

Methanol Additive in Diethyl Ether Antisolvent for High-quality MAPbI₃ Perovskite Films in ambient Atmosphere

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Perovskite solar cells have attracted considerable attention owing to easy and low-cost solution manufacturing process with high power conversion efficiency. However, the fabrication process is usually performed inside glovebox to avoid the moisture, as organometallic halide perovskite is easily dissolved in water. In this study, we propose one-step fabrication of high-quality MAPbI₃ perovskite films in 50 % RH humid ambient air by using diethyl ether as an anti-solvent and methanol as an additive into this anti-solvent. Because of the existence of methanol, the water molecules can be efficiently removed from the gaps of perovskite precursors and the perovskite film formation can be slightly controlled leading to pinhole-free and low roughness film. Concurrently, methanol can modify a proper DMSO ratio in the intermediate perovskite phase to regulate perovskite formation. Planar solar cells fabricated by using this method exhibited the best efficiency of 16.4 % with a reduced current density-voltage hysteresis. This efficiency value is approximately 160 % higher than the devices fabrication by using only diethyl ether treatment. This method presents a new path for controlling the growth and morphology of perovskite films in the humid climates and uncontrolled laboratories.

