Investigation of hybrid perovskite solar cells by X-ray
Photoelectron Spectroscopy

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ABSTRACT

Many problems related to the modern materials, like e.g. organic-inorganic perovskite films which are used as an absorbing layer in the solar cell applications, can be solved only by understanding the chemical and physical interactions that occur at the film surface and/or at the interfaces between neighboring layers. One of the most suited methods to be used to investigate the surface and interface properties of the materials is an X-ray Photoelectron Spectroscopy (XPS) [1-5]. This previously called electron spectroscopy for chemical analysis method allows measuring not only the chemical and electronic states of the elements within a material, but also an overlayer growth mode and its thickness (e.g. atomic layer deposition (ALD) growth of buffer and encapsulating layers in the perovskite solar cells) as well as the elemental composition and empirical formula can be determined [1]. In this work, the methylammonium lead triiodide (CH₃NH₃PbI₃) perovskite film and an ALD growth of Al₂O₃ at room temperature on it are investigated by photoelectron spectroscopy (PES). In particular, laboratory- and synchrotron-based XPS and resonant PES at the N1s absorption edge are used. Thanks to the used methods the chemical composition of the CH₃NH₃PbI₃ perovskite film, the ALD growth mode of Al₂O₃ on CH₃NH₃PbI₃ at RT and an electronic structure of CH₃NH₃PbI₃ are determined.