Abstract

Perovskite (PVSK) has emerged as a solar cell material rivaling silicon and quantum dots due to their increasing power conversion efficiency (PCE). PVSK is limited because its hybrid organic inorganic halide ABX_3 structure (i.e. methylammonium lead iodide, $MAPbI_3$) is unstable. To reduce degradation and enhance efficiency, Cs, formamidinium (FA) cations and a Br halide can be added to create the mixed structure CsFAMAPbIxBr1-x. This study tries a combination of Cs, FA, MA, and Br with spin-coating to optimize both efficiency and stability of the cell. One-step spin coating was used to prepare the PVSK film. PbI_2, MAI, CsI, FAI, and $PbBr_2$ at a molar ratio of 1:.7:0.15:0.15 were placed in a mixed solvent of DMF and DMSO (8:2). TiO_2 was spin coated onto FTO substrates and annealed to form the electron transport layer (ETL). UV-Visible Spectroscopy indicated that the changing of the cation/halide component did not influence the absorption of the photoactive layer. XRD revealed that the mixed PVSK had two possible crystal phases (α and δ phases) compared to the single peak of $MAPbI_3$ PVSK. After the optimization (changing temperature and time for the preferable crystallization), the mixed PVSK showed a strong alpha peak (photoactive) and negligible delta phase. The mixed PVSK exhibited a higher PCE, probably due to increased grain size. Moisture and heat stability tests revealed enhanced structural stability against excessive heat, proving that the mixed structure can generate better performance and enhanced durability.