Optimization of Triple Cation Lead Halide Perovskite Material for Efficient and Stable Solar Cell

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**Abstract**

Formamidinium (FA) based lead-halide perovskite material has got tremendous research interest after achieving highest efficiency of 25.7% owing to their optimum bandgap of 1.48 eV with high thermal stability. However, the serious phase transition of FAPbI3 material from photoactive α-phase to non-perovskite δ-phase at ambient temperature restricts its long-term stability. In order to stabilize the photoactive α-phase cation engineering by incorporating Methylammonium (MA), Cesium (Cs) atom in the perovskite structure has shown a potential route. In this study we have optimised a triple cation 3D perovskite structure Cs0.05FA0.86 MA0.09 Pb(I0.97 Br0.03)3. Further a simple inverted architecture perovskite solar cell device has fabricated by the using the optimised perovskite structure which shows highest power conversion efficiency (PCE) of 16.2% with the photovoltaic parameters Voc~1,1V, Jsc~21.5 mAcm-2 and FF~70%. The device stored at a dark condition of 60-70% relative humidity has able to maintain a normalised PCE of 65% after 15 days.