

鉛フリーハライドペロブスカイト薄膜および太陽電池に対する SnCl_2 の効果

Effect of SnCl_2 on lead-free halide Perovskite thin films and solar cell devices

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Tin halide perovskite has been a primary candidate as possible environmentally friendly alternative for lead halide perovskites [1]. However the material instability and resulting lower photovoltaic performance compared to methylammonium lead tri-iodide, MAPbI_3 , has been a major obstacle for these perovskites. To overcome this issue, Sn^{2+} excess condition by SnF_2 addition has been proven to reduce tin vacancy during the formation of the perovskites [2]. So far, SnF_2 is known to be the best additive for tin based devices. Recently, a study on tin iodide excess condition combined with reducing atmosphere was reported to extend variation for excess Sn^{2+} source [3]. To our best knowledge, SnCl_2 has not been explored as bi-functional additive: moderate reducing agent and creating tin excess environment similar to SnF_2 . In parallel, Cl^- inclusion has been demonstrated to improve film morphology and crystal growth on lead halide perovskite [4]. Therefore it is natural to examine SnCl_2 as additive on the tin halide perovskite formation process and their optical properties, in order to obtain further insight into the advantages and drawbacks in off-stoichiometric condition for the material properties of the tin halide perovskites. We study the phase formation with X-ray powder diffraction, film morphology and microstructures using scanning electron microscopy, photocarrier lifetime by optical measurements, along with device fabrication.

One-step method was employed in this study for film fabrication as is widely used in the device fabrication. A remarkable change in film formation has been observed compared to tin fluoride additive and reasonable results for device performance was obtained. We will present further study on optical responses and device fabrication.

Part of this work was supported by JST, CREST (JPMJCR16N3) and IRCCS

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