Supporting information

Performance Promotion through Dual-Interface Engineering of CuSCN Layers in Planar Perovskite Solar Cells

Yuzeng Xu, Ying Tian, Minna Hou, Yan Wu, Yi Ding*, Ying Zhao, Xiaodan Zhang, and Guofu Hou

Institute of Photoelectronic Thin Film Devices and Technology, Key Laboratory of Photoelectronic Thin Film Devices and Technology (Tianjin), Engineering Research Center of Thin Film Photoelectronic Technology (Ministry of Education), Renewable Energy Conversion and Storage Center, Nankai University, Tianjin 300071, P.R. China

* Corresponding author. Email: yiding@nankai.edu.cn (Y. Ding)

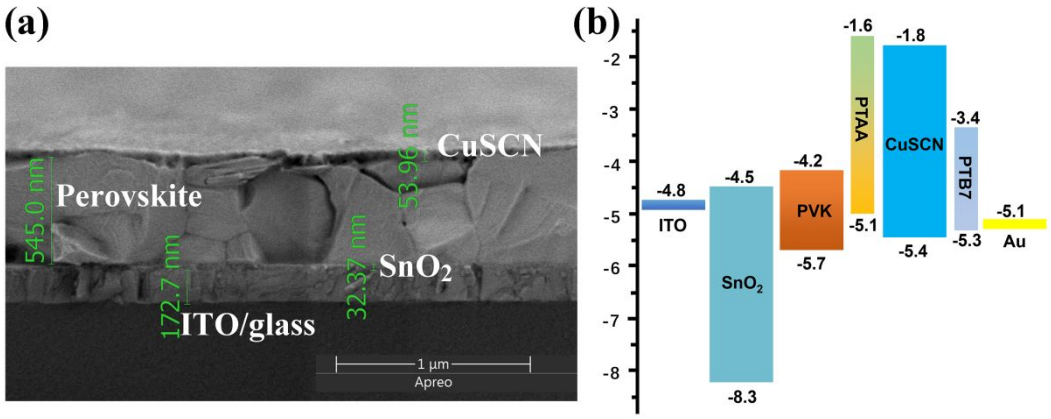

Figure S1. (a) Typical cross-sectional SEM image and (b) the possible band alignment of device.

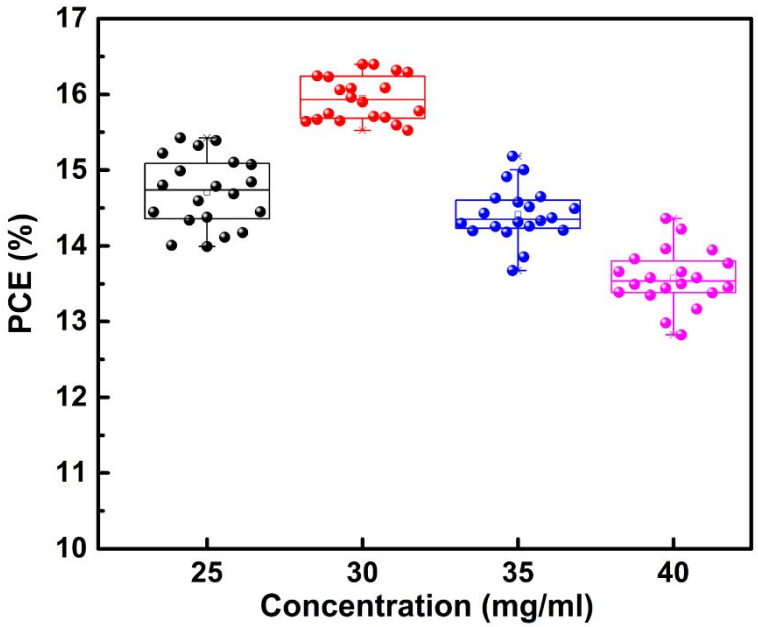

Figure S2. Relationship between device PCE and CuSCN concentration.

Table S1. Statistical photovoltaic parameters of devices fabricated with different concentration of CuSCN.

CuSCN concentration (mg/ml)	Jsc (mA/cm^2)	Voc (mV)	FF (%)	PCE (%)	Rsh (Ωcm^2)	Rs (Ωcm^2)
25	21.37±0.40	982±9	70.1±2.2	14.71±0.46	1029.22±77.08	4.27±0.41
30	21.48±0.48	1014±15	73.2±1.1	15.95±0.29	5266.14±68.36	3.63±0.37
35	22.19±0.42	970±18	67.0±2.4	14.42±0.36	1097.11±40.86	4.25±0.46
40	20.39±0.71	978±9	68.1±2.4	13.58±0.38	1727.06±15.67	4.01±0.54

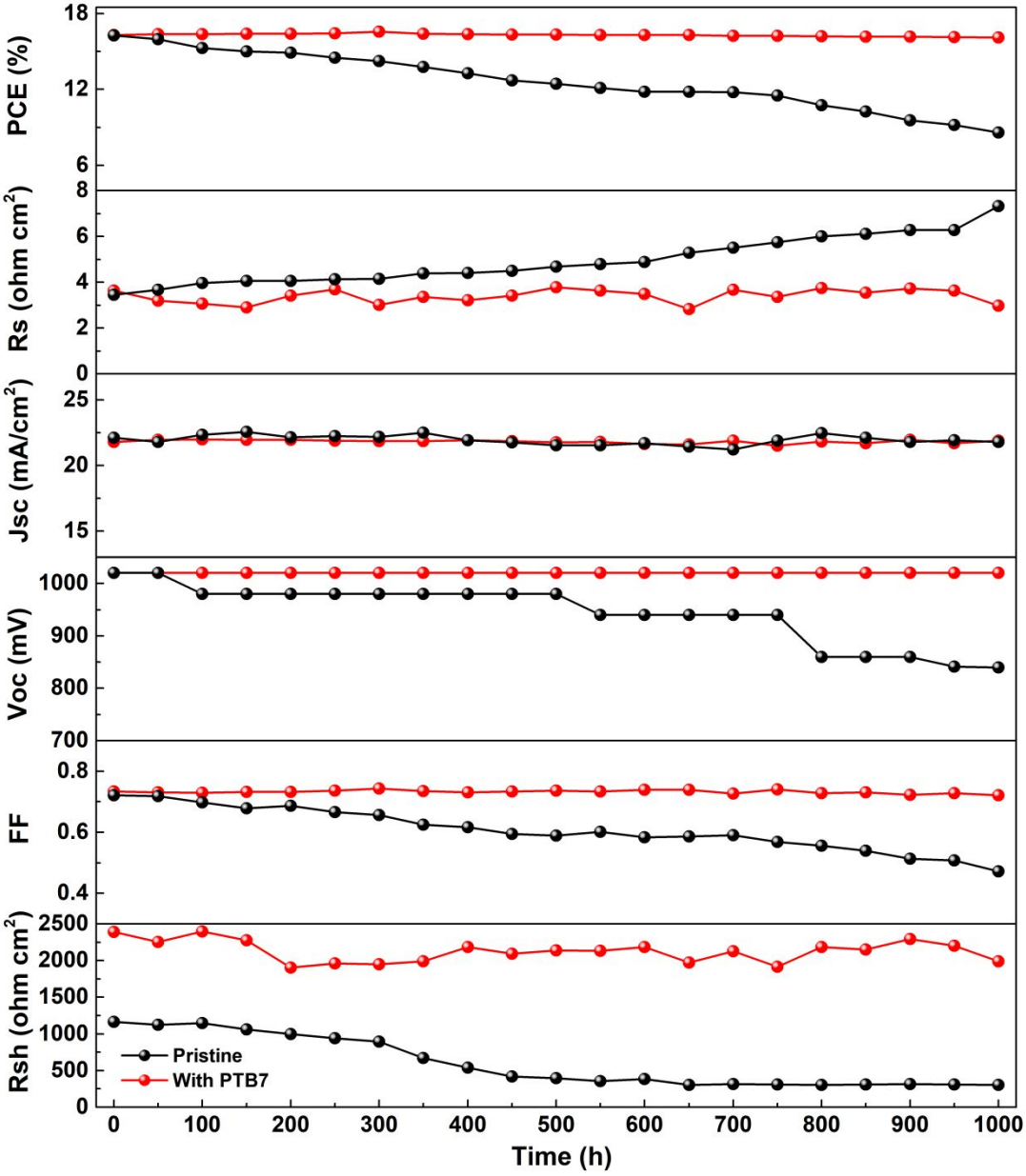

Figure S3. Time evolution of photovoltaic parameters of devices fabricated with or without PTB7 spacer.

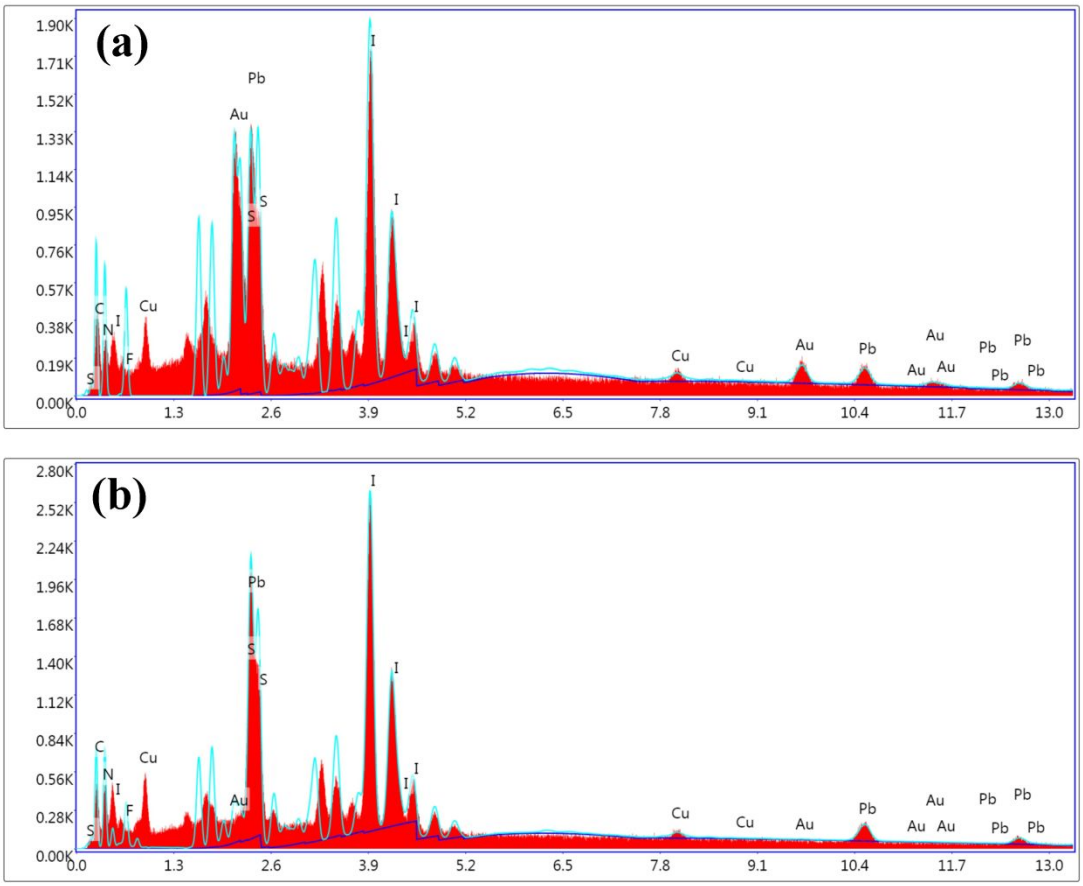

Figure S4. EDS spectra of CuSCN surface without (a) and (b) with PTB7 spacer.

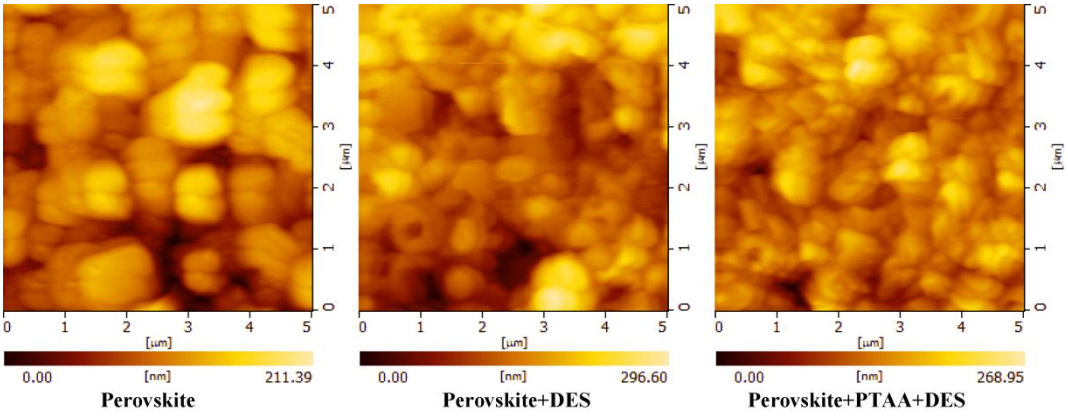

Figure S5. AFM images of perovskite surface treated with different processes.

Table S2. Analyzed parameters of PbI_2 (001) and perovskite (110) diffraction peaks.

	2-Theta	d (Å)	Height	I%	Area	I%	FWHM
PVK	12	7.0084	1635	251	29917	207	0.311
	14	6.3657	650	100	14492	100	0.379
PVK+DSE	12	6.9975	2054	417	37224	329	0.308
	14	6.3569	492	100	11327	100	0.391
PVK+PTAA+DES	12	7.0083	1899	253	35404	214	0.317
	14	6.3658	751	100	16535	100	0.374

Table S3. Statistical photovoltaic parameters of devices fabricated with different rpm of PTAA.

PTAA spin speed (rpm)	Jsc (mA/cm^2)	Voc (mV)	FF (%)	PCE (%)	Rsh (Ωcm^2)	Rs (Ωcm^2)
Null	21.49±0.41	1012±16	73.2±1.1	15.91±0.28	3999.44±32.01	3.76±0.46
2000	21.79±0.28	1020±1	73.8±0.8	16.41±0.21	3459.95±30.20	3.43±0.15
3000	21.56±0.58	1020±1	73.8±0.9	16.23±0.53	3473.06±22.57	3.47±0.25
4000	23.11±0.42	1024±22	74.5±1.4	17.63±0.39	3291.62±27.18	3.22±0.46
5000	21.85±0.86	1012±16	73.5±1.7	16.23±0.32	6676.02±10.08	3.27±0.44