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Improving the triple-cation perovskite solar cells efficiency by two-step deposition methods with perovskite seeds

As of recent years, triple-cation perovskite solar cells have received immense attention due to its superior efficiency and better stability comparing to the classic single-cation perovskite solar cells such as MAPbI₃ or FAPbI₃. A triple-cation perovskite layer which has been used most recently is cesium-containing FAPbI₃-based perovskite. One of decent approaches to fabricate the layer is spin-coating technique by using two-step deposition process in which mixed lead-halide and CsI precursor is firstly spin-coated onto a substrate, then organic cation solution is deposited on the lead-halide layer. In this work, the results show that the performance of the devices from this process is lower than expected that could be due to difficulty of cesium ion incorporation as a stabilizer for FAPbI₃-based perovskite. Perovskite seeding growth is introduced to solve the problem where the process is slightly modified from conventional two-step deposition methods by adding small amount of perovskite seed precursor into PbI₂ solution. The concentration of the perovskite seed in PbI₂ was varied for 0, 7, 14 and 20 v/v%. The highest average efficiency of 12% was obtained from 7 v/v% seeding concentration. Furthermore, the device performance could be improved by using proper amount of chlorobenzene as an anti-solvent. The highest efficiency of 17% was achieved by using 30µl of chlorobenzene.

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