**Laboratory for Thin Films and Photovoltaics**
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Empa
Materials Science and Technology

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

# Master Thesis

# Accelerated material exploration for stable perovskite absorbers

### Research area

Photovoltaics (PV)

Perovskite absorbers

Perovskite solar cells

Thin-film coating

Physical vapor deposition (PVD)

Slot-die coating

### Focus

☒ Experimental
☒ Opto-electronic characterization
☒ Analytical
☒ Literature and research

### Duration

6 months

### Entry

As soon as possible

### Contacts

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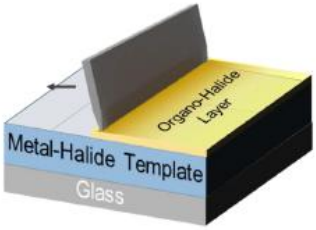
### Motivation

Perovskite-based solar cells have already outpaced the performance of current commercial silicon-based technology. Their tunable bandgap enables pairing with commercially available narrow bandgap absorbers like crystalline silicon (c-Si) or CIGS in tandem configurations, exceeding single-junction efficiency limits. All-perovskite tandems are also a very promising technology. However, stability remains a significant challenge, and investigating the large unexplored perovskite compositional space may lead to the discovery of new promising materials.




In this work, new absorber compositions will be fabricated via a hybrid two-step method that merges the strengths of the two main perovskite fabrication techniques, solution- and vapor-based processes. The obtained absorbers will be then characterized via XRD, XRF, PL&TRPL, UV-Vis, and SEM to assess their suitability for solar cell application. Promising compositions will be implemented in single-junction solar cells to evaluate their behavior in device configuration. This work will significantly contribute to tackling stability, one of the most critical issues of perovskites, accelerating the development of this new and advanced PV technology.

### Your task

You will learn to fabricate wide-bandgap perovskite (~1.8 eV) absorbers via thermal vapor deposition and slot-die coating. The focus will be to investigate new compositions to find those showing good optoelectronic properties and stability simultaneously. XRD, XRF, PL&TRPL, UV-Vis, and SEM data will be used to correlate the investigated compositions with their microstructural quality and optoelectronic properties, while a stress test chamber will be used to assess their stability. In the presence of promising compositions, you will also have the chance to fabricate the corresponding solar cells and evaluate their photovoltaic performance using JV and EQE.

Key tasks include:

- Fabrication of new perovskite absorbers using a hybrid two-step method.
- Optoelectronic and microstructural characterizations
- A comprehensive understanding of the role of processing parameters affecting the growth and optoelectronic quality of the perovskite films and PV performance of the solar cells.

Requirements

- Strong interest in solar cells
- Background in materials science, semiconductors, physics, chemistry etc.
- Master students in Switzerland is preferred

**Notes**

Please include a CV and a transcript of records with your application. The field of photovoltaic research requires a multidisciplinary knowledge. Hence, students with backgrounds in materials science, physics, chemistry etc. are welcome to apply. The project can be tailored to student's expertise and interests. For further information, please contact Alessia Romio.