Supporting Information

Performance enhancement of perovskite solar cells with the modified TiO₂ electron transport layer using Zn-based additives

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Table S1: EDX parameters for normalized atomic percentage of none-doped TiO₂ and 0.02ZTP based ETL films.

<table>
<thead>
<tr>
<th></th>
<th>O</th>
<th>C</th>
<th>Si</th>
<th>Na</th>
<th>Ca</th>
<th>Mg</th>
<th>Ti</th>
<th>Al</th>
<th>Zn</th>
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</thead>
<tbody>
<tr>
<td>None-doped TiO₂</td>
<td>65.17</td>
<td>13.98</td>
<td>11.49</td>
<td>5.59</td>
<td>1.64</td>
<td>0.96</td>
<td>0.98</td>
<td>0.19</td>
<td></td>
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<tr>
<td>0.02ZTP</td>
<td>61.97</td>
<td>14.08</td>
<td>13.43</td>
<td>6.53</td>
<td>1.76</td>
<td>1.18</td>
<td>0.60</td>
<td>0.32</td>
<td>0.14</td>
</tr>
</tbody>
</table>
Figure S1. The Zn-Ti precursor solution photos of ETL at an increasing volume ratio of 0, 0.01, 0.02, 0.04, 0.06.
Figure S2. The SEM images of none-doped TiO$_2$, 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.
Figure S3. The XRD patterns of none-doped TiO$_2$, 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.
Figure S4. SEM-EDX spectrum for none-doped TiO$_2$ and 0.02ZTP compact layer on FTO glass.
Figure S5. XPS spectra of none-doped TiO$_2$ and 0.02ZTP compact film: (a) C 1s, (b) O 1s, (c) Ti 2p, and (d) Zn 2p3.
Figure S6. The atomic force microscopy (AFM) images of 0.01ZTP and 0.04ZTP based ETL films.
Figure S7. Absorption spectra of the none-doped TiO$_2$, 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.
Figure S8. Energy level diagram of perovskite solar cells with none-doped TiO$_2$ and 0.02ZTP based ETL films.
Figure S9. Long-term stability of PVSCs under a 35% humidity