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

Controlling the device functionality by solvent engineering, solar cell versus light emitting diode

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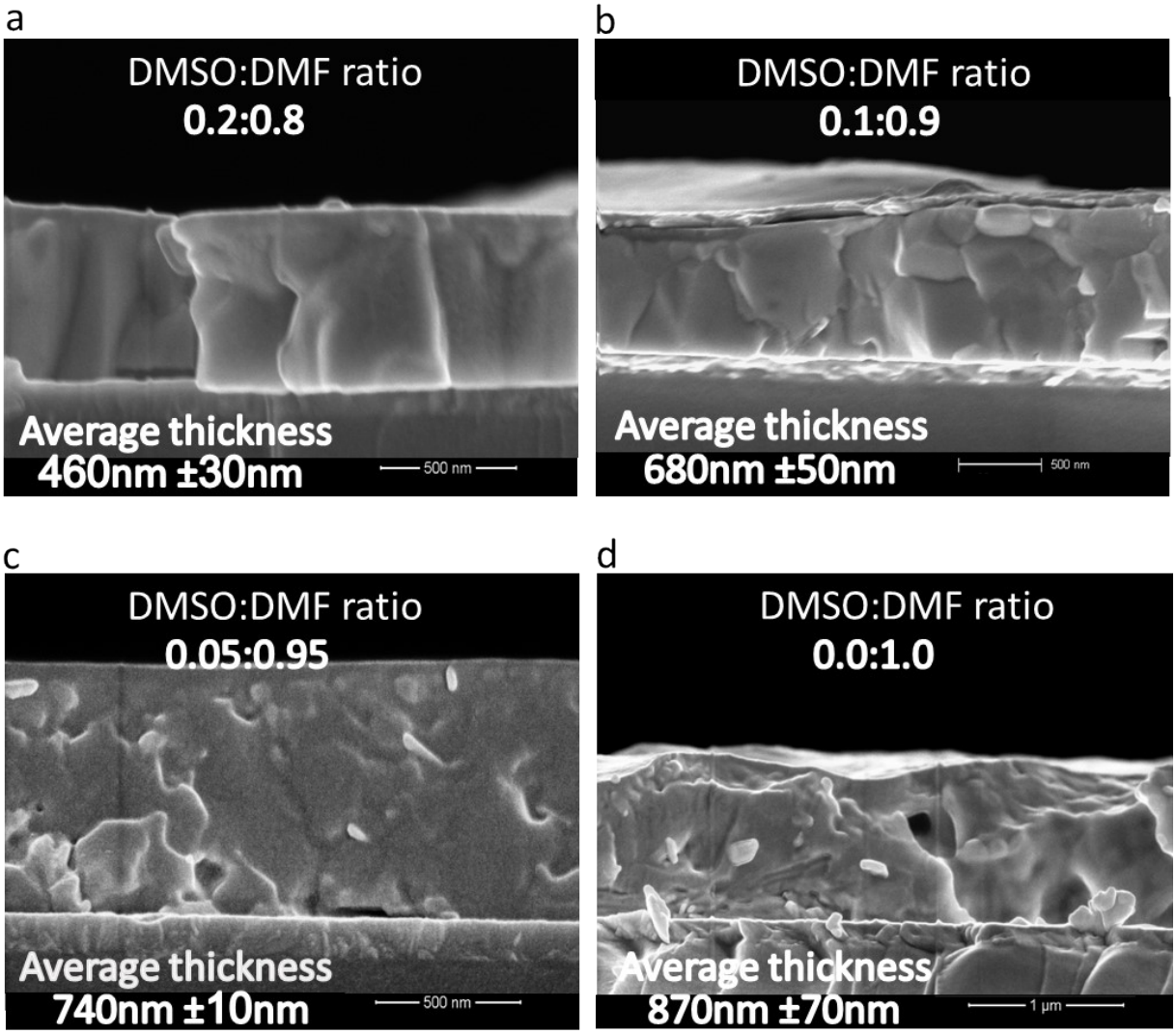
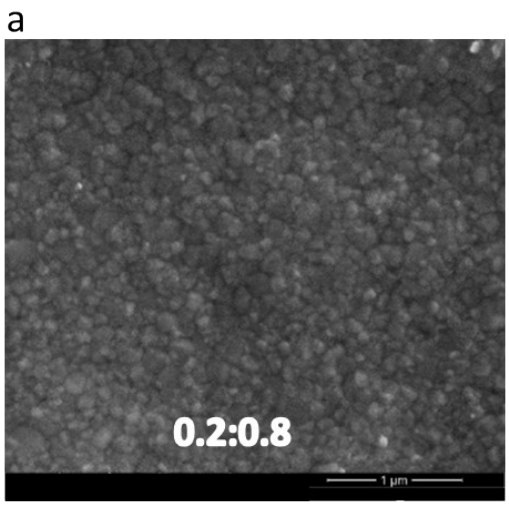
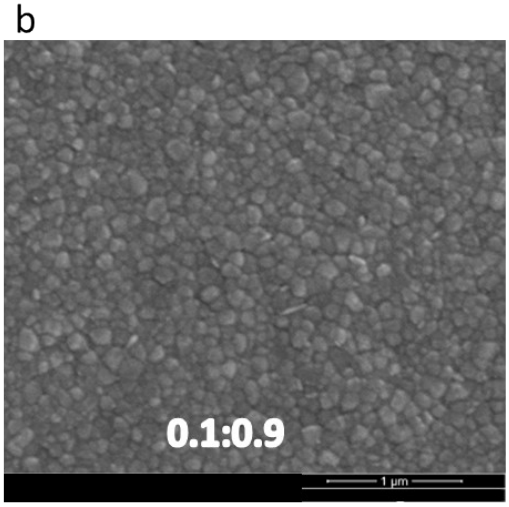
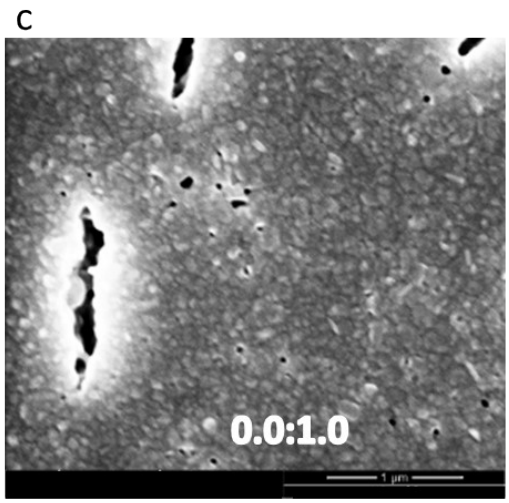


Figure S1- (a-d) Cross section SEM images of devices with different DMSO:DMF ratios, with average perovskite layer thickness of 460nm for 0.2:0.8 ratio, 680nm for 0.1:0.9, 740nm for 0.05:0.95 and 870 for 0.0:0.1.



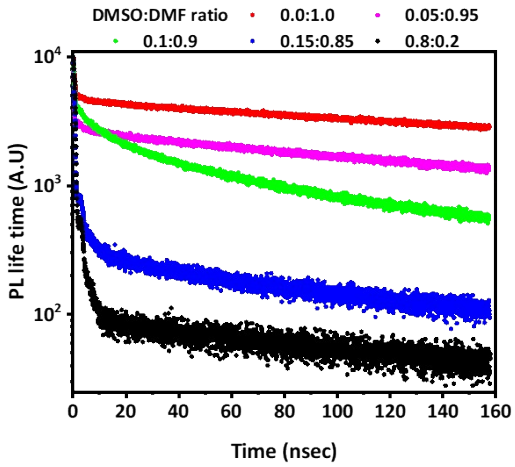




DMSO:DMF ratio	Average grain size (nm)
0.2:0.8	130±27
0.15:0.85	131±27
0.1:0.9	130±28
0.05:0.95	123±20
0.0:1.0	105±27

Figure S2- (a-c) Top view SEM images of devices with different DMSO:DMF ratios.

Table S1- Average grain size calculated from SEM images.



DMSO:DMF ratio	Average PL life time (ns)
0.0:1.0	t=190.24
0.05:0.95	t=91.85
0.1:0.9	t=44.54
0.15:0.85	t=13.55
0.2:0.8	t=0.73

Figure S3- Photoluminescence lifetime measurements for different DMSO:DMF ratios.

Table S2- Life time values calculated from PL life time measurements.

Measured parameter \ DMSO:DMF ratio	0.0:1.0	0.2:0.8
Hall mobility [$cm^2/V*s$]	7.19E-01	8.67E-01
Carrier concentration [$1/cm^3$]	4.97E+14	2.81E+15
Resistivity [Ω*cm]	1.75E+04	2.56E+03
Hall voltage [V]	1.08E-03	1.91E-04

Table S3- Hall effect measurements for 0.0:0.1 and 0.2:0.8 DMSO:DMF ratios. Presenting hall mobility, carrier concentration, resistivity and hall voltage measured values.

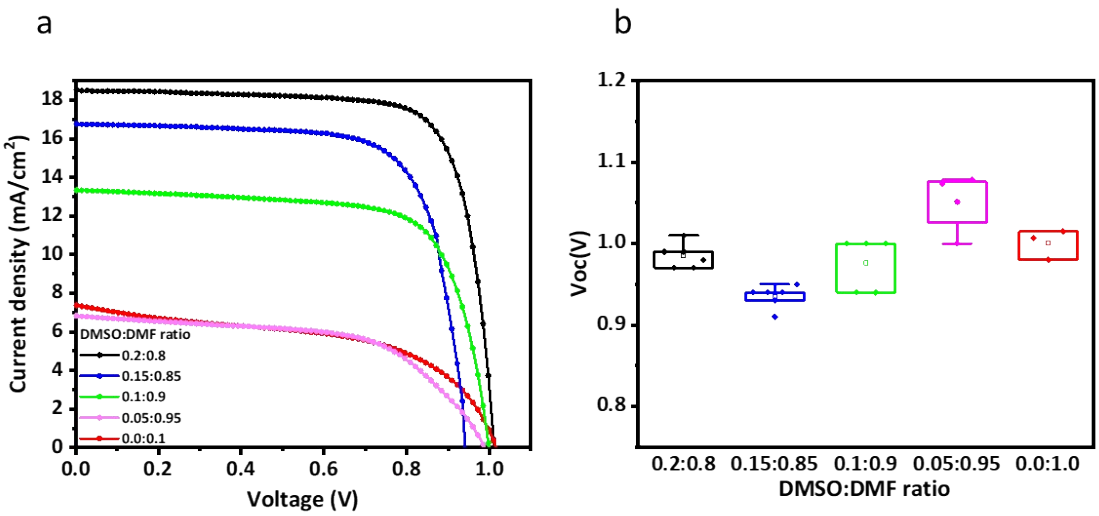


Figure S4- (a) Typical JV curve for all DMSO:DMF ratios. (b) Voc measurements of solar cells with all DMSO:DMF ratios.

DMSO:DMF ratio	Voc (V)	Jsc [mA/cm^2]	FF (%)	Solar cell efficiency (%)
0.2:0.8	0.98±0.02	17.9±0.5	76±1	13.5±0.5
0.15:0.85	0.92±0.03	16.8±0.6	69±4	10.7±0.9
0.1:0.9	0.98±0.03	12±1	69±4	8±1
0.05:0.95	1.02±0.08	10±2	58±3	6.7±0.9
0.0:1.0	0.9±0.3	7±2	42±7	3±1

Table S4- Average results for PV measurements of solar cells with all DMSO:DMF ratios.

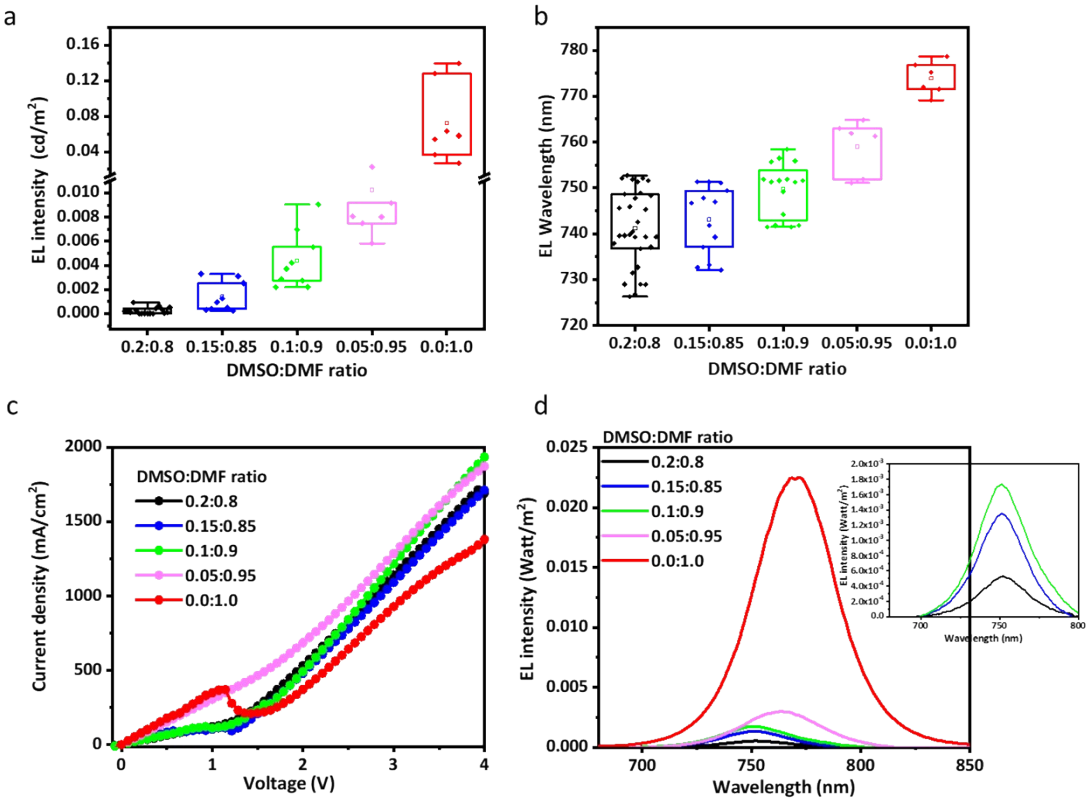


Figure S5- (a) EL intensity measured in cd/m² (b) EL wavelength at the peak maximum (c) JV of LEDs with all DMSO:DMF ratios measured during EL measurements. (d) Electroluminescence spectra of all DMSO:DMF ratios.

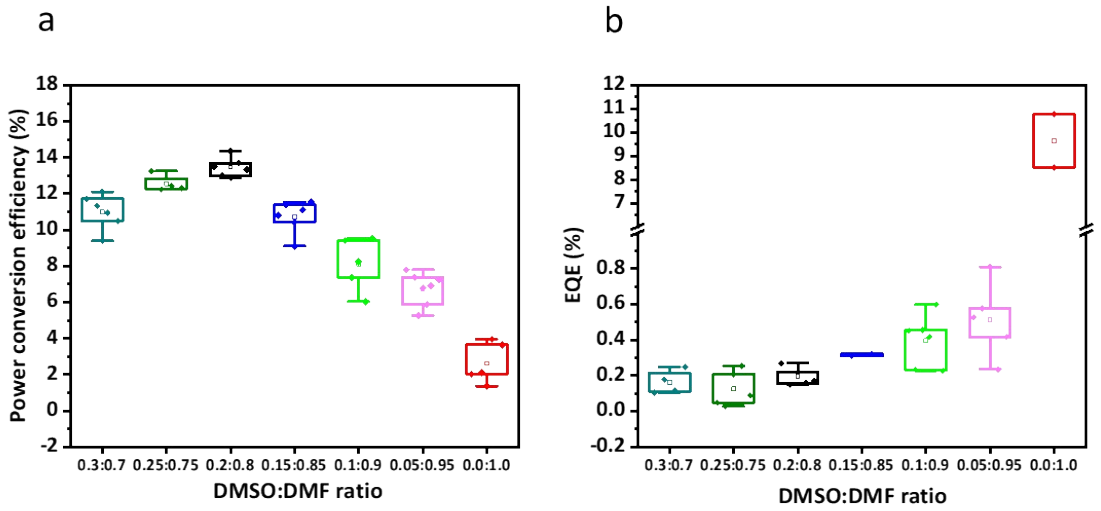


Figure S6- Solar cells and LED performance of devices with additional DMSO:DMF ratios of 0.25:0.75 and 0.3:0.7, showing a decrease in the solar cells efficiency while the LED reaches a plateau in the EQE. (a) Power conversion efficiency (PCE) of solar cells and (b) External Quantum Efficiency (EQE) of the LED.

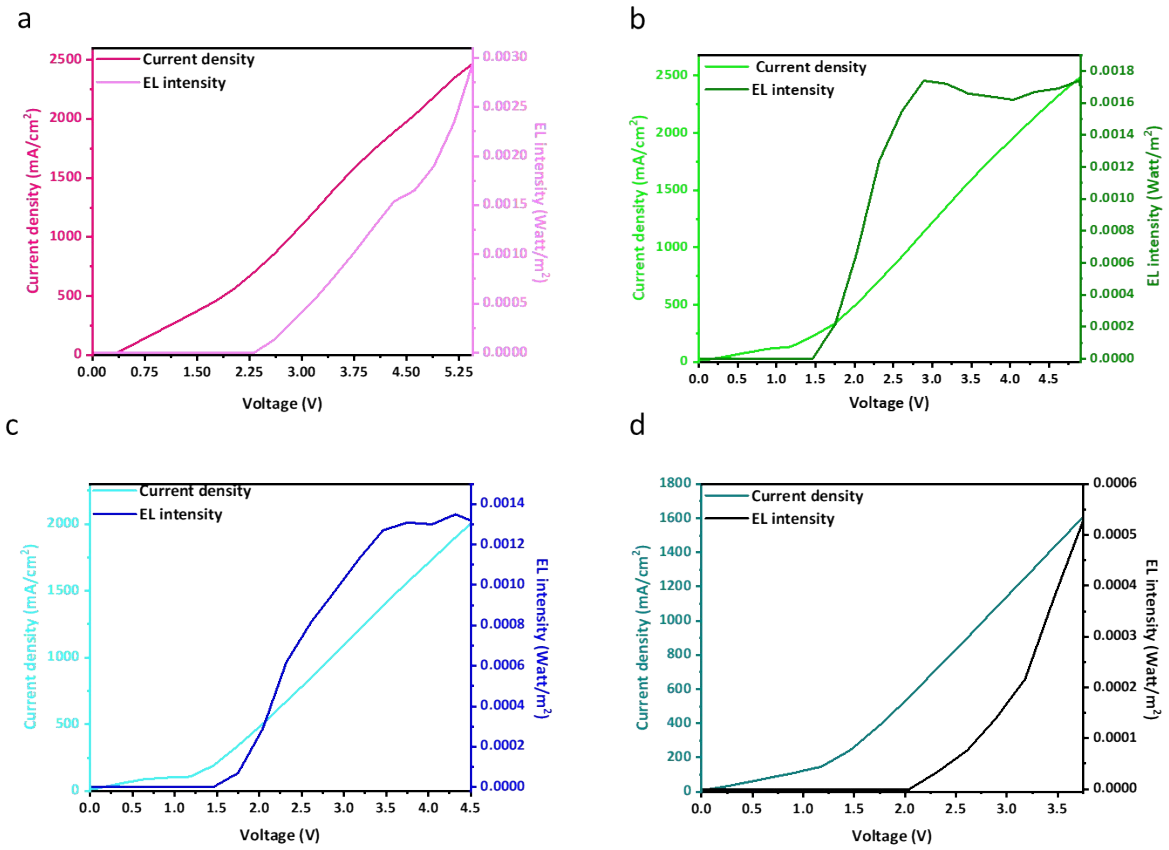


Figure S7- Current density-Voltage-EL intensity characteristics of LED devices with (a) 0.05:0.95 (b) 0.1:0.9 (c) 0.15:0.85 and (d) 0.2:0.8 DMSO:DMF ratios.

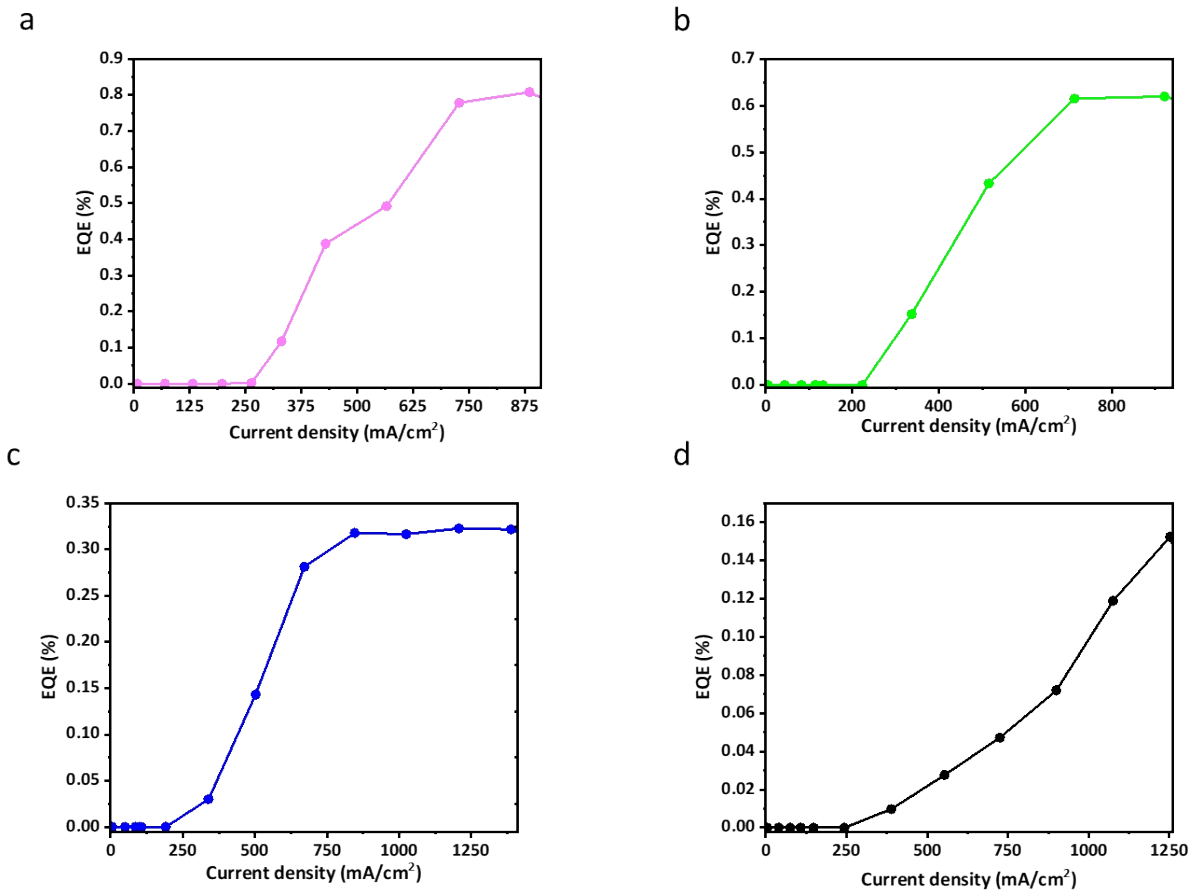


Figure S8- EQE-Current density curves of LED devices with (a) 0.05:0.95 (b) 0.1:0.9 (c) 0.15:0.85 and (d) 0.2:0.8 DMSO:DMF ratios.

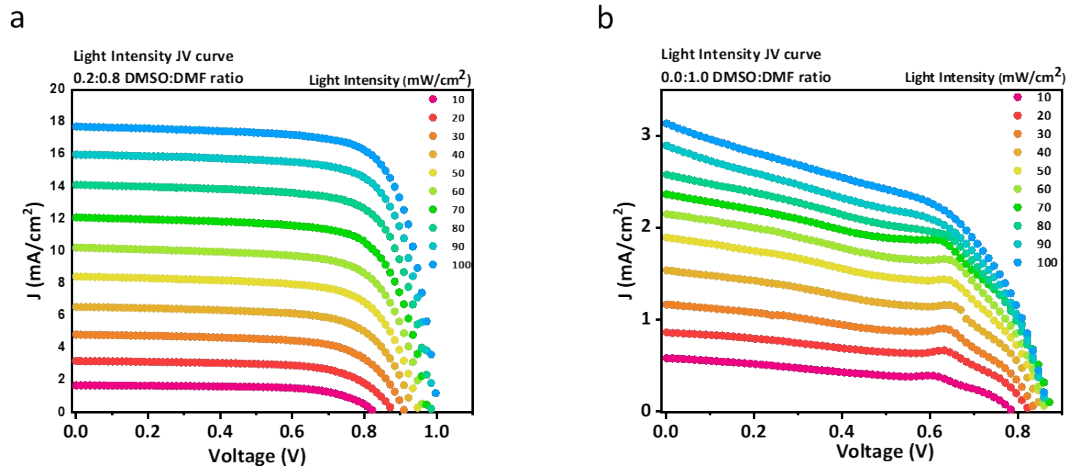


Figure S9- JV curve of light intensity measurements of (a) 0.2:0.8 DMSO:DMF ratio and (b) 0.0:1.0 DMSO:DMF ratio.