## **Electronic Supplementary Information**

## Identification and Characterization of New Intermediate to Obtain High Quality Perovskite Films with Hydrogen Halides as Additives

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Figure S1 Cross-sectional SEM images of perovskite films fabricated with different

additives deposited on the FTO glass. (a) blank, (b) HCl, (c) HBr, (d) HI.



**Figure S2** The EDX of perovskite films fabricated from different precursor solution (a) MAI+PbI<sub>2</sub>+DMF+HCl; (b) MAI+PbI<sub>2</sub>+DMF+HBr.





**Figure S3** SEM images of perovskite films from different precursor solution with adding different amount additives.