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► **To cite this version:**

Haeyon Jun, Denis Tondelier, Bernard Geffroy, Jean-Eric Bourée, Sufal Swaraj, et al.. Utility of Scanning Transmission X-ray Microscopy to Investigate Chemical Composition in Perovskite Thin Films. Journées Nationales du Photovoltaïque, Jan 2021, Dourdan, France. 2021. cea-03123519

HAL Id: cea-03123519

<https://hal-cea.archives-ouvertes.fr/cea-03123519>

Submitted on 28 Jan 2021

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Utility of Scanning Transmission X-ray Microscopy to Investigate Chemical Composition in Perovskite Thin Films

Haeyeon Jun^{1,2}, Denis Tondlier¹, Bernard Geffroy^{1,3}, Jean-Eric Bourée¹, Sufal Swaraj² and Yvan Bonnassieux¹

¹LPICM-CNRS (UMR7647), Ecole polytechnique, IP Paris, 91128 Palaiseau, France

²Synchrotron SOLEIL, L'Orme des Merisiers Saint-Aubin, BP 48 91192 Gif-sur-Yvette Cedex

³ Université Paris-Saclay, CEA, CNRS, NIMBE, LICSEN, 91191 Gif-sur-Yvette, France

Organic–inorganic lead halide perovskites with remarkable photoelectric properties have achieved power conversion efficiencies of 25.2 %, making them a promising candidate as an emerging solar cell technology [1]–[4]. Formation of high crystalline perovskite film is necessary for stable and high efficient solar cells. Among them, vacuum-based deposition processes are profitable because highly uniform and smooth thin films can be obtained [5], [6]. Especially, characterization of evaporated perovskite thin films using various technique contribute to the accurate analysis in the physical or chemical point of view [7].

Scanning transmission X-ray microscopy (STXM) is an experimental technique based on near edge X-ray absorption fine structure (NEXAFS) spectroscopy [8]. This spectro-microscopy technique allows us to obtain quantitative chemical composition maps in bulk of materials with high spatial resolution (~ 50 nm). We have been exploring the utility of this technique in order to characterize perovskite films synthesized with evaporation techniques. In this poster, we present some strategies developed to study these materials. In particular, we have shown how the soft x-ray energy range from 270 to 750 eV, that includes the C K-edge, N K-edge, Pb N-edge and I M-edge, can be used to quantify elemental and molecular concentration[9]–[11].

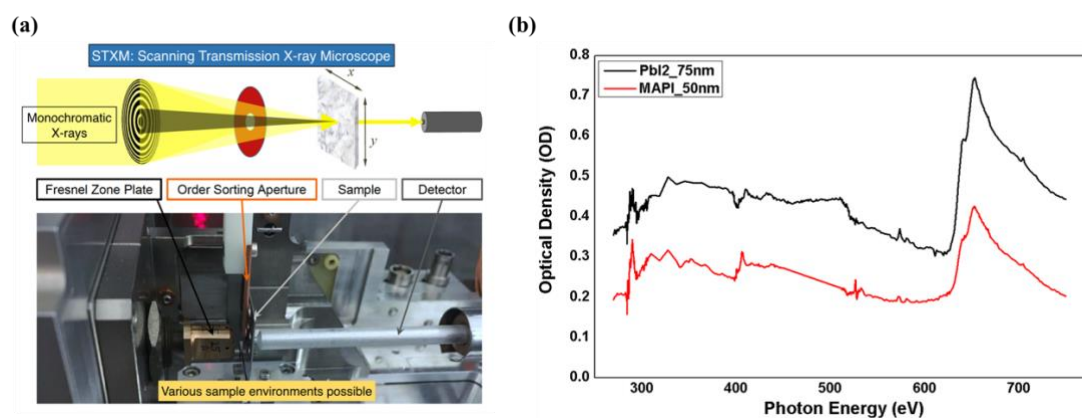


Figure 1. (a) Schematic of scanning transmission X-ray microscope (b) Carbon K-edge, Nitrogen N-edge and Iodide M-edge NEXAFS spectroscopy of PbI_2 and MAPbI_3 perovskite film.

Keywords

Organic–inorganic halide perovskite, Co-evaporation, Scanning transmission X-ray microscopy

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