Electronic Supplementary Information

Improved photostability in ternary blend organic solar cells: the role of [70]PCBM

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## 1. Time evolution of *J-V* parameters of the studied solar cells
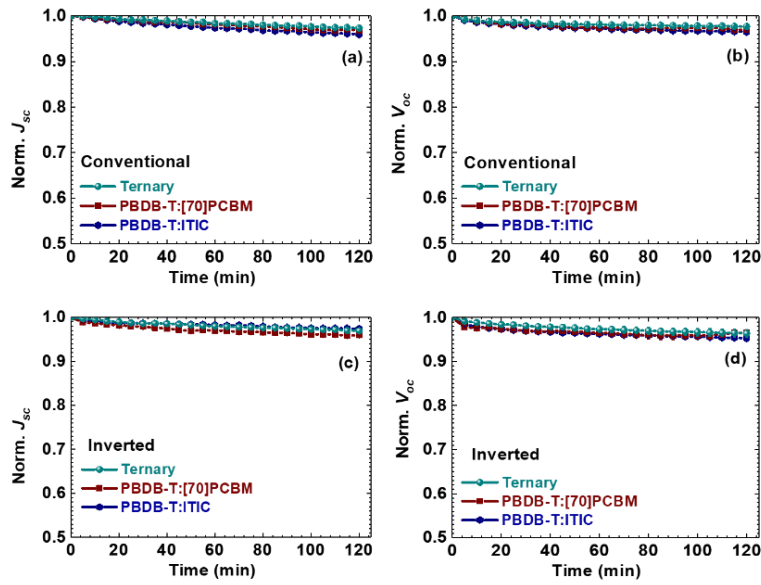
Figure s1: Photo-induced degradation behaviour of J_{sc} **(a,c)** and V_{oc} **(b,d)** of the conventional **(a,b)** and the inverted **(c,d)** solar cells: Ternary (sphere, cyan), PBDB-T:[70]PCBM (square, brown) and PBDB-T:ITIC (circle, blue).
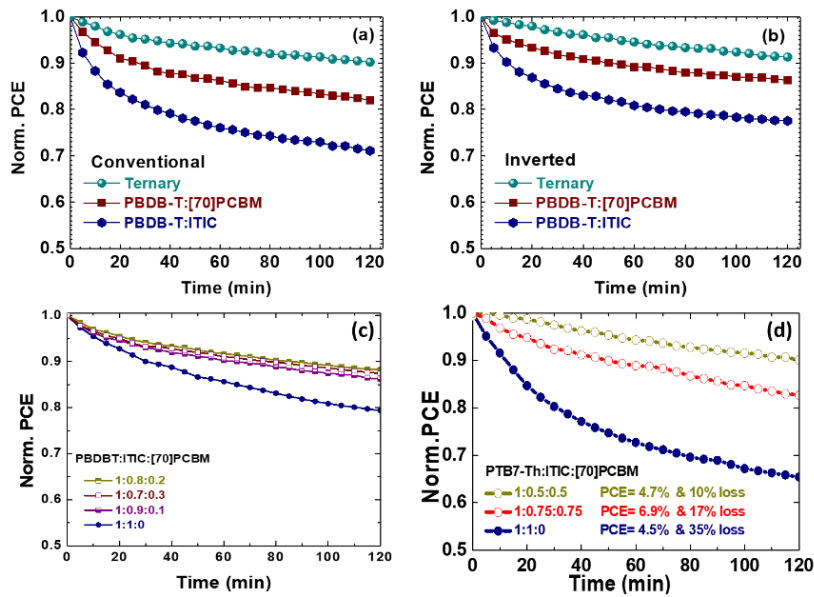
Figure s2: Photo-induced degradation behaviour of the PCE: single plot of conventional PBDB-T based devices **(a)**, single plot of inverted PBDB-T based devices **(b)**, different ratio ternary vs. PBDB-T:ITIC binary conventional solar cells **(c)** and different ratio ternary vs. PTB7-Th:ITIC binary conventional solar cells **(d)**.

2. *J-V* parameters of the studied solar cells
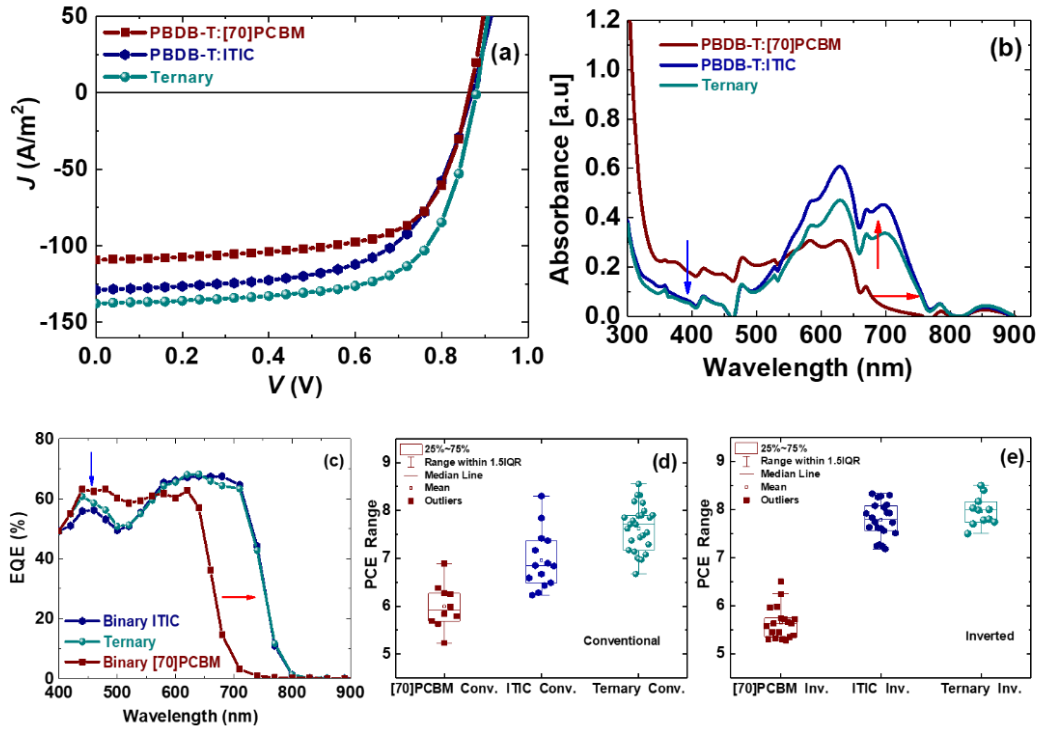
Figure s3: *J-V* curves and EQE of best performing conventional solar cells **(a,c)**, absorption spectra of their corresponding films **(b)** and devices PCE statistics **(d,e)**. Ternary (27 conventional and 11 inverted devices), PBDB-T:[70]PCBM (10 conventional and 19 inverted devices) and PBDB-T:ITIC (14 conventional and 22 inverted devices).

3. Ratio-dependent photovoltaic performance of PBDB-T based solar cells

Table s1: Ratio dependent evolution of the photovoltaic parameters of PBDB-T:ITIC:[70]PCBM conventional solar cells.

Corresponding number to ratio	Ratio (1:i:j with j=1-i)	J_{sc} (A.m^{-2})	V_{oc} (V)	FF (%)	Best PCE (%)	Avg. PCE (%)	Avg. Degradation (%)
1	1:1:0	142	0.887	65.9	8.3	7.0	23.4
2	1:0.9:0.1	140	0.885	66.2	8.2	7.8	20.5
3	1:0.8:0.2	150	0.879	65.0	8.6	7.7	16.8
4	1:0.7:0.3	145	0.876	65.6	8.3	8.0	11.0
5	1:0.5:0.5	124	0.882	64.1	7.0	6.5	13.9
6	1:0.3:0.7	122	0.872	64.2	6.8	6.4	13.6
7	1:0.2:0.8	124	0.880	64.3	7.0	6.1	13.5
8	1:0.9:0.1	113	0.875	65.8	6.5	6.1	13.1
9	1:0:1	121	0.839	71.9	7.3	6.1	16

Table s2: Ratio dependent evolution of the photovoltaic parameters of PTB7-Th:ITIC:[70]PCBM conventional solar cells.

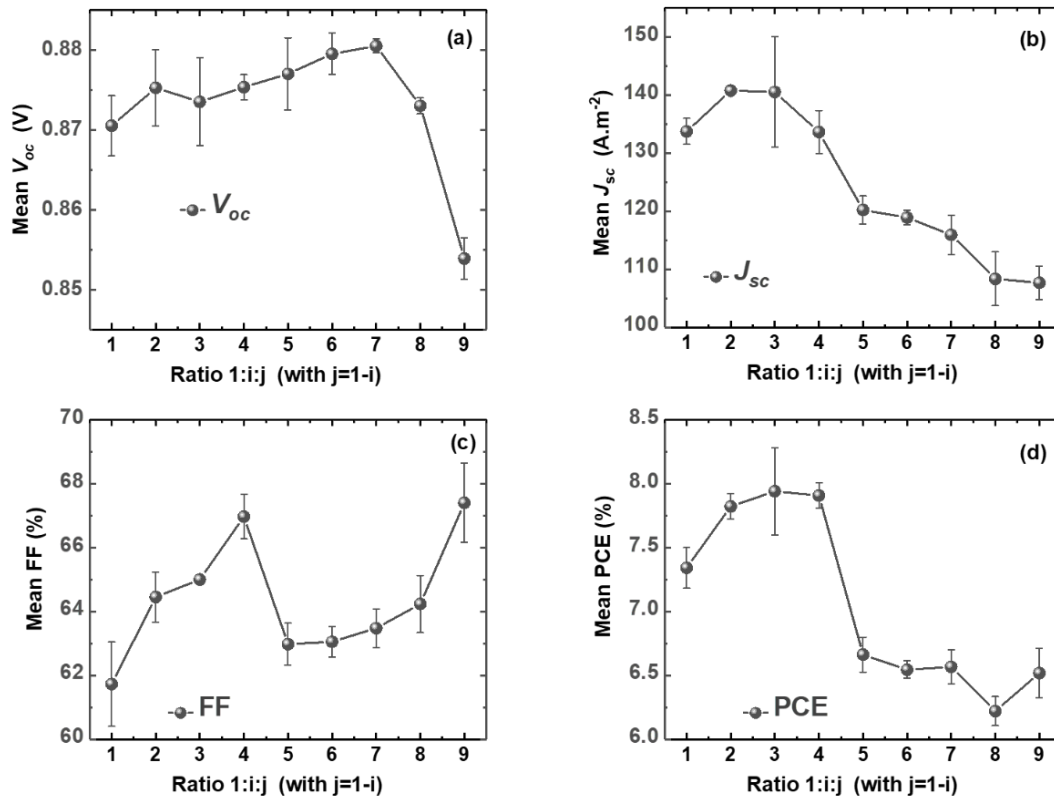| Corresponding number to ratio	Ratio (1:i:j with j=1-i)	J_{sc} (A.m^{-2})	V_{oc} (V)	FF (%)	Best PCE (%)	Avg. PCE (%)	Degradation (%)
1	1:1:0	112.6	0.81	49.5	4.5	4.2	34.6
2	1:0.9:0.1	116.9	0.812	49.7	4.7	4.6	27.6
3	1:0.8:0.2	114.7	0.799	53	4.9	4.8	20.3
4	1:0.7:0.3	87.6	0.804	55.8	3.9	3.9	23.3
5	1:0.5:0.5	110.7	0.803	51.7	4.7	4.6	9.4
6	1:0.75:0.75	147.3	0.817	57.7	6.9	6.7	17.3
7	1:0.5:1	145.7	0.822	59.9	7.2	7.1	18.6
8	1:0.25:1.25	147.3	0.825	61.2	7.4	7.2	18.9
9	1:0:1.5	147	0.804	65.3	7.7	7.4	18.7

Figure s4: Ratio dependent average photovoltaic performance of conventional PBDB-T based solar cells**:** V_{oc} **(a)**, J_{sc} **(b)**, FF **(c)**, and PCE **(d)**. The correct ratio for the numbers 1,2,3 … and 9 can be seen in Table s1.

4. Light intensity dependence measurements
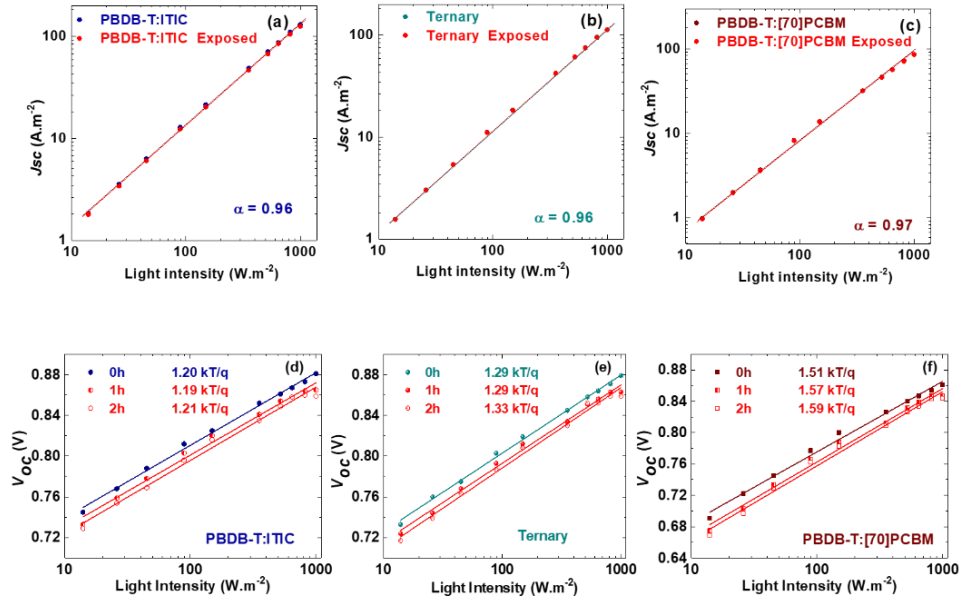
Figure s5: J_{sc} light intensity dependence of the fresh and exposed (1h and 2h): PBDB-T:ITIC (**a**), Ternary (**b**), and PBDB-T:[70]PCBM (**c**) and V_{oc} light intensity dependence PBDB-T:ITIC (**d**), Ternary (**e**), and PBDB-T:[70]PCBM (**f**) of the solar cells.

5. 2D GIWAXS peak intensity plots
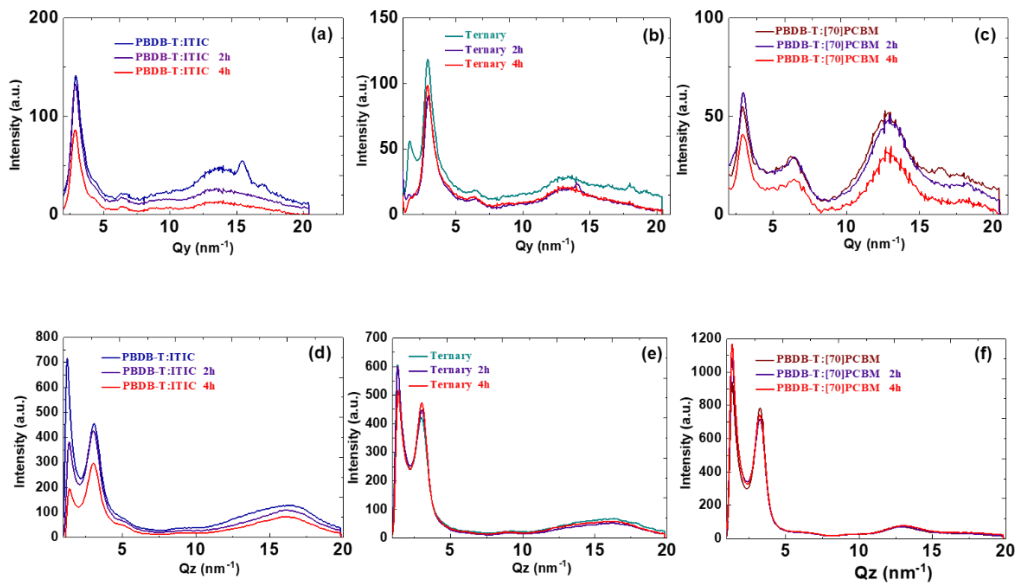
Figure s6: GIWAXS intensity plots of the fresh and exposed films (2h and 4h): in-plane intensities of PBDB-T:ITIC (**a**), Ternary (**b**), and PBDB-T:[70]PCBM (**c**) and out-of-plane intensities of PBDB-T:ITIC (**d**), Ternary (**e**), and PBDB-T:[70]PCBM (**f**).