PEROVSKITE LAYER OPTIMIZATION BY $ZrCl_4$ INTRODUCTION WITHIN FUNCTIONAL INTERFACES

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ABSTRACT

Organic-inorganic perovskite materials are widely used for solar cell applications due to their extraordinary optoelectronic properties and their panchromatic response as light absorbers [1]. Perovskite solar cells (PSCs) have rapidly evolved and reached power conversion efficiency (PCE) exceeding 25%. The perovskite-based devices present a layered architecture based on the deposition of successive thin films (compact layer-CL and / or intermediate electron transfer layer -ETL, perovskite, hole transfer layer - HTL, metal contacts). An important role in the behavior of PSCs is played by the nature, structure and morphology of each layer but also the functionality of the respective interfaces (ETL / perovskite and perovskite / HTL) [2]. To improve the optoelectronic quality of the perovskite films and subsequently enhance device performance, various strategies have been adopted, one of them being the insertion of active buffer layers ontop or underneath the perovskite [3]. Interestingly, the incorporation of ionic salts based on Cl^- ion as a buffer (e.g. KCl), has been found to effectively inhibit the formation of deep trap states at the interfaces, which promoted the surface passivation and suppressed carrier recombination [4]. In the same direction, we present here the results of a comprehensive study on the succesful $ZrCl_4$ deposition at the interfaces of planar perovskite solar cells in order to fine tune the interfaces and control perovskite crystallization. Specifically, $ZrCl_4$ solutions in several concentrations were prepared and spin-coated either to modify the conductive glass [5] or the electron transport layer [6]. The obtained homogeneous and compact films of $ZrCl_4$, as well as the perovskite films which crystallize ontop, were characterized optically, mainly with steady-state and time-resolved photoluminescnence and morphologically (with AFM and SEM microscopies). The films were incorporarated in n-i-p perovskite devices and their photovoltaic performance was evaluated. The results of this work pave the way for the use of metal chlorides with polymeric structure and octahedral coordination as efficient agents for interface engineering in optoelectronic devices.

KEYWORDS: perovksite, solar cells, zirconium chloride, buffer layer, passivation

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