

Supplementary Information

Probing the Key Roles of Back-Interface in Performance of Carbon-Based Hole-Transport-Layer Free Perovskite Solar Cells

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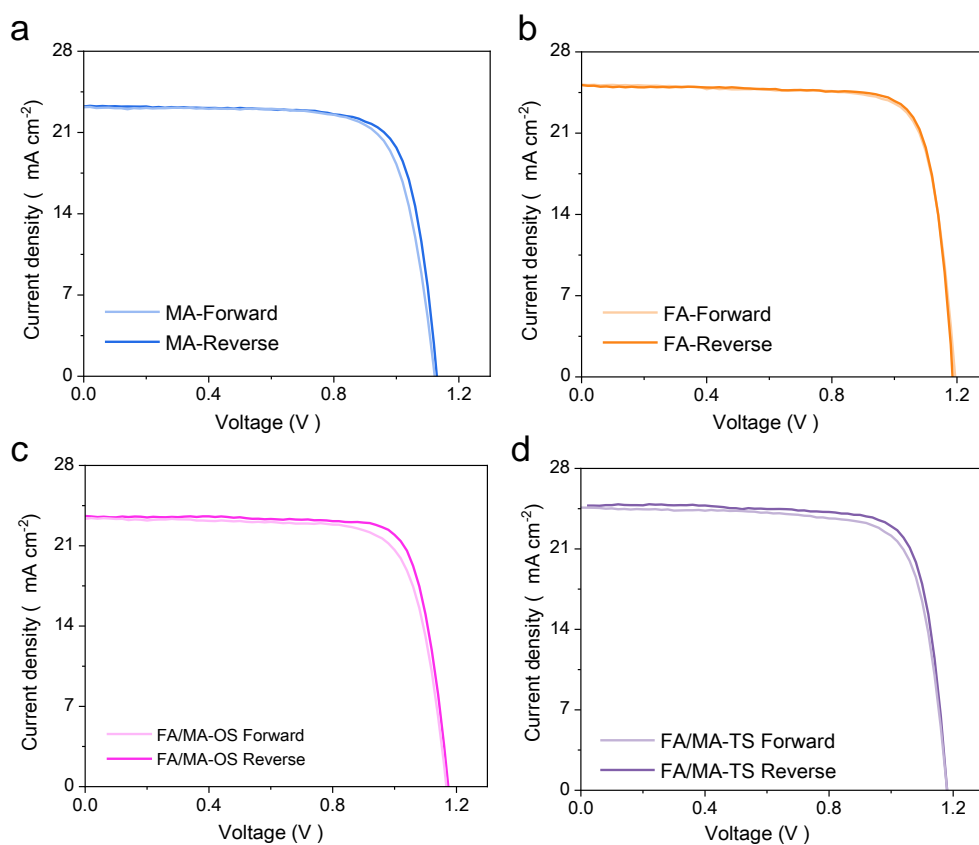


Figure S1. The photocurrent density-voltage curves of MAPbI₃, FAPbI₃, FA/MA-OS, and FA/MA-TS absorbers-based M-PSCs.

Table S1. Photovoltaic parameters of M-PSCs employing various absorbers

Devices	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	PCE (%)	Hysteresis Index (%)
MA-Forward	23.19	1.12	75.21	19.57	2.83
MA- Reverse	23.28	1.12	76.67	20.14	
FA-Forward	25.15	1.19	78.73	23.63	1.04
FA- Reverse	25.13	1.18	80.35	23.88	
FA/MA-OS -Forward	23.36	1.16	76.11	20.71	5.39
FA/MA-OS - Reverse	23.56	1.17	79.34	21.89	
FA/MA-TS-Forward	24.57	1.17	76.23	22.07	3.83
FA/MA-TS- Reverse	24.79	1.17	78.69	22.95	

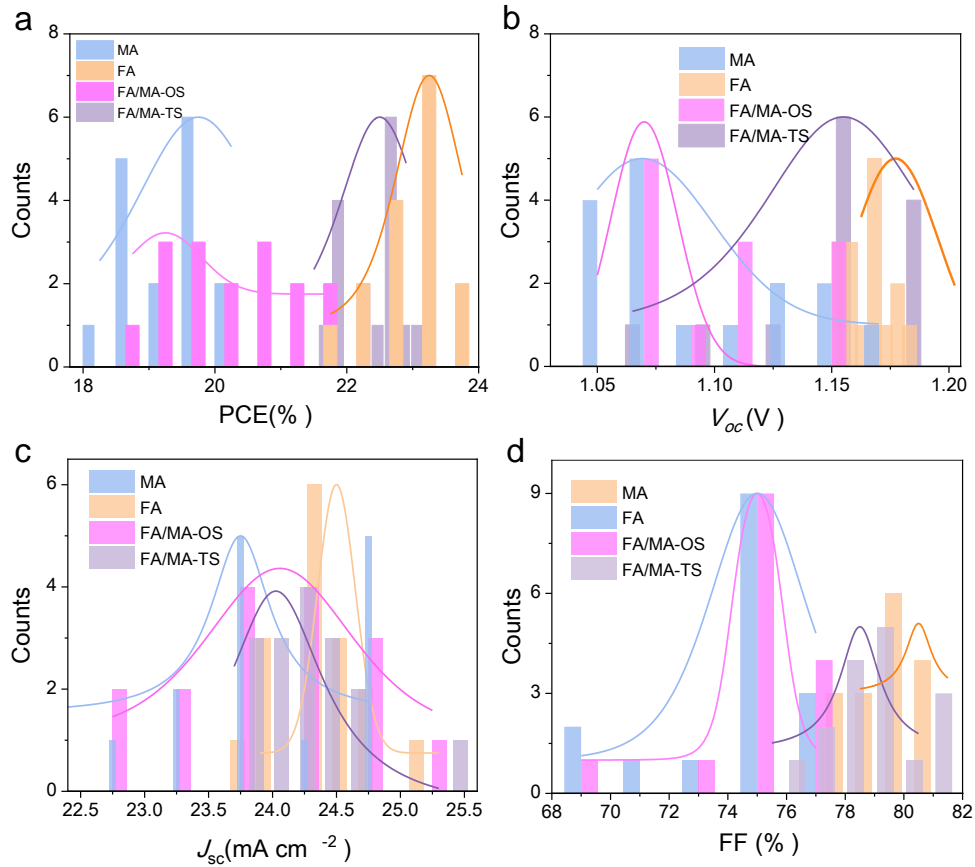


Figure S2. Histograms of PCE, V_{oc} , J_{sc} , and FF values of M-PSCs employing MAPbI₃, FAPbI₃, FA/MA-OS, and FA/MA-TS absorbers.

Table S2. Photovoltaic parameters of C-PSCs employing various absorbers.

Devices	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	PCE (%)	Hysteresis Index (%)
MA-Forward	23.38	0.98	50.30	11.59	24.83
MA- Reverse	23.60	0.99	65.39	15.42	
FA-Forward	17.65	0.95	51.59	8.72	31.71
FA- Reverse	21.78	0.95	61.47	12.77	
FA/MA-OS -Forward	18.30	0.93	39.95	6.82	30.33
FA/MA-OS - Reverse	18.82	0.95	54.52	9.79	
FA/MA-TS-Forward	19.59	0.87	40.15	6.88	34.03
FA/MA-TS- Reverse	19.87	0.92	56.77	10.43	

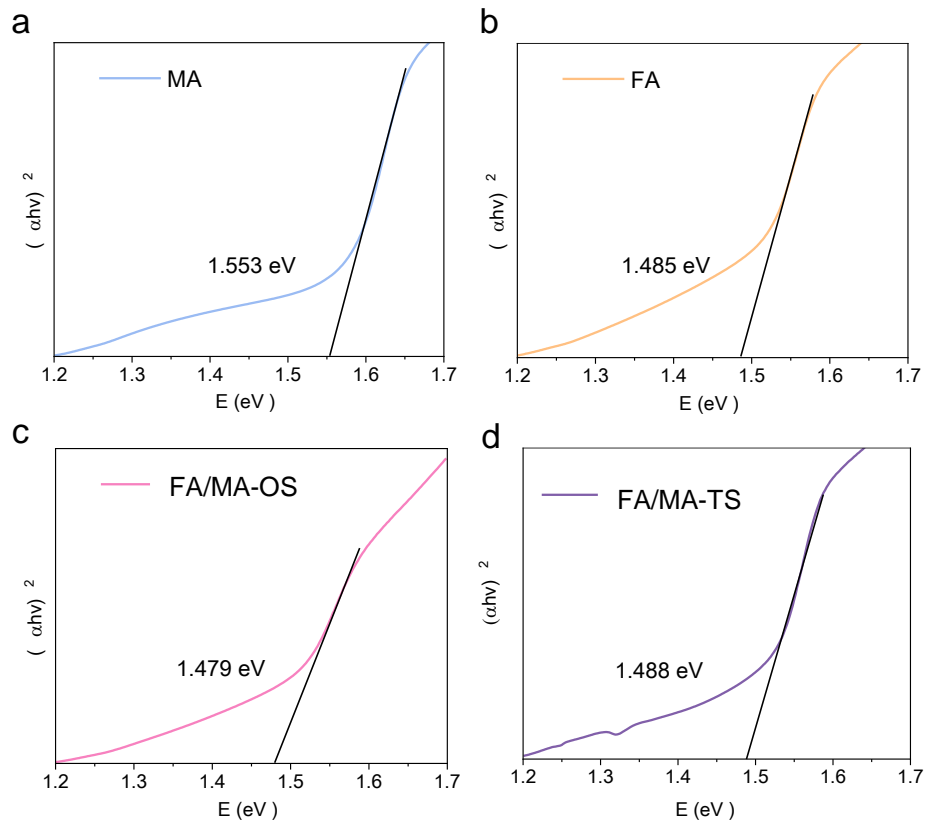


Figure S3. Tauc plots of MAPbI₃, FAPbI₃, FA/MA-OS and FA/MA-TS perovskite films.

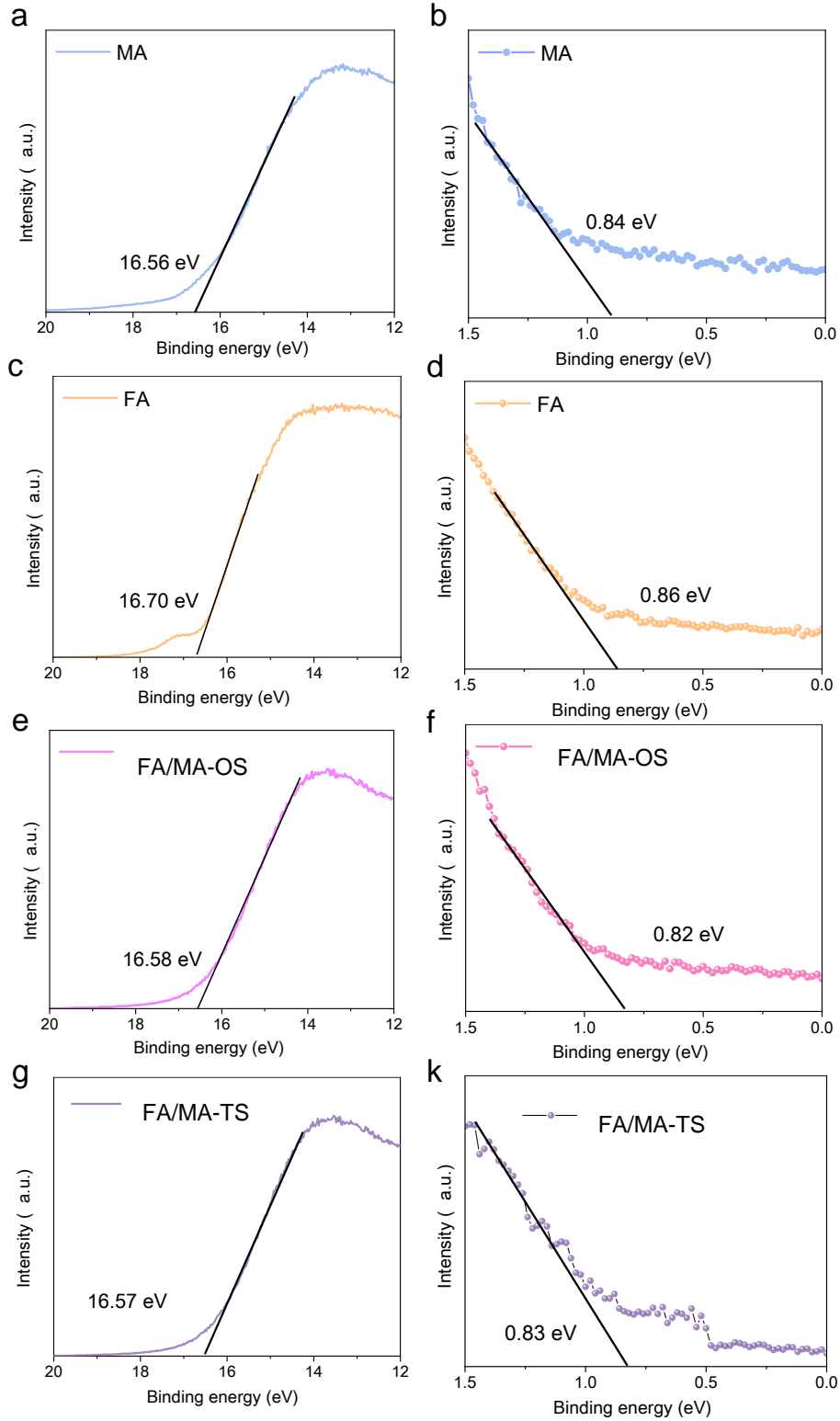


Figure S4. UPS spectra showing the cutoff regions and Fermi edges of (a, b) MAPbI₃, (c, d) FAPbI₃, (e, f) FA/MA-OS, and (g, k) FA/MA-TS perovskite films.

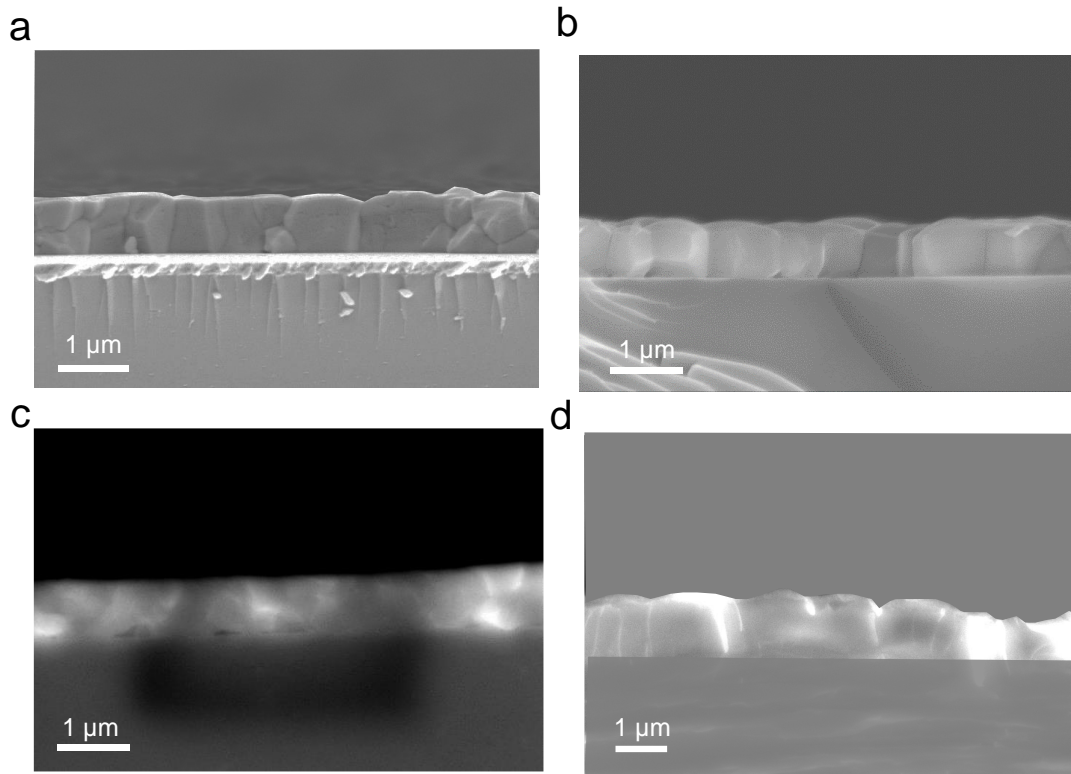


Figure S5. Cross-sectional SEM images of (a) MAPbI₃, (b) FAPbI₃, (c) FA/MA-OS, and (d) FA/MA-TS perovskite films.

Table S3. EIS fitting results for C-PSCs based on four perovskite absorbers.

Devices	R_s (Ω)	R_{ct} (Ω)	R_{rec} (Ω)
MA	1.17	0.40	29.51
FA	1.23	1.24	13.74
FA/MA-OS	1.22	0.52	19.77
FA/MA-TS	1.21	1.69	20.10