Improved environmental stability of perovskite photoactive layer mixed with functionalized porphyrin molecules

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Photovoltaic devices based on organo-metal halide perovskites have not yet reached the theoretically predicted power conversion efficiency while they still exhibit poor environmental stability, due to the penetration of moisture and oxygen into the perovskite absorber which accelerates the device degradation[1]. In this work, we demonstrate the use of appropriately porphyrin molecules with functional groups as dopants of methylammonium lead triiodide ($MAPbI_3$) precursor. In particular, the stability upon exposure to environmental conditions for 720 hours of the prepared undoped and porphyrin-doped perovskite films was investigated. XRD pattern of the undoped perovskite film presented a large increase in intensity of the PbI_2 peak as well as significant loss of crystallinity. On the other hand, the reduction in crystallinity of the PbI_2 peak is lower in the porphyrin-doped perovskite, suggesting that the enhanced stability of doped film is attributed to the hydrophobic nature of the dye. The effects of quicker degradation of the undoped perovskite film were also detected by UV-Vis absorption measurements, where significant changes in the shape and intensity of the absorption spectrum of the undoped film were observed, while improved homogeneity and larger grain size were appeared in the surface of the porphyrin-doped film after 720 hours, as revealed from scanning electron microscopy measurements.

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References:

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