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Impact of physics-based parameters on diverse design architecture of perovskite solar cells ADITYA KUMAR MISHRA, Department of Materials Science and Engineering, University of Texas, Dallas, DEIDRA HODGES, Department of Electrical and Computer Engineering, University of Texas, El Paso, JASON D. SLINKER, Department of Physics, University of Texas, Dallas — Solution processed organic–inorganic metal halide perovskite and its derivatives have emerged as one of the leading thin film photovoltaic technology due to their remarkable increase in power conversion efficiency in a very short period of time. In the context of increasing the efficiency and sustainability of perovskite solar cells (PSC) devices, we comprehensively analyzed the impact of doped and un-doped perovskite thin film in diverse design architectures of PSCs. Our method emphasized the role of different charge carrier layers and its effect on interfacial recombination mechanism and charge extraction rate within PSC devices. We also considered morphological control, crystallographic functionality, chemistry and charge transport properties of perovskite thin film for different architecture of PSC devices. We observed that photocurrent is substantially influenced by interfacial recombination process and photovoltage has functional relationship with defect density of perovskite absorption layer. A new contour mapping method to understand the characteristics of current density–voltage (J–V) curves for each device as a function of perovskite layer thickness provided an important insight about the distribution spectrum of photovoltaic properties. The Functional relationship of solar cell efficiency and fill factor with perovskite layer thickness are also discussed.

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