Perovskite solar cells stability: throwback on one decade of research

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"Entire ecosystems are collapsing. We are in the beginning of a mass extinction, and all you can talk about is money and fairy tales of eternal economic growth."
Greta Thunberg, U.N Climate Action Summit, 23rd September, 2019.

Given the current climate change, developing renewable energies is a necessity. As the sun is an immutable and inexhaustible resource, photovoltaics is, on paper, the perfect candidate. But, considering costs of production and installation, to keep being attractive, efficiencies must continue to increase. One very promising emerging family is the perovskite one, whom efficiencies have exceeded those of thin-films technologies (23.4% for CIGS) and are catching up with silicon (26.1% for c-Si single crystal cells), with a record cell at 25.2% [1]. One major drawback of perovskite is their poor stability to air, oxygen and light.

Yet, as some might have notice, on September, 23rd 2019, the revised NREL efficiencies chart only differed from the previous on a single aspect: the legend for perovskite cells went from "perovskite cells (not stabilized)" to "perovskite cells" [1].

This contribution will cover both the device aspect (perovskite composition and layers) and measurement conditions. From the basic $CH_3NH_3PbI_3$ perovskite composition we will review 2D $(CH_3(CH_2)_3NH_3)_2(CH_3NH_3)_{n-1}PbnI_{3n+1}$ [2], mix 2D/3D $((HOOC(CH_2)_4NH_3)_2PbI_4/CH_3NH_3PbI_3)$ [3] and triple cation $(Cs_x(MA_{0.17}FA_{0.83})_{(1-x)}Pb(I_{0.83}Br_{0.17})_3)$ [4]. Some studies were conducted in non-real conditions [4-5], yet to accurately assess the performances of the devices, close to real conditions should be used (continuous lighting, ambient air, high humidity, high temperature) [6-9].

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