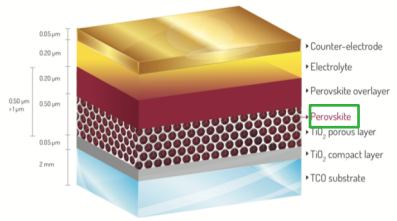
# Perovskite photovoltaic application: Liquid solution based deposition

N. Daem [1*], J. Dewalque [1], G. Spronck [1], A.Maho [1], P.Colson [1], C. Henrist [1], R. Cloots [1]
[1] GREENMAT - CESAM, University of Liege, Allée du 6 Aout 13, Sart-Tilman, 4000 Liege, Belgium.
*E-mail: Nathan.Daem@uliege.be

## Structure of solar cell

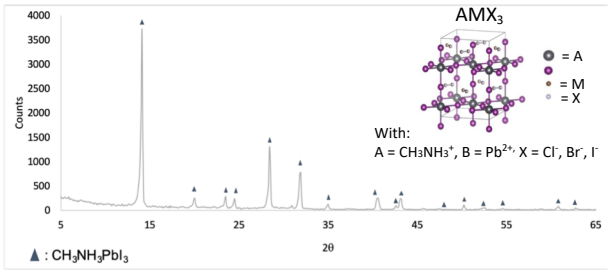



Perovskite-based cells are composed of inexpensive materials and use low-cost, atmospheric and liquid-pressure production techniques. In the laboratory GREEnMat, 2 different compositions are studied:

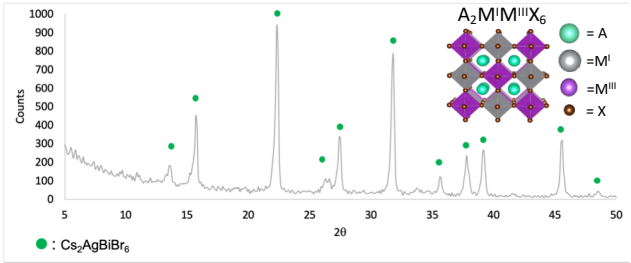
- the classical lead-based perovskite $AMX_3$, the most efficient perovskite solar cells reported so far.
- the double perovskite $A_2M^IM^{III}X_6$. The objective is to developp this thype of compound to replace the lead by less toxic elements. It consists in studying the influence of microstructural properties on the optoelectronic properties.

We study different parameters such as the influence of the carrier gas used during the ultrasonic spray deposition (USP) of the $TiO_2$ blocking layer and the differences between spin-coated and sprayed films on the photovoltaic performances

## Perovskite film (Lead-based)

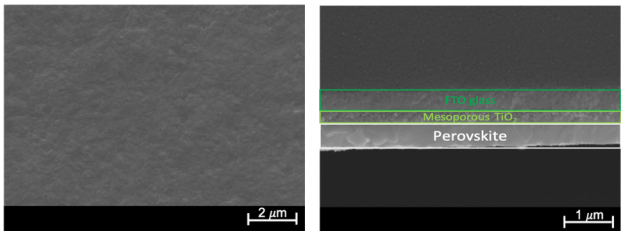



## Double perovskite film (Lead-free)



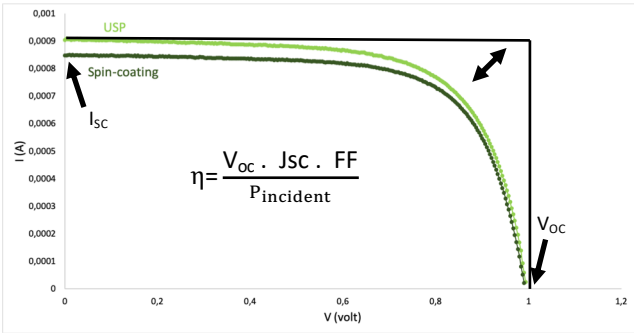

### Micrography of perovskite film

Top view ↔ Cross section



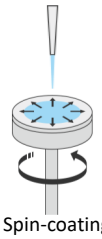

Study of the influence of $TiO_2$ blocking layer

| Samples | Solvent | Precursor | Carrier gas | Annealing (°C) |
|---|---|---|---|---|
| **Spin - coating** | EtOH | TTIP | - | 500 |
| **USP** | EtOH | TAA | $O_2$ or $N_2$ or Air | 500 |




✓ Increase of efficiency with TiO2 USP layer
→ Best cell: η = 16.9 % with USP $TiO_2$ (carrier gas: $O_2$)

### Process scale-up

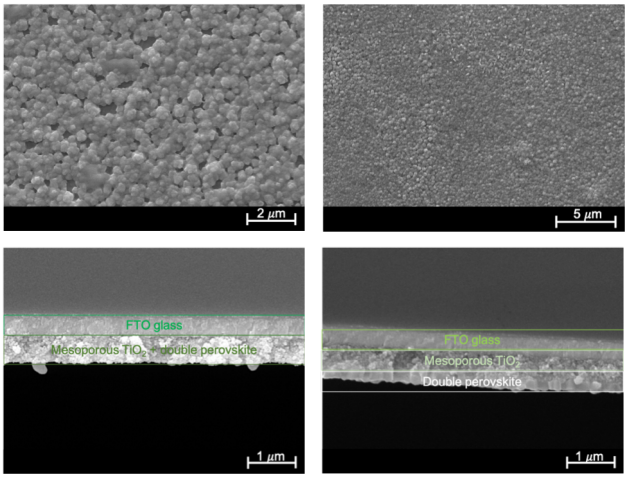


Spin-coating

Ultrasonic spray pyrolysis (USP)

### Micrography of perovskite film

Top view ↔ Cross section




✓ Transfer of the best spin-coating settings to USP
✓ Promising results with uniform and covering films
⌛ Assembly of USP made cells in the coming weeks

## Acknowledgements

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## References

1. Saliba et al. Chem. Mater. 2018, 30, 4193–4201
2. Greul et al. J. Mater. Chem. A (2017), 19972–19981.