Supporting Information

Improving Thermal Stability of Perovskite Solar Cells by Thermoplastic Additive Engineering

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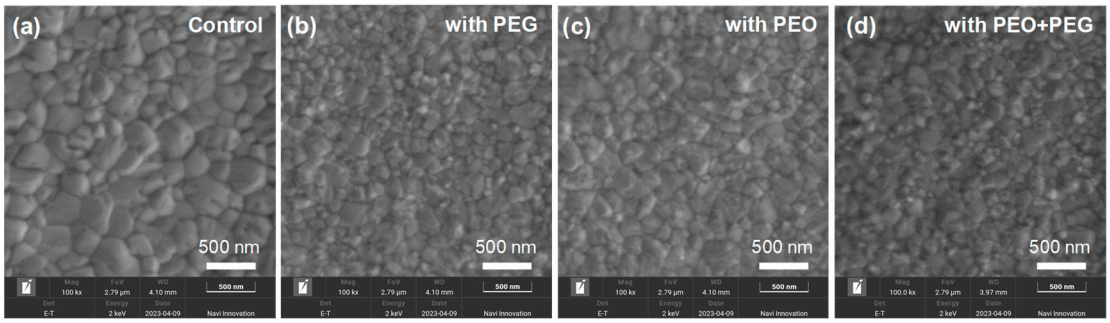

Figure S1. SEM images of (a) the control $MAPbI_3$ perovskite film, (b) PEG treated $MAPbI_3$ perovskite film, (c) PEO treated $MAPbI_3$ perovskite film and (d) PEO+PEG treated $MAPbI_3$ perovskite films. Scale bar: 500 nm.

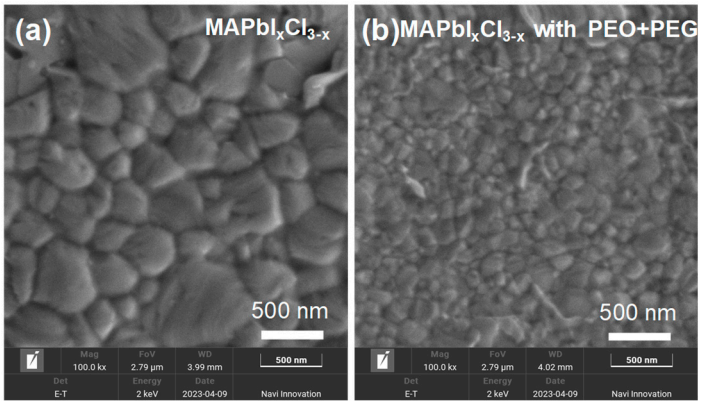

Figure S2. SEM images of (a) $MAPbI_xCl_{3-x}$ perovskite film (a) without and (b) with PEO+PEG treatment. $MAPbI_xCl_{3-x}$ perovskite film was prepared by two step method, similar to the fabrication of $MAPbI_3$ perovskites, and MAI was partially replaced by MACl with a concentration of 5 mg/mL.

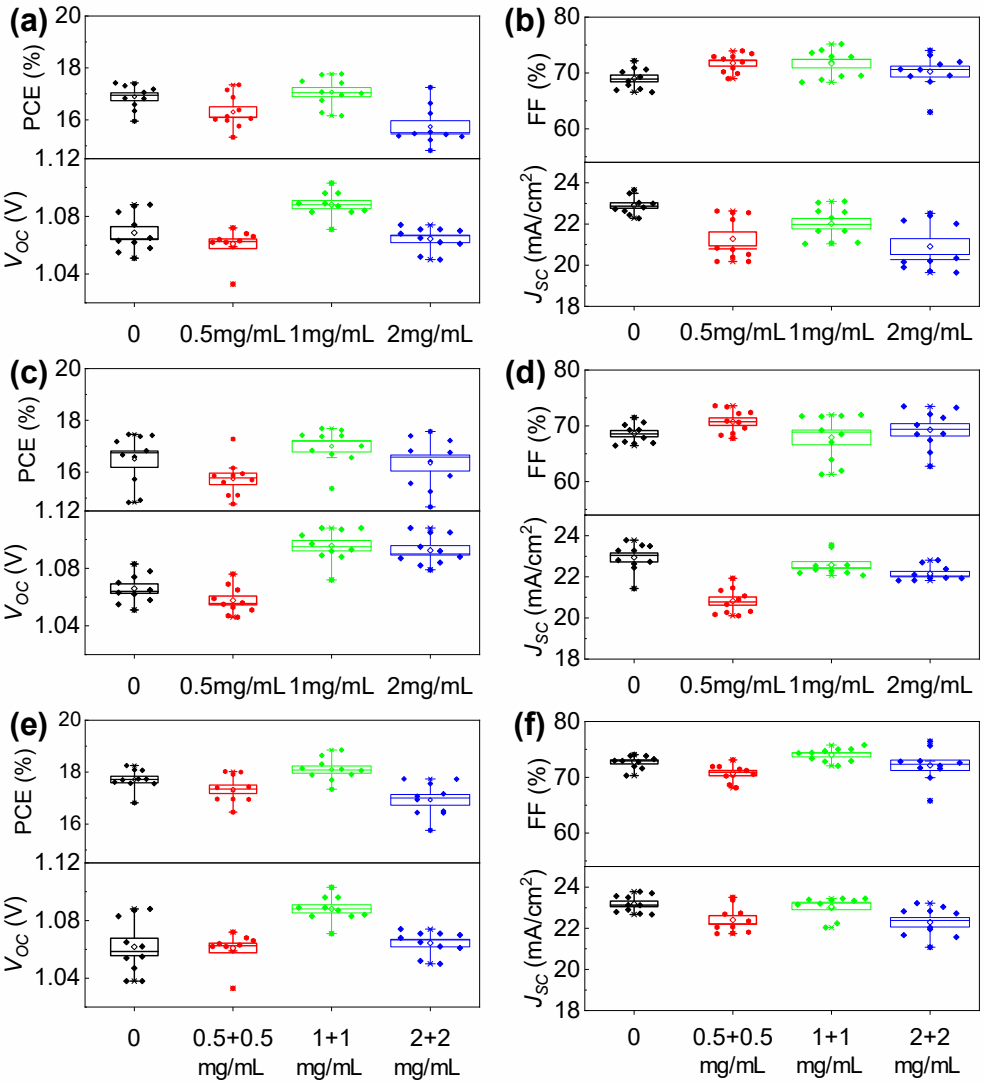

Figure S3. Statistical distribution of (a) PCE and V_{OC} and (b) FF and J_{SC} of the PSCs with different concentrations of PEG (0, 0.5, 1, and 2 mg/mL), (c) PCE and V_{OC} and (d) FF and J_{SC} of the PSCs with different concentrations of PEO (0, 0.5, 1, and 2 mg/mL), (e) PCE and V_{OC} and (f) FF and J_{SC} of the PSCs with different concentrations of PEO+PEG (0, 0.5+0.5, 1+1, and 2+2 mg/mL).

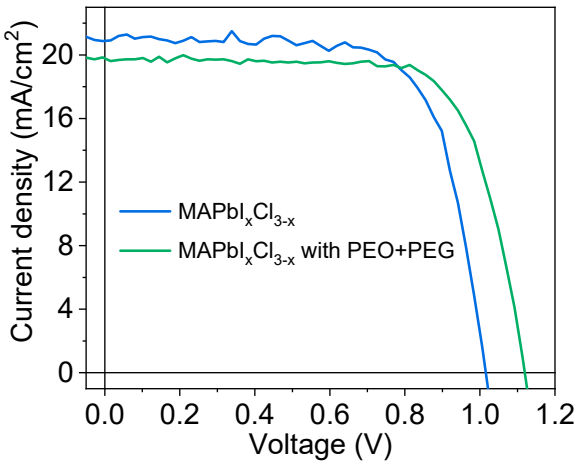

Figure S4. *J-V* curves of the PSCs based on $MAPbI_xCl_{3-x}$ before and after PEO+PEG treatment.

Table S1. Photovoltaic parameters of the $MAPbI_xCl_{3-x}$ PSCs without and with PEO+PEG treatment.

Devices	V_{OC} (V)	J_{SC} (mA/cm^2)	FF	PCE (%)
$MAPbI_xCl_{3-x}$	1.021	22.91	0.70	15.11
$MAPbI_xCl_{3-x}$ with PEO+PEG	1.120	19.61	0.69	15.21