Fully functional semi-transparent perovskite solar cell fabricated at ambient air.

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Abstract

Organic-inorganic perovskite functions as an efficient light harvester in solar cells. The possibility to tune its optical properties, as well as the option to use it as thin film absorber (few hundreds nanometers thickness) make this material highly attractive in the photovoltaic research. These properties also enable the utilization of perovskite for the fabrication of semitransparent solar cells. In this work, we demonstrate the fabrication of perovskite solar cells of controlled transparency, by a mesh assisted deposition process. Sequential fabrication of perovskite was performed under ambient atmosphere, where in the first step a PbI_2 grid is formed, and following the grid reacts with methylammonium iodide, resulting in a perovskite grid pattern. The most efficient solar-cells included a photoanode that is composed of mesoporous TiO_2 with Al_2O_3 nanoparticles. The resulting semi-transparent perovskite solar cells, including a semi-transparent contact composed of MoO_3/ Au/ MoO_3 yielded a power conversion efficiency of 5.5% with an average transparency of 26% and efficiency of 8% for cells fabricated with a gold contact.

The innovative fabrication methods that were used in this work, as well as the novel architecture of fully semitransparent solar cell, illustrates the potential of perovskite in future PV technologies.