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Supporting Information

Vapour-assisted multi-functional perovskite thin films for solar cells and photodetectors

*Yukun Wang, Dezhi Yang, Xiaokang Zhou, Saad M. Alshehri, Tansir Ahamad, Agafonov Vadim, and Dongge Ma**

Thin film characterization: X-ray diffraction (XRD) patterns were obtained using a Bruker D8 grazing incident X-ray diffraction (GIXRD) in a conventional theta/2theta geometry with Cu Kα radiation (λ=1.5406Å). The surface morphology of the perovskite films were imaged using a Hitachi SU3500 SEM with an accelerating voltage of 10 keV. Film thickness was measured with a Veeco Dektak 6M Stylus Profilometer.

Device Performance Measurements: Current density-voltage cures were measured using a Keithley 2400 source meter under one sun illumination (AM 1.5G, 100mW cm^{-2}). The light intensity was determined by a calibrated silicon diode with KG-5 visible color filter. The external quantum efficiency (EQE) measurement was performed on the QE-R3011 system from Enli Technology Co. Ltd (Taiwan). The dark current-voltage characteristics were recorded using a Keithley 236 source measure unit. For the frequency response measurement, a NIR laser diode (Thorlabs L850P010), modulated with a pulse generator, (8114A, Agilent) was employed to trigger the samples. The photocurrent was amplified by a high speed trans-impedance amplifier (DHPCA-100, Femto) and the output signal was displayed on a 500MHz bandwidth oscilloscope (54825, Agilent). The bandwidth of

photodetectors was calculated by using the fast Fourier transform (FFT) algorithm and the corrections were made by using a Si PIN photodetector (S5972, Hamamatsu).

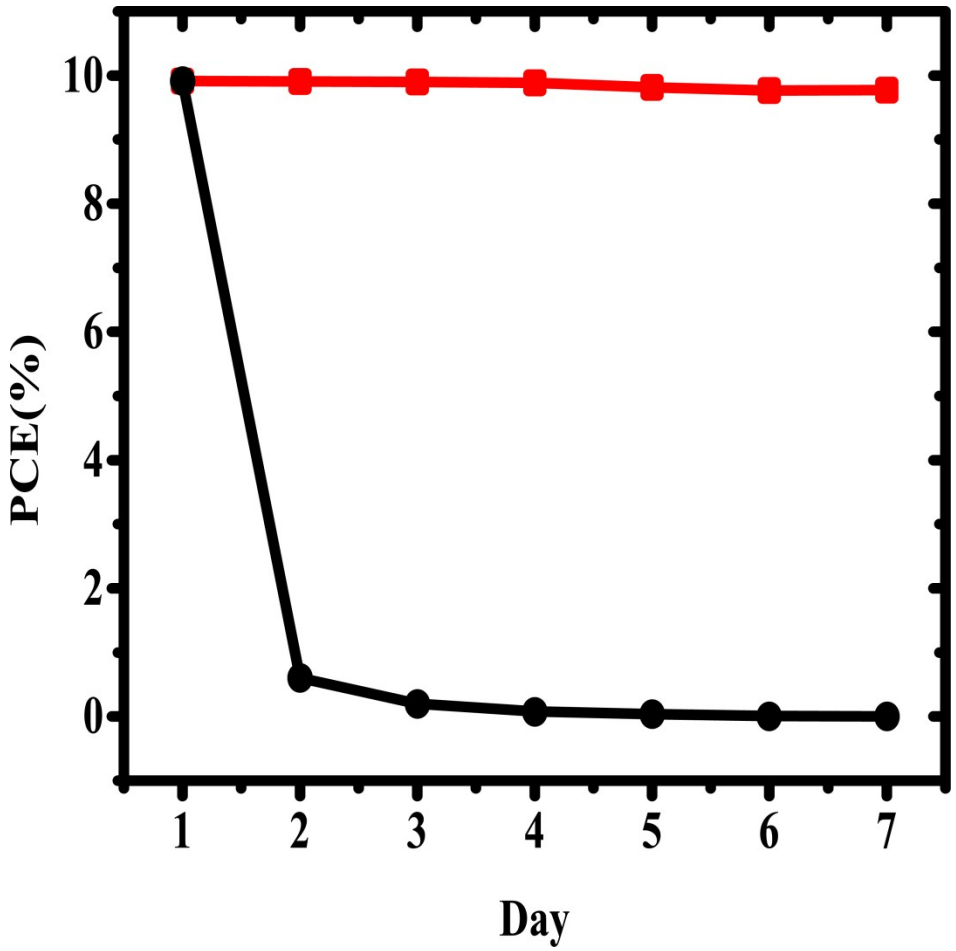

Figure S1. Stability test of devices: in nitrogen (the red curve); in air (the black curve).

Table S1. Performance parameter results from different annealing durations.

Annealed time (h)	J_{sc} (mA/cm^2)	*V*oc (V)	FF (%)	PCE (%)
0.0	0.0	0.0	0.0	0.0
0.5	0.57	3.9	54.6	1.2
1.0	0.71	14.0	50.2	5.0
4.0	0.84	19.1	61.8	9.9

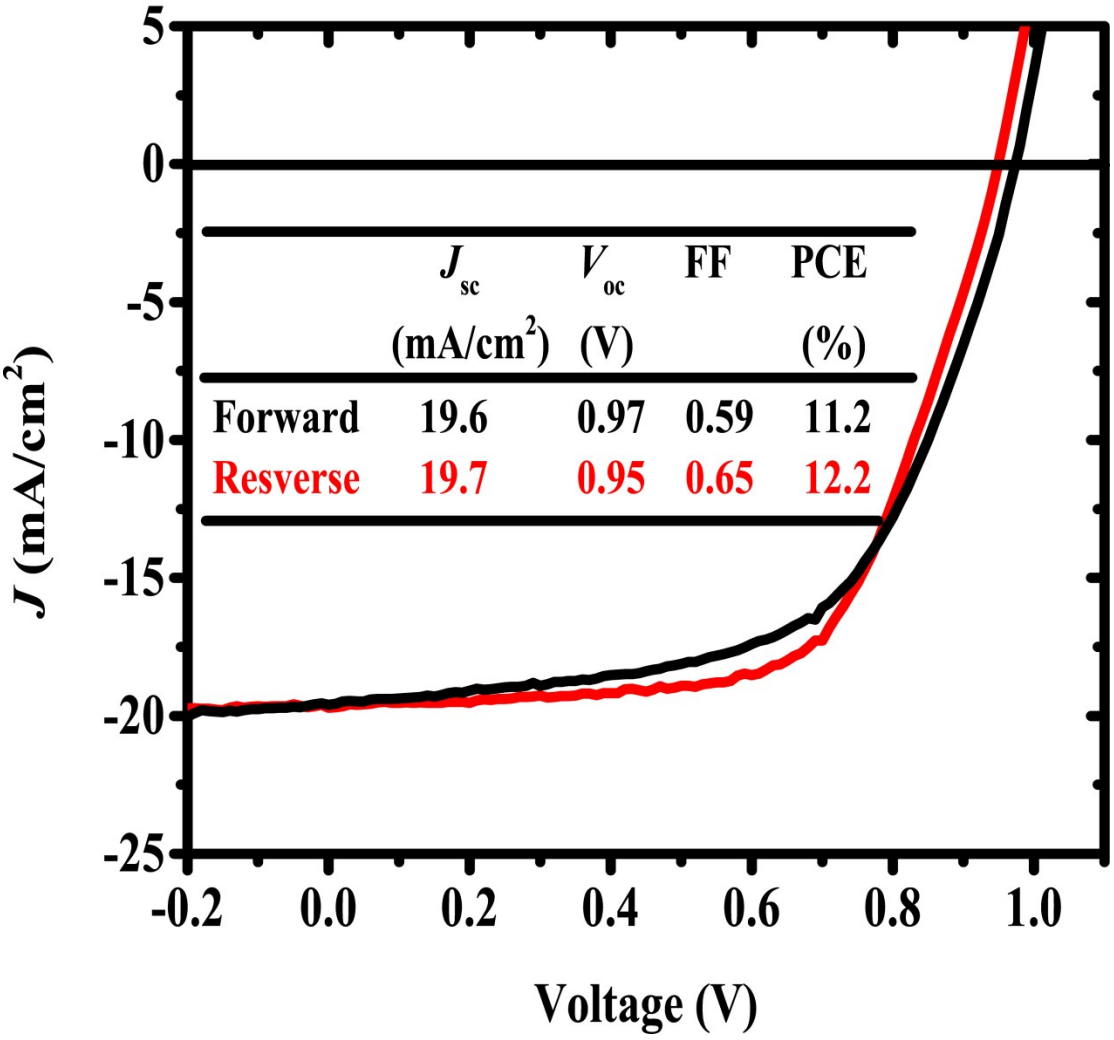

Figure S2. PCE of the device — ITO/PEDOT/$CH_3NH_3PbI_3$/PCBM/Al.