Supporting Information

Effect of the incorporation of poly(ethylene oxide) copolymer on the stability of perovskite solar cells

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Table S1. Volumes used in the preparation of perovskite dispersions with P(EO/EP).

<table>
<thead>
<tr>
<th>P(EO/EP) concentration (mg mL(^{-1}))</th>
<th>Volume of MAPbI(_3) stock solution (µL)</th>
<th>Volume of P(EO/EP) stock solution (µL)</th>
<th>Volume of DMF:DMSO (4:1) (µL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>130</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>0.5</td>
<td>130</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>1.0</td>
<td>130</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>1.5</td>
<td>130</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>2.0</td>
<td>130</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>130</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

Table S2. Summary of the photovoltaic parameters of the PSCs measured under simulated AM 1.5G solar illumination (intensity = 100 mW cm\(^{-2}\)) using forward scan (F) and reverse scan (R). The values in parenthesis are for the best-performing devices.

<table>
<thead>
<tr>
<th>P(EO/EP) concentration</th>
<th>Scan</th>
<th>(V_{oc}) (V)</th>
<th>(J_{sc}) (mA/cm(^2))</th>
<th>FF (%)</th>
<th>PCE (%)</th>
<th>hysteresis index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>F</td>
<td>1.05±0.01 (1.05)</td>
<td>21.48±0.24 (21.83)</td>
<td>64.01±2.48 (59.21)</td>
<td>14.43±0.61 (13.57)</td>
<td>12.39±4.27</td>
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<tr>
<td></td>
<td>R</td>
<td>1.07±0.01 (1.08)</td>
<td>21.28±0.33 (21.51)</td>
<td>72.12±1.08 (73.36)</td>
<td>16.42±0.46 (17.04)</td>
<td></td>
</tr>
<tr>
<td>0.5 mg mL(^{-1})</td>
<td>F</td>
<td>1.04±0.01 (1.04)</td>
<td>20.16±1.24 (20.60)</td>
<td>59.56±2.20 (56.09)</td>
<td>12.48±0.83 (12.01)</td>
<td>12.87±6.62</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>1.05±0.01 (1.07)</td>
<td>19.90±1.02 (20.27)</td>
<td>68.99±3.37 (73.93)</td>
<td>14.34±1.32 (16.03)</td>
<td></td>
</tr>
<tr>
<td>1.0 mg mL(^{-1})</td>
<td>F</td>
<td>1.06±0.01 (1.04)</td>
<td>19.55±0.28 (20.38)</td>
<td>60.35±2.12 (60.57)</td>
<td>12.50±0.54 (12.20)</td>
<td>10.59±4.89</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>1.07±0.01 (1.06)</td>
<td>19.32±0.37 (20.16)</td>
<td>67.91±2.16 (69.64)</td>
<td>14.03±0.31 (14.14)</td>
<td></td>
</tr>
<tr>
<td>1.5 mg mL(^{-1})</td>
<td>F</td>
<td>1.05±0.01 (1.04)</td>
<td>20.18±0.45 (19.73)</td>
<td>62.12±2.65 (60.74)</td>
<td>13.16±0.50 (12.46)</td>
<td>7.27±5.03</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>1.06±0.01 (1.07)</td>
<td>20.11±0.40 (19.63)</td>
<td>65.98±3.20 (70.00)</td>
<td>14.06±0.82 (14.70)</td>
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<tr>
<td>2.0 mg mL(^{-1})</td>
<td>F</td>
<td>1.03±0.01 (1.04)</td>
<td>19.52±0.84 (20.08)</td>
<td>58.66±5.46 (63.66)</td>
<td>11.79±1.73 (13.29)</td>
<td>7.49±7.54</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>1.04±0.01 (1.04)</td>
<td>19.03±1.18 (19.97)</td>
<td>64.03±3.50 (64.12)</td>
<td>12.68±1.14 (13.31)</td>
<td></td>
</tr>
</tbody>
</table>

*Average and standard deviation values were obtained based on 12 devices.
Figure S1: Photographs of the setup at XRD2/LNLS beamline for in situ GIWAXS measurements.

Figure S2: GIWAXS reciprocal lattice maps for standard perovskite sample. (a) The moment at anti-solvent is dripped onto the film, (b) after 200 s, (c) after 400 s and (d) after 600 s.
Figure S3: GIWAXS reciprocal lattice maps for film containing 0.5 mg mL\(^{-1}\) of P(EO/EP) copolymer. (a) the moment at anti-solvent is dripped onto the film, (b) after 200 s, (c) after 400 s and (d) after 600 s.
Figure S4: GIWAXS reciprocal lattice maps for film containing 1.0 mg/mL of P(EO/EP) copolymer. (a) the moment at anti-solvent is dripped onto the film, (b) after 200 s, (c) after 400 s and (d) after 600 s.
Figure S5: GIWAXS reciprocal lattice maps for film containing 1.5 mg mL$^{-1}$ of P(EO/EP) copolymer. (a) the moment at anti-solvent is dripped onto the film, (b) after 200 s, (c) after 400 s and (d) after 600 s.
Figure S6: SEM images of perovskite films: a) without the addition of P(EO/EP) or with b) 0.5 mg mL\(^{-1}\) of P(EO/EP), c) 1.0 mg mL\(^{-1}\) of P(EO/EP), d) 1.5 mg mL\(^{-1}\) of P(EO/EP) and e) 2.0 mg mL\(^{-1}\) deposited on FTO/c-TiO\(_2\)/meso-TiO\(_2\) layers.
Figure S7: Normalized PCE evolution as a function of spray time for PSCs without (standard) and with 0.5 mg mL$^{-1}$ of P(EO/EP). After each interval of exposure of the PSC to the spray, we performed J-V measurements under illumination (100 mW cm$^{-2}$). 1$^{st}$ J-V measure (before spray exposure); 2$^{nd}$ J-V measure (10 s of spray exposure); 3$^{rd}$ J-V measure (20 s of spray exposure); 4$^{th}$ J-V measure (30 s of spray exposure) and 5$^{th}$ J-V measure (40 s of spray exposure).