Contribution ID: **1** Type: **Oral**

Surfaces and buried interfaces characterization of Mn/ZnO and Cu2ZnSnS4 based device: lessons learned from lab to synchrotron facilities

A detailed picture of the thermally activated processes occurring at the Mn/ZnO interface was obtained by a combination of wide range of techniques. The low energy electron diffraction (LEED), the scanning tunnelling microscopy (STM) and spectroscopic techniques based on Auger electron (AES) and on high energy X-ray: X-ray photoelectron and absorption spectroscopies (HAXPES and XANES) and the kinematical X-ray standing wave method (KXSW) allow not only to investigate the chemistry at the heterojunction but also to describe in detail the thermal structure transformations and diffusion process.
We also highlighted the structural and electronic properties of ZnO/CdS/Cu2ZnSnS4/Mo interfaces in different photovoltaic cells by the combination of SEM and destructive XPS depth profiles. The observed composition changes play a key role in the cell performances. The results may also drive a better control of the interfaces in quaternary based photovoltaic cells. Instead of destructive XPS depth profiling, a sounder understanding is possible using bulk sensitive hard X-ray photoemission at various detection angles.

References:
(1) Mac C. Mugumaoderha et al., Phase Transitions at the Mn/ZnO(0001) Interface Probed by High-Energy X-ray Spectroscopies, in Journal of Physical Chemistry C 116, (2012) 665-670.
(2) Mac C. MUGUMAODERHA et al., Physical-Chemistry on the Mn/ZnO(0001) interface investigated by High-Energy X-ray Spectroscopies, Journal of Physical Chemistry C 115, 42 (2011) 20603-20609.
(3) Mac MUGUMAODERHA Cubaka, Structural and electronic properties of (Zn,M)O fabricated by thermal incorporation of a M thin film grown on ZnO polar surfaces (M=Co or Mn), PhD thesis, PUN, Belgique (Namur), October 2011, ISBN: 978-2-87037-739-0.
(4) Mac C. Mugumaoderha et al., Two steps processes fabrication of large scale CZTS thin film absorber for sustainable photovoltaics., book of abstract ECOSS31 (2015), We-B06, p205.
(5) Mac C. Mugumaoderha and Jean-Jacques Piraux, CZTS based cell investigated by destructive X-ray photoemission depth profile, book of abstract ELSPEC (2016), p117.
(6) J. J. Scragg et al., Effects of Back Contact Instability on Cu2ZnSnS4 Devices and Processes, Chem. Mater., 25 (2013) 3162-3171.
(7) Jes K. Larsen et al., Cadmium Free Cu2ZnSnS4 Solar Cells with 9.7% Efficiency, Advance Energy Materials 9, 21 (2019)

Primary author: Dr MUGUMAODERHA CUBAKA, Mac (Physics Departments, ISP-Bukavu and University of Namur)

Presenter: Dr MUGUMAODERHA CUBAKA, Mac (Physics Departments, ISP-Bukavu and University of Namur)