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Supporting Information

Understanding Effects of Precursor Solution Aging in Triple Cation Lead Perovskite

Passarut Boonmongkolras[a], Daehan Kim[a], Esra M. Alhabshi[b], Issam Gereige[b], Byungha Shin[a*]

[a] Department of Material Science and Engineering, Korea Advanced Institute of Technology, Daejeon 34141, Korea
[b] Saudi Aramco Research & Development Center, Dhahran 31311, Kingdom of Saudi Arabia

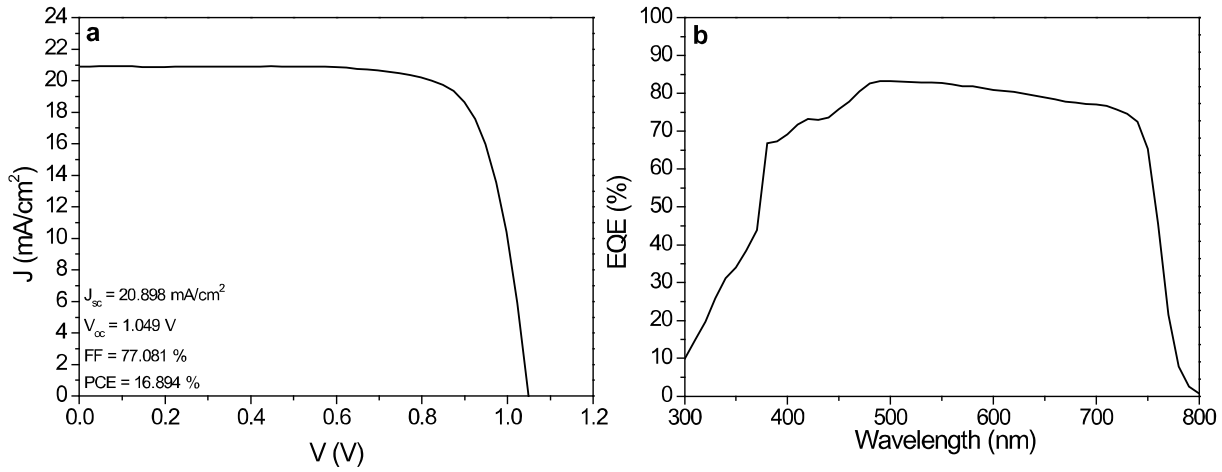

Figure S1: Device performance (a) JV curve and (b) EQE of the best performing cell.

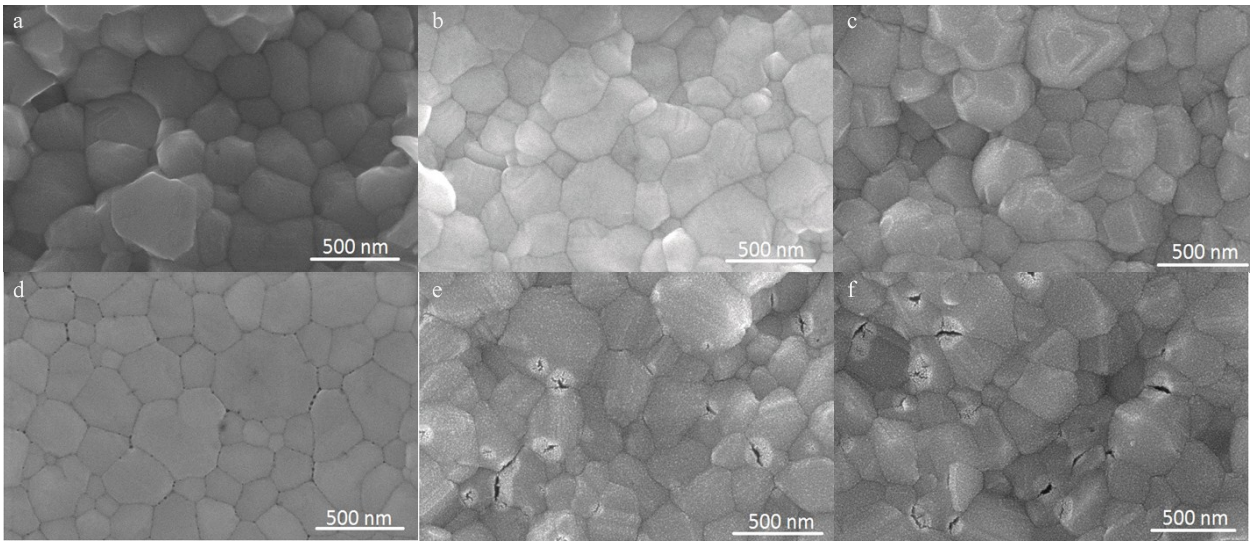

Figure S2: SEM images of the films fabricated from different triple cation lead halide perovskite solution where (a) – (f) are 2, 6, 24, 72, 168, and 720 hr, respectively.

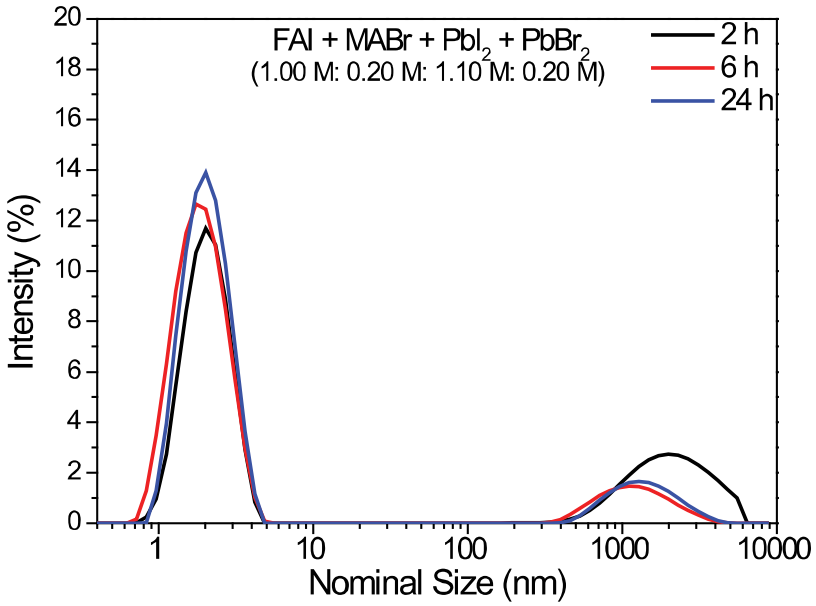

Figure S3: DLS data of the precursor solution containing FAI + MABr + PbI_2 + $PbBr_2$ with respect to its aging time.

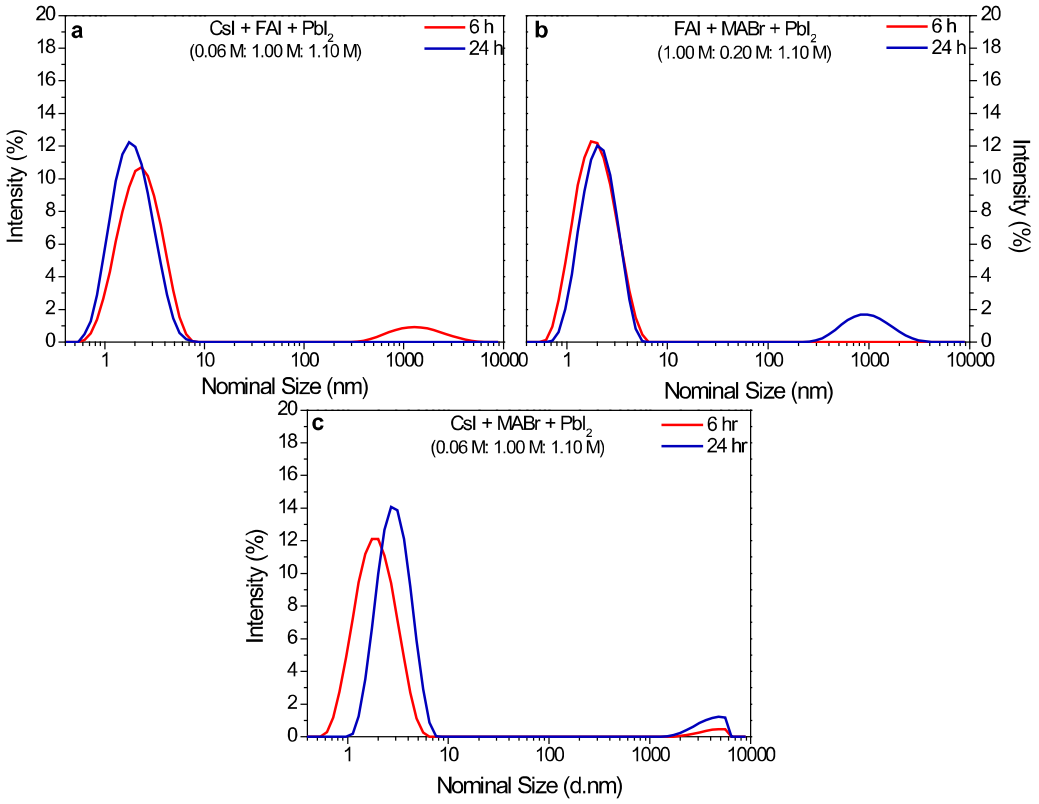

Figure S4: DLS data of the precursor solution containing (a) CsI + FAI + PbI_2, (b) FAI + MABr + PbI_2, and (c) CsI + MABr + PbI_2 with respect to its aging time.

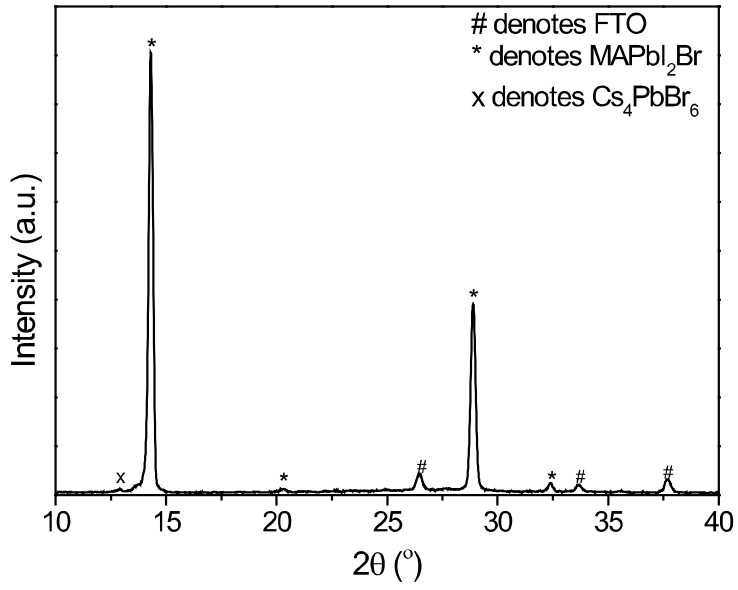

Figure S5: XRD pattern of $MAPbI_2Br$ perovskite film with addition of CsI. The amount of CsI added was equal to the amount added in triple cation precursor solution.

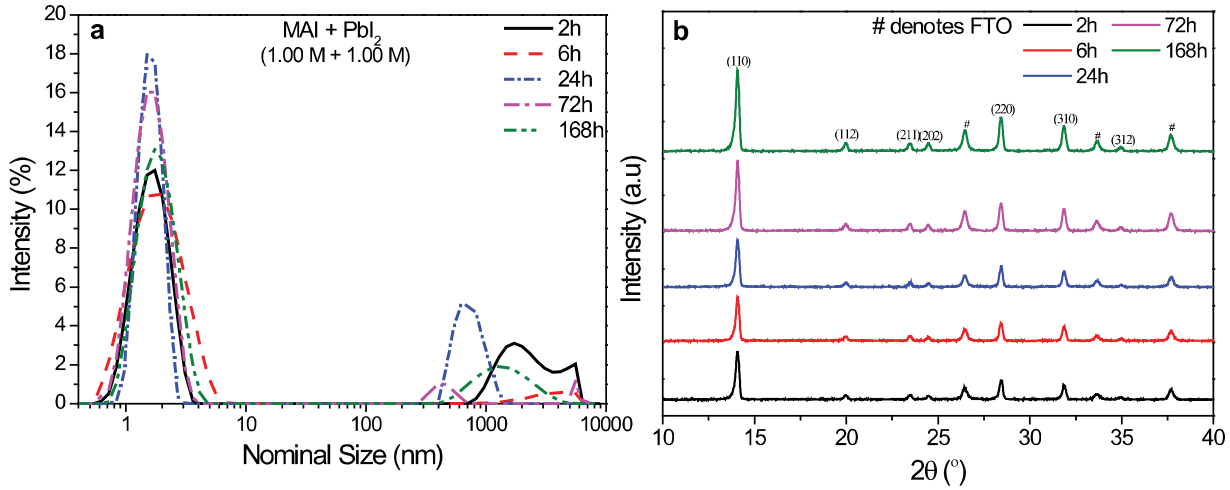

Figure S6: (a) DLS and (b) XRD data of $MAPbI_3$ with respect to its perovskite precursor solution aging time.

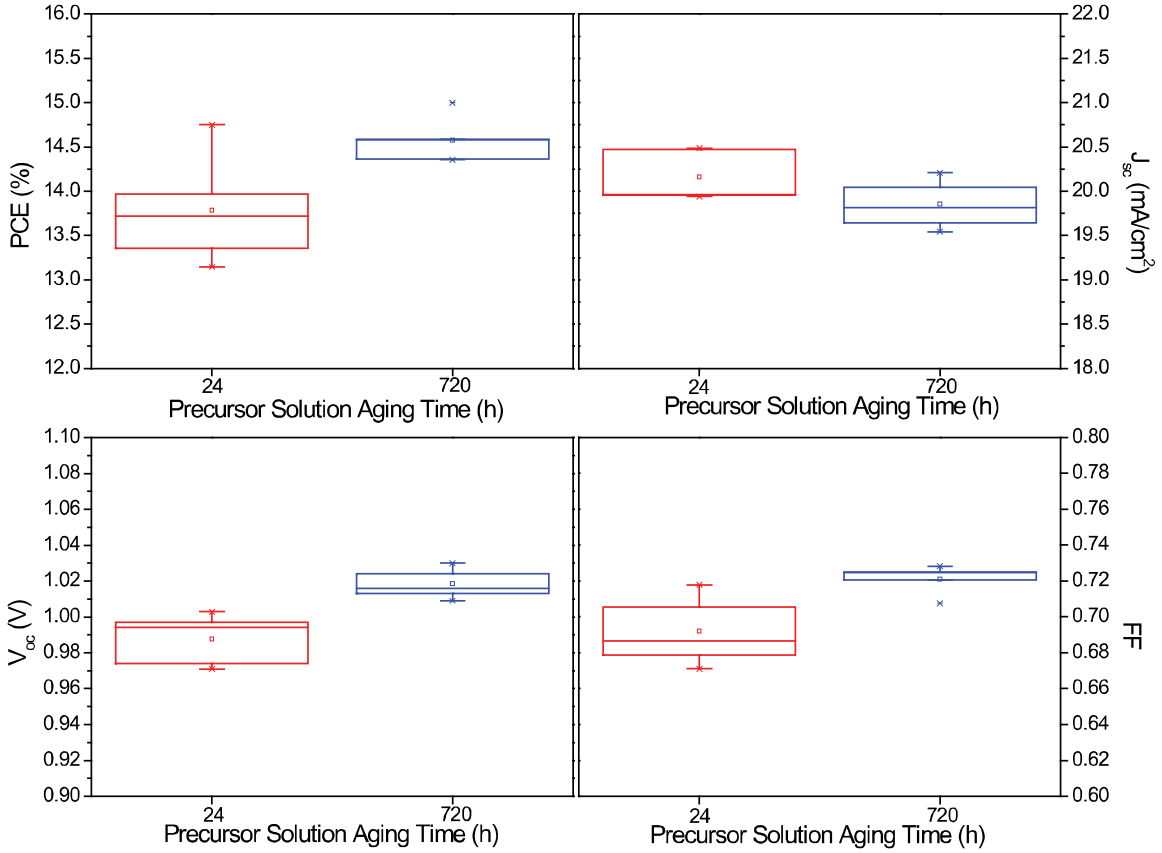

Figure S7: Device distribution of $MAPbI_3$ perovskite with different precursor solution aging time.

Input Precursors	Cation: Lead: Halide Molar Ratio (A: B: X Molar Ratio)	6 h	24 h	72 h or more
FAI + PbI_2 + MABr + $PbBr_2$ + CsI (Triple-cation Lead Halide)	1.26: 1.30: 3.86	X	O	O
FAI + PbI_2 + MABr + $PbBr_2$	1.20: 1.30: 3.80	O	O	O
FAI + $PbBr_2$	1.00: 1.10: 3.20	O	O	O
MABr + $PbBr_2$	1.00: 1.10: 3.20	X	O	O
FAI + PbI_2	1.00: 1.10: 3.20	O	O	O
MABr + PbI_2	1.00: 1.10: 3.20	X	O	O
CsI + FAI + PbI_2	1.06: 1.10: 3.26	O	X	O
MABr + FAI + PbI_2	1.20: 1.10: 3.40	X	O	O

Table 1: Summary of DLS experiments with different combinations of the precursors. The label "O" indicates the existence of the large aggregates within the precursor solution and "X" indicates no large aggregates.