

Abstract

The present diploma thesis deals with the fabrication of flexible perovskite solar cells, via slot – die coating, a Roll – to – Roll (R2R) compatible technique. The parameterization of crucial deposition parameters for each layer of the solar cell structure, and especially for perovskite took place. The procedure that has been developed paves the way for the future upscaling and large area production of perovskite solar cells.

The first chapter is an introduction about the fundamentals for photovoltaics and the various generations of solar cells technologies until now. The next chapter focuses on perovskites and especially hybrid perovskites, as their optoelectronic properties are very attractive. In particular, the bandgap tunability, the formation and degradation of the perovskite as long as the main parameters, which affect its formation and stability are described. The third chapter refers to the deposition and characterization techniques, which are used and their principles.

The fourth chapter describes the experimental conditions. The architecture of the solar cell, the materials that have been used and the preparation of the corresponding solutions are presented. Moreover, the way that controlled conditions of humidity had been achieved as long as the analytical procedure of fabrication of perovskite solar cells are reported.

The results of the experiments are represented at the fifth chapter. Firstly, The optimization of each layer of the solar cell structure is reported, beginning with the HTL, PEDOT:PSS. Different solution concentrations have been investigated in order to achieve good printability of the solution and reduced roughness and ideal thickness of the layer. Moving on to perovskite layer, the effect of nitrogen flow and processing temperature to the morphological, optical and crystal properties of perovskite has been studied. Concerning the ETL, PCBM, the proper deposition parameters have been found so as to achieve the planarization of the perovskite's surface with the minimum thickness of PCBM layer. Finally, the effect of the above parameters to the photovoltaic performance of the solar cells has been examined.

In the last chapter, a brief review of the examined parameters, the results and the conclusions that have been obtained are presented. Also, the raised concerns and problems and the proposed solutions and future steps are discussed.

