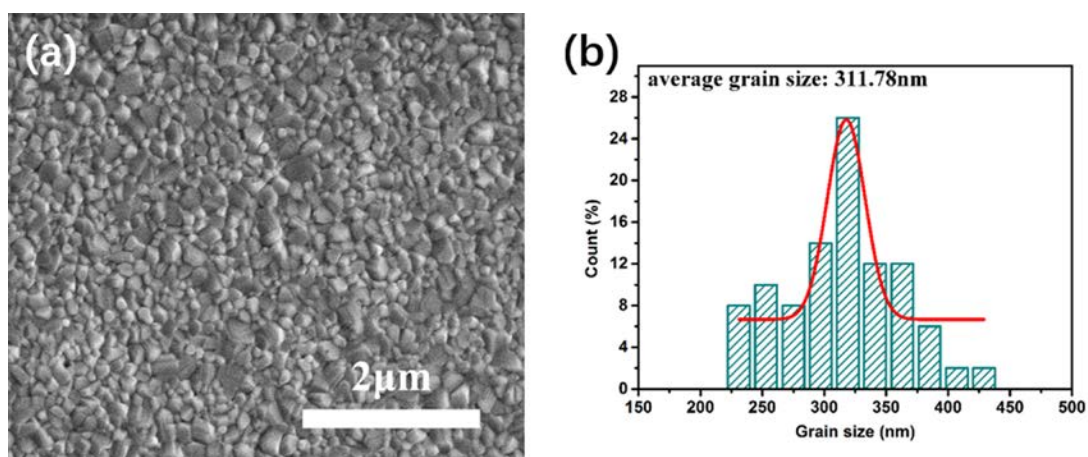


Fig. S1 (a) the top-view SEM images and (b) corresponding grain size statistical distribution of the MAPbI₃ films with 0.5 mol% Pb(SCN)₂ (1 mol% SCN⁻).

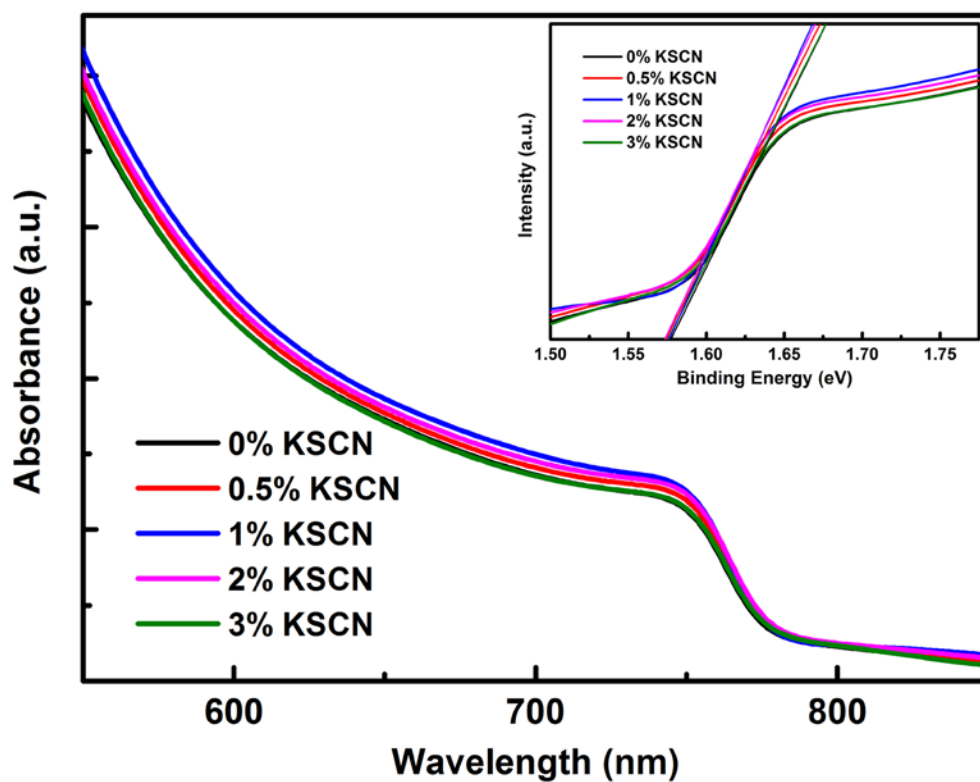


Fig. S2 UV-Vis spectra of perovskite films with different concentration of KSCN.

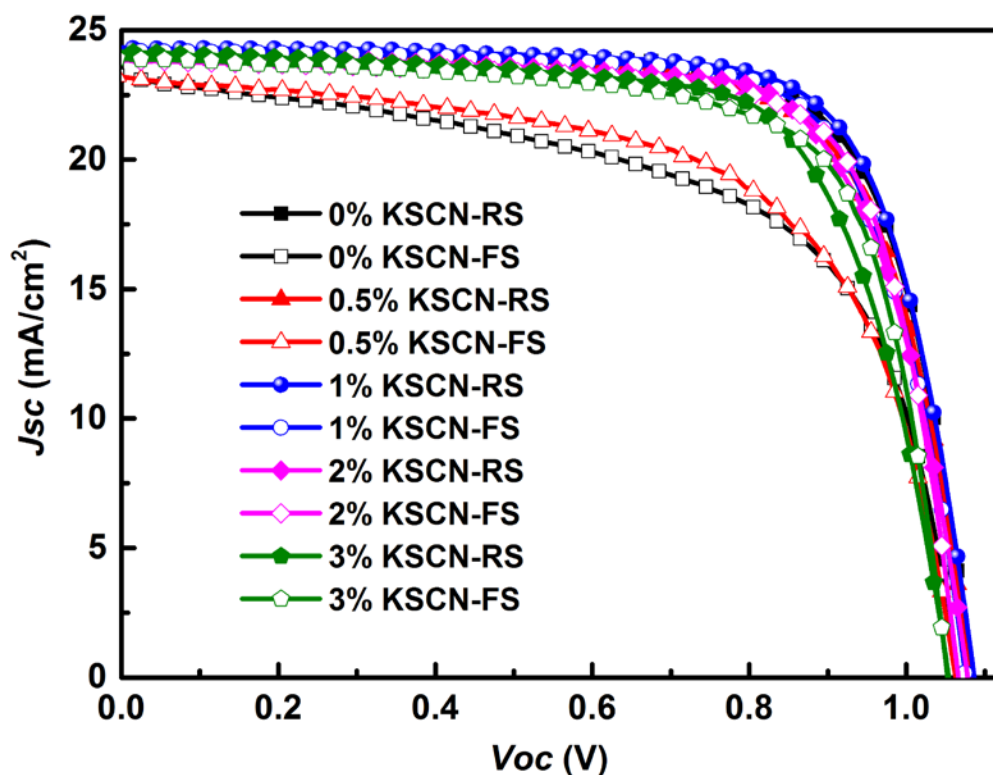


Fig. S3 The J - V curves of the perovskite solar cells with different concentrations of KSCN additives tested under 1 Sun AM 1.5G with a scan rate of 50 mV s^{-1} .

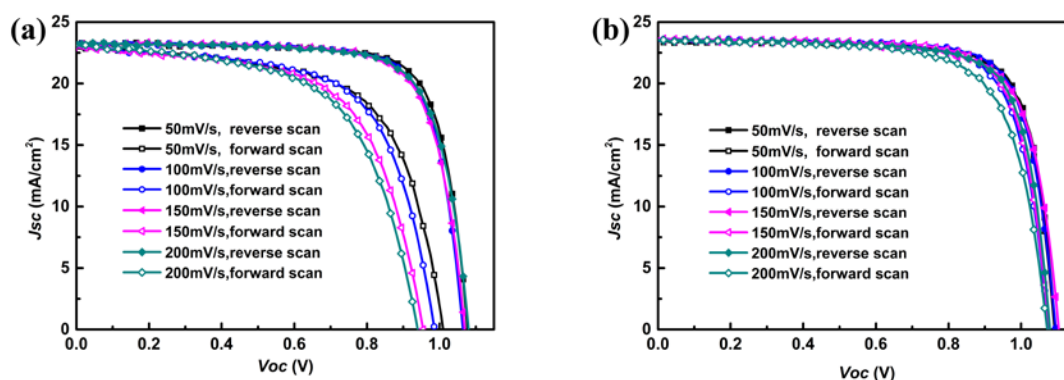


Fig. S4 The J - V curves of perovskite solar cells tested at different scan rates under 1 Sun AM 1.5G. (a) the perovskite solar cell without KSCN; (b) the perovskite solar cell with 1 mol% KSCN.

Table S1. The carrier lifetime (τ) of the MAPbI₃ films with different concentrations of KSCN additives.

Lifetime	MAPbI ₃ + KSCN (0 mol%)	MAPbI ₃ + KSCN (0.5 mol%)	MAPbI ₃ + KSCN (1 mol%)	MAPbI ₃ + KSCN (2 mol%)	MAPbI ₃ + KSCN (3 mol%)
τ_1 (ns)	58.03	49.21	117.89	63.68	94.69
τ_2 (ns)	158.61	171.59	265.23	237.28	227.28
Average τ (ns)	79.33	161.75	236.69	221.44	193.33

Table S2. Average photovoltaic parameters derived from *J-V* measurements of the perovskite solar cells with different concentrations of KSCN additives.

KSCN concentration (mol%)	Voc (V)	Jsc (mA/cm ²)	FF	PCE (%)
0	1.073±0.010	23.21±0.40	0.720±0.015	17.96±0.64
0.5	1.078±0.009	23.48±0.36	0.729±0.013	18.44±0.55
1	1.090±0.009	23.66±0.28	0.741±0.009	19.12±0.36
2	1.081±0.009	23.62±0.30	0.731±0.009	18.65±0.47
3	1.068±0.011	23.42±0.35	0.718±0.012	17.96±0.62

Table S3. Photovoltaic parameters derived from *J-V* measurements of the optimal perovskite solar cells with different concentrations of KSCN additives.

KSCN concentration (mol%)	Scan direction	Voc (V)	J_{sc} (mA/cm ²)	FF	PCE (%)	HI
0	R-S	1.075	24.16	0.743	19.30	23.7%
	F-S	1.065	23.19	0.596	14.72	
0.5	R-S	1.085	24.03	0.719	18.75	19.0%
	F-S	1.065	23.18	0.615	15.18	
1	R-S	1.090	24.33	0.740	19.62	2.5%
	F-S	1.085	24.23	0.727	19.12	
2	R-S	1.085	24.11	0.717	18.76	0.8%
	F-S	1.075	23.84	0.738	18.91	
3	R-S	1.055	24.16	0.701	17.88	0.7%
	F-S	1.055	23.88	0.715	18.01	