Supporting information for:

KCl induced "slow-release effect" on PbI_2 to elevate the crystallization of perovskite and the reverse-bias stability of carbon-electrode based solar cells

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Supplementary Figures:

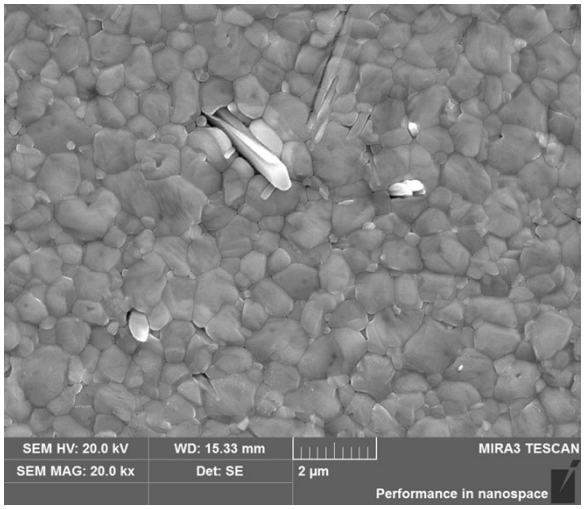

Figure S1. SEM image of needle-like structures on the surface of PVSK films (with 96 mM KCl)

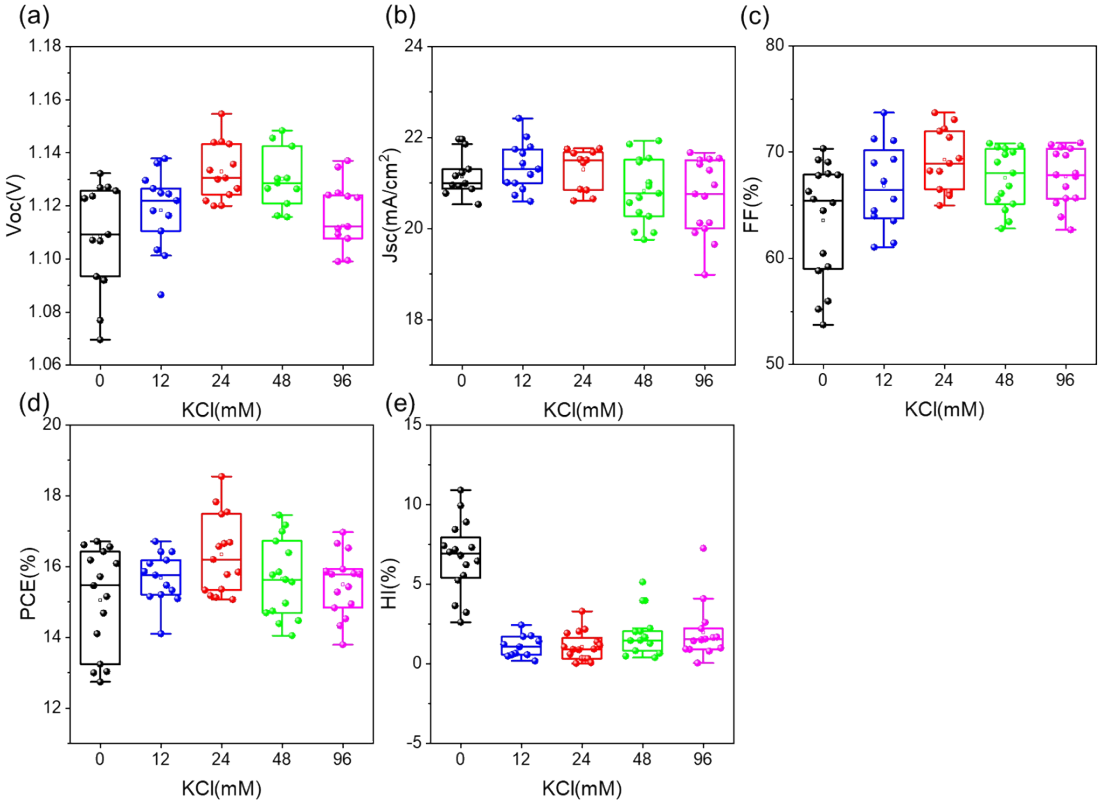

Figure S2. Statistics on performance parameters: (a) V_{OC}; (b) J_{SC}; (c) *FF*; (d) *PCE*; (e) *HI*.

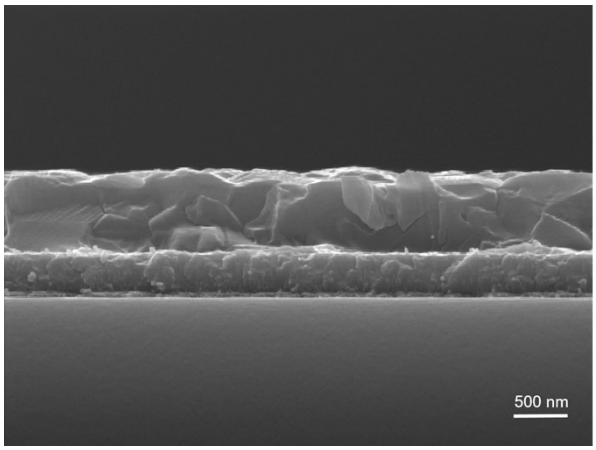

Figure S3. Typical cross-sectional SEM image of thicker PVSK film.

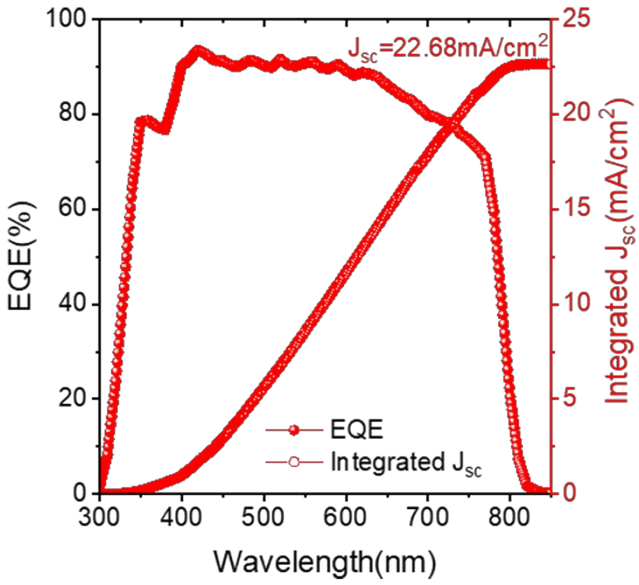

Figure S4. External quantum efficiency (EQE) test.

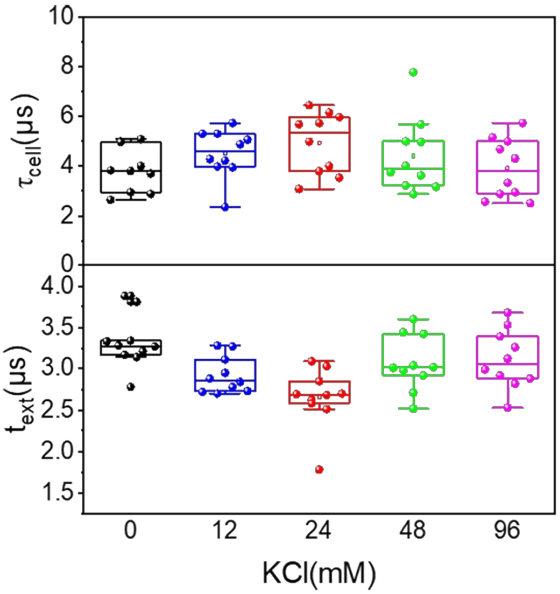

Figure S5. Extraction-time (t_{ext}) and lifetime (τ_{cell}) of carriers in devices, picked from TPC / TPV curves.

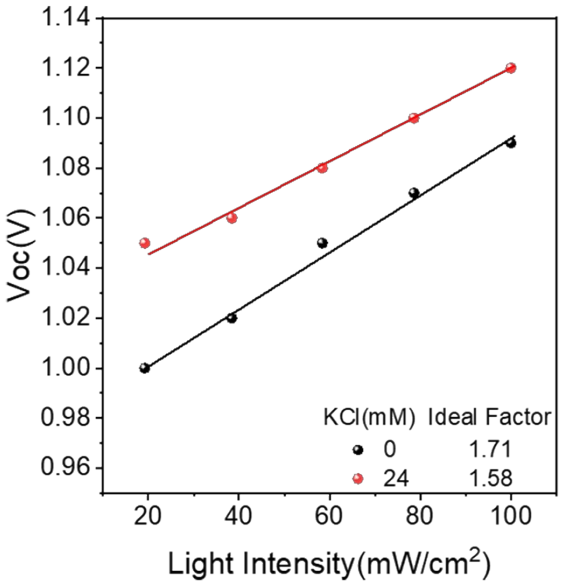

Figure S6. Dependence of V_{OC} on light intensity.

Dependence of V_{OC} on light intensity is monitored and the plots are fitted by formula (1), to obtain the ideal factor (n):

$$V_{oc} \propto \frac{nK_BT}{e} lnP \tag{1}$$

where K_B, T, and P is the Boltzmann constant, absolute temperature and light intensity, respectively. As shown in Figure S4, the ideal factor (n) decreases from 1.71 to 1.58, indicating that non-radiative recombination is suppressed at after KCl blending (24 mM).

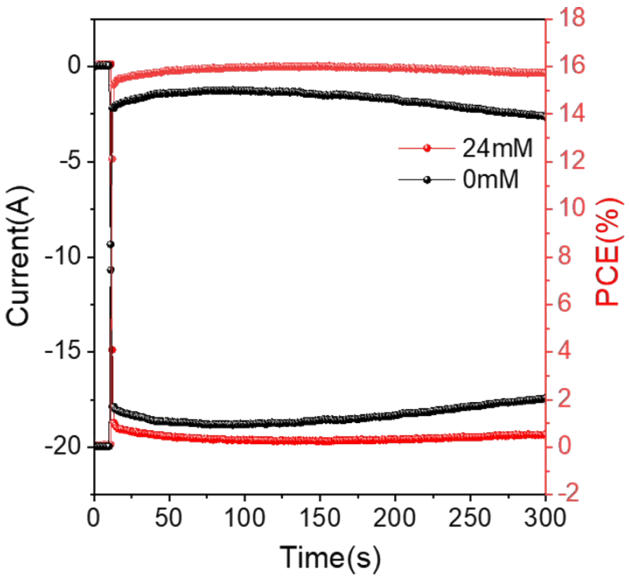

Figure S7. Quasi-maximum power point tracking (Q-MPPT) test on the hole-conductor-free, planar CPSCs.

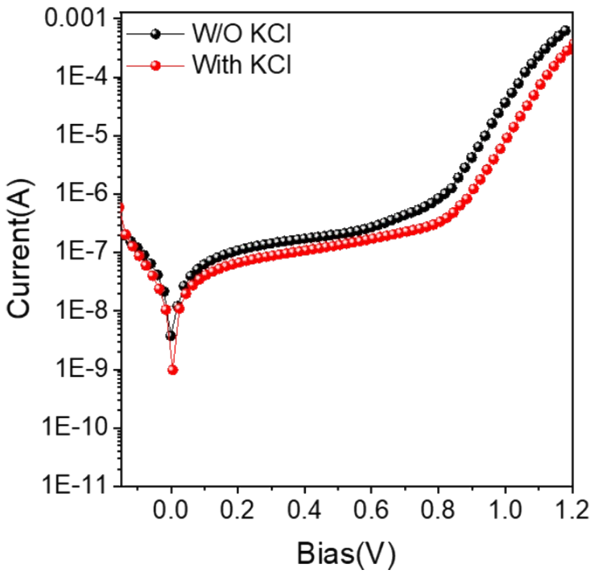

Figure S8. Dark current-density test on the hole-conductor-free, planar CPSCs.

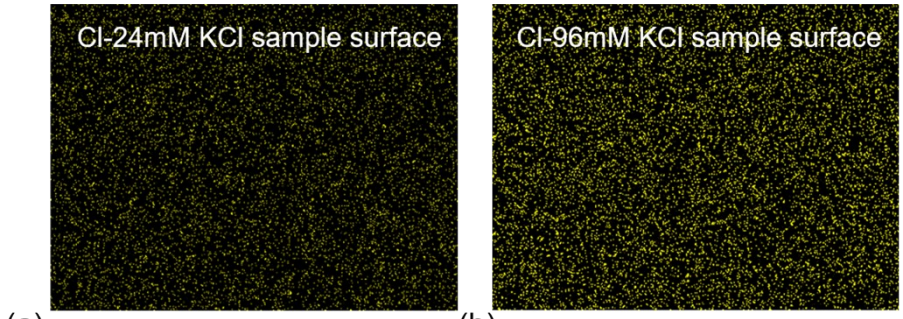

Figure S9. EDX of PVSK: (a) PVSK with 24 mM KCl; (b) PVSK with 96 mM KCl.

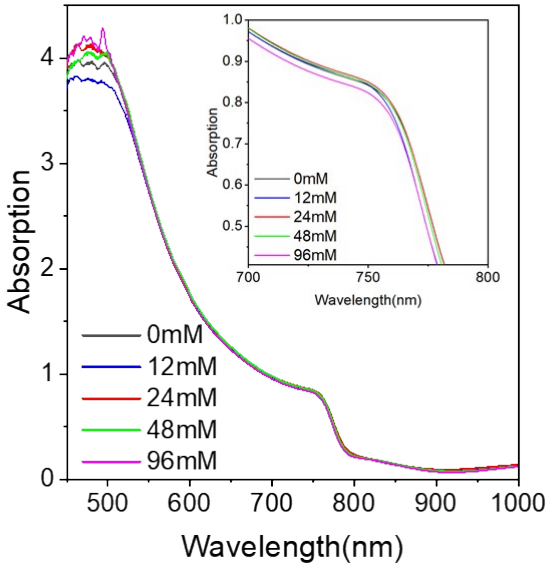

Figure S10. UV-Visible absorption of PVSK.

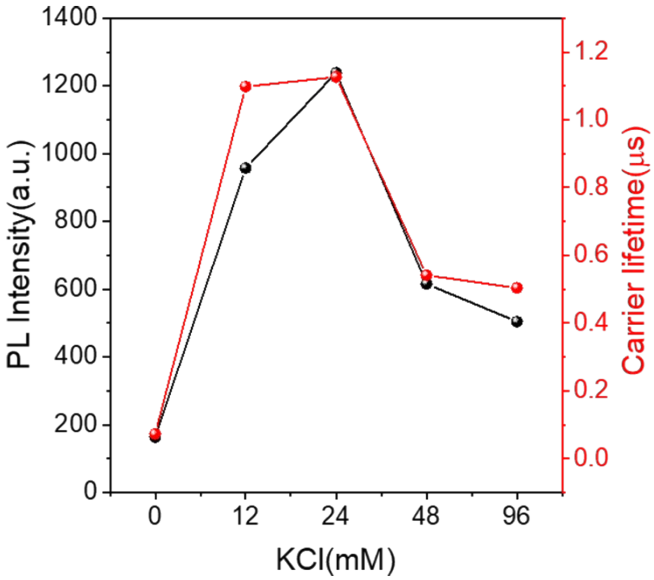

Figure S11. PL intensity and TRPL-derived lifetime of PVSK.

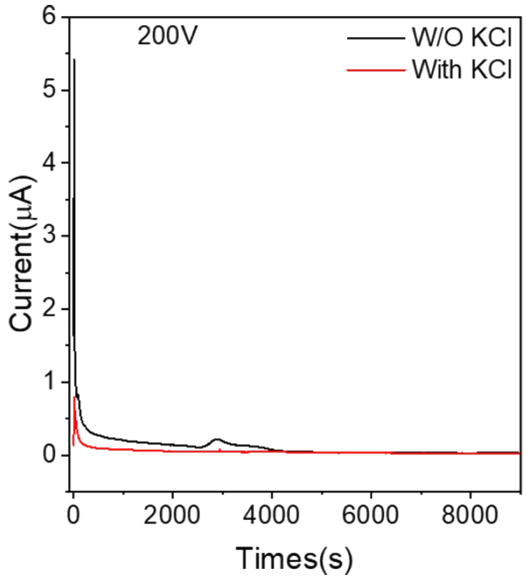

Figure S12. Current tracking on PVSK film, with current-time I (t) curves recorded at bias of 200 V.

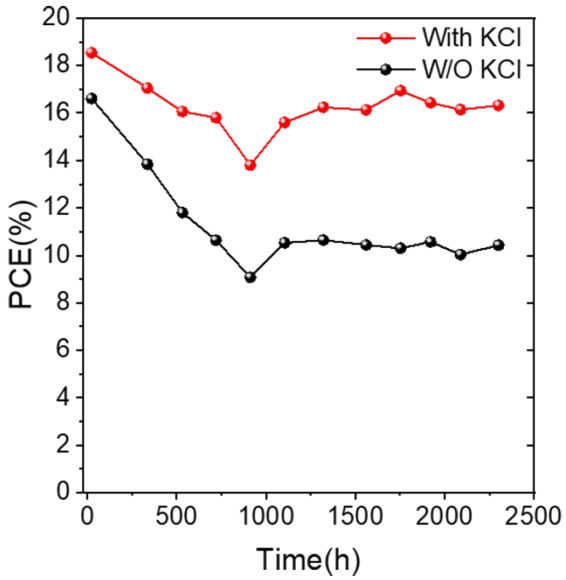

Figure S13. Storage stability test of the hole-conductor-free, carbon-electrode based perovskite solar cells.

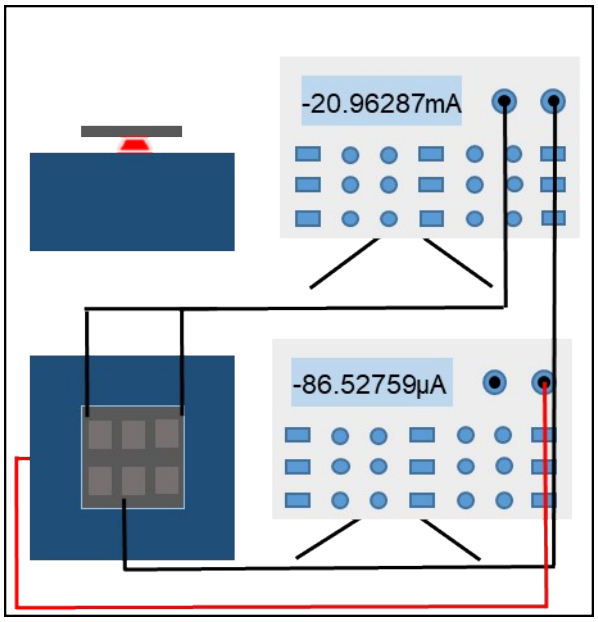

Figure S14. Diagram to show EQE test of reverse-bias luminescence (RBL).

Supplementary Tables:

Table S1. Parameters of the champion control and target devices.

Parameters	W/O KCl -FS	W/O KCl-RS	With KCl -FS	With KCl -RS
V_{oc} (V)	1.13	1.12	1.15	1.14
J_{sc} (mA/cm^2)	22.19	22.19	22.76	22.73
FF (%)	63.45	69.43	70.11	69.96
PCE (%)	15.95	17.36	18.54	18.22

Table S2. EDX of control PVSK or PVSK grown without KCl blending in PbI_2 (surface).

Element	**Signal Type**	**Wt%**	**Wt% Sigma**	**Atomic**
Cl	EDS	0.00	0.08	0.00
I	EDS	61.70	0.31	72.46
Pb	EDS	38.30	0.31	27.54
Total		100.00		100.00

Table S3 EDX of PVSK with 24 mM KCl (surface).

Element	**Signal Type**	**Wt%**	**Wt% Sigma**	**Atomic**
Cl	EDS	0.03	0.08	0.12
I	EDS	62.17	0.30	72.78
Pb	EDS	37.80	0.30	27.10
Total		100.00		100.00

Table S4 EDX of PVSK with 96 mM KCl (surface).

Element	Signal Type	Wt%	Wt% Sigma	Atomic
Cl	EDS	0.23	0.08	0.95
I	EDS	62.40	0.30	72.47
Pb	EDS	37.37	0.30	26.58
Total		100.00		100.00