

## Supplement information

### Enhanced Performance of Perovskite Solar Cells by luminescent Small Molecule DBP: Perovskite Absorption Spectrum Modification and Interface Engineering

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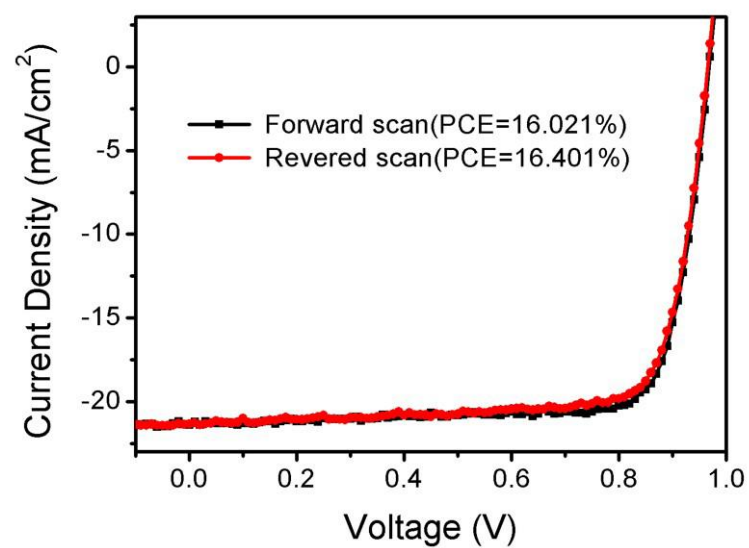


Figure S1 Forward and reverse scan  $J$ - $V$  curves of the PSCs made with optimized concentration DBP in DB

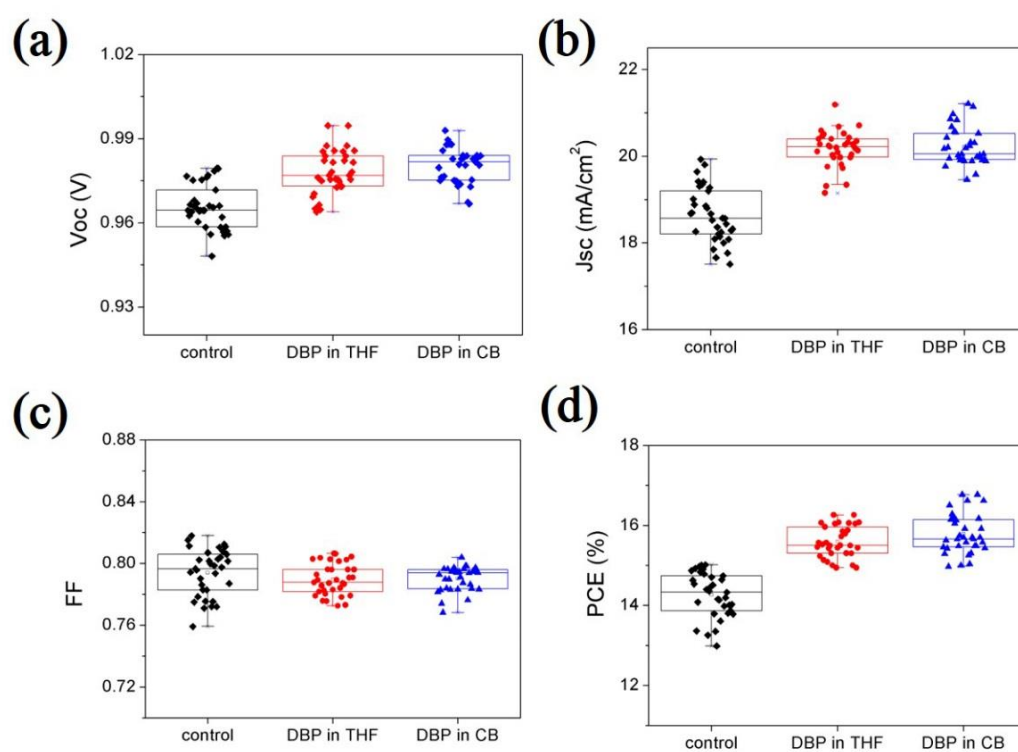


Figure S2 (a)  $V_{oc}$ , (b)  $J_{sc}$ , (c) FF and (d) PCE statistical distribution of PSCs without and with DBP based on thirty-six devices for each kind, respectively.

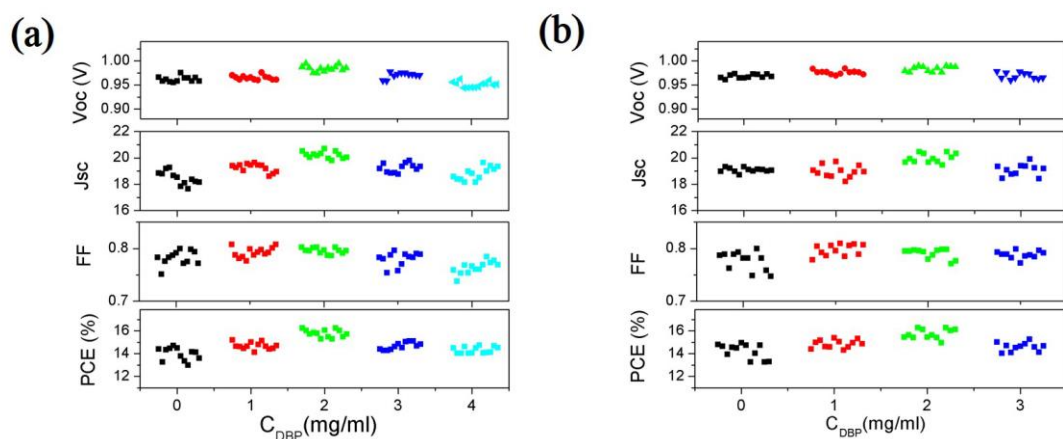


Figure S3 Photovoltaic parameter statistical distributions of PSCs plotted as a function of DBP concentrations ( $C_{\text{DBP}}$ ) in (a) THF and (b) CB solvents, the data points with the same colour correspond to the same DBP concentration

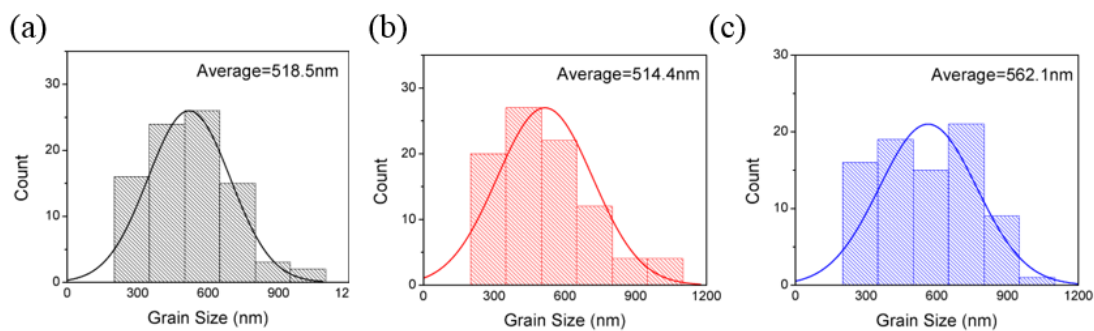


Figure S4 Histograms of crystal grain size distribution corresponding to the top-view SEM images of three films including perovskite, perovskite/DBP (in THF) and perovskite/DBP (in CB), as shown in Figure 2.

Table S1. Photovoltaic performance of reference and only solvent treatment PSCs under AM 1.5 G illumination (100 mW. cm<sup>-2</sup>). The data were obtained based on eighteen devices for each condition.

	Voc (V)	Jsc (mA/cm <sup>2</sup> )	FF	PCE (%)
Reference	0.97 ± 0.008	18.64 ± 0.63	0.793 ± 0.022	14.26 ± 0.56
THF	0.97 ± 0.006	18.92 ± 0.41	0.783 ± 0.033	14.33 ± 0.65
CB	0.97 ± 0.008	18.69 ± 0.61	0.794 ± 0.015	14.41 ± 0.43

Table S2 PL delay lifetime with weight fractions fitted by a bi-exponential decay function

Samples	$\tau_1$ /ns	A <sub>1</sub> (%)	$\tau_2$ /ns	A <sub>2</sub> (%)
perovskite	28.73	53.25	94.54	46.75
perovskite/DBP (in THF)	20.85	17.73	116.21	80.04
perovskite/DBP (in CB)	17.82	9.36	121.54	88.16

Table S3 Fitting parameters of EIS data for the PSCs with and without DBP

	Rs (ohm·cm <sup>2</sup> )	Rct (ohm·cm <sup>2</sup> )	Rrec (ohm·cm <sup>2</sup> )
None DBP	1.94×10 <sup>-8</sup>	130.5	227.5
DBP in THF	1.45×10 <sup>-8</sup>	61.5	333.8
DBP in CB	1.74×10 <sup>-8</sup>	61.3	348.2

Table S4. the roughness and surface potential of three kinds of films including perovskite, perovskite/DBP (in THF), perovskite/DBP (in CB)

Samples	Roughness (nm)	Surface potential (mV)
perovskite	12.35	131.4
perovskite/DBP (in THF)	12.51	232.3
perovskite/DBP (in CB)	12.37	297.5