Stability Enhancement of Perovskite Solar Cells with Functional Nanocomposites and Interface Engineering

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Poor stability and reproducibility of perovskite solar cells (PSCs) have prevented the devices from practical applications that can withstand sustained long-term operation under outdoor conditions. Furthermore, most of presented high efficiency PSCs utilize halogenated antisolvents such as toluene and chlorobenzene to assist perovskite crystal growth, excellent coverage and high uniformity, but they are highly toxic and detrimental to environment. To solve such issues, we developed functional composites such as Ag-rGO, perovskite-NiO, perovskite/Ag-rGO, NiO-carbon-graphite, etc and utilized them for ambient-air and antisolvent-free processed highly stable PSCs. In addition, to solve interfacial degradation whcih affects device performance Al2O3/NiO layers were used for interface engineering between elecrtron transport layer and active layer. By introducing the functional composites with interface engineering, we obtained high efficiency of >18 % and fill factor of >78% with excellent reproducibility. More importantly, the devices without encapsulation showed significant enhancement in long-term stability with retaining over 95 % of its original values under ambient condictions.