

VACUUM-DEPOSITED HALIDE PEROVSKITES AND BROADBAND TRANSPARENT CONDUCTING OXIDES FOR PHOTOVOLTAICS

Monica Morales-Masis

MESA+ Institute for Nanotechnology, University of Twente, Enschede 7500 AE, The Netherlands

*m.moralesmasis@utwente.nl

Abstract:

Pulsed Laser Deposition (PLD) has offered unique options for the development of complex oxides growth, allowing multi-compound deposition independent of the relative volatility of the elements and ultimate control of interfaces. In this presentation we discuss the rather unexplored but great potential of PLD for: 1. The implementation of broadband transparent electrodes on top of sensitive solar cell absorbers. 2. The single-source deposition of halide perovskite thin films for solar cells and beyond.

In the first part of the presentation we discuss recent developments and application of high-performance TCOs, with a special focus on Zr-doped indium oxide (IZrO), a promising broadband transparent and conducting oxide for perovskite-silicon tandem solar cells^[1-3]. We demonstrate PLD-grown IZrO rear electrode on semitransparent halide perovskite solar cells resulting in reduced damage of sensitive electron transport layers and an improved stabilized efficiency of 15.1%. In the second part, we discuss the recent progress on the growth of hybrid and inorganic halide perovskites by PLD with focus on target preparation and optimization of PLD parameters to achieve optimum control on polymorph formation and optical properties^[4]. All these are important steps forward in the controlled growth and future scalability of optoelectronic materials for efficient devices such as solar cells and LEDs.^[5]

References

- [1] E. Aydin, M. De Bastiani, ...Y. Smirnov, M.Morales-Masis,...S. De Wolf, "Zr-Doped Indium Oxide (IZRO) Transparent Electrodes for Perovskite-Based Tandem Solar Cells," *Adv. Funct. Mater.*, vol. 3, 2019.
- [2] M. Morales-Masis et al., "Highly Conductive and Broadband Transparent Zr-Doped In₂O₃ as Front Electrode for Solar Cells". *IEEE J. Photovoltaics*, vol. 8, no. 5, 2018.
- [3] Y. Smirnov, R. Kuik, L. Schmengler,...M.Morales-Masis, "Scalable Pulsed Laser Deposition of Transparent Rear Electrode for Perovskite Solar Cells", *Under review*
- [4] VM Kiyek, YA Birkhölzer, Y Smirnov, ..., M.Morales-Masis, "Single-Source, Solvent-Free, Room Temperature Deposition of Black γ -CsSnI₃ Films", *Adv. Mat. Interfaces*, vol 7, 2020.
- [5] T. Soto-Montero, W. Soltanpoor, M. Morales-Masis "Pressing Challenges of Halide Perovskite Thin Film Growth", *Invited Perspective, APL Materials*, 2020.