

Supporting Information

Vapor Coating Method Using Small-Molecule Organic Surface Modifiers to Replace N-Type Metal Oxide Layers in Inverted Polymer Solar Cells

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Table S1. Comparison of our work with previous reports on inverted organic solar cells

Electron transport layer	Device configuration	J_{sc} [mA cm ⁻²]	V_{oc} [V]	FF	PCE [%]	Ref.
Metal oxide	ZnO/p-DTS(FBTTh ₂) ₂ :PC ₇₀ BM/MoO _x /Ag	14.50	0.72	0.60	6.29	S1
	ZnO(30nm)/PCDTBT:PC ₇₀ BM/MoO _x /Ag	10.41	0.88	0.69	6.33	S2
	ZnO(60nm)/PTB7:PC ₇₀ BM/MoO ₃ /Au	13.40	0.71	0.65	6.26	S3
	TiO ₂ (30nm)/PTB7:PC ₇₀ BM/MoO ₃ /Ag	14.36	0.70	0.63	6.12	S3
	TiO ₂ :Cs/PTB7:PC ₇₀ BM/MoO ₃ /Ag	14.73	0.72	0.66	6.53	S3
	ZnO(30nm)/PTB7:PC ₇₀ BM/MoO ₃ /Ag	14.72	0.72	0.69	7.22	S4
	ZnO(40nm)/PBDT-DTNT:PC ₇₀ BM/MoO ₃ /Ag	15.20	0.69	0.55	6.10	S5
	ZnO-R/PTB7:PC ₇₀ BM/MoO ₃ /Ag	13.70	0.71	0.69	6.71	S6
	ZnO(50nm)/PTB7:PC ₇₀ BM/MoO ₃ /Au	12.50	0.74	0.65	6.00	Our work
Polymer surface modifier	PEIE(10nm)/p-DTS(FBTTh ₂) ₂ :PC ₇₀ BM/MoO _x /Ag	12.60	0.77	0.54	5.18	S1
	PFN(5nm)/PTB7:PC ₇₀ BM/MoO ₃ /Al	17.37	0.75	0.69	8.96	S7
	PEIE(10nm)/PTB7:PC ₇₀ BM/MoO ₃ /Au	14.40	0.71	0.68	7.02	S4
Metal oxide /buffer layer	ZnO/PEIE/p-DTS(FBTTh ₂) ₂ :PC ₇₀ BM/MoO _x /Ag	15.20	0.77	0.67	7.88	S1
	ZnO/PFN-Br/PBDT-DTNT:PC ₇₀ BM/MoO ₃ /Ag	17.40	0.75	0.61	8.40	S5
	ZnO-R/polar solvent/PTB7:PC ₇₀ BM/MoO ₃ /Ag	16.76	0.71	0.73	8.69	S6
Small molecule surface modifier	ETA-VC/PTB7:PC ₇₀ BM/MoO ₃ /Au	14.20	0.73	0.61	6.28	Our work
	ETA-VC/PTB7:PC ₇₀ BM/MoO ₃ /Au	14.23	0.73	0.67	6.99	

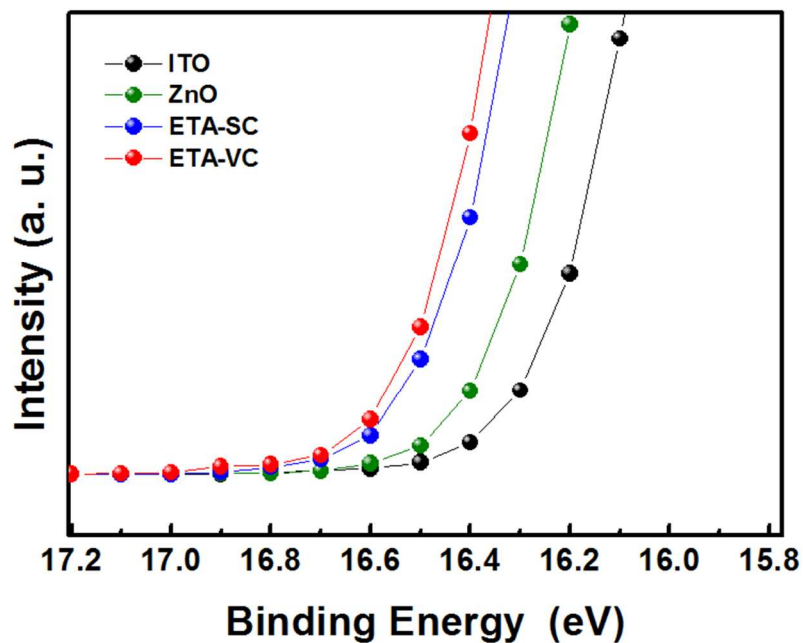


Figure S1. Photoemission cutoff region of ultraviolet photoemission spectra of ZnO-coated and ETA-treated ITO substrates.

Table S2. Calculated work functions of ITO substrates with different treatments.

	Bare ITO	ZnO	ETA-SC	ETA-VC
Work function (eV)	4.74	4.63	4.52	4.48

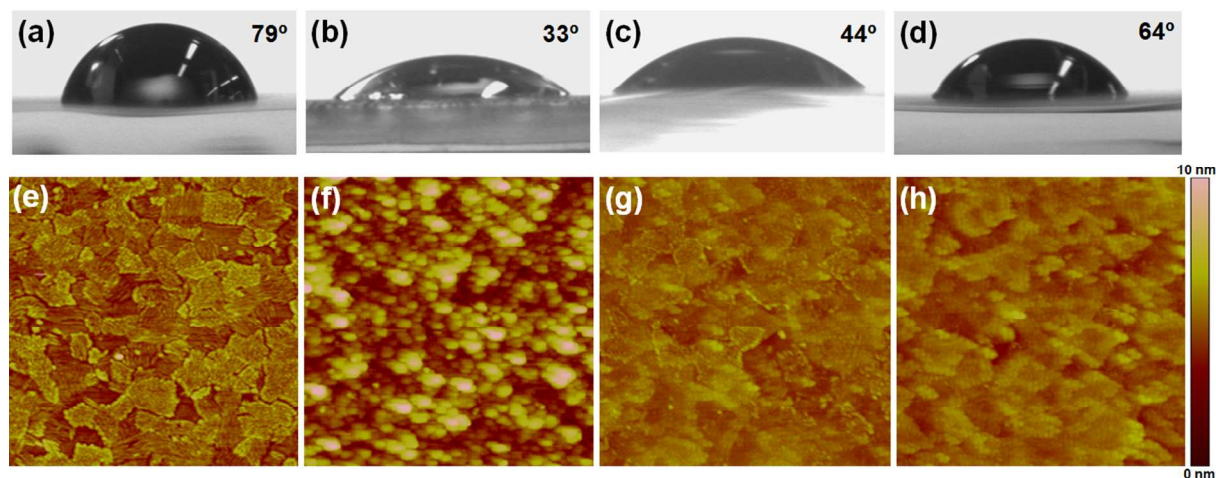


Figure S2. Contact angle measurements (a-d) and AFM topography images (e-h) of bare ITO (a and e), ZnO-coated (b and f), ETA-SC-treated (c and g), and ETA-VC-treated (d and h) ITO substrates, respectively. The size of the AFM images is 1.5 μm x 1.5 μm .

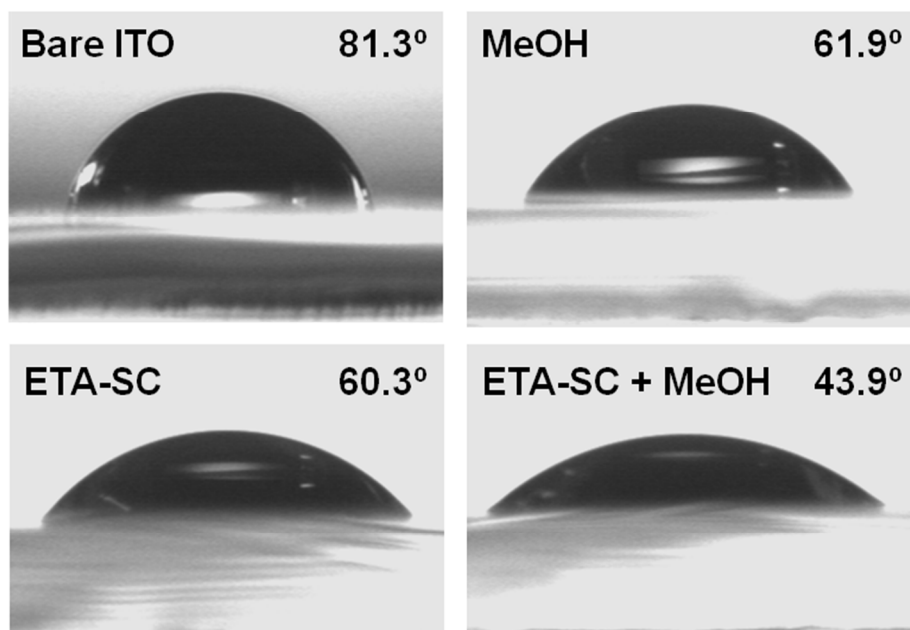


Figure S3. Contact angles measurements of bare ITO and ITO substrates with MeOH, ETA-SC (before washing with MeOH), and ETA-SC + MeOH (after washing with MeOH) treatment.

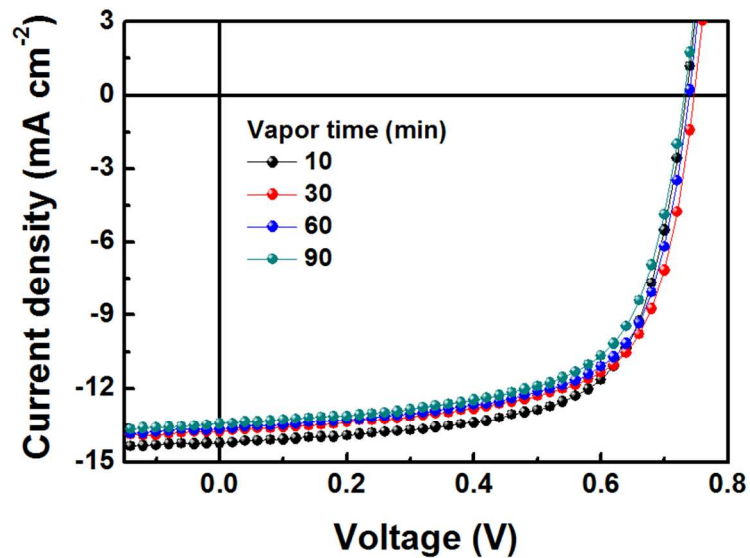


Figure S4. J - V characteristics of PTB7:PC₇₀BM-based iPSCs with ETA-VC as a function of exposure time to ETA vapor.

Table S3. Device characteristics of devices with ETA-VC as a function of vapor exposure time.

Vapor time (min)	J_{sc} (mA cm ⁻²)	V_{oc} (V)	FF	PCE (%)
10	14.23	0.73	0.67	6.99
30	13.77	0.75	0.67	6.84
60	13.65	0.74	0.66	6.65
90	13.43	0.73	0.65	6.36

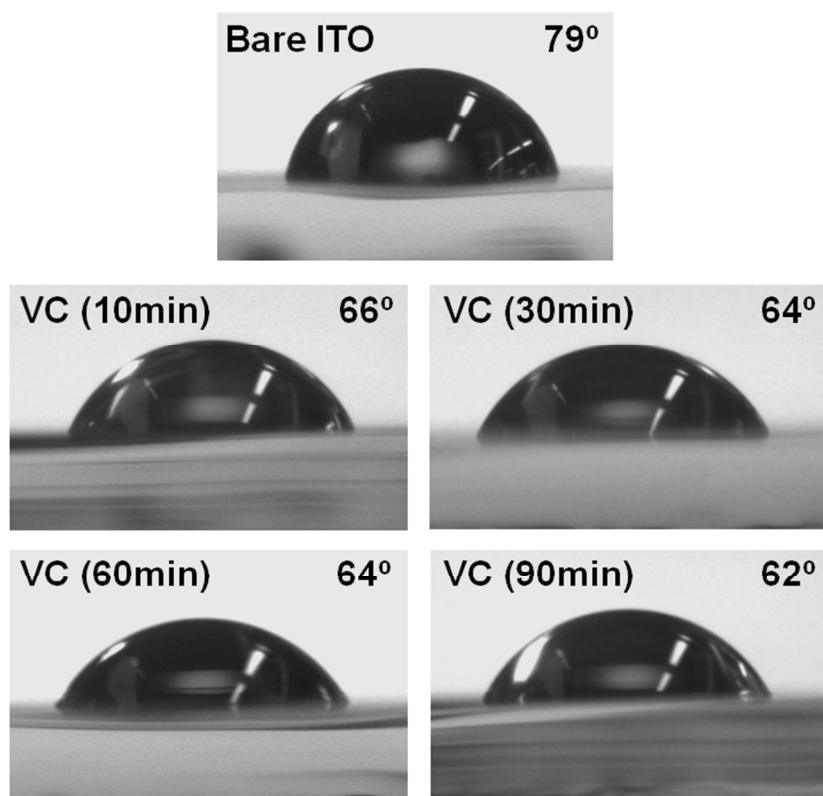
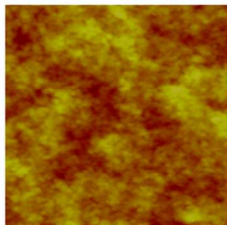
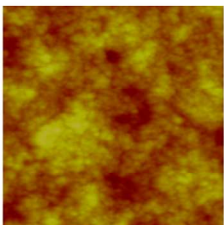
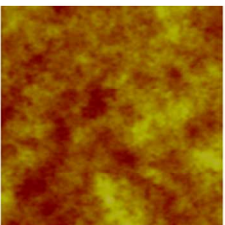
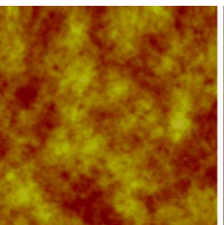
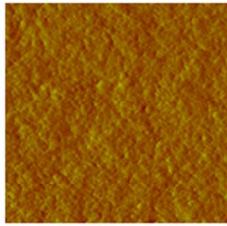
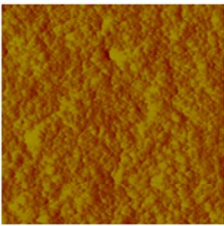
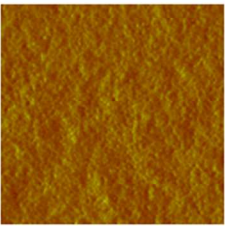


Figure S5. Contact angle measurements of ETA-VC ITO substrates as a function of vapor exposure time.

Table S4. Surface morphology and thickness of PTB7:PC₇₀BM BHJ films spin-coated on different substrates.

	ITO	ITO / ZnO	ITO / ETA-SC	ITO / ETA-VC
Topography image				
Phase image				
Surface roughness (nm)	1.50±0.02	1.52±0.03	1.46±0.03	1.47±0.03
Thickness (nm)	190±20	190±15	190±15	190±15

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