Direct experimental evidence of ionic migration in halide perovskite films by GDOES measurements

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In recent years, halide perovskite solar cells (PSCs) have been studied steadily due to their potential properties: high power conversion efficiency (PCE) to over 21% and low processing cost [1]. However, the stability of PSCs under operating conditions is the main challenge to be addressed before commercialization [2]. It has been suggested that ionic migration could impact optoelectronic performance and affect device operation and long-term stability [3]. In this study, glow-discharge optical emission spectroscopy (GDOES) is used to analyze the depth profiles of constituent elements in halide perovskite films with applied voltage. Solar cells based on halide perovskite (CH3NH3PbI3-XClX) are fabricated by one-step solution-process with PCE of 12.7% (active area of 0.28 cm2) and short-circuit current density (Jsc) of 21.9 mA/cm2. A shift of iodide and chloride ions distribution in perovskite films is observed depending on applied voltage. In this communication, it is shown that GDOES is a powerful method to investigate ionic migration in PSCs under operating conditions.

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[2] M. Shahbazi and H. Wang, Progess in reseach on the stability of organometal perovskite solar cells, Solar Energy, 2016, 123,74-87.

[3] S. Meloni, T. Moehl, W. Tress and M. Gratzel, Nature communications, DIO:10.1038/ncomms10334.