Potential of Perovskite for Indoor Applications

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In recent decades, the world has known the successful implementation of the Internet of Things with the implementation of 75 billion devices by 2025 [1]. Photovoltaic embedded devices drew the attention as an innovative alternative to supply IoT devices as well as many products with low electric consumption called Product Integrated PV (PIPV) [2]. Recent research has shown the potential of PSC for indoor applications [3,4]. Optimization approaches have been developed, such as increasing the bandgap and passivation of interfaces. To assess the performance of a solar cell for outdoor application, protocols and references spectra were implemented, unlike for indoor application. Therefore, the need to set up a standard spectrum and requirement for the development of the PV applications for indoor applications.

The main purpose of this study is to compare the performance of several technologies of conventional solar cells (c-Si, CIGS, III-V) to perovskite solar cells developed at IPVF for IoT and PIPV applications (see Fig. 1 - left). Furthermore, the losses in power with angular position was studied considering different solar cells architectures and technologies. The behavior of the different technologies will be shown as a function of variable irradiance intensity under both AM1.5G and indoor spectra.

Perovskite solar cells, of certain architecture considered in this study: Baseline + $Pb(SCN)_2$, 2D-OAI and 2D-PEAI showed promising results under indoor light conditions as cost-effective technology. However, this technology is still facing its biggest challenge, the stability under continuous illumination (see Fig. 1 - right). Ageing tests to assess perovskite solar cell stability in its different architecture were performed. As a result, surface passivation technics notably the two-dimensional perovskite layer (2D-PEAI and 2D-OAI) showed better stability than the baseline + $Pb(SCN)_2$ i.e., perovskite layer enhancement technique. Certainly, a better stability than the baseline architecture for the absence of any passivation approach. Furthermore, the planar perovskite solar cells showed acceptable stability even still in early development stages.

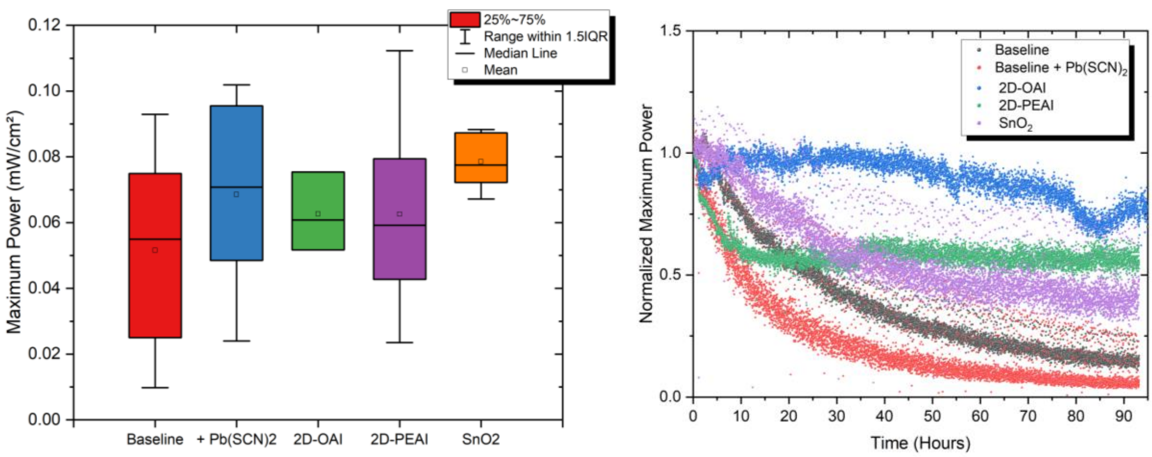

Fig. 1 Left: Maximum power of different PSC architectures under indoor spectrum 800 Lux (2.3 W/m²). Right: Normalized Pmax variation as a function of accelerated aging time of different PSC architectures.

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