Wide-Field Hyperspectral Measurements of Perovskite/CIGS Tandem Mini-Modules

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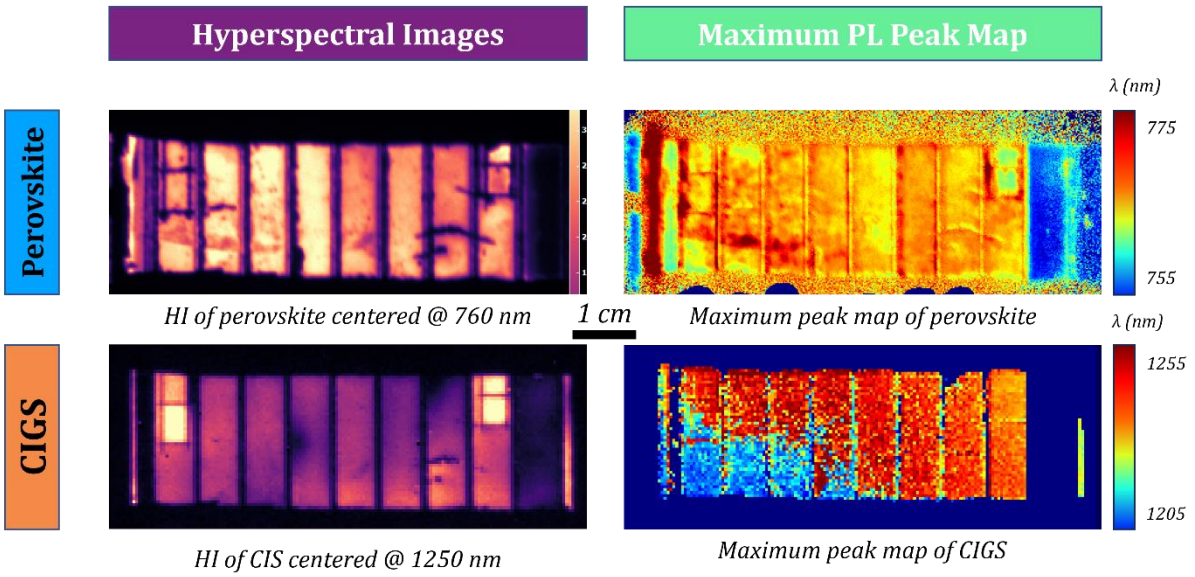
Abstract: In the context of high-power conversion efficiency devices, tandem solar cells will undoubtedly play a major role. Contrary to the often-studied Si bottom cell, this study will focus on the characterization of an all-thin-film approach using a CIGS bottom cell combined with a perovskite top cell [1,2]. This tandem structure allows to combine the high-efficiency tunable bandgaps of both cells with all the advantages of thin-film technologies.

We report here the general assessment of large-scale tandem modules by optical characterization. Hyperspectral Imaging (HI) technique was used to acquire the photoluminescence spectra of the two cells from UV to NIR using two camera detectors [3]. In order to correctly excite the two absorbers, two wide-field LEDs at 405 nm for the top-cell and 890 nm for the bottom-cell, were used. Absolute calibration of both cameras enabled quantitative analysis (Bandgap energy, Quasi-Fermi-Level-Splitting) of each cell of the tandem module. The characterization of a perovskite/CIGS mini-module by HI will be presented (see figure). Ageing tests were also carried out on this specific module to probe the effect of environmental stresses. The effect of degradation was investigated before and after damp heat test using multiple cycles at 85 % relative humidity and at 85 °C. Although the PCE was not in the state-of the art, this first study paves the way for the future development of tandem modules.



Hyperspectral images and maximum peak position map of Perovskite / CIGS module.

References

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3. Cacovich, S. *et al.* Imaging and quantifying non-radiative losses at 23% efficient inverted perovskite solar cells interfaces. *Nat. Commun.* **13**, 2868 (2022).