Supplementary information

Inhibition PbI_2-induced defects by doping MABr for high-performance perovskite solar cells

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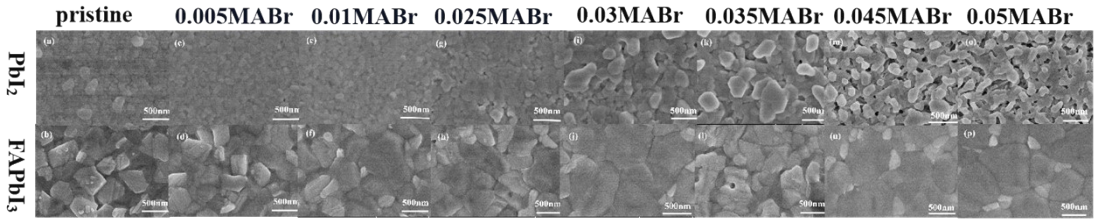
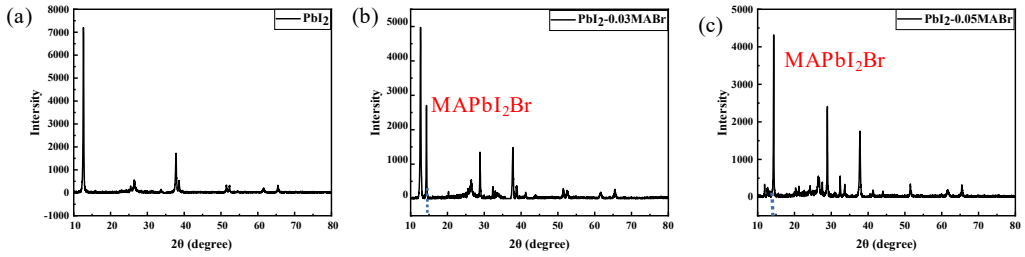
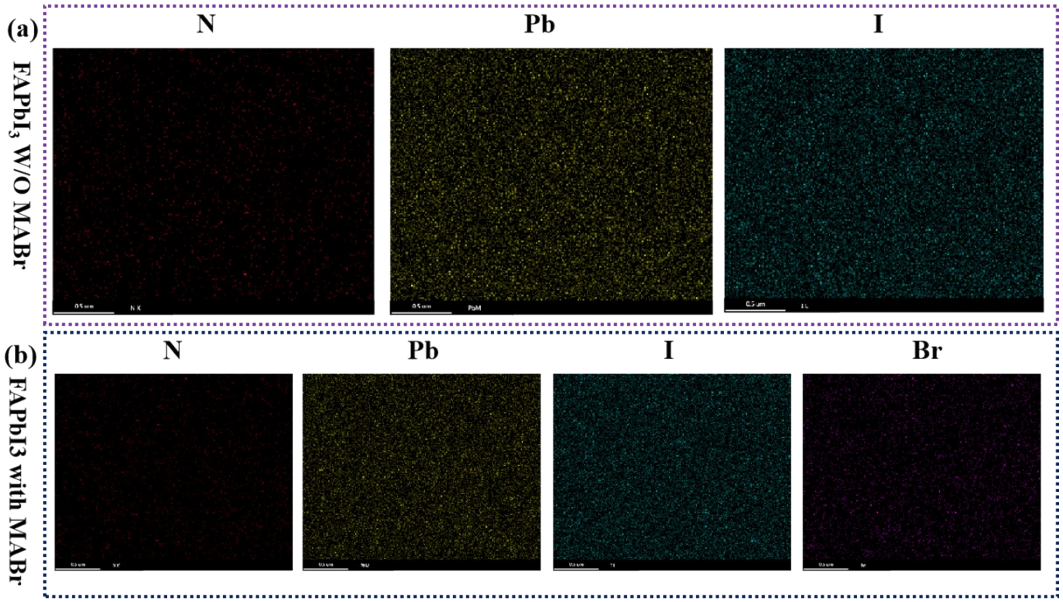


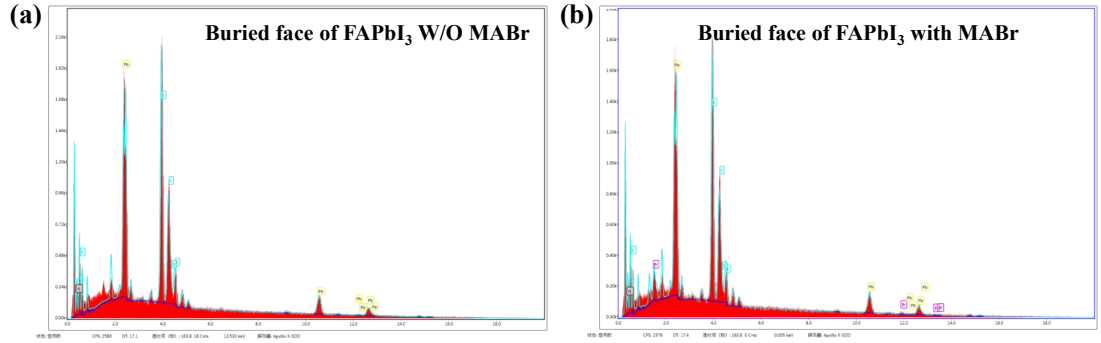
Supplementary Fig. 1. (a), (c), (e), (g), (i), (k), (m), (o) shows the SEM images of PbI_2 with MABr = 0, 0.005, 0.01, 0.025, 0.03, 0.035, 0.045, 0.05; whereas Fig. 1 (b), (d), (f), (h), (j), (l), (n), (p) shows the SEM images of corresponding $FAPbI_3$.



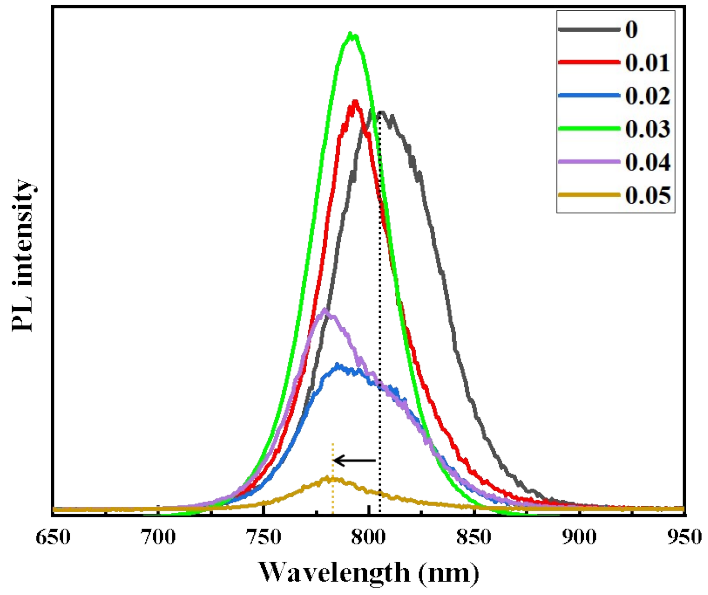
Supplementary Fig. 2. XRD patterns of (a) PbI_2; (b) PbI_2-0.03MABr; (c) PbI_2-0.05MABr.



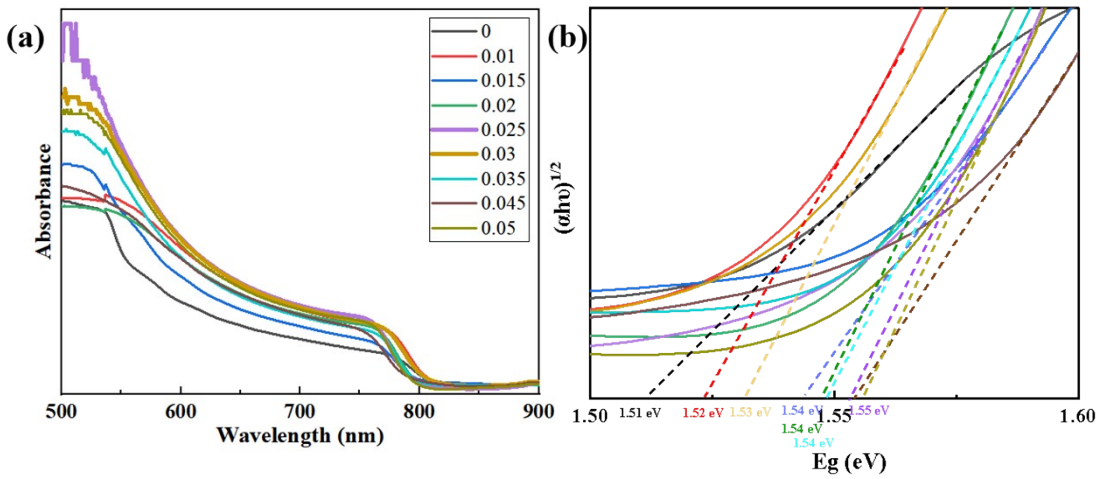
Supplementary Fig. 3. The elements distribution diagram of the $FAPbI_3$ buried face without MABr (a) and with MABr (b).



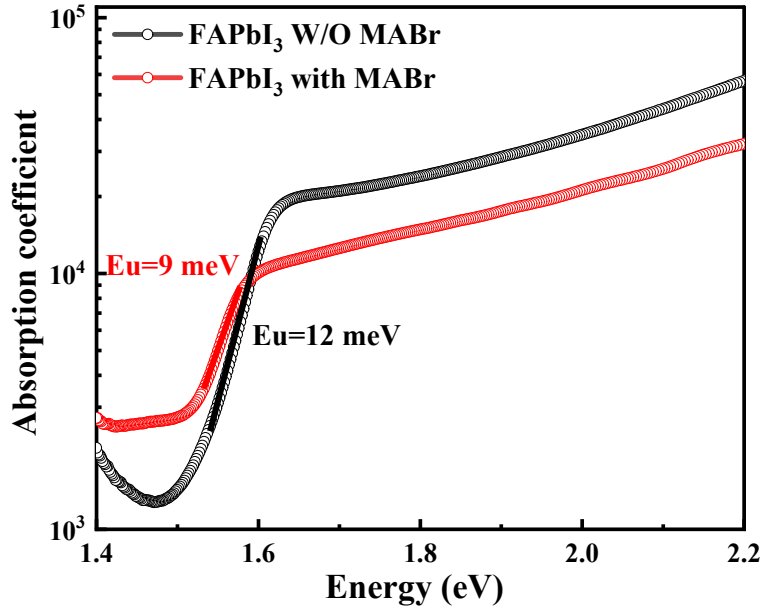
Supplementary Fig. 4. The full elements distribution spectrum of the buried face of $FAPbI_3$ (a) without and (b) with MABr.



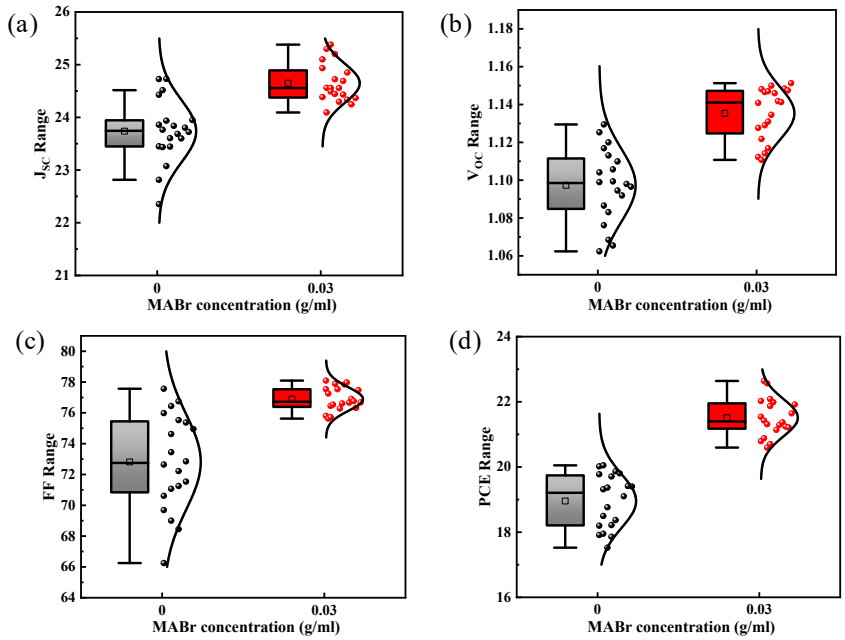
Supplementary Fig. 5. PL spectrum for $FAPbI_3$ samples with MABr from 0 to 0.05 g/ml.



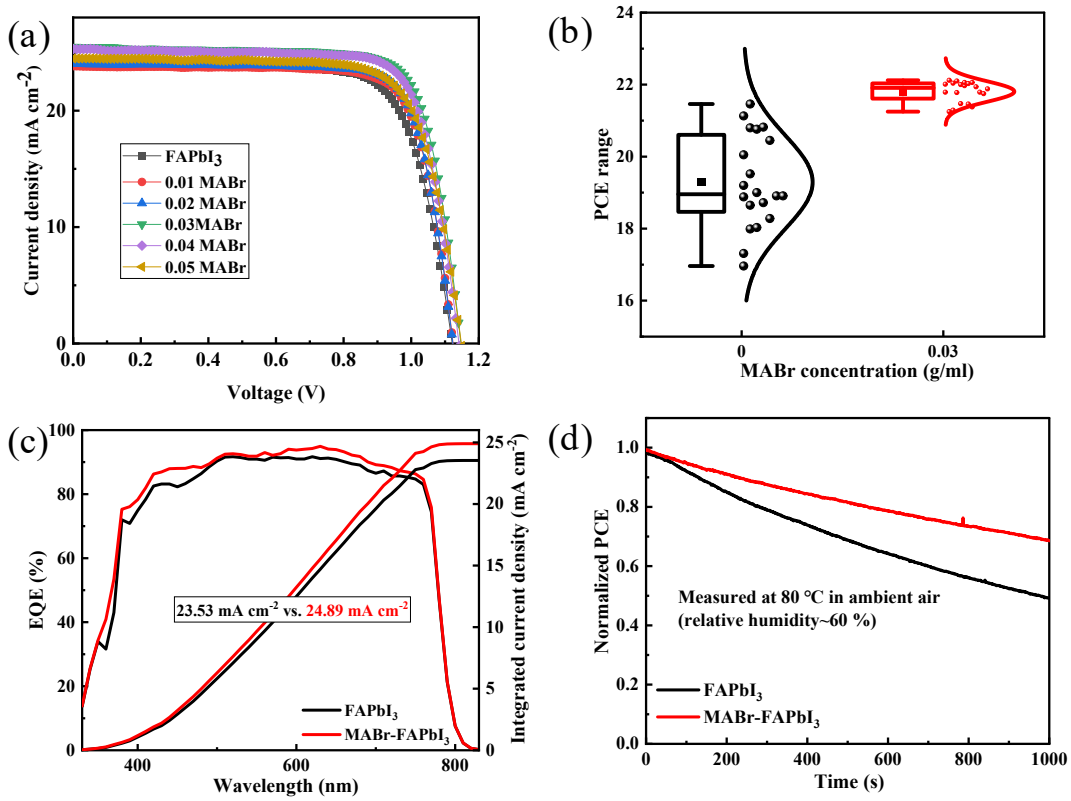
Supplementary Fig. 6. (a) Absorption spectra of as-prepared films with increasing MABr from 0 to 0.05g/ml; (b) the band gaps of these corresponding films.



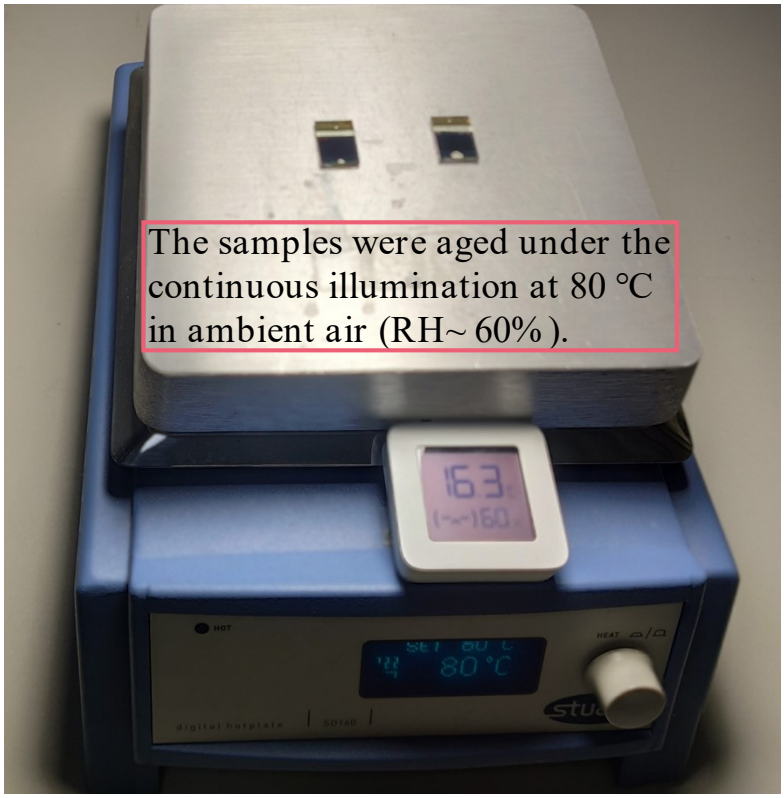
Supplementary Fig. 7. The Urbach tail energy from the Tauc plot of $FAPbI_3$ without (Black line) and with (Red line) MABr.



Supplementary Fig. 8. Statistical plot of $FAPbI_3$ with MABr = 0, 0.03g/ml: (a) J_{sc}; (b) V_{oc}; (c) *FF*; (d) PCE.



Supplementary Fig. 9. (a) Current-Voltage curves of $FAPbI_3$ under different doping concentration of MABr = 0, 0.01, 0.02, 0.03, 0.04, 0.05g/ml; (b) statistical plot of $FAPbI_3$ with MABr = 0, 0.03g/ml; (c) IPCE spectra obtained for the devices with and without MABr; (d) the device performance test at 80 ℃ in ambient air (relatively humidity of 60) for 1000 seconds.



Supplementary Fig. 10. Stability test at 80 ℃ in ambient air (relatively humidity of 60 %) for 1000 seconds

Table S1 Performance parameters of PSCs with various MABr concentration.

MABr concentration	J_{SC} (mA cm^{-2})	V_{OC} (V)	FF (%)	PCE (%)
0	23.95	1.12	74.95	20.05
0.01	23.76	1.12	77.11	20.51
0.02	23.98	1.12	78.58	21.11
0.03	25.30	1.15	77.84	22.64
0.04	25.14	1.14	77.38	22.23
0.05	24.45	1.15	75.01	21.08

Table S2. Fitted EIS parameters for the PSCs based on pristine $FAPbI_3$ and MABr modified $FAPbI_3$ ETLS.

ETL	R_s	R_{tr}	C_{tr}	R_{rec}	C_{rec}
$FAPbI_3$	9.8	58.28	$1.3*10^{-7}$	49.4	$1.1*10^{-7}$
MABr-$FAPbI_3$	7.1	9.8	$1.1*10^{-6}$	58.3	$2.4*10^{-7}$