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The effect of Coumarin additives on optoelectronic properties and power conversion efficiency of Formamidinium based-perovskite solar cells.

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Perovskite solar cell (PSC) is among the emerging photovoltaic technologies known for their high solar power conversion efficiency (PCE) and low manufacturing costs. However, their solution- based processing leads to the formation of defects within the bulk of the perovskite layer and at its interfaces with the charge transport layers. These defects act as charge trapping centers and provide the degradation routes which not only reduces the PCE of perovskite solar cells but also leads to instability issues. Various defect passivation strategies have been developed but the use of additives appears to have gained preferences over the others. In this work, 1-D Solar cell capacitance simulator (SCAPS-1D) was employed to study the effects of Coumarin additive on the PCE of formamidinium-based PSC. Parametric studies were carried out on the Coumarin modified PSC device in order to identify routes for further improvement in the PCE. It was found that a further reduction in defect density, band gap and series resistance together with an increase in the charge carrier mobilities are important in achieving higher PCE. This study provides an insight into the role of additives in enhancing the PCE of PSC and the output serves as a reference to guide the design of effective experimental model PSC devices.
Keywords: Coumarin additive, perovskite film, power conversion efficiency, SCAPS-1D.

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