Supporting Information

High Efficiency PTB7-based Inverted Organic Photovoltaics on Nano-ridged and Planar Zinc Oxide Electron Transport Layers

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UV-Vis-NIR Absorption Spectroscopy

Figure S1 shows the absorption spectrum of statically and dynamically baked ZnO thin films #2S and 2D. The films are highly transparent in the visible region above 400 nm and an onset of absorption is seen near the band gap of ZnO at ~370 nm.[1] Additional light scattering is apparent for the nano-ridged film due to increased surface roughness.

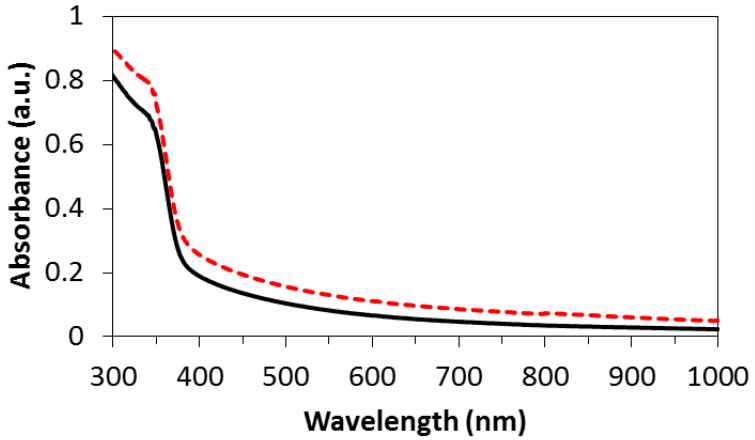

Figure S1. Absorbance of statically baked (black solid line) and dynamically baked (red dotted line) ZnO films on glass (i.e. films #2S and 2D, respectively).

Relative Density Calculations

The index of refraction of a material is related to its density and may be lowered by non-scattering porosity.[2] The relative density of the ZnO films was calculated using the method in Ohyama et al.[3]

Table S1. Refractive indices (at 600 nm) and calculated relative densities of the various ZnO films.

Film #	Spin Speed (rpm)	Conc. (M)	n	Rel. Dens. (%)
1S	4k	0.44	1.663	58.9
2S	4k	0.54	1.660	58.5
3S	2k	0.44	1.635	55.8
4S	2k	0.54	1.627	54.9
1D	4k	0.44	1.774	71.6
2D	4k	0.54	1.735	67.0
3D	2k	0.44	1.656	58.1
4D	2k	0.54	1.721	65.4

External Quantum Efficiency

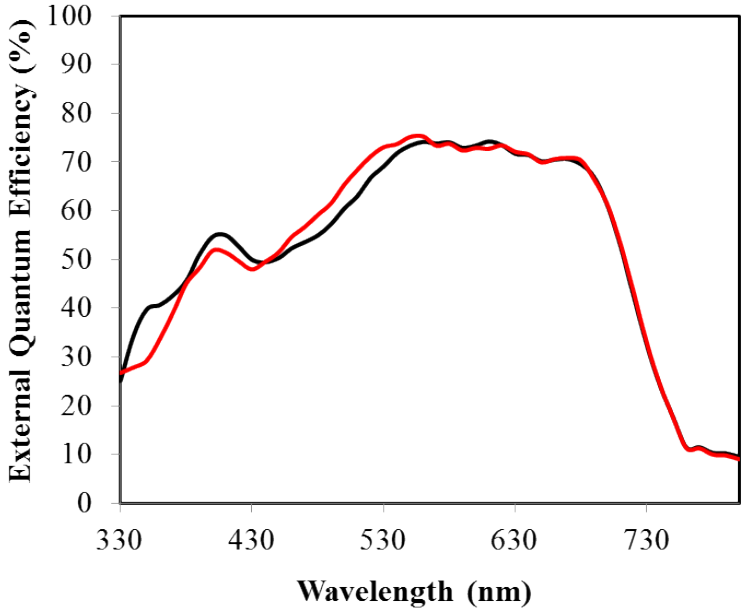

Figure S2. External quantum efficiency (EQE) spectra of devices with ZnO films 3S (red) and 3D (black).

Device Performance with Varied Active Layer Thickness

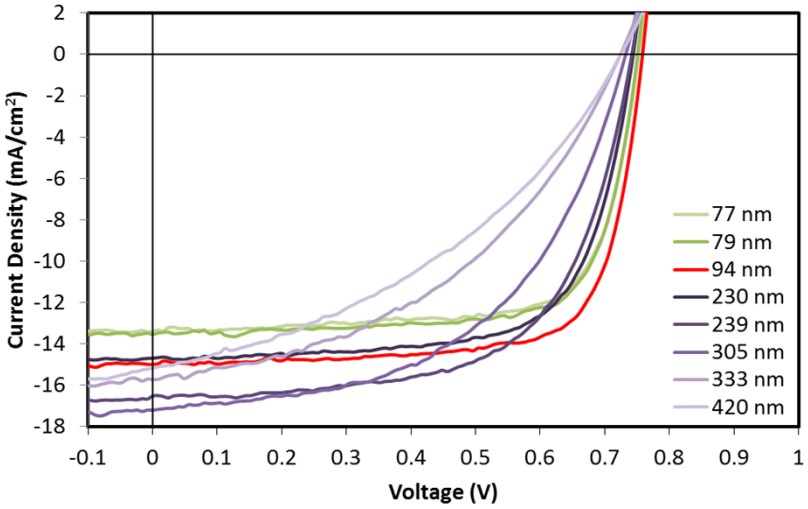

Figure S3. J-V curves of devices using the 4S ZnO films with varied active layer film.

Table S2. Average performance parameters of inverted devices on 4S ZnO with varied active layer thickness.

Active Layer Thickness (nm)	V_{OC} (V)	FF (%)	J_{SC} (mA/cm^2)	PCE (%)
77 +/- 11	0.75 +/- 0.00	73.2 +/- 0.4	13.32 +/- 0.10	7.27 +/- 0.06
79 +/- 13	0.75 +/- 0.00	73.7 +/- 0.5	13.40 +/- 0.09	7.39 +/- 0.08
94 +/- 9	0.75 +/- 0.00	73.4 +/- 0.6	14.50 +/- 0.28	8.01 +/- 0.19
230 +/- 14	0.74 +/- 0.00	69.0 +/- 0.6	14.63 +/- 0.09	7.51 +/- 0.02
239 +/- 26	0.74 +/- 0.00	62.6 +/- 0.4	16.31 +/- 0.18	7.54 +/- 0.09
305 +/- 40	0.73 +/- 0.01	50.7 +/- 1.7	16.24 +/- 0.97	5.98 +/- 0.59
333 +/- 23	0.72 +/- 0.00	44.2 +/- 0.8	14.84 +/- 0.83	4.74 +/- 0.23
420 +/- 33	0.72 +/- 0.00	39.9 +/- 0.8	14.40 +/- 0.71	4.15 +/- 0.17

References

1. Y. M. Sun, J. H. Seo, C. J. Takacs, J. Seifter and A. J. Heeger, *Adv. Mater.*, 2011, **23**, 1679-+.
2. B. E. Yoldas and D. P. Partlow, *Thin Solid Films*, 1985, **129**, 1-14.
3. M. Ohyama, H. Kozuka and T. Yoko, *Thin Solid Films*, 1997, **306**, 78-85.