High-Performance and Stable Perovskite Solar Cells by Adding Polymer Additive in Barium Doped Methylammonium Lead Halide

Chang Gung Univ. [1]

○Ming-Chung Wu[1], Yin-Hsuan Chang[1], Ying-Han Liao[1], Shun-Hsiang Chan[1], Yi-Yin Li[1],

E-mail: mingchungwu@cgu.edu.tw

The organic-inorganic lead halide perovskite solar cells (PSCs) is seen as a potential photovoltaic device due to its high power conversion efficiency, and it can be fabricated through the simple solution process. However, the most critical issues that hamper its commercialization is its content of toxic lead. The existent of lead not only shows deleterious effect on human but also harmful to our environment. To address this toxicity issue, intensive effort has been dedicated to developing low-toxic PSCs. According to tolerance factor and Goldschmidt's rule, Ba^{2+} is well meet to these rules. Besides, it also maintain the charge balance in perovskite. Based on these reason, non-toxic Ba^{2+} with the addition polymer additive into the perovskite layer has become a promising method to improve the perovskite device performance, which may result in better morphology, crystallinity, and improve the coverage between perovskite layers. The 10.0 mol% Ba^{2+}-doped device had high V_{OC} and J_{SC}, however, it had a lower FF, which was mainly due to the defects on the surface. Adding polymer additive into the perovskite layer has become a promising method to improve the perovskite device performance, which may result in better morphology, crystallinity, and improve the coverage between perovskite layers. Moreover, it has been reported that the more compact perovskite film can be formed with the addition of long-chain polymers in the previous study. With PEG as a polymer additive, it merged with the 10.0 mol% Ba^{2+}-doped perovskite perfectly with better morphology without pinholes. The fabricated PSCs with 10.0 mol% Ba^{2+} replacement, shows an average PCE of 15.0% (~20 devices) and champion PCE of 16.1%. The high-performance lead-reduced device has great potential for commercialization, which is much eco-friendlier to the environment and even the whole world.