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Supplementary Materials for

Peroptronic Devices: Perovskite Based Light-Emitting Solar Cells

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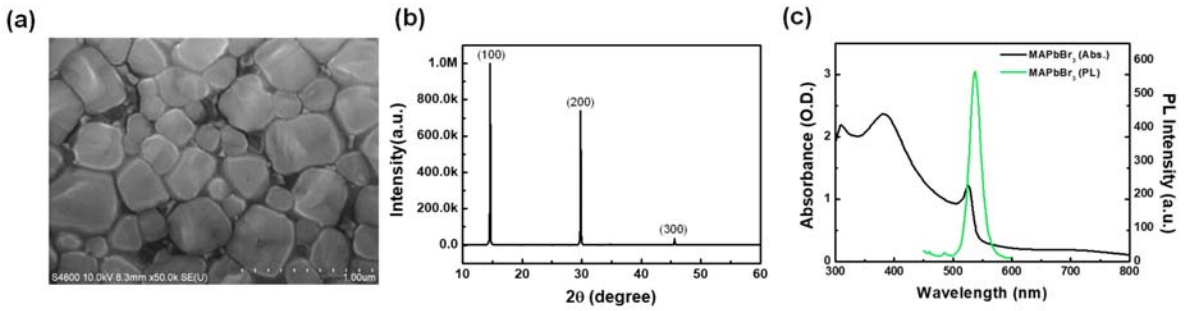

Figure S1. Characteristics of two-step, solution-processed $MAPbBr_3$ films. (a) SEM image. (b) X-ray diffractogram. (c) Absorption and photoluminescence spectra.

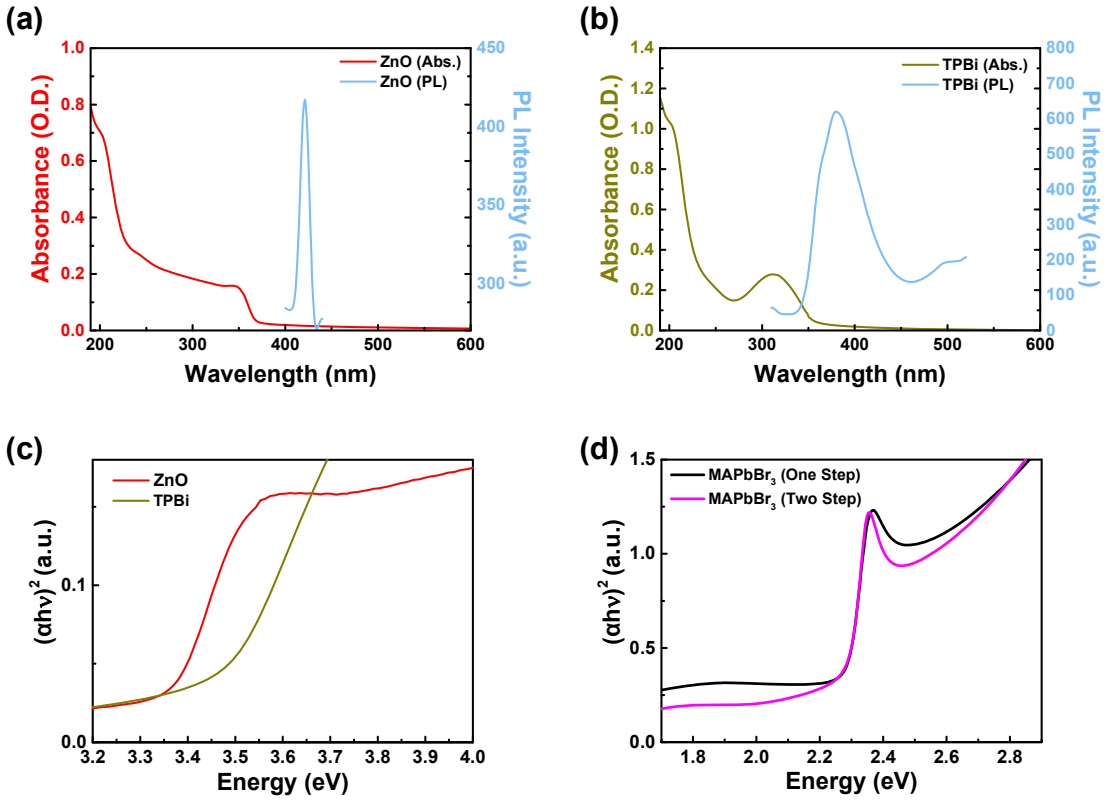

Figure S2. Optical properties. (a) Absorption and PL of ZnO ETL. (b) Absorption and PL of ZnO ETL. (c) Tauc plots of ZnO and TPBI ETLs. (d) Tauc plots of $MAPbBr_3$ films prepared by one step and two step methods.

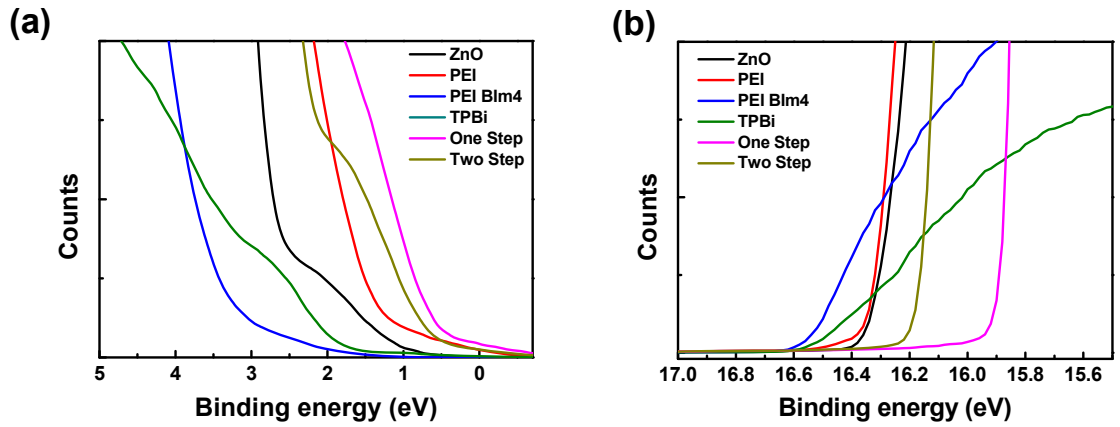

Figure S3. UPS spectra. (a) Close-up of Fermi edge region of different films. (b) Close-up of secondary edge region of different films. For these measurements, thin ETL layers were deposited onto one-step $MAPbBr_3$ layers.

Table S1. Energy levels of different films deposited on $MAPbBr_3$ derived from UPS and UV-vis data.

Structure	*WF* (eV)	E_{VB} *(eV)*	E_{CB} *(eV)*	E_g (eV)
$MAPbBr_3$	5.31	5.74	3.46	2.28
ZnO	4.88	7.53	4.18	3.35
PEI	4.86	7.17	1.13	6.04
$PEIBIm_4$	4.64	7.31	2.14	5.17
TPBI	4.66	6.53	3.08	3.45

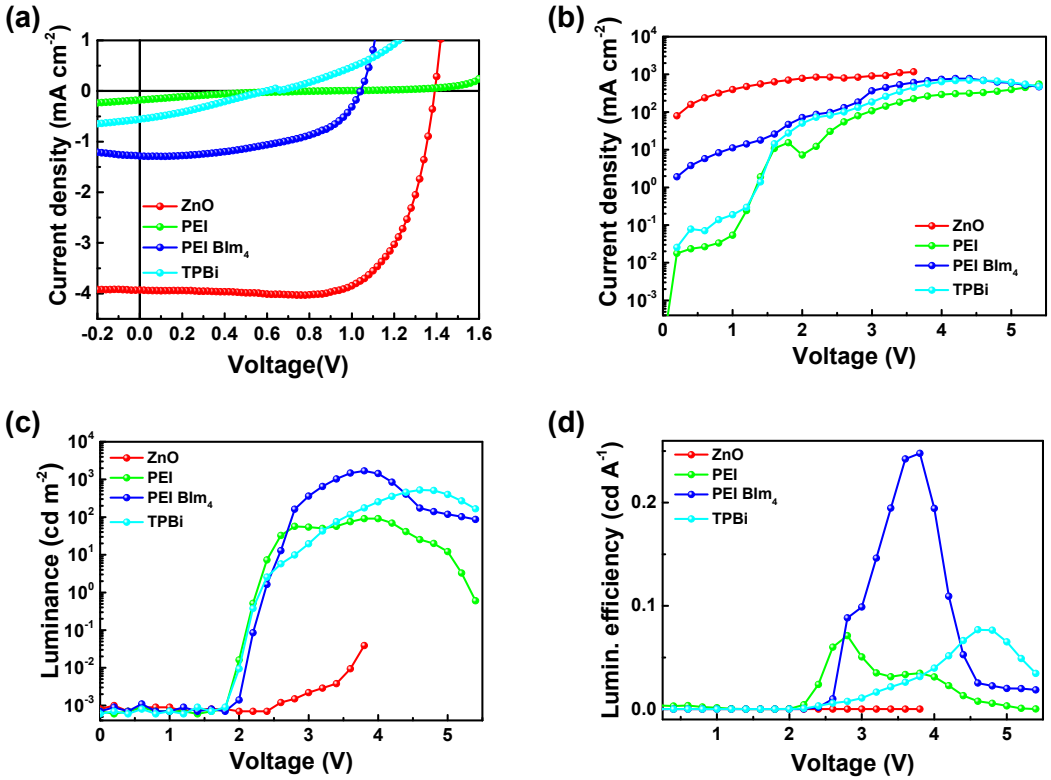

Figure S4. Solar cell and LED characteristics of $MAPbBr_3$ devices prepared using the 2-step method. (a) J-V characteristics under 100 mW/cm-2 simulated solar irradiation. (b) J-V characteristics under forward bias. (c) Luminance vs applied bias. (d) Luminous efficiency vs applied bias.

Table S2. Optoelectronic characteristics of LESC devices with $MAPbBr_3$ prepared by the two-step method.

Structure	J_{sc} (mA/cm^2)	V_{oc} (V)	FF	PCE (%)	L_{max}* [cd m^{-2}]	L_{max}* [cd A^{-}]	L_{max}* [lm W^{-}]	EQE* [%]
ZnO	3.93	1.39	0.72	3.92	0.039 @ 3.8	0.00002 @ 3.8	0.000016 @ 3.8	0
PEI	0.18	0.85	0.17	0.025	91.55 @ 3.8	0.071 @ 2.8	0.08 @ 2.8	0.016 @ 2.8
$PEIBIm_4$	1.29	1.04	0.52	0.70	1685.30 @ 3.8	0.25 @ 3.8	0.21 @ 3.6	0.056 @ 3.8
TPBI	0.56	0.59	0.29	0.096	525.65 @ 4.6	0.077 @ 4.6	0.052 @ 4.6	0.017 @ 4.6

*The potential (in V) at which each parameter was measured is denoted after the symbol @.