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UNRAVELING THE FORMATION MECHANISM OF 2D/3D PEROVSKITE HETEROSTRUCTURE FOR PEROVSKITE SOLAR CELLS USING MULTI-METHOD

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The formation of a two-dimensional (2D) / three-dimensional (3D) perovskite heterostructure appears to be a promising way to improve the interface between the perovskite and electron/hole transport layers in perovskite solar cells, consequently improving both device efficiency and stability. The paper reports on the formation mechanism of a 4-fluorophenethylammonium based 2D perovskite layer desposited on top of a 3D triple-cation perovskite by a spin-coating deposition process. A significant improvement in the device open-circuit voltage is obtained, leading to an enhanced power conversion efficiency. The formation mechanism of the 2D perovskite layer is studied by optical, chemical, structural and morphological characterizations. Presence of bromide inside the 2D phase is revealed, demonstrating how the stoichiometry of the 2D perovskite is affected by the chemical composition of the 3D layer underneath. We conclude from this study that a concomitant formation mechanism exists besides the most commonly described one involving the lead iodide (PbI_2) excess contained in the 3D bulk. This work therefore provides new insights into the synthesis mechanisms of 2D/3D perovskite heterostructures, opening routes to optimize their fabrication processes and develop new efficient and functional 2D/3D structures.