

Supporting Information

The introduction of perovskite seed layer for high performance perovskite solar cells

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This supporting information presents the following contents.

Supporting Tables S1

Supporting Figures S1-S7

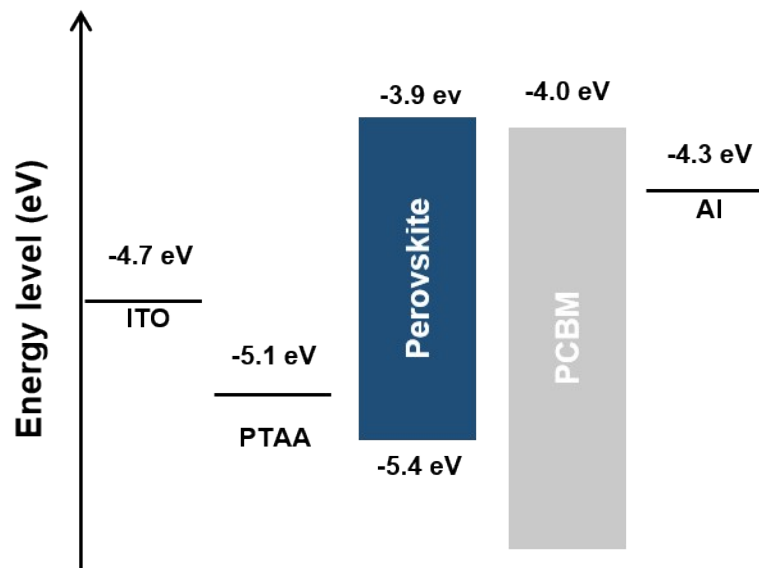


Figure S1. Energy band diagram of perovskite solar cells.

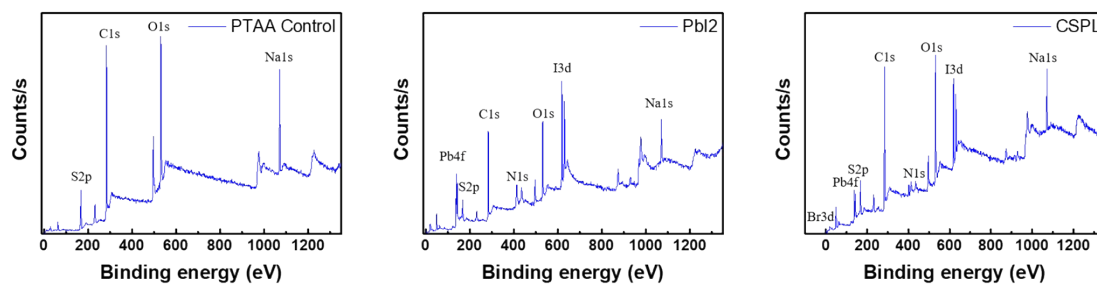


Figure S2. XPS survey spectrum of PTAA control, PbI₂ seed layer and CSPL films after washing by DMF solvent.

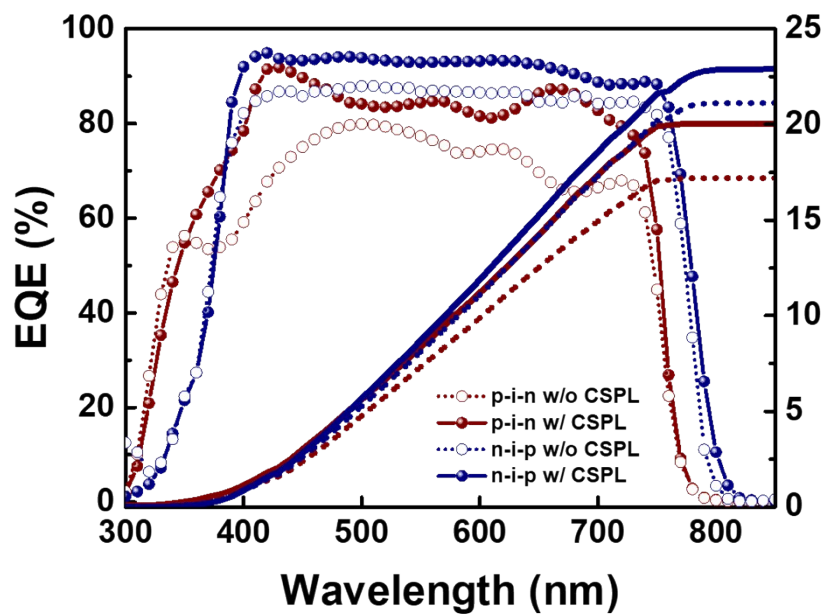


Figure S3. EQE and calculated J_{sc} of p-i-n structure and n-i-p structure of CSPL perovskite solar cells. (p-i-n w/o CSPL: $17.25 J_{sc}(\text{mAcm}^{-2})$, p-i-n w/ CSPL: $20.05 J_{sc}(\text{mAcm}^{-2})$, n-i-p w/o CSPL: $21.13 J_{sc}(\text{mAcm}^{-2})$, n-i-p w/ CSPL: $22.90 J_{sc}(\text{mAcm}^{-2})$)

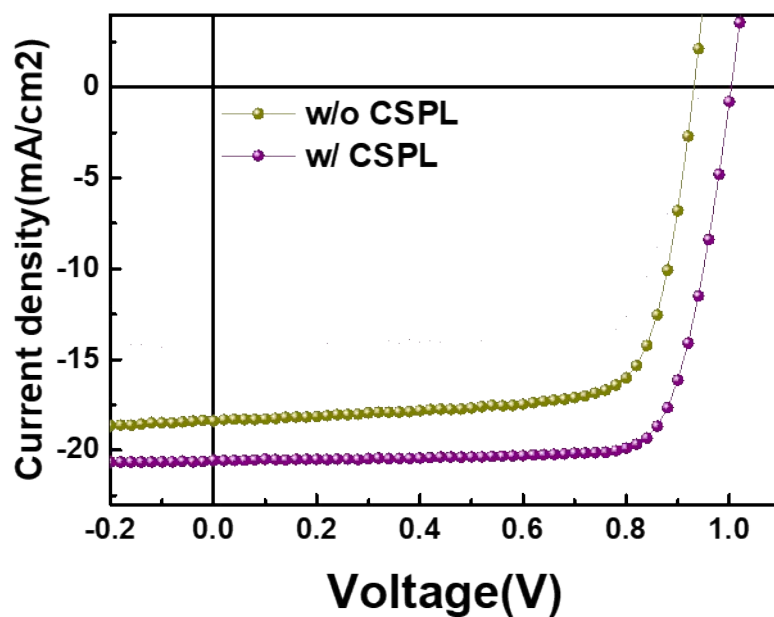


Figure S4. *J-V* characteristics of perovskite solar cells without and with CSPL based on PEDOT:PSS HTL.

Table S1. Solar cells characteristic of p-i-n structure perovskite devices without and with and without CSPL based on PEDOT:PSS HTL.

	J_{sc} (mA cm ⁻²)	V_{oc} (V)	<i>FF</i>	<i>PCE</i> (%)
w/o S.L.	18.39	0.93	0.75	12.81
w/ S.L.	20.09	1.00	0.79	16.25

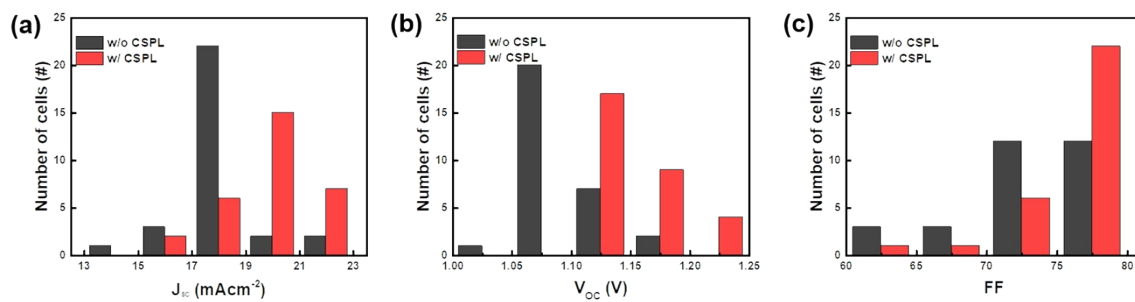


Figure S5. Histogram of device statistics from a total of 30 p-i-n structure solar cell devices (ITO/PTAA/seed layer/MAPbBr_xI_{3-x}/PC₆₁BM/Al) comprising without and with CSPL. (a) Short circuit current density, (b) open circuit voltage, (c) fill factor.

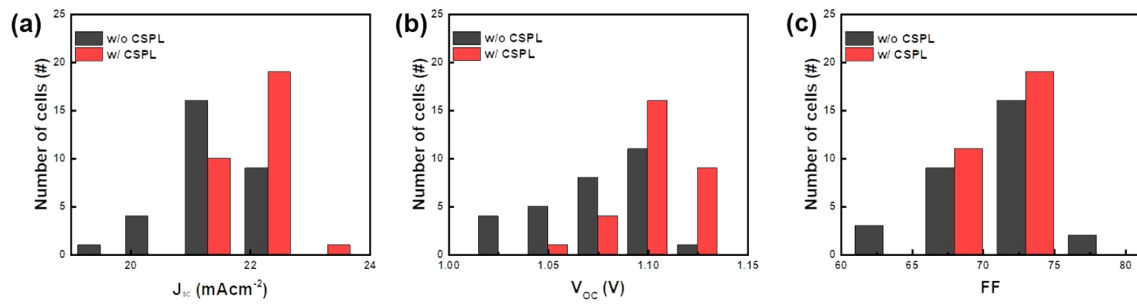


Figure S6. Histogram of n-i-p device statistics from a total of 30 solar cell devices (FTO/bl-TiO₂/Mesoporous TiO₂+Perovskite((FAPbI₃)_{0.85}(MAPbBr₃)_{0.15})/Spiro-MeOTAD/Au) comprising without and with CSPL. (a) Short circuit current density, (b) open circuit voltage, (c) fill factor

5 μm X 5 μm

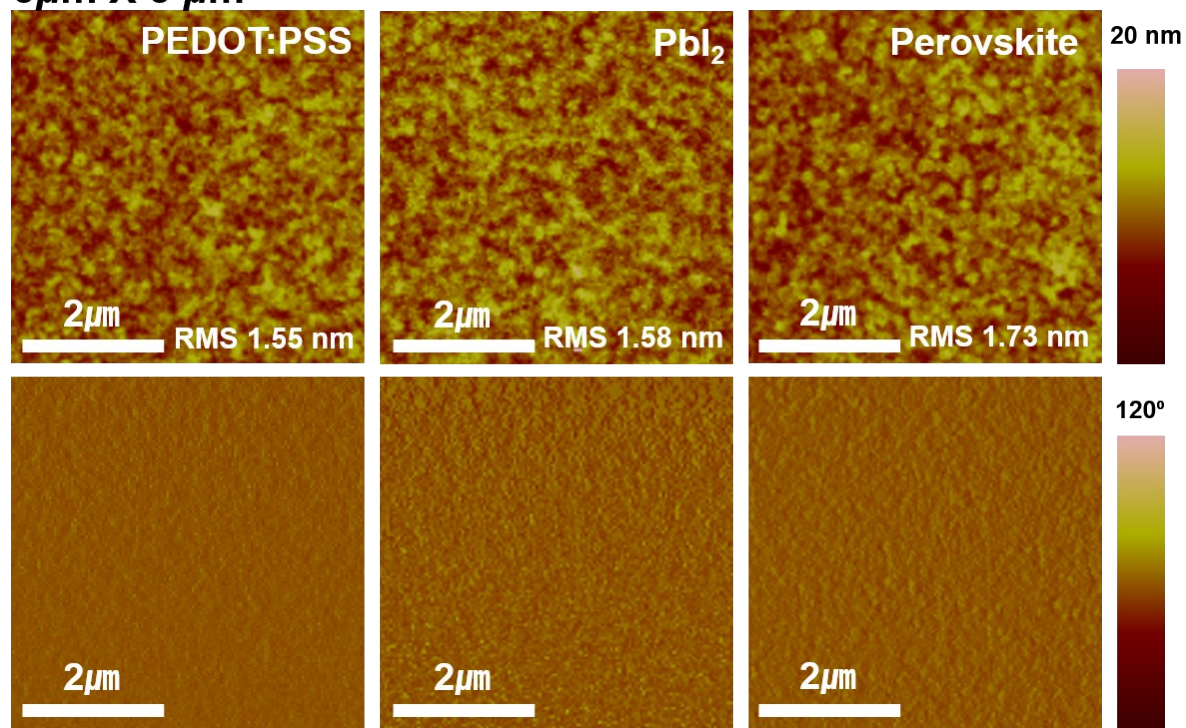


Figure S7. Atomic force microscope (AFM) surface image of PEDOT control substrate, PbI_2 , CSPL films respectively, after washed by DMF solvent.

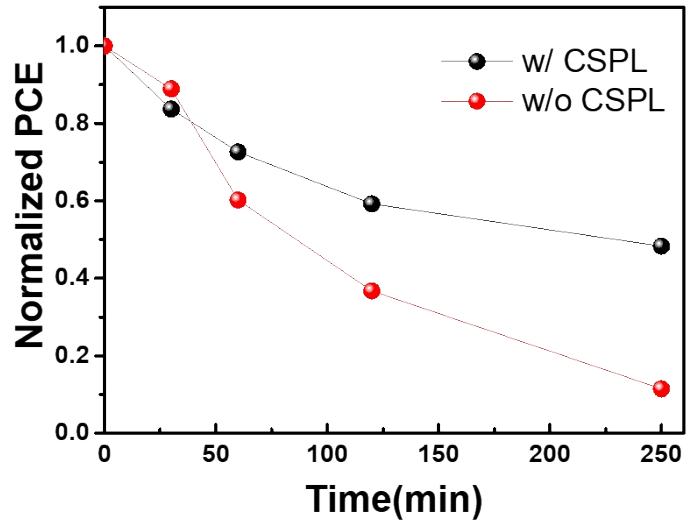


Figure S8. Stability test was performed for non-encapsulated cells (with and without CSPL PeSCs) under an air about 40% humidity condition.