

Supporting Information for
**Trifunctional polyethylene oxide buffer layer for stable and efficient
all-inorganic CsPbBr₃ perovskite solar cells**

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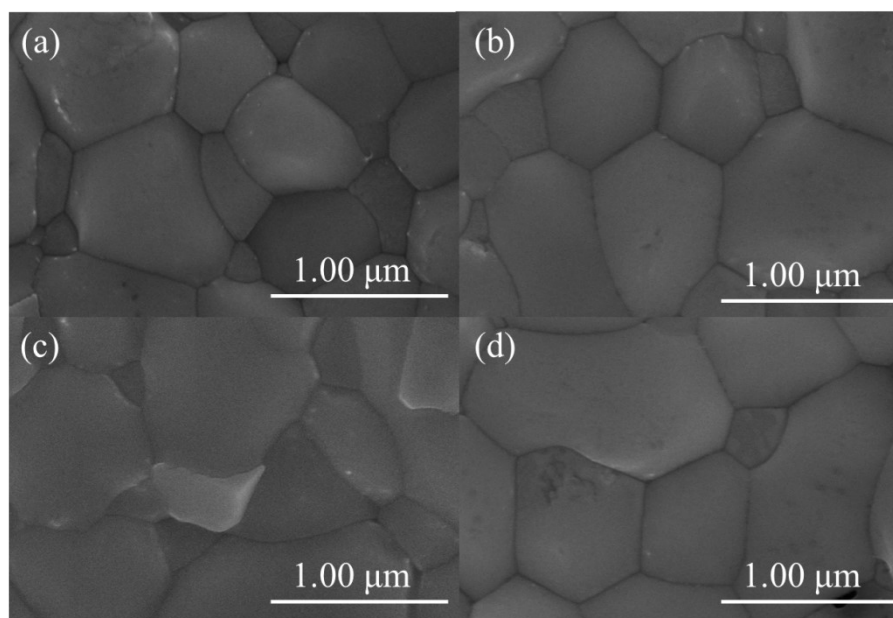


Figure S1. Top-view SEM images of (a) pristine CsPbBr₃ films as well as the CsPbBr₃ films tailored by (b) PEO-0.05,

(c) PEO-0.1 and (d) PEO-0.5.

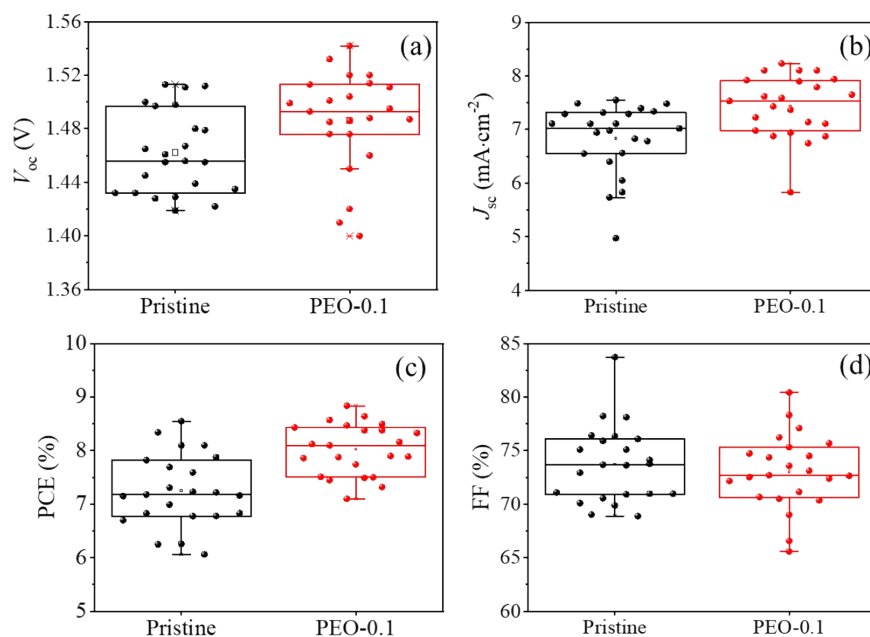


Figure S2. Box charts for the photovoltaic data of (a) J_{sc} , (b) V_{oc} , (c) FF and (d) PCE for the carbon-based HTM-free all-inorganic CsPbBr₃ PSCs without and with PEO-0.1.

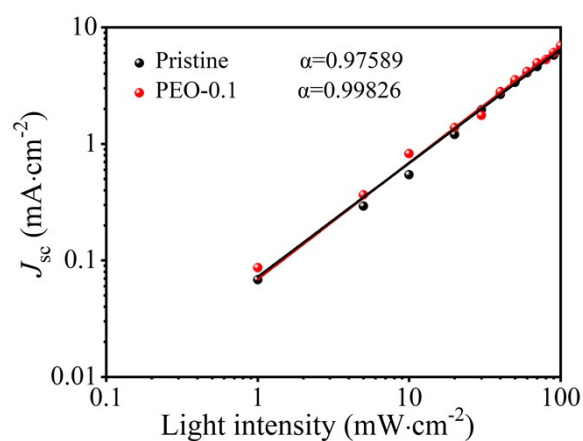


Figure S3. J_{sc} upon light intensity modulated J - V measurements.

Table S1. Photovoltaic data of the carbon-based HTM-free all-inorganic CsPbBr₃ PSCs with and without PEO modification.

Samples	V_{oc} (V)	J_{sc} (mA cm ⁻²)	PCE (%)	FF (%)
Pristine	1.429	5.73	6.25	76.33
PEO-0.05	1.486	7.14	7.5	70.69

PEO-0.1	1.495	7.80	8.84	75.81
PEO-0.5	1.458	6.47	7.32	77.6

Table S2. The photovoltaic data for the state-of-the-art carbon-based HTM-free all-inorganic CsPbBr₃ PSCs.

Samples	V_{oc} (V)	J_{sc} (mA cm ⁻²)	PCE (%)	FF (%)	Ref
FTO/TiO ₂ /DTPT/CsPbBr ₃ /DTPD/Carton	1.574	8.52	11.21	83.67	1
FTO/TiO ₂ /CsPbBr ₃ /DCC/Carton	1.611	7.79	10.16	80.96	2
FTO/TiO ₂ /CsPbBr ₃ /I Br-CQDs/Carton	1.651	7.84	10.79	83.36	3
FTO/SnO ₂ -SnS ₂ /CsPbBr ₃ /Carton	1.635	7.80	10.72	84.04	4
FTO/TiO ₂ /CsPbBr ₃ /Carton	1.46	8.12	9.6	81	5
FTO/TiO ₂ /CsPbBr ₃ /DAP/Carton	1.621	7.57	10.31	84.05	6
FTO/TiO ₂ /CsPbBr ₃ /Carton	1.43	6.81	7.81	79.96	7
FTO/TiO ₂ /CsPbBr ₃ /Carton	1.30	5.64	5.30	72.3	8
FTO/TiO ₂ /CsPbBr ₃ - thiourea /Carton	1.38	8.81	9.11	75	9
FTO/TiO ₂ /CsPbBr ₃ /UV-360 /Carton	1.568	7.69	9.61	79.70	10
FTO/TiO ₂ /CsPbBr ₃ /Pt ₃ M Carton	1.520	6.77	7.62	74.05	11
FTO/SnO ₂ /GQDs/CsPbBr ₃ /Carton	1.522	7.91	9.51	78.4	12
ITO/SnO ₂ /GQDs/CsPbBr ₃ /Carton	1.530	4.79	5.71	77.9	13
FTO/SnO ₂ -RbCl/CsPbBr ₃ /Carton	1.601	7.69	10.04	81.6	14
FTO/N-TiO ₂ /CsPbBr ₃ /Carton	1.58	6.55	8.50	81.96	15
FTO/TiO ₂ /CsPbBr ₃ -Br-GO/Carton	1.579	7.72	9.44	77.44	16
FTO/TiO ₂ /CsPbBr ₃ -g-C ₃ N ₄ /Carton	1.277	7.80	8.00	80.32	17
FTO/TiO ₂ /T-CsPbBr ₃ /Carton	1.595	7.56	9.82	81.41	18
FTO/TiO ₂ /Ac/CsPbBr ₃ /Carton	1.595	7.31	9.60	82.33	19
FTO/TiO ₂ /M-CsPbBr ₃ /Carton	1.584	7.42	9.65	82.11	20
FTO/TiO ₂ /CsPbBr ₃ -L-lysine/Carton	1.565	7.64	9.68	81.0	21
FTO/TiO ₂ /CsPbBr ₃ /[BMIM]Cl/Carton	1.61	7.45	9.92	83	22
FTO/Sb-TiO ₂ /CsPbBr ₃ /Carton	1.586	6.64	8.26	78.4	23
FTO/TiO ₂ /CsPbBr ₃ /Carton	1.545	7.37	9.35	82.2	24
FTO/TiO ₂ /CsPbBr ₃ -PEG/Carton	1.41	7.56	7.8	73	25
FTO/TiO ₂ /CsPbBr ₃ -BiBr ₃ /Carton	1.39	7.83	8.73	80	26
FTO/TiO ₂ /CsPbBr ₃ /Carton	1.15	7.65	5.84	66.3	27
FTO/Sr-TiO ₂ /CsPbBr ₃ /Carton	1.23	6.54	5.92	73.6	28
FTO/TiO ₂ /CsPbBr ₃ /Carton-PANi/G	1.59	6.87	8.87	81.21	29
FTO/SQE/CsPbBr ₃ /Carton	1.572	7.68	9.15	75.8	30
FTO/TiO ₂ /CsPbBr ₃ /ONC/CNT	1.33	5.55	5.87	80	31
FTO/TiO ₂ /CsPbBr ₃ -SnBr ₂ /Carton	1.37	7.66	8.63	82.22	32
FTO/TiO ₂ /CsPbBr ₃ /PVAc/Carton	1.540	7.28	8.62	76.91	33
FTO/TiO ₂ /CsPbBr ₃ / Carton	1.34	6.46	5.86	68.04	34
FTO/TiO ₂ /CsPbBr ₃ -ZrO/Carton	1.44	7.75	8.19	73.52	35
FTO/TiO ₂ /CsPbBr ₃ -RPQDs/ Carton	1.470	7.33	8.20	76	36
FTO/TiO ₂ /CsPbBr ₃ /CdZnSe@ZnSe/ Carton	1.498	7.25	8.65	79.6	37
FTO/TiO ₂ /CsPbBr ₃ / Carton	1.20	5.3	3.9	64	38
FTO/ TiO ₂ /CsPbBr ₃ / PEO/Carton	1.495	7.80	8.84	75.81	This work

Table S3. The summary of carrier lifetime from TRPL analysis.

Sample	τ_1 (ns)	τ_2 (ns)
Pristine	0.195	2.37
PEO-0.05	0.107	2.66
PEO-0.1	0.087	2.78
PEO-0.5	0.126	2.43

Table S4. The summary of impedance from EIS analysis.

Sample	R_s (ohm)	R_{rec} (ohm)
Pristine	310	500
PEO-0.05	244.8	700
PEO-0.1	192.6	1100
PEO-0.5	299.2	624.1

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