

## **Supporting Information**

### **Surface Passivation of Perovskite Films via Iodide Salt Coatings for Enhanced Stability of Organic Lead Halide Perovskite Solar Cells**

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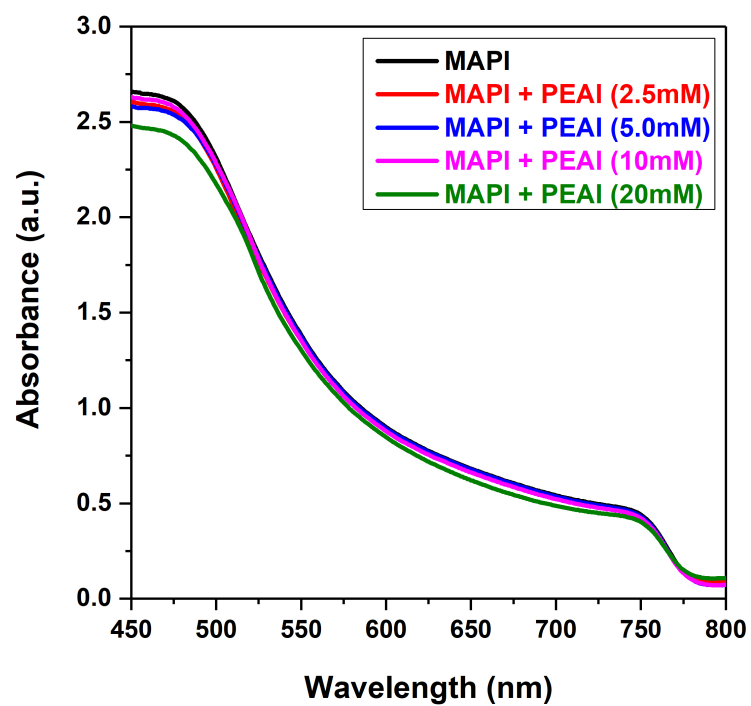


**Figure S1:** UV-VIS absorbance data collected from methylammonium lead iodide films coated with various concentrations of phenylethylammonium iodide ( $\text{PhEtNH}_3\text{I}$ ) of 2.5 mM (red), 5.0 mM (blue), 10 mM (magenta) and 20 mM (green).

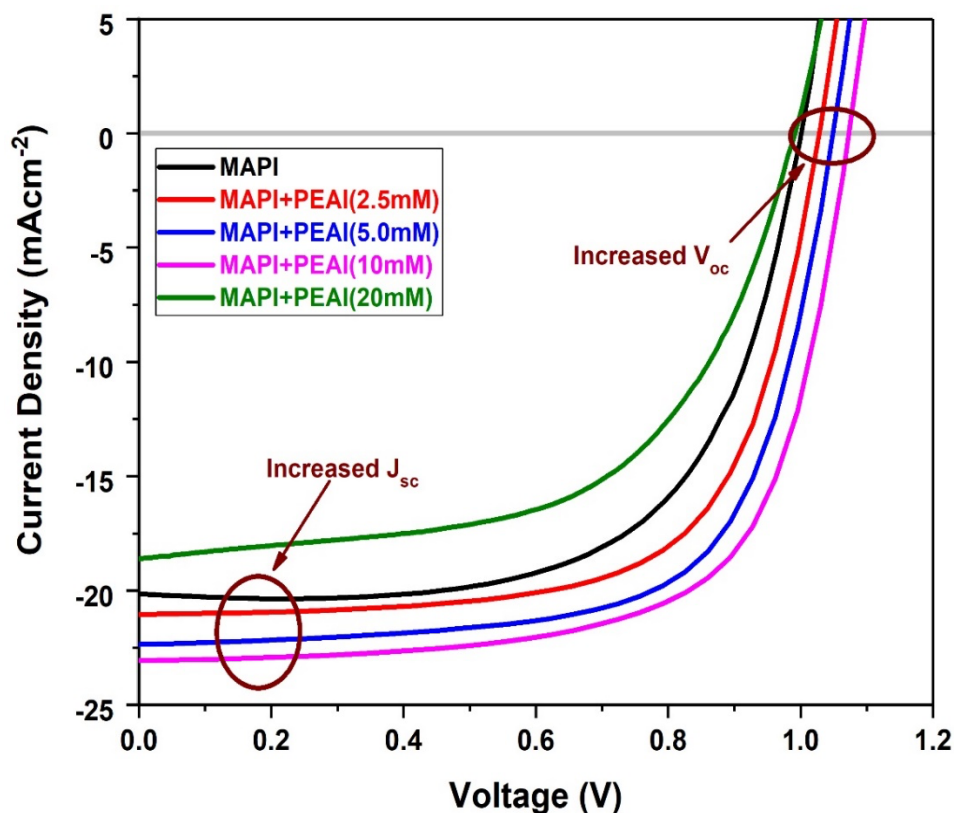


**Figure S2:** The current-voltage measurement of initial performances of devices without and with various concentrations of PhEtNH<sub>3</sub>I coating. The architecture is FTO/compact-TiO<sub>2</sub>/mesoporous-TiO<sub>2</sub>/perovskite (salt)/spiro-OMeTAD/Au. Devices were measured with xenon lamp Am1.5 simulated solar spectrum with a scan rate of 0.125 V/s. The initial device is held at open circuit conditions for 60 seconds to stabilise and scanned from 0 V to 1.2 V.

**Table S1:** Device performance parameters of initial performance for devices based on varies concentration of PhEtNH<sub>3</sub>I (PEAI) coated on CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite films. (FB-SC stands for reverse scan and SC-FB stands for forward scan)

| Device Type   | Pixel Area (cm <sup>2</sup> ) | Scan Direction | V <sub>oc</sub> (V) | J <sub>sc</sub> (mAcm <sup>-2</sup> ) | FF   | PCE (%) |
|---------------|-------------------------------|----------------|---------------------|---------------------------------------|------|---------|
| MAPI (Ref.)   | 0.12                          | FB-SC          | 1.00                | 20.16                                 | 0.64 | 12.95   |
|               |                               | SC-FB          | 0.99                | 17.06                                 | 0.49 | 8.35    |
| +PEAI (2.5mM) | 0.12                          | FB-SC          | 1.03                | 21.04                                 | 0.66 | 14.55   |
|               |                               | SC-FB          | 1.02                | 22.91                                 | 0.53 | 12.46   |
| +PEAI (5.0mM) | 0.12                          | FB-SC          | 1.05                | 22.36                                 | 0.67 | 15.95   |
|               |                               | SC-FB          | 1.00                | 21.37                                 | 0.66 | 14.20   |
| +PEAI (10mM)  | 0.12                          | FB-SC          | 1.07                | 23.07                                 | 0.68 | 16.73   |
|               |                               | SC-FB          | 1.05                | 22.95                                 | 0.67 | 16.01   |
| +PEAI (20mM)  | 0.12                          | FB-SC          | 0.99                | 18.61                                 | 0.58 | 10.72   |
|               |                               | SC-FB          | 0.99                | 18.93                                 | 0.43 | 8.15    |

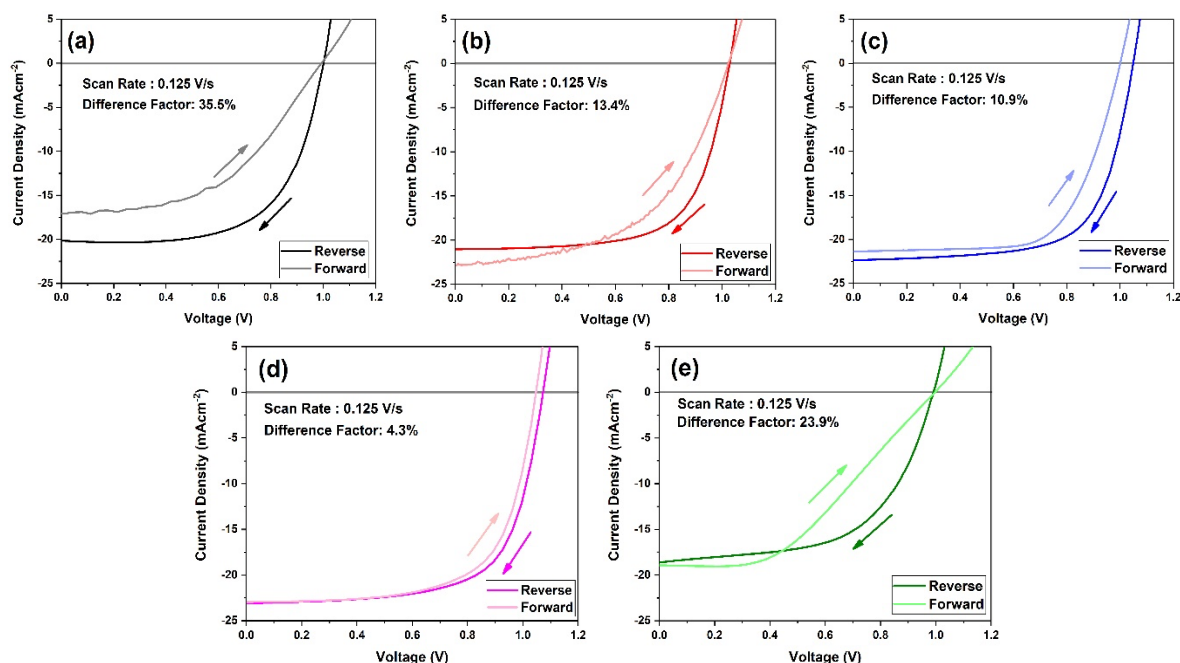


**Figure S3:** Influence of the PhEtNH<sub>3</sub>I concentration on current-voltage hysteresis of the CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> devices. The devices are measured in reverse scan (FB-SC) and forward scan (SC-FB) under simulated AM1.5 100 mW cm<sup>-2</sup> sunlight with (a) MAPI (black), (b) 2.5 mM (red), (c) 5 mM (blue), (d) 10 mM (magenta) and (e) 20 mM (green) PhEtNH<sub>3</sub>I (PEAI) salt coated on CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite solar cells. The scan rate is 0.125 V/s for all devices.

It is worth noting that all devices suffer from hysteresis effect, which depends primarily on scan rate and scan direction. The forward scan (SC-FB) and reverse scan (FB-SC) of all devices are recorded and presented in Figure S3. In order to describe the difference between efficiency of forward scan and reverse scan, we use a difference factor according to the following equation:

$$\text{Difference Factor} = \frac{(\eta_{\text{reverse}} - \eta_{\text{forward}})}{\eta_{\text{reverse}}} \quad (1)$$

Where  $\eta_{\text{reverse}}$  and  $\eta_{\text{forward}}$  corresponds to the power conversion efficiency (PCE) of reverse scan and forward scan respectively. As shown in Figure S3, at a scan rate of 0.125 V/s, there is a significant decrease from 35.5 % to 13.4 % in difference factor with 2.5 mM PhEtNH<sub>3</sub>I as compared with no PhEtNH<sub>3</sub>I coating. This implies that the PhEtNH<sub>3</sub>I treatment could effectively reduce hysteresis effect. Further increase the concentration of PhEtNH<sub>3</sub>I alleviate hysteresis effect. Specifically, at 10 mM the difference factor is as little as 4.3%. However, further increase concentration of PhEtNH<sub>3</sub>I to 20 mM makes the difference factor rises back to 23.9 %. Based on the above results, we conclude that PhEtNH<sub>3</sub>I treatment can effectively reduce the hysteresis effect and resulted in more reproducible perovskite devices.