Perovskite Solar Cell: A Simple Hot Casting Method to Formulate High-quality, Lead-free, Sn-based Perovskite Films with Reduced Pinholes

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Hybrid organic-inorganic lead halide perovskite solar cells, PVSCs, have emerged in the past decade as a promising, low cost, thin film photovoltaic device with the power conversion efficiency (PCE) increasing from 3.8% to 22.7%. However, poor long-term stability of PVSCs and toxic nature of lead limits future commercial applications. Fabrication of uniform perovskite films with full coverage and fewer pinholes are the prerequisites for achieving a high-performance perovskite. To achieve a good morphology, one-step solution processing and anti-solvent engineering were used. All precursors (Formamidinium Iodide and Tin Iodide) were dissolved in DMSO and GBL. Before put in the spin coater, the precursor solution and the glass substrates were heated to 60 oC, 70 oC, 80 oC, 90 oC, and 100 oC. During spin coating, the anti-solvent wash with toluene was performed to removed excess DMSO. After spin-coating, the perovskite glass substrates were annealed at 100 degrees Celsius. Perovskite layers were characterized by X-Ray Diffraction (XRD) and its surface morphology was investigated by a Scanning Electron Microscope (SEM). From the SEM pictures, it was concluded that 70 oC was the optimal temperature for the precursor to create a pinhole free perovskite layer. Through the XRD peak analysis, the morphology and crystallinity of the perovskite structure were analyzed and confirmed to have a stable and simple cubic structure with a lattice constant of 4.09A. Thus, 70 oC had the optimal temperature to construct a perovskite film.

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