Designing All-Perovskite Tandem Solar Cells for Space Applications

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Abstract:

Metal halide perovskites are ideal candidates for producing lightweight, high-specific-power, and cost-effective tandem solar cells for space power applications due to their outstanding photoelectrical properties, tunable bandgaps, low-temperature processing, and compatibility with flexible substrates. Here, we discuss the design and development of all-perovskite tandem solar cells for space power applications. All-perovskite tandem solar cells are fabricated by integrating a wide-bandgap (~1.8 eV) Pb-based mixed-halide (Br-I) perovskite top subcell with a narrower-bandgap (~1.2 eV) divalent metal alloyed (Pb-Sn) iodide perovskite bottom subcell. Tailoring the halide perovskite composition and thickness for each subcell, their heterointerfaces, the interconnection, the substrate, and electrode materials enables us to optimize the photovoltaic performance of these tandem devices with respect to the terrestrial (AM1.5G) and space (AM0) solar spectra. We will discuss some preliminary space-qualified assessment results of all-perovskite tandem solar cells and discuss key challenges facing these devices. Finally, an outlook will be provided on the research directions necessary to realize the full potential of perovskite tandem devices as reliable and efficient power sources for space applications.

Conflicts of Interest

The authors declare no conflict of interest.

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