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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.

