Surface passivation of tin perovskite solar cells using organic molecule

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Tin perovskite solar cells (PSCs) provide an alternative solution to the more toxic lead-based perovskite solar cells. Unfortunately, the solar cell efficiency of tin-based perovskite is notably lower than lead-based PSCs despite the bandgap value closer to the Shockley-Queisser limit. This can be attributed to the oxidation of tin in the presence of oxygen and the fast crystallization of tin perovskite which causes the formation of pin-holes and grain boundaries which can act as the recombination centers. Here, we report the use of organic molecule to improve the surface quality of perovskite layer. We found that the surface morphology of the perovskite layer has been improved significantly with the addition of organic surfactant and this contributed to more efficient interfacial charge transfer as evident from impedance spectroscopy. The performance of the photovoltaic device fabricated with this additive improved as a result of reduced carrier recombination namely surface recombination. The organic molecule bonded on the surface of perovskite passivate the defects and grain boundaries, suppressing charge carrier recombination as evident from the increased open-circuit voltage. Additionally, this monolayer of organic molecule protects the perovskite layer from oxidation and thus the solar cells show longer stability at ambient atmosphere.