World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:18, No:05, 2024

Simple and Scalable Thermal-Assisted Bar-Coating Process for Perovskite Solar Cell Fabrication in Open Atmosphere

Authors : Gizachew Belay Adugna

Abstract : Perovskite solar cells (PSCs) shows rapid development as an emerging photovoltaic material; however, the fast device degradation due to the organic nature, mainly hole transporting material (HTM) and lack of robust and reliable upscaling process for photovoltaic module hindered its commercialization. Herein, HTM molecules with/without fluorine-substituted cyclopenta[2,1-b;3,4-b']dithiophene derivatives (HYC-oF, HYC-mF, and HYC-H) were developed for PSCs application. The fluorinated HTM molecules exhibited better hole mobility and overall charge extraction in the devices mainly due to strong molecular interaction and packing in the film. Thus, the highest power conversion efficiency (PCE) of 19.64% with improved long stability was achieved for PSCs based on HYC-oF HTM. Moreover, the fluorinated HYC-oF demonstrated excellent film processability in a larger-area substrate (10 cm×10 cm) prepared sequentially with the absorption perovskite underlayer via a scalable bar coating process in ambient air and owned a higher PCE of 18.49% compared to the conventional spiro-OMeTAD (17.51%). The result demonstrates a facile development of HTM towards stable and efficient PSCs for future industrial-scale PV modules.

Keywords : perovskite solar cells, upscaling film coating, power conversion efficiency, solution processing
Conference Title : ICECSE 2024 : International Conference on Energy Conservation and Solar Energy
Conference Location : Vancouver, Canada
Conference Dates : May 20-21, 2024