Introduction

The most efficient perovskite compounds for PV application contain lead, which is toxic to humans and environment. A major challenge is therefore to replace lead with a less toxic element while maintaining high conversion efficiency. The double perovskite structures have only been considered very recently for PV application and have shown very high stability under ambient conditions (air, moisture, temperature) compared to lead-based perovskite compounds. For now, only Cs₂AgBiBr₆ compound has been assembled in PV cell with maximum efficiency close to 2.5%. In order to increase the PV efficiency of the cells, the scientific community agrees on the need to better control the film morphology (uniformity, coverage rate, crystallite size, grain boundaries, thickness...).

Objective

Spin-coating

Cs₂AgBiBr₆ films

Ultrasonic spray pyrolysis (USP)

Concentration | Mesoporous TiO₂ | Anti-solvent smoothing
--- | --- | ---
- 0.15M | - 200 nm | - Chlorobenzene
- 0.30M | - 500 n | - Isopropanol
- 0.45M | - 1 µm | - Toluene
- 0.50M |
- 0.55M |
- 0.60M |

0.30M (250 nm) | 500 nm | Toluene

Power conversion efficiencies

<table>
<thead>
<tr>
<th>Thermal treatment</th>
<th>Samples</th>
<th>Voc (V)</th>
<th>Jsc (mA/cm²)</th>
<th>FF</th>
<th>PCE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheating: 75°C</td>
<td>0.30 M (without mesoporous TiO₂)</td>
<td>0.763</td>
<td>0.5</td>
<td>56</td>
<td>0.3</td>
</tr>
<tr>
<td>Heating: 280°C (5 min)</td>
<td>0.30 M + toluene dripping</td>
<td>0.700</td>
<td>0.5</td>
<td>30</td>
<td>0.2</td>
</tr>
<tr>
<td>0.30 M + 500 nm mesoporous TiO₂ + toluene dripping</td>
<td>0.726</td>
<td>1.7</td>
<td>63</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Preheating: 85°C</td>
<td>0.30 M + 500 nm mesoporous TiO₂</td>
<td>0.720</td>
<td>2.5</td>
<td>67</td>
<td>1.2</td>
</tr>
<tr>
<td>Heating: 300°C (5 min)</td>
<td>0.30 M + 500 nm mesoporous TiO₂</td>
<td>0.679</td>
<td>3.7</td>
<td>67</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Acknowledgements

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References