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Meniscus Guided Film Coating for Large-Area Perovskite Solar Cells

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Abstract : Perovskite solar cells (PSCs) have been gaining impressive progress with excellent power conversion efficiency (PCE) of 25.5% in small-area devices. However, the conventional film coating approach is not applicable to large-area module fabrication. Meniscus-guided coating, including blade coating, slot-die coating, and bar coating, is solution processing and promising for large-area and cost-effective film coating to industrial-scale PSCs. Here, we develop simple and scalable solution shearing (SS) and bar coating (BC) methods to coat all layers on large-area (10x10 cm^2) substrate in FTO/c-TiO_2/mp-TiO_2/$CH_3NH_3PbI_3$/Spiro-OMeTAD/Ag device structure, except the Ag electrode. All solution-sheared PSC exhibited a champion power conversion efficiency of 15.89% in the conational DMF/DMSO solvent. Whereas a very high PCE of 20.30% compared to the controlled spin-coated device (SC, 17.60%) was achieved from the large area sheared perovskite film in a green ACN/MA solvent. Similarly, a remarkable PCE of 18.50% was achieved for a device fabricated from a large-area perovskite film in a simpler and more compatible Bar-coating system. This strategy demonstrates the huge potential for module fabrication and future PSC commercialization.

Keywords : Perovskite solar cells, larger area film coating, meniscus-guided film coating, solution-shearing, bar-coating, power conversion efficiency
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