

Supplementary Information

High-performance and moisture-stability perovskite solar cells with 2D modified layer via introducing high dipole moment cation

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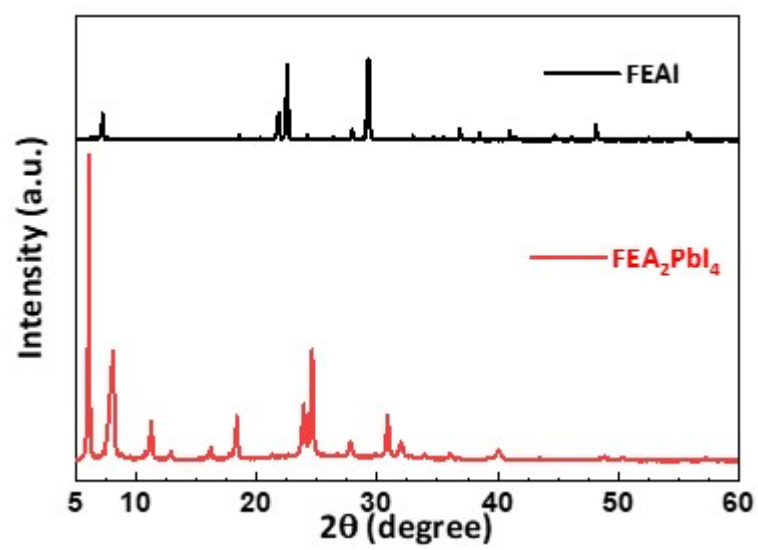


Fig. S1. XRD patterns of FEAi power and $(\text{FEA})_2\text{PbI}_4$ film.

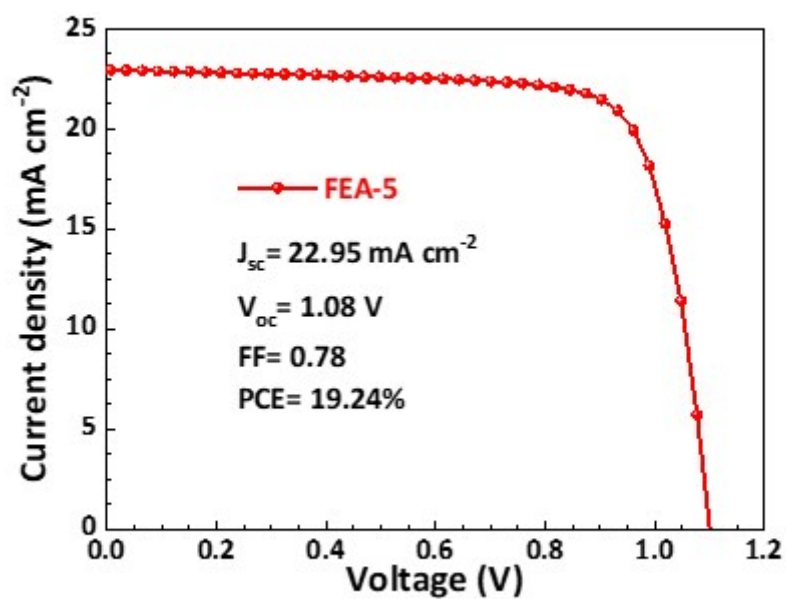


Fig. S2. The current density-voltage (J - V) curve of the best devices modified with FEAI (5mg mL⁻¹).

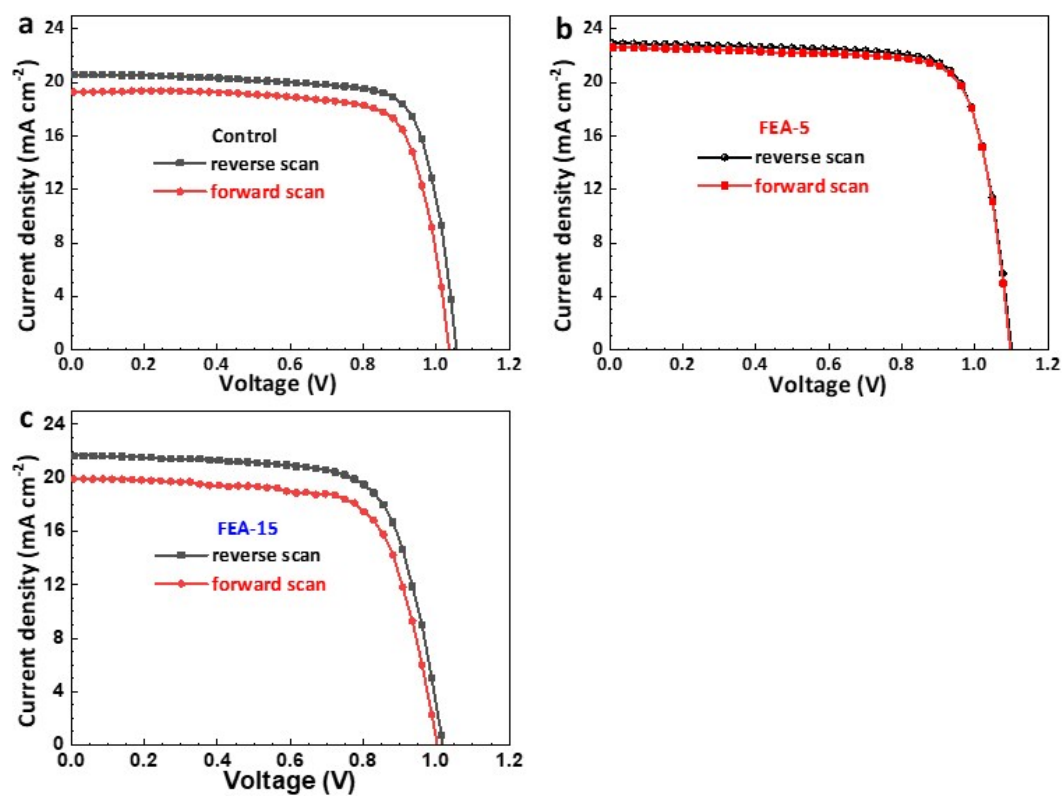


Fig. S3. The J - V curve of different devices (a) control, (b) FEA-5, (c) FEA-15 from reverse scan and forward scan.

Table S1. The R_{ct} and R_{rec} of the devices modified with different concentrations of FEAL.

Concentration	R_{ct}	R_{rec}
(mg mL⁻¹)	(KΩ)	(KΩ)
FEA-0 (Control)	4.029	7.795
FEA-5	2.876	9.499

Table S2. The corresponding photovoltaic parameters of devices modified with different concentrations of FEAL.

Concentration	V_{oc}	J_{sc}	FF	PCE
(mg mL⁻¹)	(V)	(mA cm⁻²)	(%)	(%)
FEA-0 (Control)	1.05	20.49	0.77	16.74
FEA-5	1.08	22.65	0.78	19.24
FEA-15	1.06	21.50	0.73	17.40

Table S3. The integrated current density of the control devices and devices modified with FEAI.

Concentration	J_{sc}
(mg mL⁻¹)	(mA cm⁻²)
FEA-0 (Control)	20.93
FEA-5	21.51
FEA-15	20.01

Table S4. The thickness of perovskite absorber layer for control and the modified film.

Concentration	Thickness
(mg mL⁻¹)	(nm)
FEA-0 (Control)	511.4
FEA-5	599.8

Table S5. Photovoltaic parameters of the PSCs (0.09 cm² aperture) under 1 sun simulated irradiation.

Concentration	Scan	V_{oc}	J_{sc}	FF	PCE
(mg mL⁻¹)	direction	(V)	(mA cm⁻²)	(%)	(%)
FEA-0 (Control)	Reverse	1.05	20.49	0.77	16.74
	Forward	1.03	19.68	0.76	15.56
FEA-5	Reverse	1.08	22.65	0.78	19.24
	Forward	1.04	22.43	0.75	18.49
FEA-15	Reverse	1.06	21.50	0.73	17.40
	Forward	1.01	19.91	0.70	15.60