

## Electronic Supplementary Information

### 12.88% Efficiency in Doctor-Blade Coated Organic Solar Cells through Optimizing the Surface Morphology of a ZnO Cathode Buffer Layer

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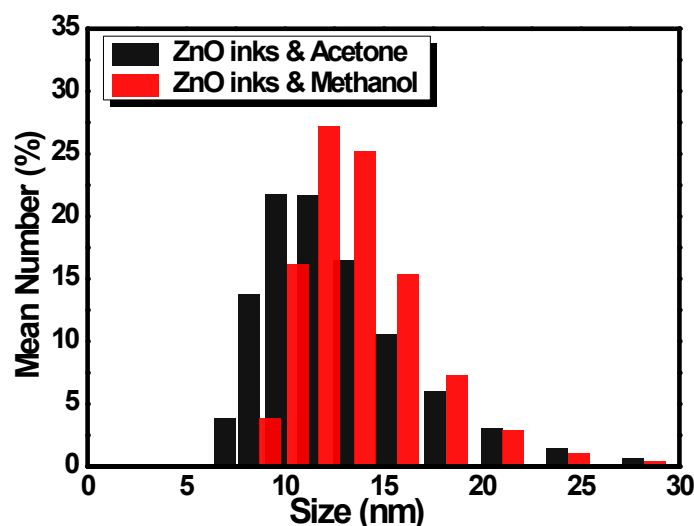
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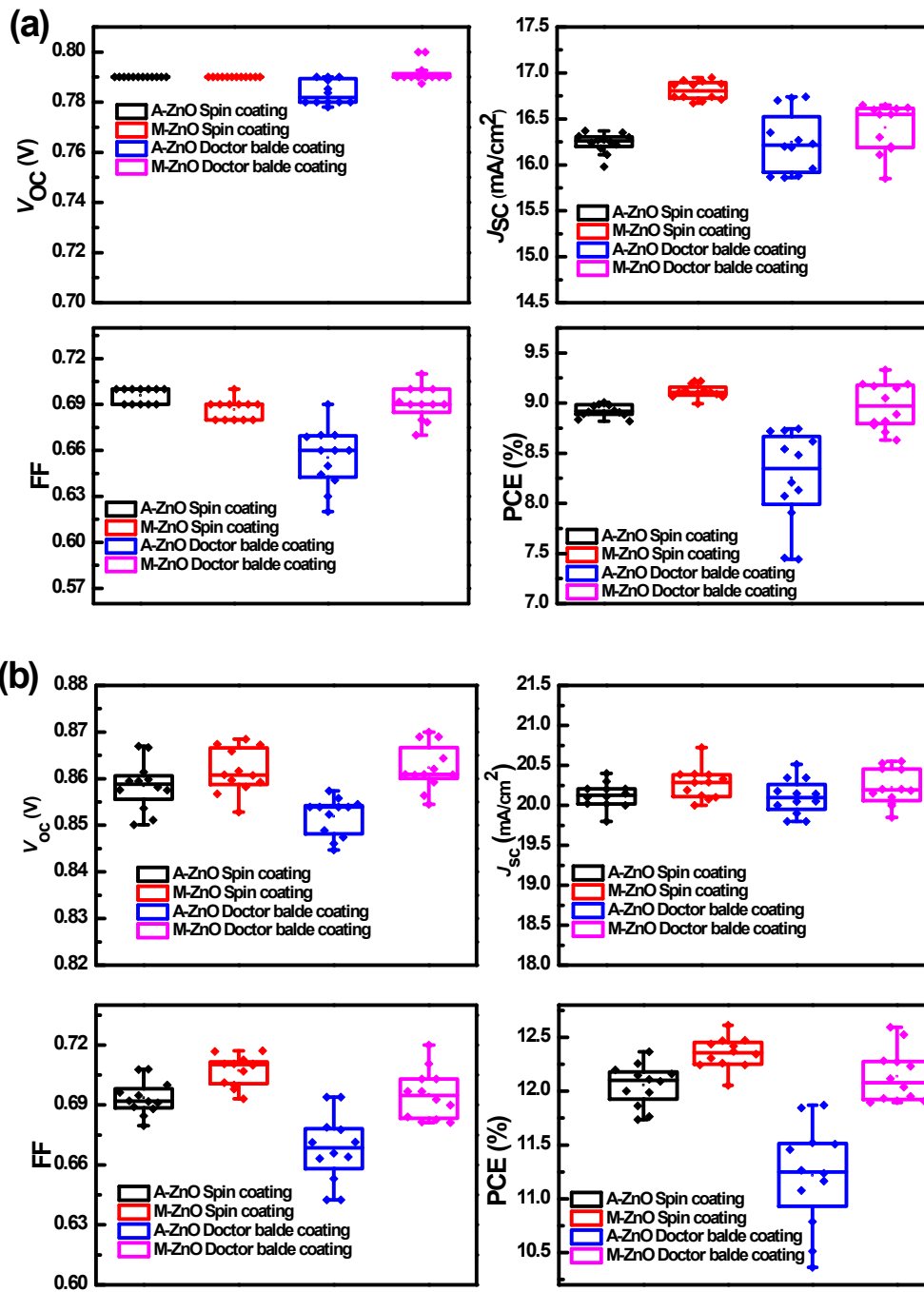
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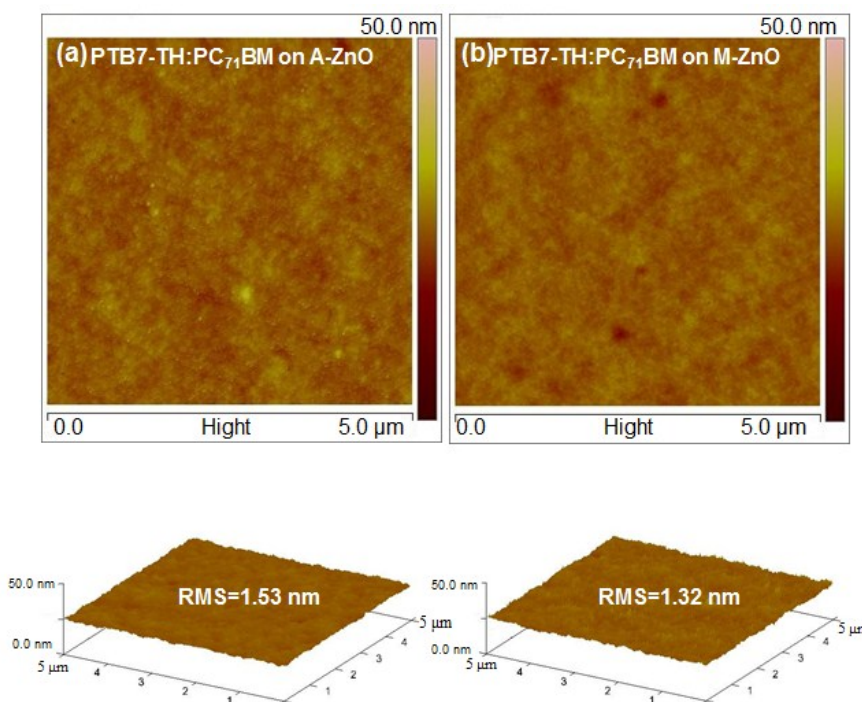
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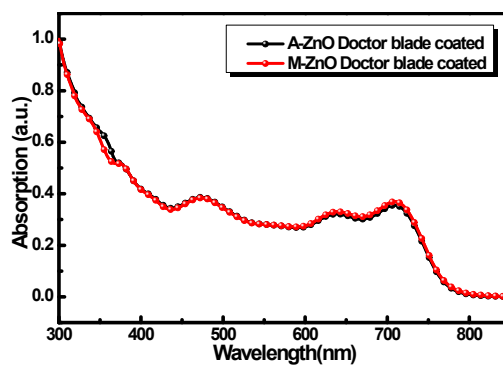
**Figure S1.** Particle diameter of ZnO dispersed in acetone and methanol with concentration of 10 mg/mL that recorded by the dynamic light scattering measurement (DLS).



**Figure S2.** Performance distribution of the (a) PTB7-Th:PC<sub>71</sub>BM and (b) PBDB-TF:IT-4F devices fabricated through spin-coating and doctor-blade coating.



**Figure S3.** AFM images of the doctor blade coated photoactive layers on the top of A-ZnO and M-ZnO CBLs.



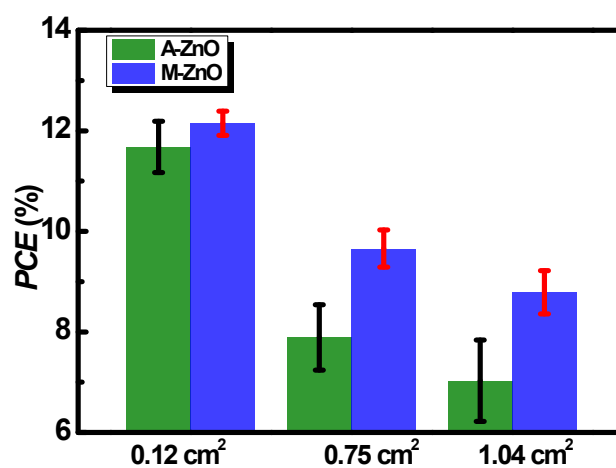
**Figure S4.** Absorption spectra of the doctor-blade coated PTB7-Th:PC<sub>71</sub>BM on the top of A-ZnO and M-ZnO layers.

**Table S1.** Fitting parameters of the electrochemical impedance spectra of the spin-coated and doctor blade coated cells.

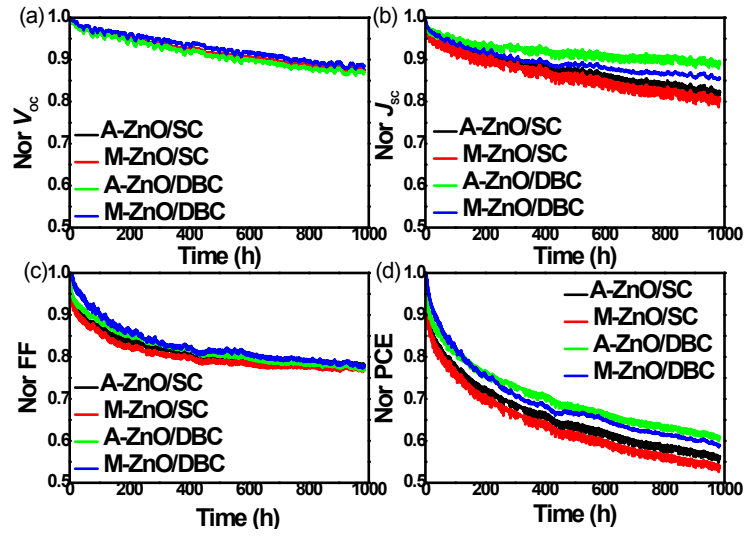
Device	$R_s$ ( $\Omega\text{cm}^2$ )	$R_1$ ( $\Omega\text{cm}^2$ )	$R_2$ ( $\Omega\text{cm}^2$ )
A-ZnO SC	15.3	43.6	35.8
M-ZnO SC	13.6	43.1	32.1
A-ZnO DBC	16.8	43.4	130.1
M-ZnO DBC	14.3	43.2	92.5

**Table S2** Device performance of the A-ZnO SC, M-ZnO SC, A-ZnO DBC, M-ZnO DBC cells that used for LBIC mapping.

Entry	Process	ZnO	$V_{oc}$ (V)	$J_{sc}$ (mA/cm <sup>2</sup> )	FF (%)	PCE (%)
9	SC	A-ZnO	0.85	20.25	71	12.22
10	SC	M-ZnO	0.85	20.68	72	12.75
11	DBC	A-ZnO	0.86	20.06	68	11.73
12	DBC	M-ZnO	0.85	20.55	71	12.40



**Figure S5.** The device performance of the doctor-blade coated solar cells for the 0.12, 0.75 and 1.04 cm<sup>2</sup>.



**Figure S6.** Normalized (a)  $V_{oc}$ , (b)  $J_{sc}$ , (c) FF, and (d) PCE decay of the spin- and DB-coated

PTB7-Th:PC<sub>71</sub>BM inverted solar cells.