UP-scaling of inverted small molecule based organic solar cells

Patil, Bhushan Ramesh; Madsen, Morten

Publication date:
2015

Document version
Final published version

Citation for published version (APA):

Terms of use
This work is brought to you by the University of Southern Denmark through the SDU Research Portal. Unless otherwise specified it has been shared according to the terms for self-archiving.
If no other license is stated, these terms apply:

• You may download this work for personal use only.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying this open access version

If you believe that this document breaches copyright please contact us providing details and we will investigate your claim. Please direct all enquiries to puresupport@bib.sdu.dk

Download date: 05. Apr. 2020
UP-SCALING OF INVERTED SMALL MOLECULE BASED ORGANIC SOLAR CELLS

Bhushan Ramesh Patil and Morten Madsen
Mads Clausen Institute, University of Southern Denmark, Sønderborg, Denmark

Introduction

Organic solar cells (OSC) face challenges in large scale fabrication, i.e., performance of OSC reduces significantly with up-scaling. This work focuses on large-scale fabrication of OSC with high performance and stability.

Materials and fabrication

- Inverted Small molecule based OSC fabricated using Tetraphenyldibenzoperiflanthene (DBP) and Fullerene (C70), as electron donor and acceptor respectively.
- Bathocuproine (BCP) as electron transport layer, Molybdenum trioxide (MoO3) as hole transport layer and silver (Ag) used as metal electrode.
- All the layers fabricated in a highly sophisticated cluster deposition system available at Mads Clausen Institute, University of Southern Denmark.

Initial work and results

<table>
<thead>
<tr>
<th>Layer</th>
<th>Thickness (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag</td>
<td>100</td>
</tr>
<tr>
<td>MoO3</td>
<td>10</td>
</tr>
<tr>
<td>DBP</td>
<td>10</td>
</tr>
<tr>
<td>C70</td>
<td>30</td>
</tr>
<tr>
<td>BCP</td>
<td>10</td>
</tr>
<tr>
<td>ITO</td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
</tr>
</tbody>
</table>

Inverted OSC stack

Cell area = 2 mm²

- $V_{OC} = 844.13$ mV
- $J_{SC} = 11.03$ mA/cm²
- FF = 60.48%
- PCE = 5.63%

Initial work and results (degradation)

- Light - after fabrication
- Dark - after fabrication
- Light - after 22h of fabrication
- Dark - after 22h of fabrication

Cell area = 2 mm²

- $V_{OC} = 820.95$ mV
- $J_{SC} = 9.54$ mA/cm²
- FF = 60.24%
- PCE = 4.72%

After 22 hours

- Approximately 16% degradation of PCE in less than 24 hours!

Work in progress

- Fabrication of large-scale OSC with cell area 16, 50, 130 and 350 mm².
- Stability and performance optimization of large-scale OSC.

Acknowledgement

Special thanks to Prof. Morten Madsen for his constant guidance and help.

This work is done under SDU2020 Project 'Production of Next-Generation Energy Devices.'

References