**Imidazolium Functionalized Polyelectrolyte Assisted Perovskite Crystallization for Efficient and Stable Perovskite Solar Cells**

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**Abstract**:

In order to maximize the performance of Hybrid Organic Inorganic Perovskite Solar Cells (HOIP- SCs), it is crucial to minimize the intrinsic defect states to enhance film quality and morphology. An efficacious approach to achieve improved photovoltaic parameters is incorporation of an additive in the perovskite framework. In this work, an imidazolium containing cationic conjugated poly-electrolyte (CPE), PFBT-MI, with bromide as counter ion was employed in varying concentration that effectively passivated the ionic defects in the MAPbI3 structure resulting in improved morphology and charge transport of perovskite films. By incorporating PFBT-MI CPE imparted higher crystallinity with reduced defect states and lower charge recombination. The 1% doped perovskite device achieved the highest power conversion efficiency (PCE) of 19.23% in comparison to the pristine device. The counter bromide ion reduced the iodine vacancies and minimized the ion migration resulting in lower hysteresis in the modified device. Moreover, the PFBT-MI modified devices gave better hydrophobic surface retaining 85% normalized PCE upon ambient exposure as compared to pristine which contributed to the device long term stability.