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

Table s1. Typical indoor OSC lifetime experiments based on ISOS.

Dark storage lifetime					
Test protocols	Active layer	Initial PCE (%)	Lifetime	Size	Ref.
ISOS-D-1	P3HT: PCBM	3.14	245 days	1.2 × 3.5 cm^2	[1]
ISOS-D-3	P3HT: PCBM	2.7	>12000h	5 × 5 cm^2	[2]
ISOS-D-1	PTB7: $PC_{70}BM$	7.76	<300h	-	[3]
ISOS-D-2	P3HT: PCBM	≈1.6	≈5000h	38, 110, and 186 cm^2	[4]
ISOS-D-2	P3HT: $PC_{70}BM$	3.16	≈160h	-	[5]
ISOS-D-2	DPPTTT: $PC_{70}BM$	2.86	≈120h	12 mm^2	[5]
ISOS-D-1	PTB7: P(NDI2OD-T2)	7.07	>72days	0.1 cm^2	[6]

Constant irradiance lifetime					
Test protocols	Active layer	Initial PCE(%)	Lifetime(h)	Size	Ref.
ISOS-L-1	DR3TSBDT: $PC_{70}BM$	9.6	5600	-	[7]
ISOS-L-1	PCDTBT: $PC_{70}BM$	5.5	>12000	0.5 cm^2	[8]
ISOS-L-1	PCDTBT: $PC_{70}BM$	5.5	≈18000	7.06 mm^2	[9]
ISOS-L-2	P3HT: PCBM	3.54	≈2300	0.04 cm^2	[10]
ISOS-L-1	PCDTBT: $PC_{70}BM$	5.2	14500	4 mm^2	[11]
ISOS-L-1	PTB7-Th: PC70BM	10.5	>600	0.28 cm^2	[12]
ISOS-L-1	P3HT: PCBM	3.7	>6500	-	[13]

Table s2. The standard error of collected data.

			Open circuit samples		
color	I_{sc}(mA)	P_{max}(mW)	FF(%)	V_{oc}(V)	PCE(%)
	0	0	0	0	0
	0.39	1.263	2.169	0.007	1.219E-2
	0.78	2.525	4.338	0.014	2.438E-2
	1.17	3.788	6.506	0.021	3.656E-2
	1.56	5.05	8.657	0.028	4.875E-2
	1.95	6.313	10.84	0.035	6.094E-2
	2.34	7.575	13.01	0.042	7.312E-2
	2.73	8.838	15.18	0.049	8.531E-2
	3.12	10.1	17.35	0.056	9.75E-2
			Short circuit samples		
	0	0	0	0	0
	1.043	3.95	0.525	8.325E-3	3.725E-2
	2.085	7.9	1.05	1.665E-2	7.45E-2
	3.127	11.85	1.575	2.498E-2	1.117E-2
	4.17	15.8	2.1	3.33E-2	1.49E-2
	5.213	19.75	2.625	4.163E-2	1.863E-2
	6.255	23.7	3.15	4.995E-2	2.235E-2
	7.297	27.65	3.675	5.828E-2	2.6507E-2
	8.34	31.6	4.2	6.66E-2	2.98E-2

Table s3. The linear fitting parameters of I_{sc}, P_{max} and V_{oc}.

	I_{sc}		P_{max}		V_{oc}	
	Value	Error	Value	Error	Value	Error
Slope	0.09	9.86E-4	0.39	4.04E-3	-0.014	3.09E-4
Intercept	1.64	0.66	8.33	2.70	7.48	6.89E-3

Table s4. The non-linear fitting parameters of PCE.

	Full data		Radiation intensity over 800w/m^2	
	Value	Standard Error	Value	Standard Error
a	3.25	0.026	3.25	0.013
b	1.34	0.076	0.88	0.042
c	9.13E-04	9.79E-05	7.30E-04	6.78E-05

Table s5. The linear fitting results.

Connection of	PCE with temperature		PCE with time	
	Value	Error	Value	Error
Slope	1.06E-2	6.70E-4	-6.70E-6	2.99E-6
Intercept	2.85	1.50E-2	3.22	4.16E-2

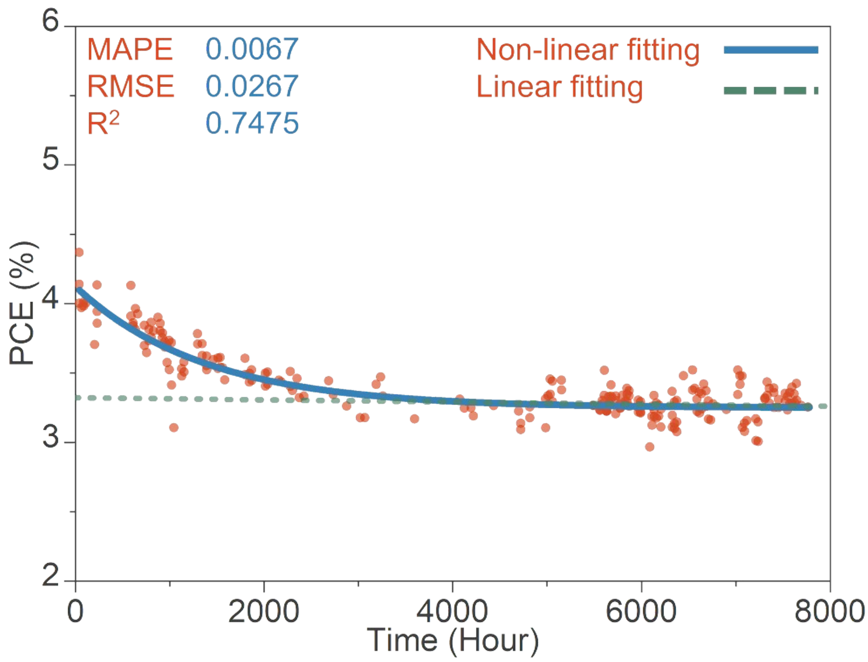

Figure s1 Fitting result of time and PCE (radiation intensity over 800w/m2)

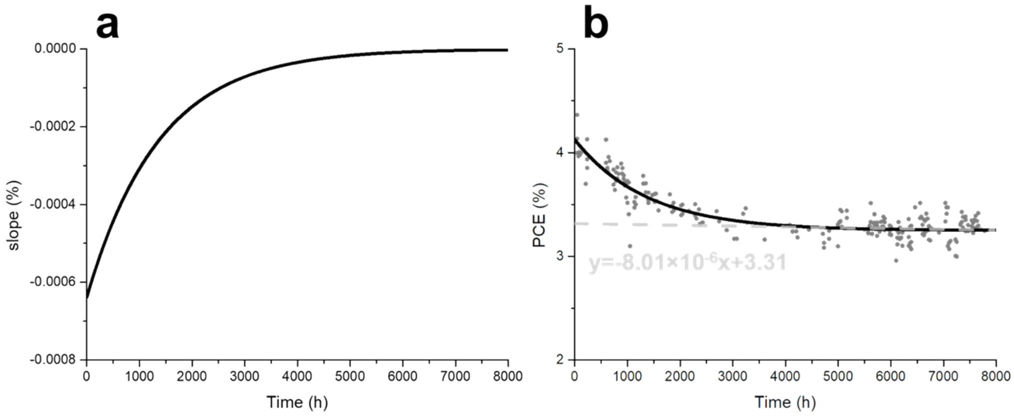

Figure s2 Linear fitting result based on the slope rate.
(a)The slope rate of the non-linear model. (b) the fitting results.

The absolute value of slope rate of the non-linear model decreases with time as shown in Figure s1a and stable at 6000h. We used the slope rate and value at 6000h to set up the linear fitting model and the result was shown as Figure s1b. The extrapolation E0 value was around 3.31% and the decrease ratio was about 8.01×10-6 per hour. The T80 was over 9 years (≈9.43 years).

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