SOLAR CELLS

Printing organic photovoltaics

Energy Environ. Sci. http://doi.org/crcx (2018)

Large-area organic solar cells are coming onto the market with promising applications as building-integrated photovoltaic elements. Though fullerene-based devices still play a dominant role, non-fullerene acceptors have recently been demonstrated to enable high power conversion efficiencies while allowing greater tunability of the optoelectronic properties and higher thermal and photostability than fullerene counterparts. However, the upscaling of record lab-scale solar cells to industrial-scale modules without significant efficiency losses is still a key issue. Now, Florian Machui and colleagues in Germany, Saudi Arabia and the United Kingdom propose a roll-to-roll fabrication method for non-fullerene acceptor-based solar cells achieving efficiencies of 5% on 60 cm^2 area modules.

The researchers reconsider materials, processing methods and device architectures that have been employed for fabricating lab-scale devices based on indacenodithiophene acceptors to ensure compatibility with larger-scale, roll-to-roll production. They change chemical formulations to avoid materials that require high-temperature treatments; replace spin coating and high vacuum deposition with doctor blading; and use laser patterning for module interconnections, which allows geometric fill factors of 93%. They transition from a 0.15 cm^2 cell with 6.3% efficiency to a fully printed large-area module of 12 cells with a total active area of 60 cm^2 and efficiency of 5.0%. To be entirely compatible with industrial requirements, the modules are processed from non-halogenated solvents or by slot-die coating with negligible losses in terms of efficiency.

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Published online: 10 July 2018
https://doi.org/10.1038/s41560-018-0212-2