# Additive engineering for stable halide perovskite solar cells

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Abstract
Halide perovskite solar cells (PSCs) have already demonstrated power conversion efficiencies above 25%, which makes them one of the most attractive photovoltaic technologies. However, one of the main bottlenecks towards their commercialization is their long-term stability, which should exceed the 20-year mark. Additive engineering is an effective pathway for the enhancement of device lifetime. Additives applied as organic or inorganic compounds, improve crystal grain growth enhancing power conversion efficiency. The interaction of their functional groups with the halide perovskite (HP) absorber, as well as with the transport layers, results in defect passivation and ion immobilization improving device performance and stability. In this talk, we will briefly summarize the different types of additives recently applied in PSC to enhance not only efficiency but also long-term operational stability. We discuss the different mechanism behind additive engineering and the role of the functional groups of these additives for defect passivation. Special emphasis is given to their effect on the stability of PSCs under environmental conditions such as humidity, atmosphere, light irradiation (UV, visible) or heat, taking into account the recently reported ISOS protocols. We also discuss the relation between deep-defect passivation, non-radiative recombination and device efficiency, as well as the possible relation between shallow-defect passivation, ion immobilization and device operational stability. We will also show our most recent results applying additives in PSC where we have been able to obtain efficiencies above 21 % and highly stable devices showing null degradation after more than 10000 h under continuous light irradiation of 1 sun.

**REFERENCES**

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**FIGURES**

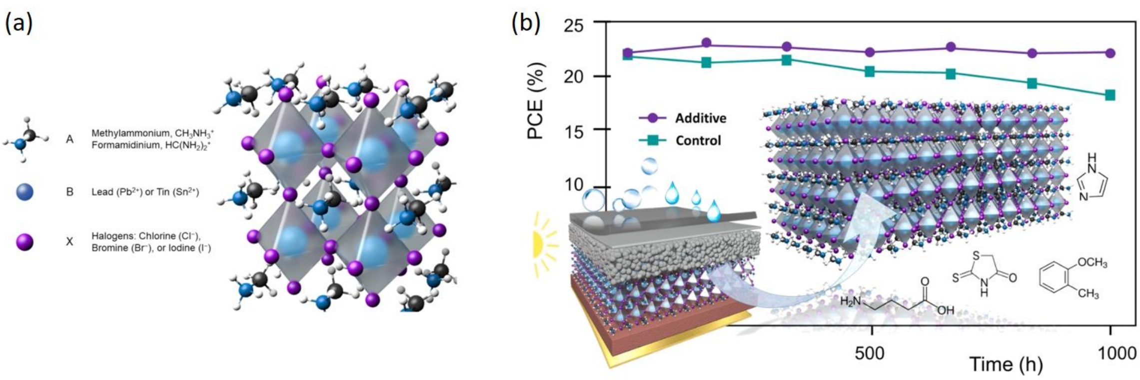


**Figure 1:** (a) Schematic representation of Halide perovskite structure and (b) the effect of additive engineering on perovskite solar cell operational stability [7].