Supporting information for

Air-processed polymer tandem solar cells with power conversion efficiency exceeding 10%

Ning Li[1] & Christoph J. Brabec[1,2]

[1] Institute of Materials for Electronics and Energy Technology (i-MEET), Friedrich-Alexander University Erlangen-Nürnberg, Martensstraße 7, 91058 Erlangen, Germany

[2] Bavarian Center for Applied Energy Research (ZAE Bayern), Haberstraße 2a, 91058 Erlangen, Germany

*Correspondence should be addressed to Ning Li. Email: Ning.Li@fau.de; Tel.: +49 (0)9131 - 8527634; Fax: +49 (0)9131 - 8528495.

Keywords: ((Organic photovoltaics; Organic tandem solar cells; PTB7-Th, PBDTTT-EFT or PCE10; Solvent treatment; Air-processing))

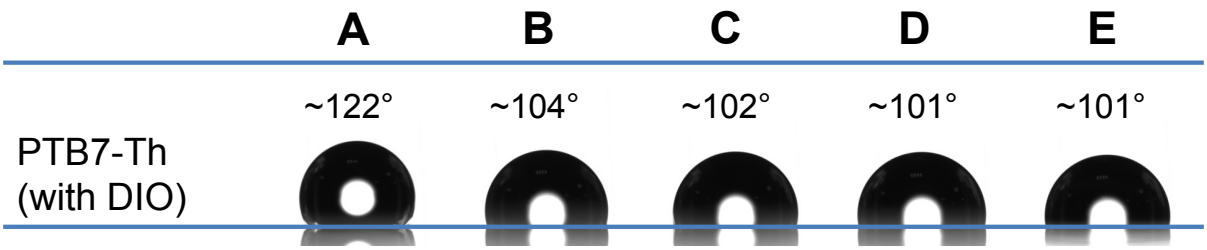

Figure S1 **Contact angles of water droplets on PTB7-Th. A**: as printed; **B**: annealed at 140°C for 5 min after deposition; **C**: annealed at 140°C for 10 min after deposition; **D**: dried in air over 24 h after deposition; **E**: treated with methanol after deposition.

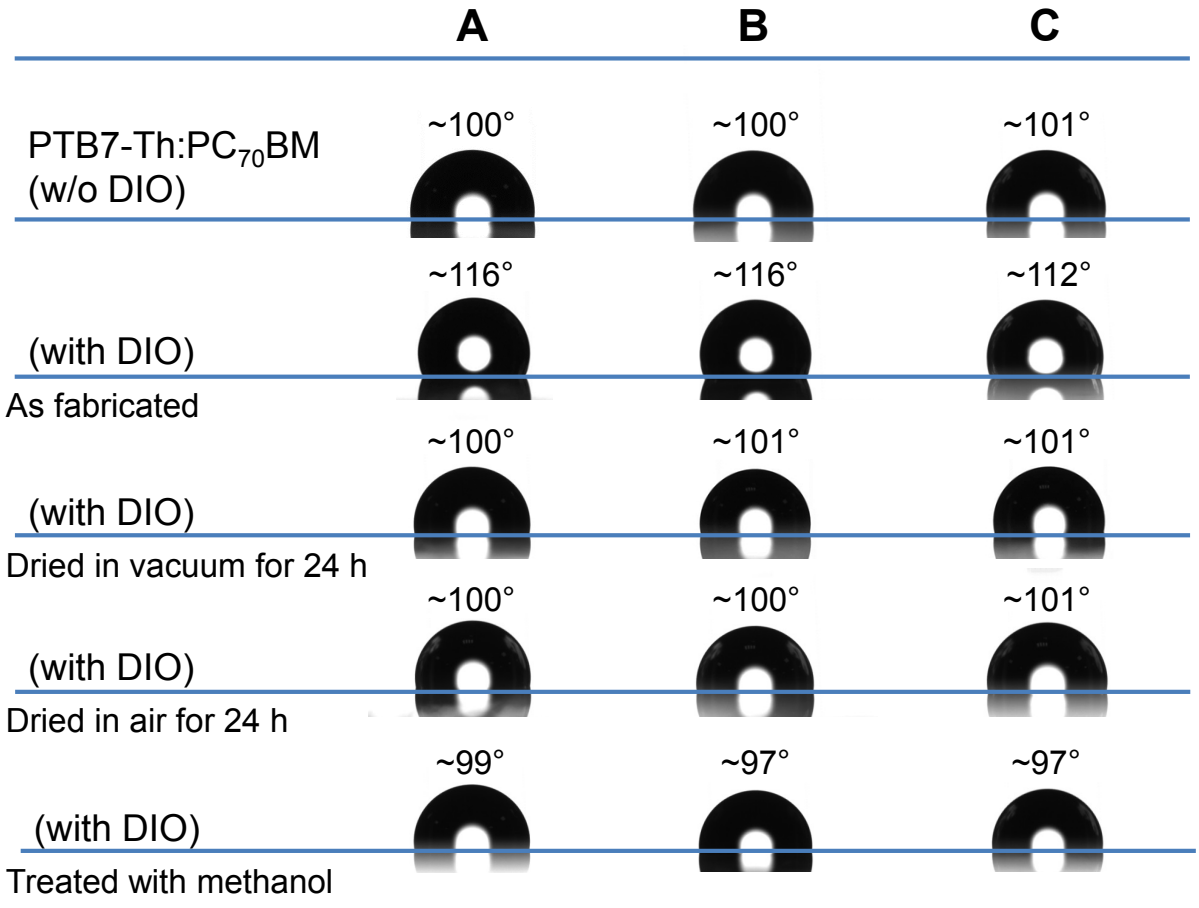

Figure S2 **Contact angles of water droplets on PTB7-Th:$PC_{70}BM$.** The samples with and without DIO were treated with different methods. A: spin-coated in nitrogen; B: spin-coated in air; C: doctor-bladed in air.

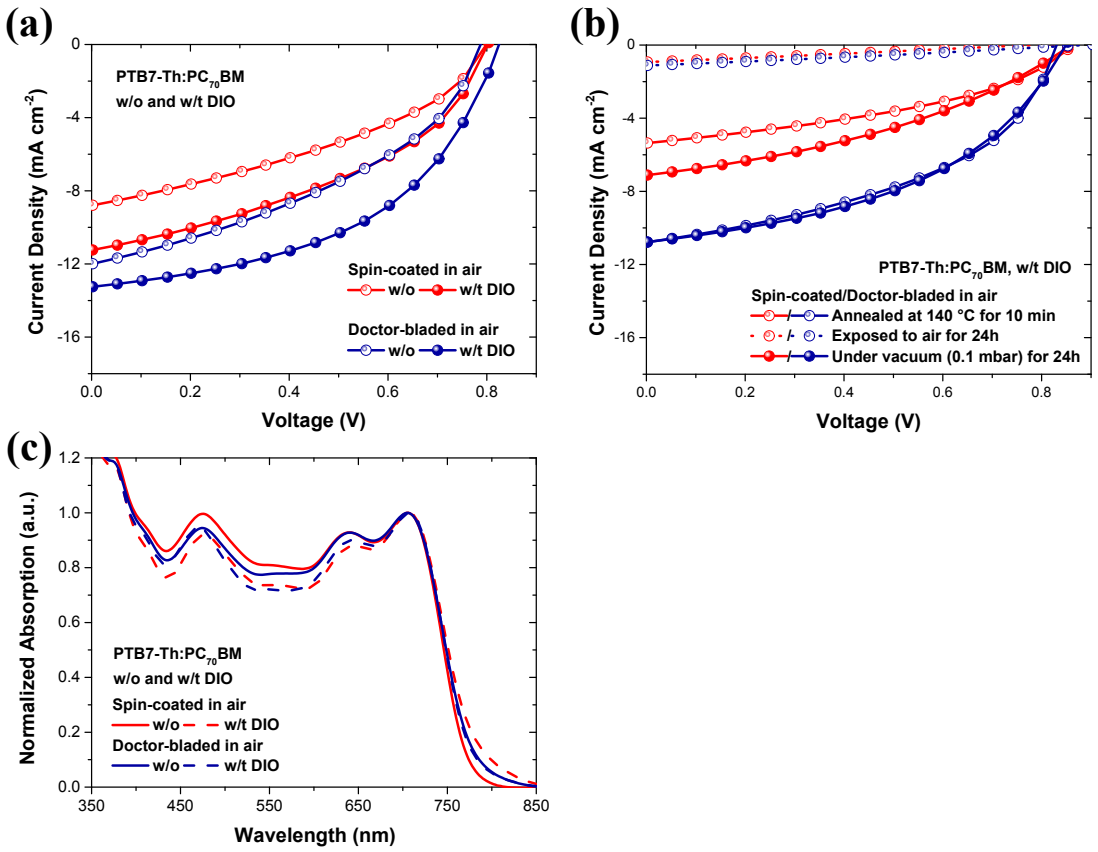

Figure S3 (**a**) and (**b**) J-V characteristics of air-processed PTB7-Th:$PC_{70}BM$ solar cells in a regular architecture with various treatments. (**c**) Absorption spectra of air-processed PTB7-Th:$PC_{70}BM$ films with and without Dio.

Table S1 Photovoltaic parameters of the air-processed PTB7-Th:$PC_{70}BM$ solar cells in a regular architecture with various treatments.

Device	Dio	Treatment after deposition of the active layer	V_{OC} [V]	J_{SC} [mA cm^{-2}]	FF [%]	PCE [%]	R_P [kΩ cm^2]	R_S [Ω cm^2]
Spin-coated in Air	w/o	-	0.80	8.79	38.2	2.69	1640.2	2.66
	w/t	-	0.80	11.23	41.3	3.71	1692.7	2.71
		140°C, 10 min	0.86	5.36	40.3	1.86	1647.6	6.11
		Exposed to air, 24h	0.79	0.93	25.9	0.19	-	-
		0.1 mbar, 24h	0.86	7.11	37.0	2.26	1783.8	25.71
Doctor-bladed in Air	w/o	-	0.79	11.99	39.7	3.76	2046.1	2.37
	w/t	-	0.82	13.25	48.8	5.30	2601.2	3.35
		140°C, 10 min	0.83	10.78	45.1	4.04	2098.6	3.17
		Exposed to air, 24h	0.89	1.12	24.4	0.24	-	-
		0.1 mbar, 24h	0.85	10.77	44.8	4.10	2380.8	7.78

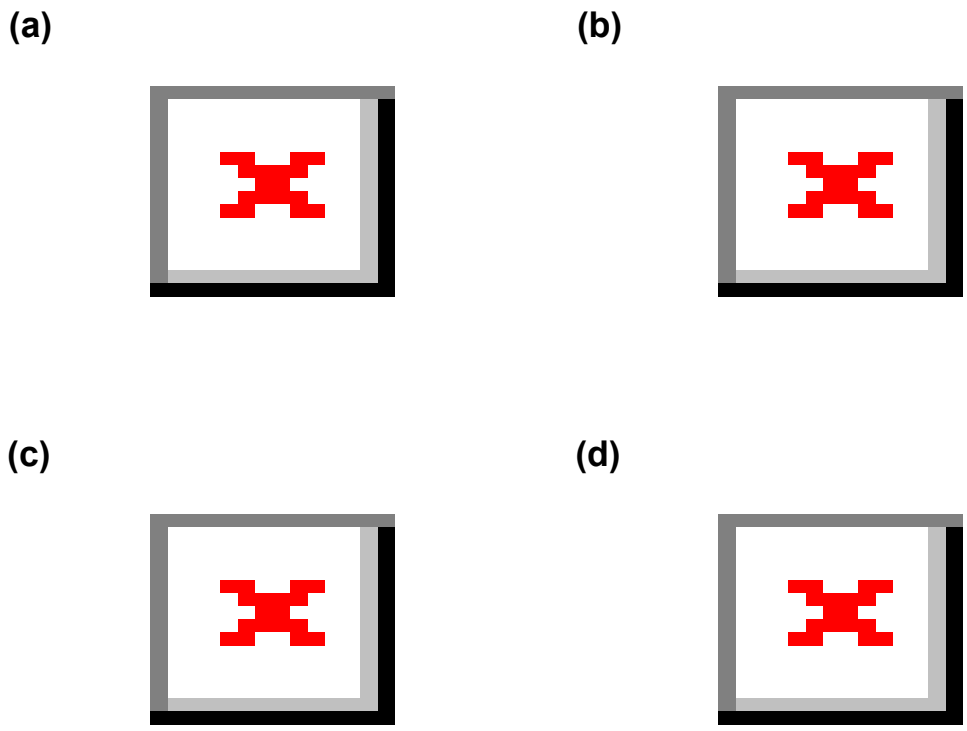

Figure S4 optical microscopy images of (**a**) PTB7-Th dried in vacuum. (**b**) PTB7-Th treated with methanol. (**c**) PTB7-Th:$PC_{70}BM$ dried in vacuum. (**d**) PTB7-Th:$PC_{70}BM$ treated with methanol. The thin films with 3% DIO were deposited by doctor-blading in air on glass substrates. Scale bar: 50 µm.

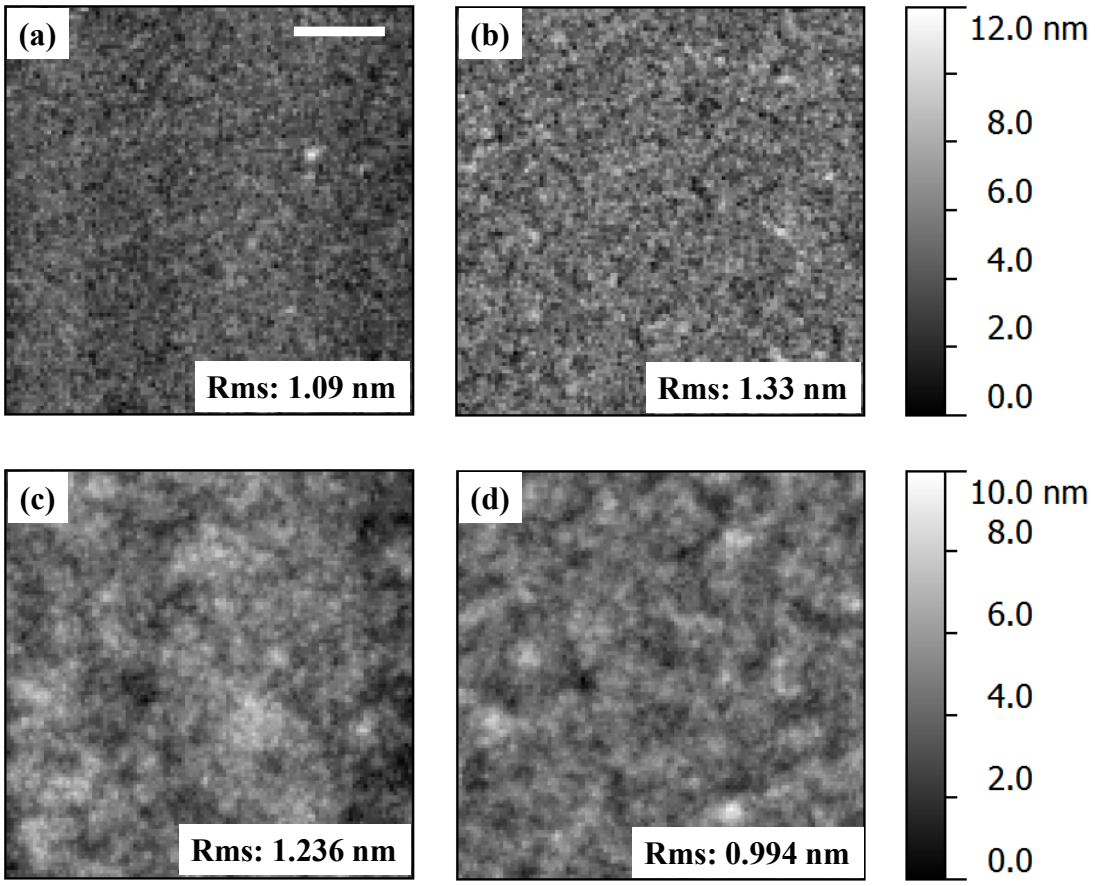

Figure S5 AFM images of (**a**) PTB7-Th dried in vacuum. (**b**) PTB7-Th treated with methanol. (**c**) PTB7-Th:$PC_{70}BM$ dried in vacuum. (**d**) PTB7-Th:$PC_{70}BM$ treated with methanol. The thin films with 3% DIO were deposited by doctor-blading in air on glass substrates. Scale bar: 1 μm.

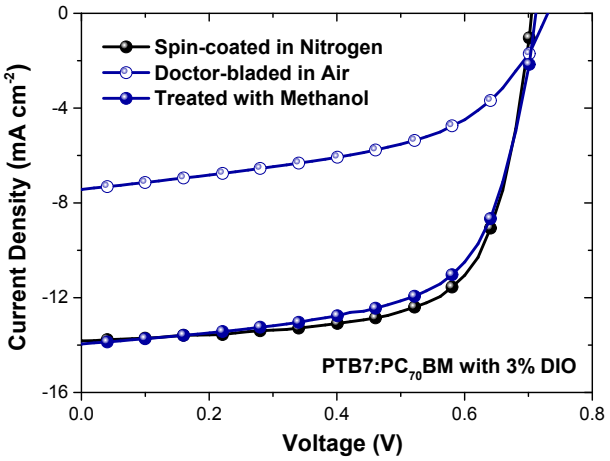

Figure S6 J-V characteristics of PTB7:$PC_{70}BM$ single cells fabricated under different conditions.

Table S2 Photovoltaic parameters of PTB7:$PC_{70}BM$ solar cells fabricated under different conditions.

Device	Treatment	V_{OC} [V]	J_{SC} [mA cm^{-2}]	FF [%]	PCE [%]
Spin-coated in N_2	-	0.70	13.87	68.9	6.69
Doctor-bladed in Air	-	0.73	7.43	51.9	2.82
	Methanol	0.71	13.95	64.5	6.38

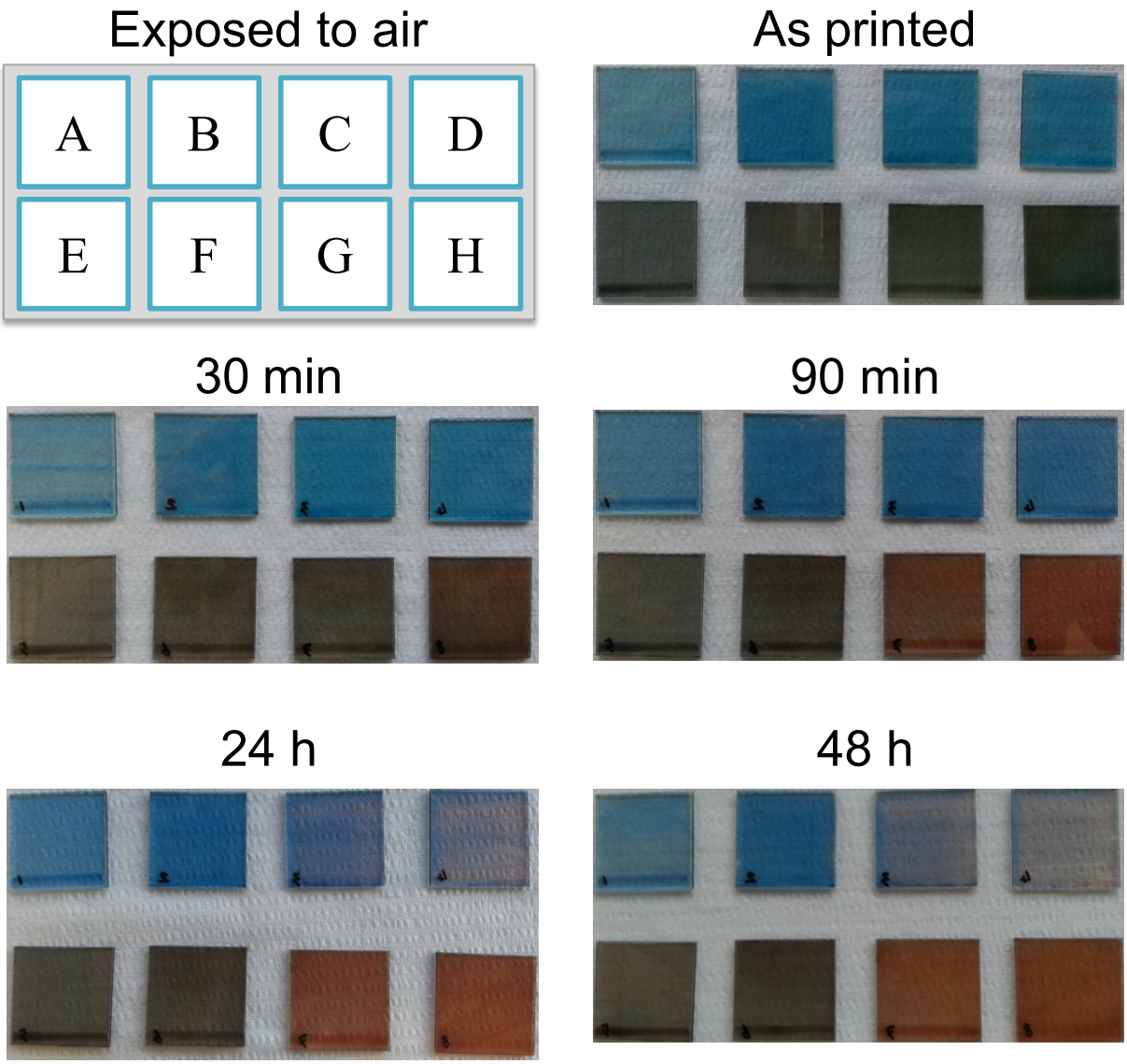

Figure S7 Environmental stability of PTB7-Th and PTB7-Th:$PC_{70}BM$ thin films. PTB7-Th (**A-D**) and PTB7-Th:$PC_{70}BM$ (**E-H**) were doctor-bladed in air on ITO-coated glasses. The samples were exposed to air after deposition with and without methanol treatment. **A** and **E**: without DIO; **B** and **F**: with DIO, treated with methanol; **C** and **G**: with DIO, no treatment; **D** and **H**: with DIO, samples were coated on top of PEDOT:PSS.