FABRICATION AND CHARACTERIZATION OF LARGE-SCALE PEROVSKITE SOLAR CELLS

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In recent years, the perovskite hybrid solar cells (PSCs) are considered as one of the most promising technologies in the photovoltaic field. They have attracted the interest of both research and industrial societies worldwide [1] because of their excellent optoelectronic properties, ease of fabrication and low-production cost. However, today the records reached in terms of efficiency are performed by laboratory scale cells (<1cm²); The efficiency reached by the lab-scale cells is 25,6% while the large surface reaches today 17,9%. Therefore, the transition from lab-scale device fabrication based on spin-coating deposition to industrial-scale production process typically requires the re-evaluation of many factors associated with device fabrication and characterization.

The slot-die coating is a presents a deposition method that meets the requirements of industrial scale transition of perovskite (like roll-to-roll coating). It allows, sharp control over the thickness and material composition, a large-scale deposition and to save money, as no solution would be wasted during the process. In this work, we present a one-step slot-die deposition method of a double cation perovskite. A recent study [2] published by Bernard et al.,[2,3] established the optimized parameters of coating and ink composition. The best-stabilized PCE of lab-scales cells reached was of 17.5 %, these values are among the best reported for slot-die coated high bandgap perovskite. Our study consists in transferring this know-how to modules of 12-cm² surface by adapting the manufacturing parameters. The first results are very encouraging as we reached an efficiency of 15.7% with a remarkable V_{oc} of 6.9V for 6 cells, which is not far from the maximum theoretical value achievable by a double cation perovskite.

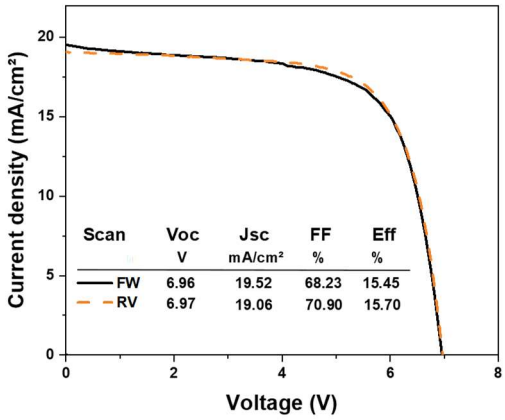

Figure : IV curve of the best module fabricated by a one-step slot-die coating process

In addition, this work aims to make the manufacturing process more accountable to industry by replacing the ETL layer, which until now has been made up of a superposition of a compact and mesoporous TiO2 layers, with a SnO2 layer, which is more stable and less energy consuming to manufacture. Therefore, a study on the ink composition as well as the quenching method is necessary in order to crystallize perovskite on a planar structure like SnO2.

Finally, many experiments will be carried out in the coming weeks. They will focus on the large area module deposition as well as an ETL replacement. Our upcoming results will be presented during the conference.

[1] Ajay Kumar Jena, « Halide Perovskite Photovoltaics: Background, Status, and Future Prospects », *Chemical Reviews*, s. d., 68.
[2] Sophie Bernard et al., « One-Step Slot-Die Coating Deposition of Wide-Bandgap Perovskite Absorber for Highly Efficient Solar Cells », *Solar RRL* 5, n° 9 (septembre 2021): 2100391, https://doi.org/10.1002/solr.202100391.