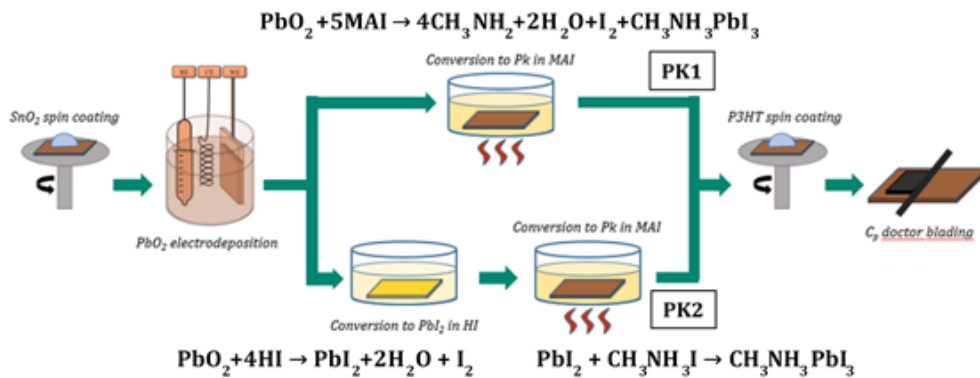


# Electrodeposition of Perovskites for Large Surface Solar Devices: Impact of Deposition Parameters, Substrate Nature and Conversion Route.

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Hybrid organic/inorganic perovskite solar cells have emerged substantially in the solar community, and are considered as a remarkable alternative because of its low cost and its efficiency's fascinating rise in the last ten years<sup>1</sup>. Spin coating is so far the most used technique for elaborating perovskite active layers, though it presents many constraints such as limited surface coverage, non-homogeneity, and undefined perovskite crystallinity. To avoid all the restrictions mentioned, electrodeposition could be used as an alternative<sup>2</sup>. Herein, electrodeposition of PbO<sub>2</sub> was used as a first step to elaborate controlled CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite layers. Then, conversion of PbO<sub>2</sub> films into perovskite was conducted either by direct immersion in CH<sub>3</sub>NH<sub>3</sub>I solution, or by conversion into PbI<sub>2</sub> before immersion in CH<sub>3</sub>NH<sub>3</sub>I solution. In this work, the impact of different electrodeposition parameters on both PbO<sub>2</sub> and perovskite films was studied. The main interfering parameters are the applied voltage, electrodeposition time, the concentration and the pH of the electrolyte. An effect of the substrate nature was also observed by conducting the study on both “Glass/ITO” and “Glass/ITO/SnO<sub>2</sub>” substrates. Cyclic voltammetry, chronocoulometry, profilometry, UV-visible spectroscopy, photoluminescence spectroscopy, X-Ray Diffraction and Scanning Electron Microscopy were all used to optimize the deposition parameters. In addition, the impact of each conversion route was evaluated by comparing the efficiencies in a “Glass/ITO/SnO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>/P3HT/Carbon” solar cell, having an active surface of 0.25 cm<sup>2</sup>. While the efficiency for directly converted perovskite films is negligible, it reaches 3.3% when using a two-step conversion. This opens the way to promising performances using electrodeposition.



*Figure 1: Diagram showing the consecutive steps for elaborating the solar cell*

## REFERENCES

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2. Huang, J. *et al.* Direct conversion of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> from electrodeposited PbO for highly efficient planar perovskite solar cells. *Sci. Rep.* **5**, 15889 (2015).