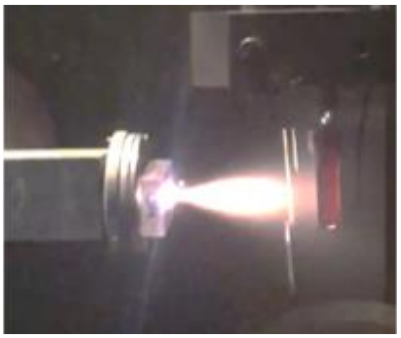
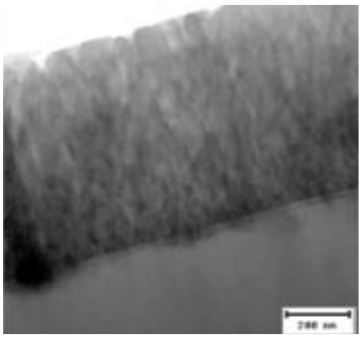
NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2025-2026

Elaboration of hybrid halide perovskite thin films for solar cell application

General Scope:





In the last decade, much attention has been paid to hybrid organic–inorganic lead halide perovskites for the possibility to realize photovoltaic devices with efficiency larger than 25%. However, the realization of high-quality devices is quite difficult because the perovskite family is unstable under the effects of temperature, humidity and light. Moreover, most of the high-performance absorber layers have been grown by solution processing techniques which could present drawbacks due either to a high defect concentration or to the residual presence of the solvent traces in the film.

To overcome such inconvenience, full dry growth processes proved to be successful for materials based on metal oxides have been explored. Among these, the versatile pulsed laser deposition (PLD) permits us to grow layers in a wide range of parameter values, starting from a single stoichiometric target. This technic combines the advantage of solution process (low-temperature) without the inconvenient associated with a solvent. Here, the stoichiometry preservation from the target to film allows the growth of films as pure as the single crystals up to large-area coatings on a variety of substrates, including flexible materials[1]

Research topic and facilities available:

In the first part of the internship, it will be necessary to study the composition of the target in order to obtain the desired stoichiometry of the film. These targets will be produced by synthesizing $MAPbX_3$ or $CsPBX_3$ hybrid perovskite powders. These powders will then be pelletized for use in the PLD deposition chamber to produce deposits a few microns thick.

The obtained films will be characterized by X-ray Diffraction (powder and at grazing angle, both available at the Institut Néel), as well as by Scanning Electron Microscopy. The epitaxy quality will be monitored by texture measurements including XRD and EBSD as well as transmission electron microscopy.

As this project is being conducted in collaboration with INRS in Varennes (Montreal, Quebec) students have the opportunity to spend one month of their internship on site studying the deposition of thin layers of epitaxial perovskite oxides. Travel expenses may be covered by the research network (IRN-NMC).

Possible extension as a PhD:

Yes if funding

Required skills:

Good skills in Materials Sciences (Deposition techniques, vacuum knowledges, characterization techniques: XRD, SEM)

Good writing and oral skills

Starting date: February-March 2025

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More information: http://neel.cnrs.fr

1 E. Ghavidel, A. D. Carlo, A. Ishteev, J. Barichello, K. Konstantinova, D. Saranin, V. Campanari, F. Martelli, B. Paci, A. Generosi, M. Guaragno, A. Cricenti, D. Becerrill, M. Luce, F. Matteocci and A. D. Trolio, *Journal of Materials Chemistry C*, 2024, **12**, 13141–13148.