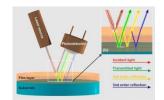
# Film Metrology & More..

# ThetaMetrisis APPLICATION NOTE #026

Thickness measurement of Perovskites films



#### Introduction:

Perovskites are widely used for the development of solar cells. These types of solar cells are systematically investigated due to their promising photovoltaic performance. The thickness and the morphology of perovskite films are the most significant factors that influence the performance of solar cells. In particular, it has been found that the efficiency of a perovskites solar cells is considerably dependent on the film thickness, when the thickness of perovskite is less than 400 nm; whereas the efficiency is significantly dependent on the film morphology of the perovskite layer when its thickness is greater than 400nm¹. In this application note, we measure the thickness of perovskite films using FR-Tools.

#### Means & Methods:

Samples for characterization were two  $CH_3NH_3PbBr_3$  perovskite films with different thicknesses on a standard  $ITO/SiO_2/Soda$ -lime substrate, as shown in the schematic<sup>2</sup>. Reflectance measurements performed using ThetaMetrisis FR-Basic VIS/NIR, operating at the spectral range of 350-1020nm.

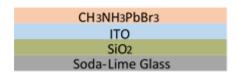
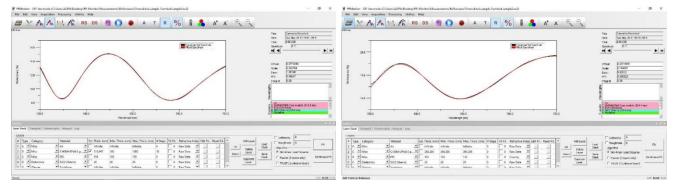


Figure 1. Schematic of the layer stack

## Results:

Typical obtained reflectance spectra (black line) and fitted reflectance spectra (red line), as seen on the FR-Monitor software, of both samples, are illustrated in **Figure 2a**) and **b**), respectively. The fitting for both measurements was applied in the 500-750 nm spectral range, and the thickness of the perovskite thin film in sample 1 was measured at 516.9 nm, while the thickness in sample 2 was measured at 394.4 nm.



**Figure 2a):** Experimental and fitted reflectance spectra of Sample 1. Thickness measured at 515 nm.

**Figure 2b)**: Experimental and fitted reflectance spectra of Sample 2. Thickness measured at 392 nm.

### **Conclusions:**

A demonstration of FR-Basic performance on thickness measurements of perovskite thin films was demonstrated.

<sup>&</sup>lt;sup>1</sup> K. Wang, C. Liu, P. Du, L. Chen, J. Zhu, A. Karim, and X. Gong, "Efficiencies of perovskite hybrid solar cells influenced by film thickness and morphology of CH<sub>3</sub>NH<sub>3</sub>Pbl<sub>3-x</sub>Cl<sub>x</sub> layer," Org. Electron. physics, Mater. Appl., vol. 21, no. February, pp. 19–26, 2015.

<sup>&</sup>lt;sup>2</sup> Xinyan Technology co. Limited