Evaluation of Polymer Solar Cells Efficiency to Understand the Burn-In Loss

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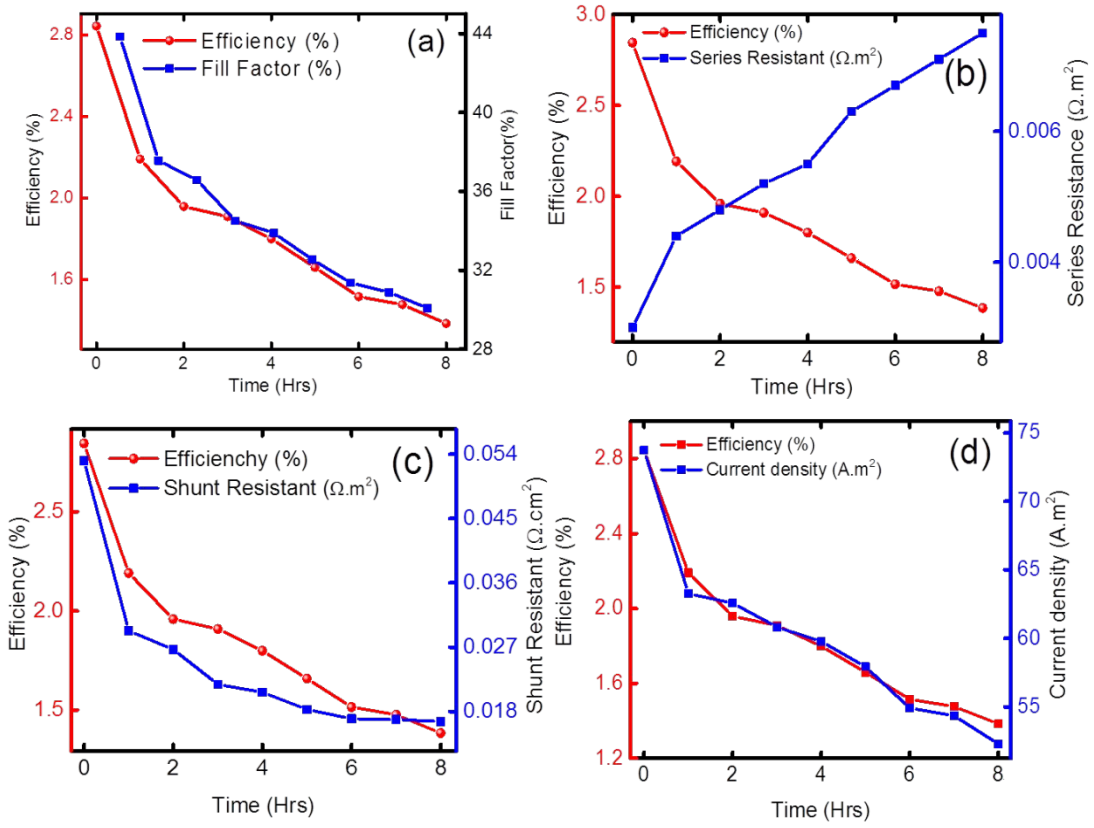

Figure S1. variation of efficiency with (a) fill factor, (b) series resistance, (c) shunt resistance, and (d) J_{SC}.

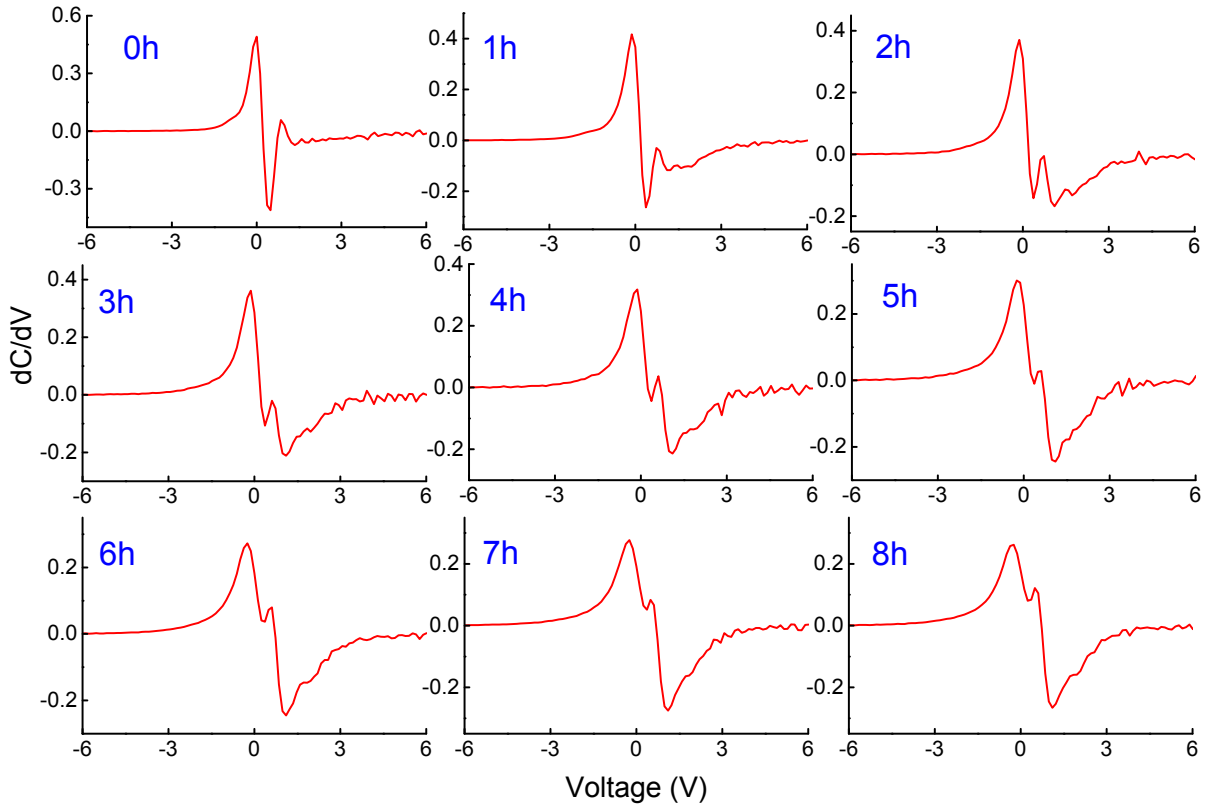

Figure S2. The derivative of capacitance-voltage characteristics of device under light (0-8h).

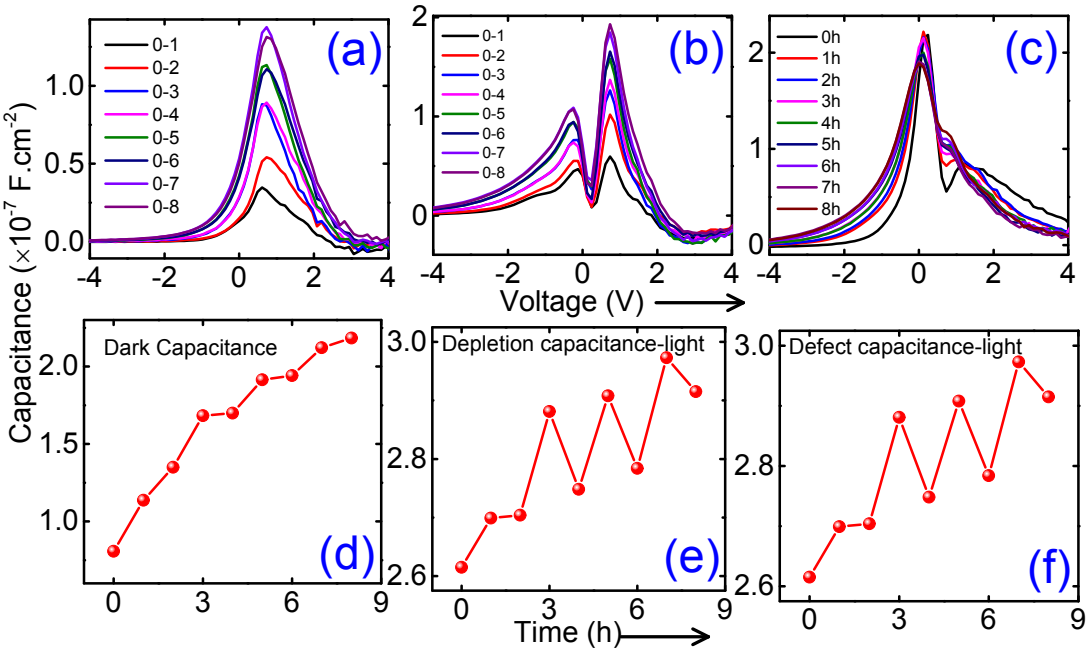

Figure S3. spectral representation of change in capacitance under (a) dark condition, (b) light condition, (c) difference in the capacitance between dark and light illuminated conditions for 0h-8h, with respect to ageing time (d) variation of peak value of dark capacitance, (e) variation of peak value of depletion capacitance under light, (f) variation of peak value of defect capacitance under light.

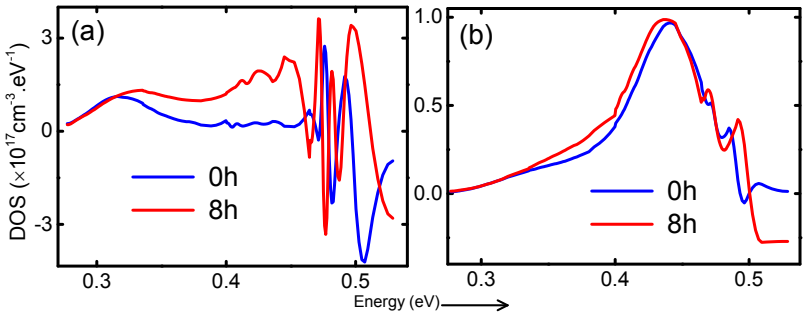

Figure S4. Device density of trap states distribution (0 and 8h) under (a) dark and (b) light conditions.

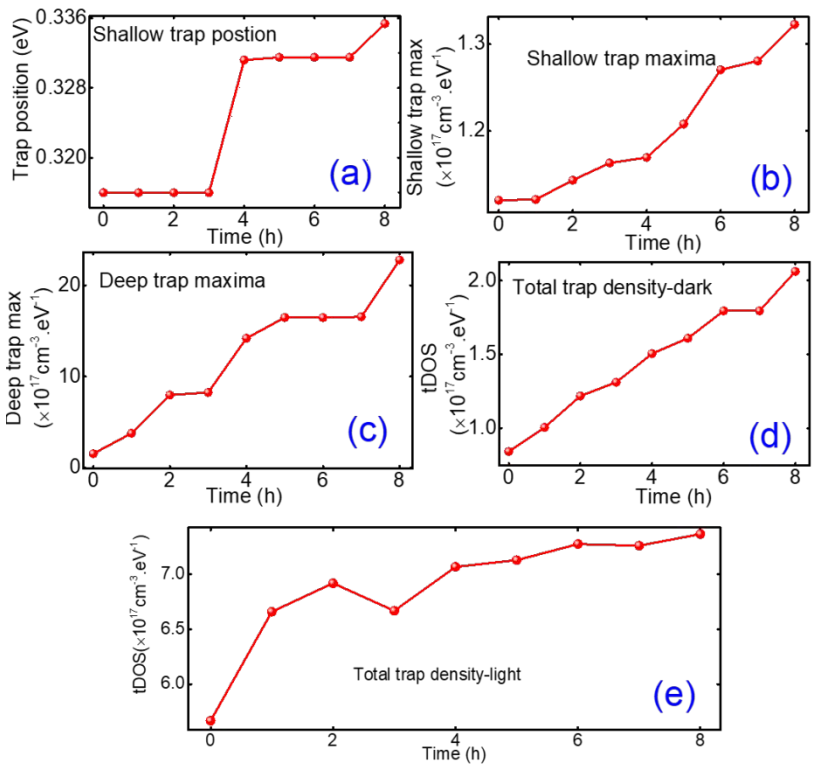

Figure S5. With respect to ageing time (a) variation in the energetic position of the shallow trap peak, (b) variation in the energetic position of the shallow trap peak maxima, (c) variation in the position of the deep trap maxima, (d) variation in the total density of trap states under dark and (e) variation in the total density of trap states under light.

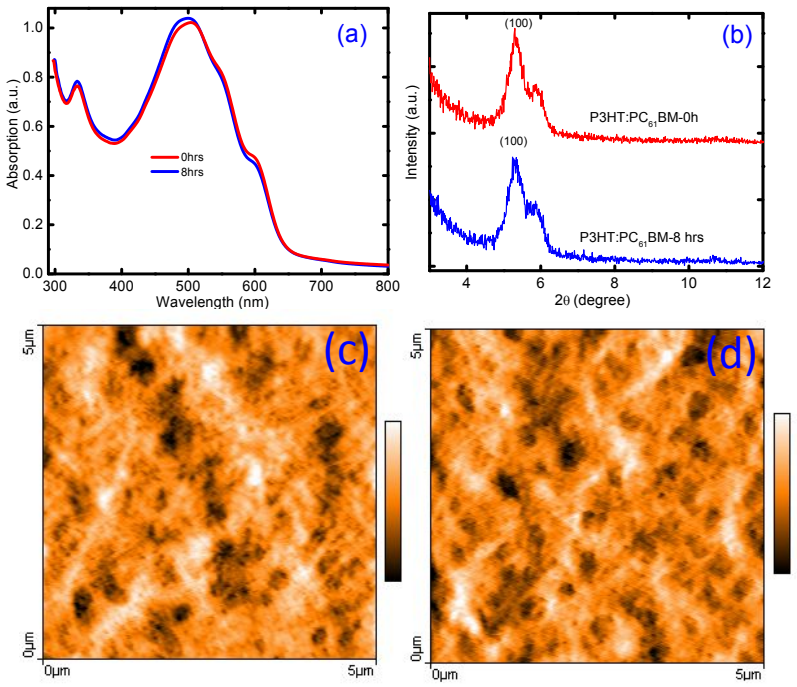

Figure S6. (a) UV-visible spectra, (b) GI-XRD spectra of P3HT:PC_{61}BM active layer, AFM surface topography of P3HT:PC_{61}BM (c) as prepared device (0h) and (d) after 8h of continuous illumination.

Table S1. Diode current density.

	0	1	2	3	4	5	6	7	8
dark RB(1V)	0.0851	0.2412	0.2248	0.2604	0.1702	0.3624	0.4661	0.4261	0.5553
Dark FB(1V)	4.6726	4.444	4.4173	4.4013	4.414	4.312	4.2907	4.2310	4.2293

Table S2. Photovoltaic parameters.

Time (h)	J_{SC} ($A.m^{-2}$)	V_{OC} (mV)	FF (%)	η (%)	R_s ($\Omega.m^2$)	R_{sh} ($\Omega.m^2$)
0	73.730	554	43.05	1.746	0.0030	0.0531
1	63.266	554	37.56	1.283	0.0044	0.0293
2	62.828	554	36.06	1.196	0.0048	0.0267
3	60.565	554	34.28	1.202	0.0052	0.0218
4	59.770	554	33.45	1.104	0.0055	0.0207
5	57.930	554	31.83	1.018	0.0063	0.0183
6	54.902	554	31.11	0.931	0.0067	0.0170
7	54.353	554	30.47	0.907	0.0071	0.0169
8	52.293	554	30.09	0.849	0.0075	0.0166

Table S3. Capacitance-voltage parameter.

Time (h)	Dark		Light	
	N ($x10^{17}cm^{-3}$)	V_{bi} (mV)	N ($x10^{16}cm^{-3}$)	V_{bi} (mV)
0	1.984	554	2.547	500
1	3.142	523	2.843	470
2	3.129	523	2.917	460
3	3.565	521	3.417	450
4	3.795	520	3.641	440
5	4.384	515	3.785	440
6	4.479	514	3.914	440
7	4.765	512	3.996	430
8	5.173	511	4.125	430

Table S4. Capacitance-voltage parameters.

#	Device tested under dark			Device tested under light			
				Depletion capacitance peak		Defect capacitance peak	
	FWHM	V_{peak} (V)	C ($\times10^{-7}Fm^{-2}$)	V_{peak} (V)	C ($\times10^{-7}Fm^{-2}$)	V_{peak} (V)	C ($\times10^{-7}$ Fm^{-2})
0	1.0605	0.7067	0.8073	0.275	2.615	1.50	1.478
1	1.2663	0.7364	1.1365	0.1615	2.699	0.85	1.945
2	1.3216	0.7364	1.3493	0.1538	2.704	0.81	2.383
3	1.2352	0.7364	1.6818	0.1981	2.881	0.80	2.627
4	1.3532	0.7364	1.6993	0.1881	2.748	0.74	2.734
5	1.3405	0.7364	1.9142	0.1800	2.908	0.68	2.946
6	1.4230	0.7364	1.9411	0.1756	2.784	0.74	3.019
7	1.3849	0.7364	2.1208	0.2278	2.973	0.72	3.209
8	1.4838	0.7666	2.1833	0.1627	2.915	0.74	3.2937

Table S5. Parameter of density of trap states.

Time (h)	Shallow trap peak position (eV)	Shallow trap peak intensity (T_W) (10^{17} $cm^{-3}eV^{-1}$)	Deep trap peak intensity (at Ew-0.4487eV) (10^{16} $cm^{-3}eV^{-1}$)	Total trap DOS ($cm^{-3}eV^{-1}$) (10^{16} $cm^{-3}eV^{-1}$) (dark)	Total trap DOS ($cm^{-3}eV^{-1}$) (10^{15} $cm^{-3}eV^{-1}$) (light)
0	0.31597	1.1202	1.53894	0.8421	5.6671
1	0.31597	1.1211	3.77547	1.0054	6.6572
2	0.31597	1.1433	7.97135	1.2180	6.9161
3	0.31597	1.1631	8.25632	1.3115	6.6656
4	0.33120	1.1695	14.1996	1.5051	7.0642
5	0.33150	1.2079	16.4659	1.6091	7.1256
6	0.33150	1.2704	16.4659	1.7947	7.2712
7	0.33150	1.2804	16.5532	1.7948	7.2565
8	0.33538	1.3225	22.7831	2.0614	7.3624