Exploring the Photovoltaic Properties and Stability of Triple Cation Tin Halide Perovskite Solar Cells

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Tin halide perovskite solar cells are a promising alternative to highly efficient, but toxic lead perovskite based solar cells [1]. Their power conversion efficiencies (PCEs) have been continuously improved over the last three years mainly due to compositional engineering. Currently, PCEs up to 8 - 9.6% are reported [2,3], however, the long-term stability is still an important issue. In this contribution, we present a novel triple cation based tin perovskite $MA_{0.75}FA_{0.15}PEA_{0.1}SnI_3$ (MA: methylammonium, FA: formamidinium, PEA: phenylethylammonium) with a mixed 2D/3D crystal structure. Solar cells with this material as absorber layer show very encouraging stability under inert conditions. After more than 5400 h of storage, still 87% of the initial PCE are retained and further stability tests under active load and continuous illumination revealed exceptional stability also in operation [4]. These devices exhibit PCEs of 5.0%, a photocurrent generation up to a wavelength of 1000 nm and only limited trap-mediated recombination. Furthermore, the incorporation of bromide into this triple cation tin iodide perovskite was investigated, which led to increased optical band gaps and enhanced photovoltages of the solar cells.

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