Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Title Solution-Processed Barium Hydroxide Modified Al doped Zinc Oxide Layer for Highly Efficient Inverted Organic Solar Cells

Hong Zhang, Tobias Stubhan, Ning Li, Mathieu Turbiez, Gebhard J. Matt, Tayebeh Ameri, and Christoph J. Brabec

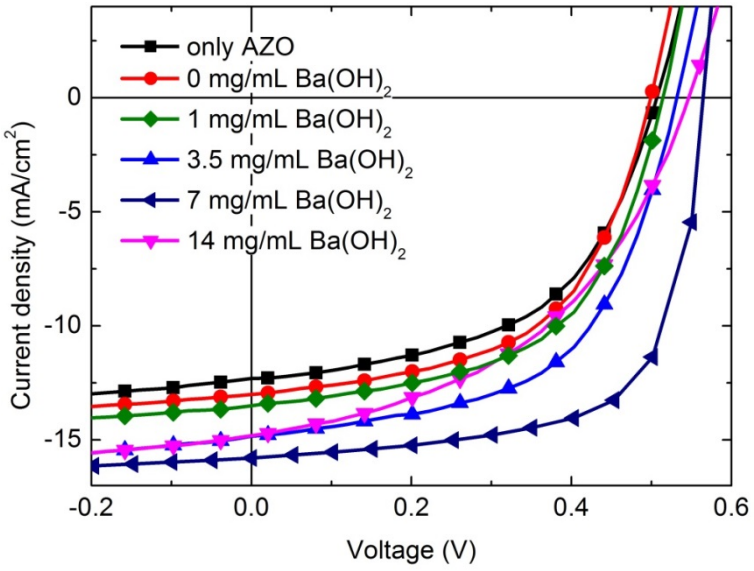

Figure S1. *j-V* characteristics of typical devices with different concentrations of $Ba(OH)_2$.

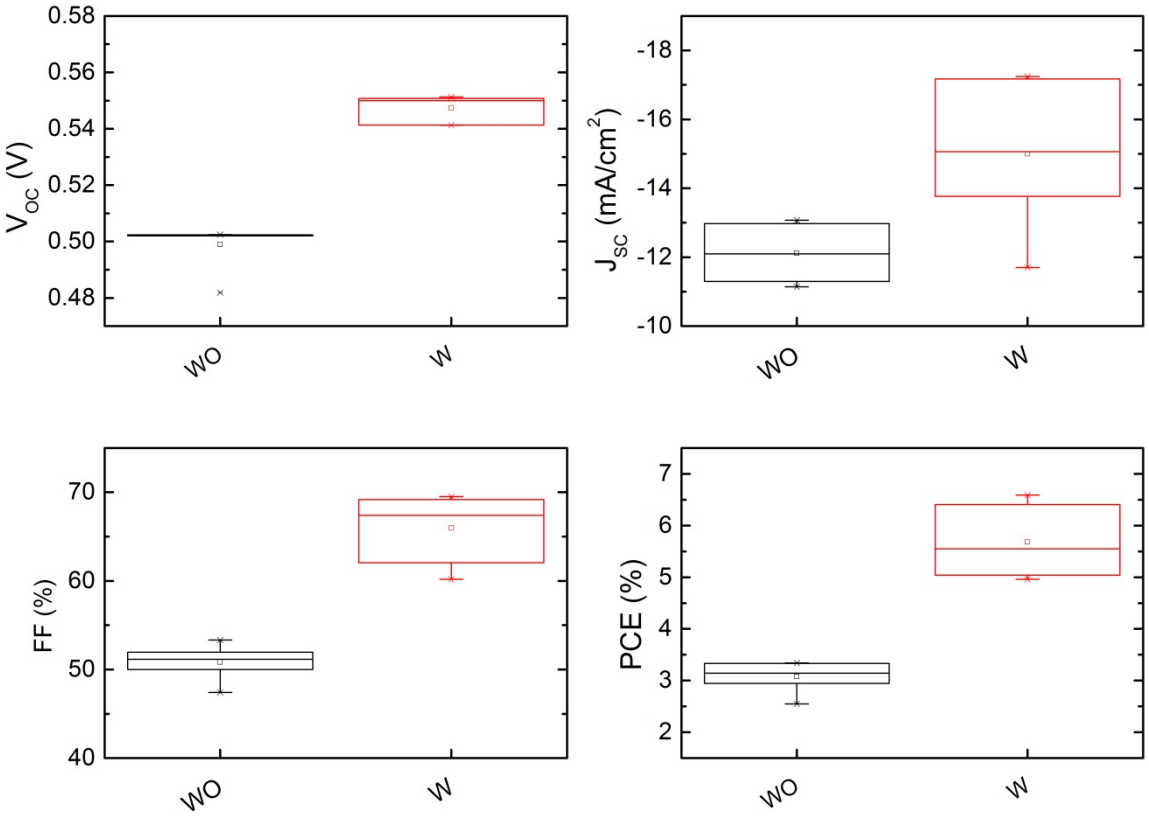

Figure S2. Photovoltaic parameters distribution of over 6 solar cells; the boxes represent the 25–75% distribution range, and hollow squares represent the mean values (WO = without $Ba(OH)_2$ and W = with $Ba(OH)_2$).

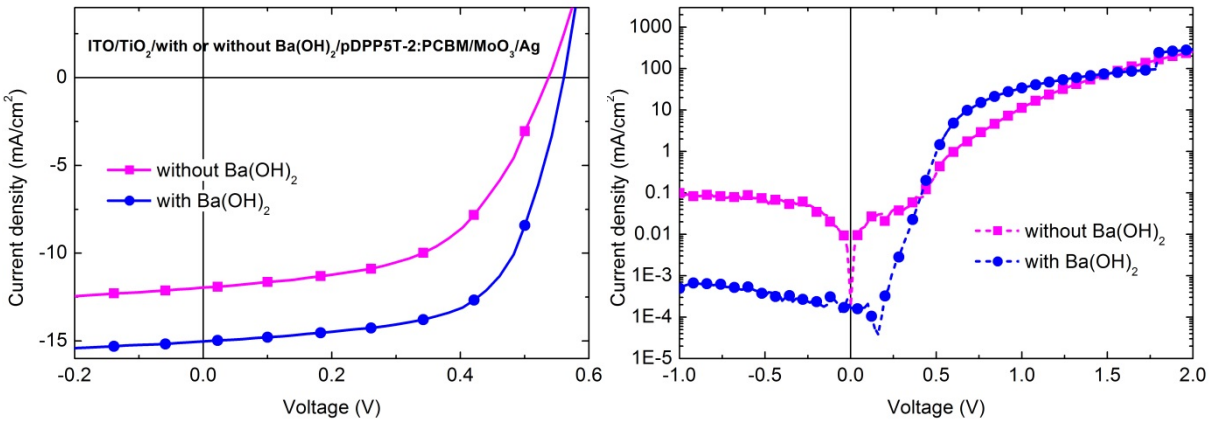

Figure S3. a) *j-V* characteristics of inverted pDPP5T-2:$PC_{61}BM$ organic solar cells without and with the $Ba(OH)_2$ layer on TiO_2 layer. b) Corresponding logarithmic plot of dark *j-V* characteristics.

Table S1. Key values of the *j-V* characteristics of inverted pDPP5T-2:$PC_{61}BM$ organic solar cells without and with the $Ba(OH)_2$ layer on TiO_2 layer.

iOSCs (pDPP5T-2:$PC_{61}BM$)	V_{OC} (V)	J_{SC} (mA cm^{-2})	*FF* (%)	*PCE* (%)	R_S (Ω cm^2)	R_{Sh} (kΩ cm^2)
Without $Ba(OH)_2$	0.54	-12.00	54.00	3.50	2.47	5.16
With $Ba(OH)_2$	0.56	-15.02	63.18	5.32	0.64	552.79

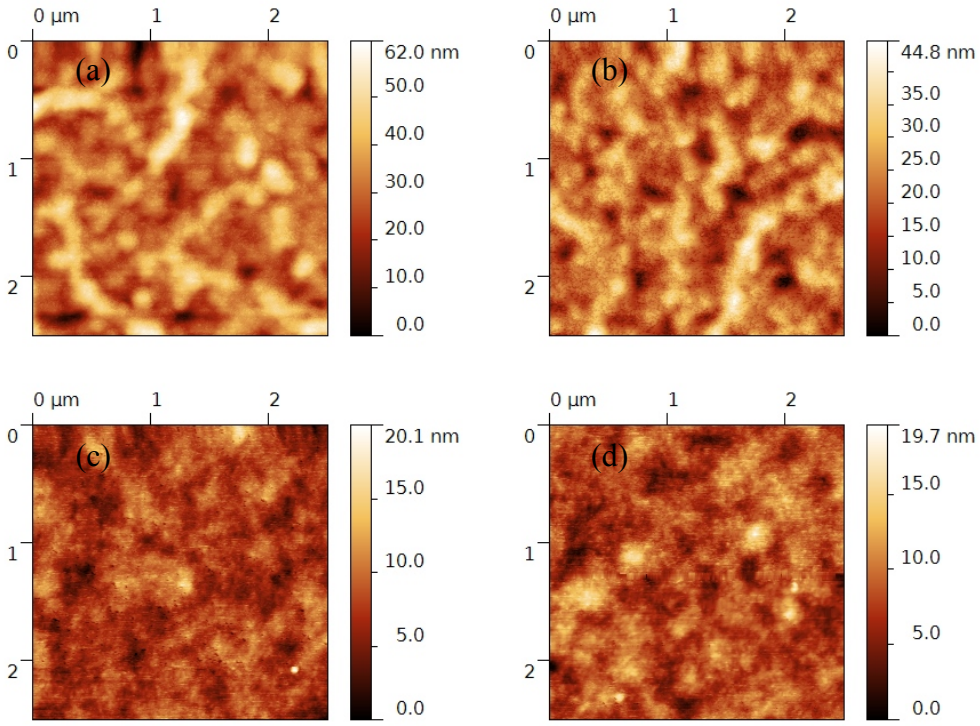

Figure S4. Surface topographic AFM images (size: 2.5 ×2.5 µm^2) of (a) bare AZO layer, (b) thin $Ba(OH)_2$ on the AZO layer, (c) pDPP5T-2:$PC_{61}BM$ BHJ film on the AZO layer without $Ba(OH)_2$ inserted and (d) (c) pDPP5T-2:$PC_{61}BM$ BHJ film on the AZO layer with $Ba(OH)_2$ inserted.

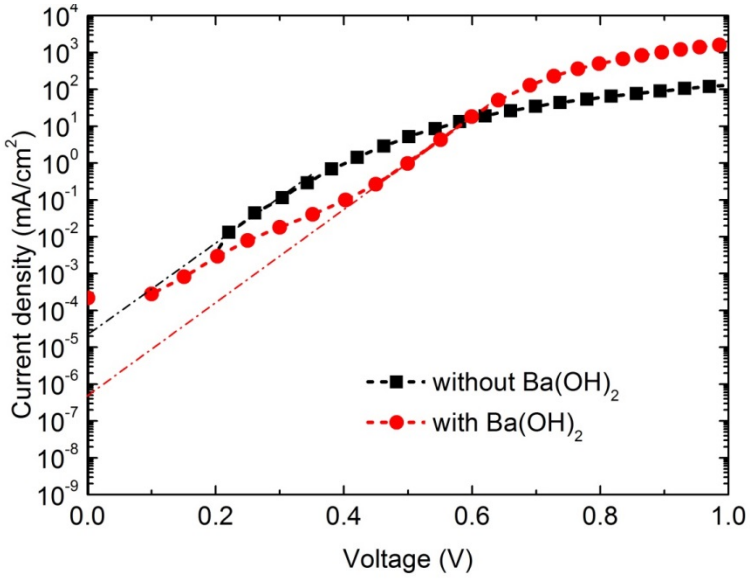

Figure S5. Semilog plot of dark *j-V* characteristics curves of inverted organic solar cells without and with the $Ba(OH)_2$ layer .The dashed lines show the extrapolated line for determining saturation current density from intercept and diode ideality factor from the slope.

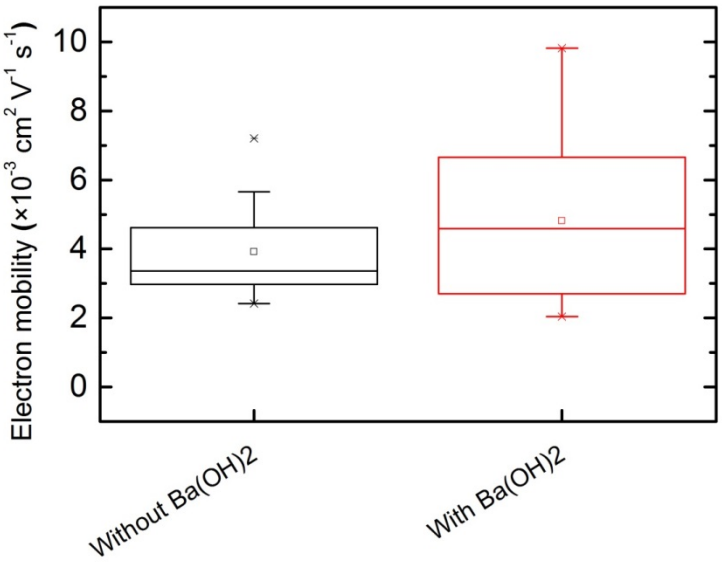

Figure S6. The box chats is obtained from *j-V* fitting on 12 electron-only devices without and with the $Ba(OH)_2$ layer.

The solid lines represent the fit using the SCLC model as given in the following Equation,

$$J_{SCL} = \frac{9}{8}\varepsilon_0\varepsilon_r\mu\frac{V^2}{L^3}$$

where J_{SCL} is the current density, μ is the effective charge carrier mobility, ε_0 the permittivity of free space, ε_r is the the dielectric permittivity of the active layer, V is the applied voltage, and L is the thickness of the active layer.

(a)

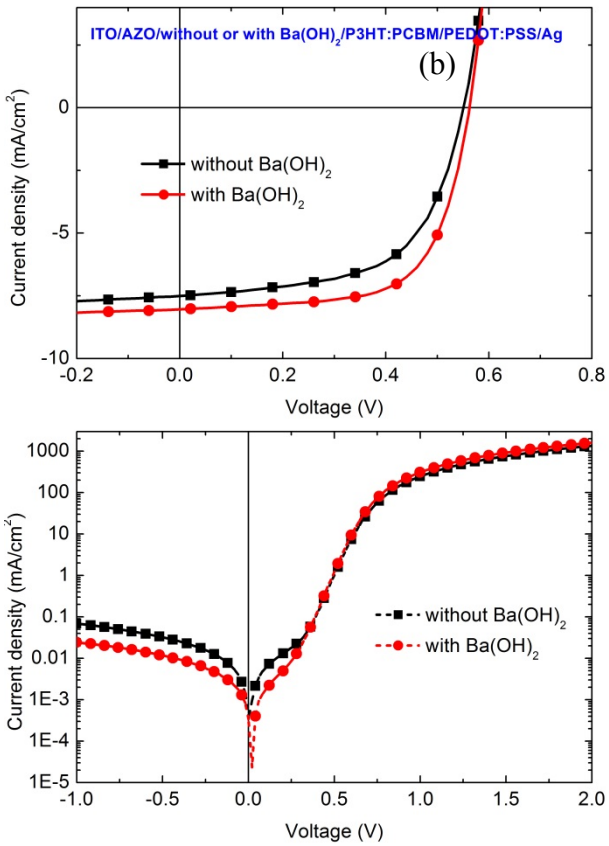

Figure S7. a) *j-V* characteristics of inverted P3HT:$PC_{61}BM$ organic solar cells without and with the $Ba(OH)_2$ layer. b) Corresponding logarithmic plot of dark *j-V* characteristics.

Table S2. Key values of the *j-V* characteristics of inverted P3HT:$PC_{61}BM$ organic solar cells without and with the $Ba(OH)_2$ layer.

iOSCs (P3HT:$PC_{61}BM$)	V_{OC} (V)	J_{SC} (mA cm^{-2})	*FF* (%)	*PCE* (%)	R_S (Ω cm^2)	R_{Sh} (kΩ cm^2)
Without $Ba(OH)_2$	0.54	-7.50	60.51	2.45	0.85	16.19
With $Ba(OH)_2$	0.56	-8.03	66.20	2.98	0.74	45.54