All-Inorganic Cesium Perovskites lead to Next Generation Solar Cells

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Recently, perovskite absorber materials have drastically paid attention in the photovoltaic field due to the impressive improvements in the photoconversion efficiencies of up to 20%. Numerous researchers pointed out their studies in the enhancement of photovoltaic characteristics due to these semiconductors are earth abundant, solution-processed active layers, and low-cost production. A key role in achieving good device performances is the device architecture including mesoporous or planar (regular or inverted structures). In particular, we studied all inorganic cesium lead triiodide, $CsPbI_3$, perovskite solar cells because this material is more thermal stable than the standard methylammonium lead triiodide $CH_3NH_3PbI_3$, but is still far from achieving their impressive power conversion efficiencies. The photoconvertion characteristics exhibited poor cell performances in mesoporous TiO_2 scaffold layer $CsPbI_3$ perovskite solar cell. The reason was demonstrated by transient absorption spectroscopy which concluded that some recombination processes occurred from the electron injected on the TiO_2 and the hole photogenerated in the perovskite $CsPbI_3$. We suggested two options to reduce the charge loss by (i) planar TiO_2 structure, or (ii) cover the nanoparticles-TiO_2 with a thin film of alumina Al_2O_3. In both cases, an improvement of the overall cell performances were showed. These results offer insight into the promising direction for developing all inorganic cesium solar cells.