

Interface Modification by Multifunctional Ammonium Salt toward High
Performance and Stability Planar Perovskite Solar Cells

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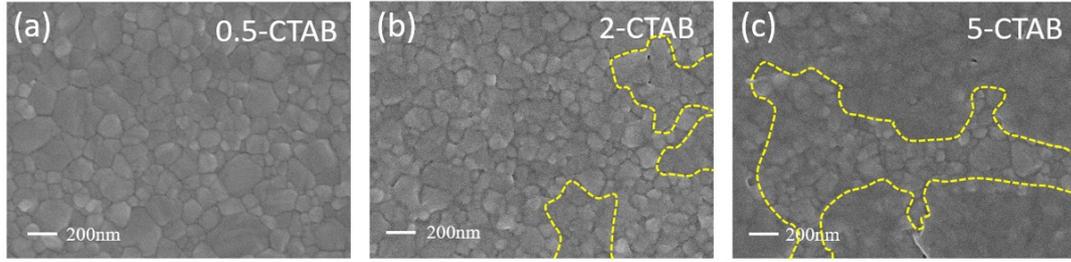


Fig. S1 Top-surface SEM images of the samples, (a) 0.5-CTAB, (b) 2-CTAB and (c) 5-CTAB.

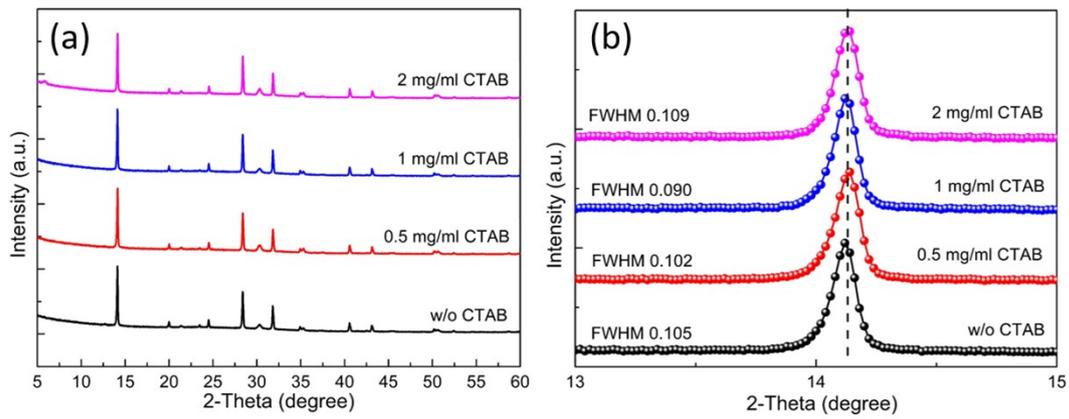


Fig. S2 (a) XRD patterns of the MAPbI₃ film and the films with CTAB. (b) Magnified spectra from 13 to 16° (FWHM is the full width at half maximum).

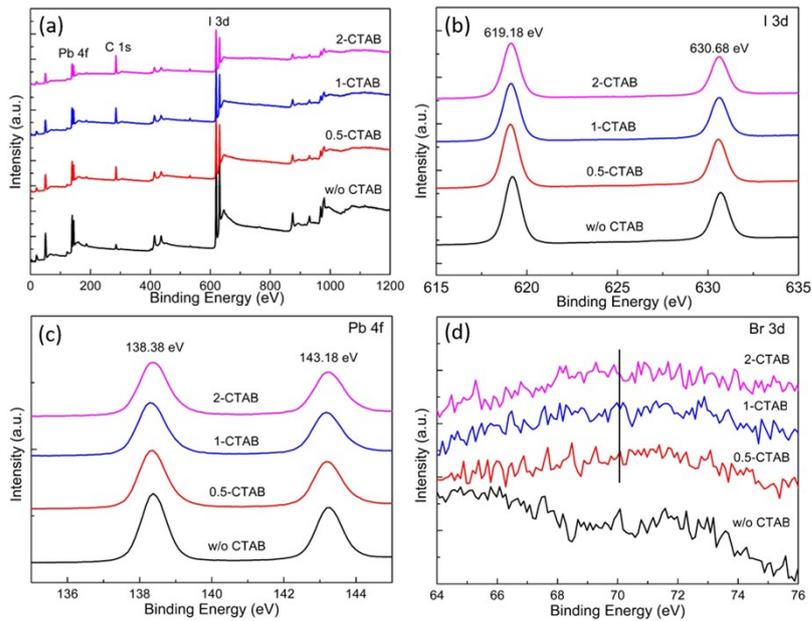


Fig. S3 XPS spectra of the MAPbI₃ film and the films with CTAB.

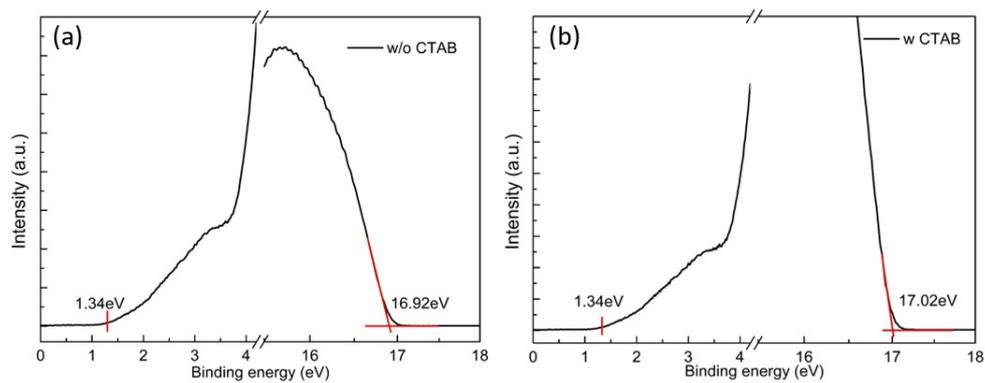


Fig. S4 UPS spectra of (a) the MAPbI₃ film and (b) the films with 1 mg/ml CTAB.

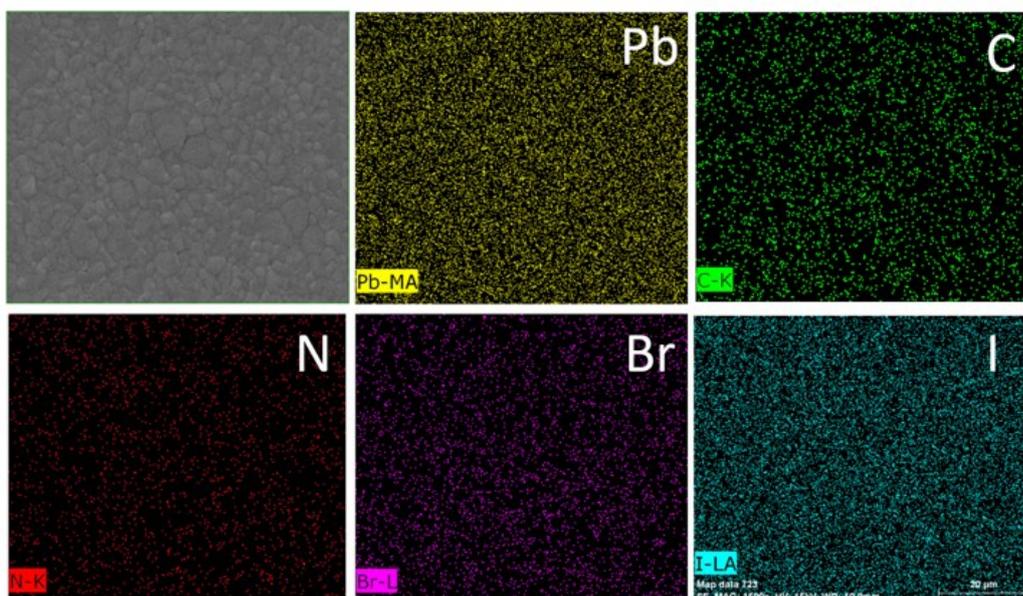


Fig. S5 EDX maps for Pb, C, N, Br and I of the CTAB-device.

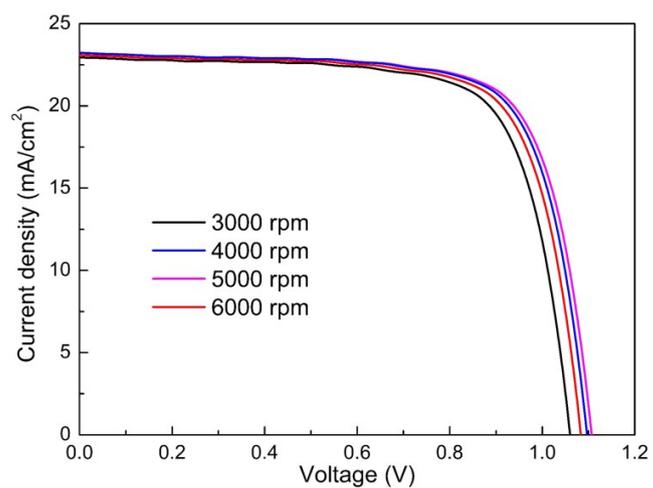


Fig. S6 J-V characteristics of the CTAB-device treated with different rotation speed.

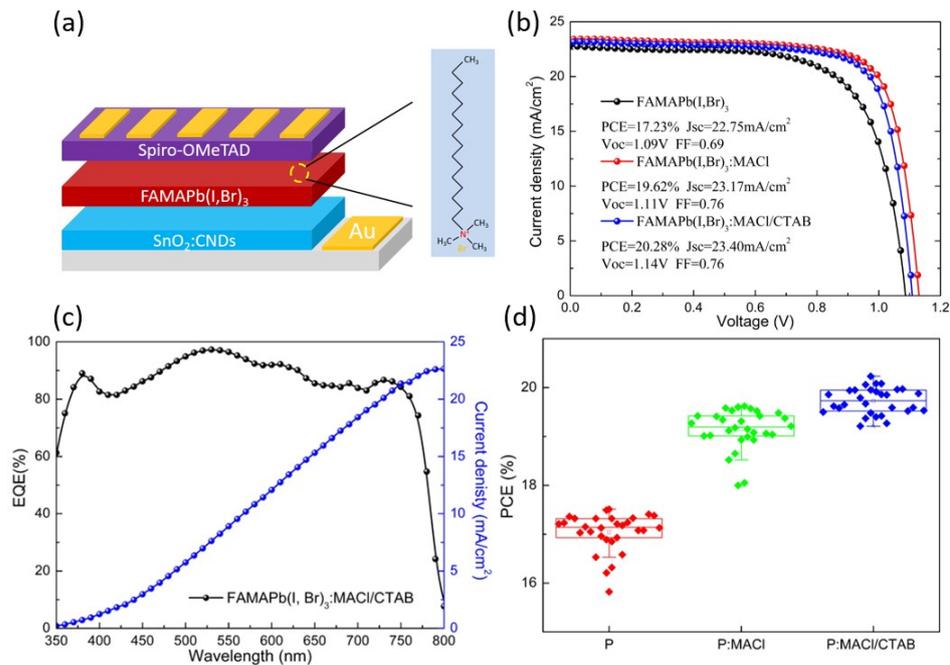


Fig. S7 (a) Schematic illustration of the device structure, (b) J-V curves obtained from the best devices with and without CTAB treatment, (c) The corresponding EQE spectrum and integral current density, (d) Statistics of the PCE distribution.

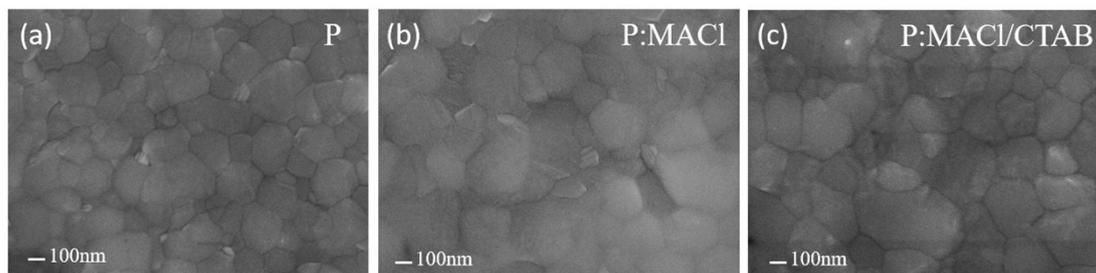


Fig. S8 Top-surface SEM images of the samples, (a) FA_{0.95}MA_{0.05}Pb(I,Br)₃ (P), (b) P doped with MACI (P:MACI), (c) P:MACI treated with CTAB (P:MACI/CTAB).

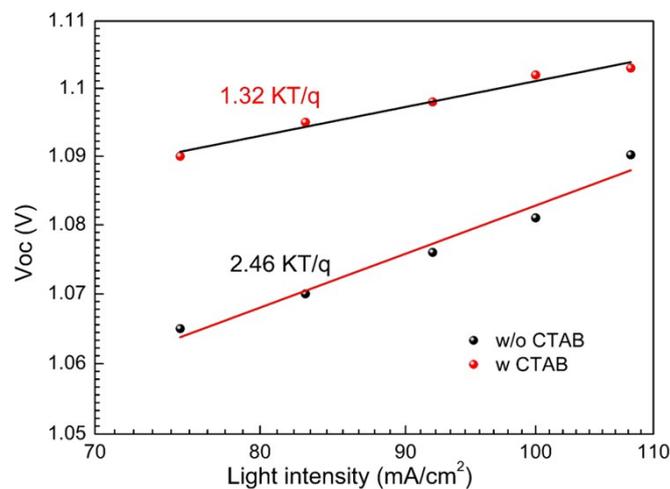


Fig. S9 V_{oc} dependence on light intensity.

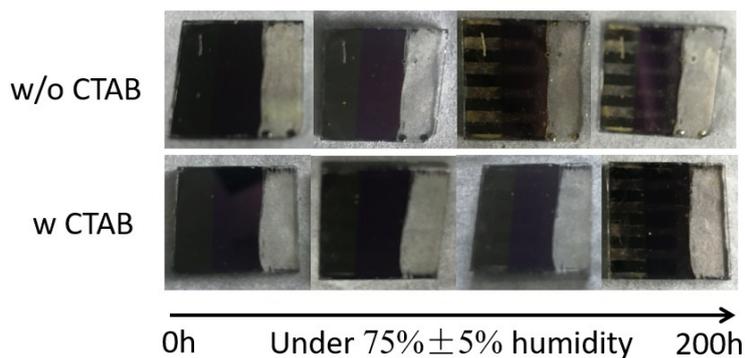


Fig. S10 Images of the PSCs with or without CTAB tested in different humidity for 200h, respectively.

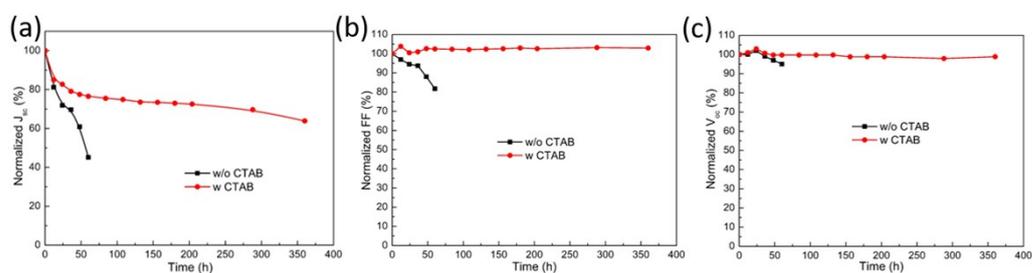


Fig. S11 The J_{sc} , V_{oc} and FF of the devices tested at 10-20 °C under 70-80% relative humidity (RH) without any encapsulation.

Table S1. The atom content of Pb, C, N, Br and I on the surface of the CTAB-film

Element	Atom %	Atom % error
C	30.20	0.94
N	19.80	0.94
I	35.77	1.18
Pb	12.97	0.86
Br	1.27	0.12

Table S2. The fitted parameters of TRPL decay curves for perovskite films

	τ_1 (ns)	A1	τ_2 (ns)	A2
w/o CTAB	13.01	0.68	62.73	0.32
w CTAB	66.49	0.81	121.00	0.21

Table S3. The results of impedance spectroscopy measurements for perovskite films

	R_s (Ω)	R_{tr} (Ω)	R_{rec} (Ω)
w/o CTAB	47.3	22.2	250.3
w CTAB	37.6	3.6	408.2