

Development of semi-transparent thin films solar cells with a focus on exploring novel hole transport materials

Summary

This PhD position focuses at the development of thin films solar cells for semi-transparent applications containing earth abundant elements and exploring novel hole transport materials.

Research field:	Chemical, materials and energy technology
Supervisors:	Prof. Dr. Ilona Oja Acik Dr. Sreekanth Mandati
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

Description

The candidate will carry out a multidisciplinary scientific activity in the framework of the projects EEA grants S-BMT-21-1(LT08-2-LMT-K-01-003), PRG627, TAR16016EK, and H2020 ERA Chair of Emerging Next Generation Photovoltaics. The PhD thesis is aimed at development of earth abundant stable materials for semi-transparent thin film photovoltaics (PV). Antimony chalcogenides are pursued as absorbers while metal oxide films would serve as electron transport layers and both these layers will be fabricated by chemical deposition methods. Majorly, robust, resource-saving and easily scalable methods such as ultrasonic spray pyrolysis, which has great potential to become front-line technology for rapid, cost-effective, large-area and high yield mass production of materials, will be utilized for the fabrication of solar cells. Sb_2S_3 is an emerging PV absorber with a bandgap of 1.8 eV and relatively large absorption coefficient ($\approx 10^4 \text{ cm}^{-1}$ at 450 nm) with earth abundant and non-toxic constituents. Our group has already demonstrated semi-transparent Sb_2S_3 solar cells with efficiencies $> 5\%$ under 1 sun and an average visible transmittance of $\approx 30\%$ (devoid of metal contact). In this thesis, the candidate will focus on exploring novel cost-effective hole transport materials (HTM), developed in collaboration with Kaunas University of Technology, Lithuania, to successfully apply in semi-transparent Sb_2S_3 solar cells. The prospective scholar is expected to identify suitable method and optimize formulations to demonstrate the effectiveness of novel HTM layers in Sb_2S_3 solar cells. Further, advanced characterization of solar cell and individual layers will be performed to unravel the band energetics, defect densities and carrier lifetime.

Supervisors

Main supervisor: Dr. Sreekanth Mandati
Co-supervisor: Prof. Dr. Ilona Oja Acik

Responsibilities and (foreseen) tasks

- Fabrication of Sb_2S_3 solar cells through optimizing underlying metal oxide and absorber layers.
- Optimization of method and formulations for successful demonstration of new hole transport materials in semi-transparent Sb_2S_3 solar cells.
- Characterization of materials and solar cell devices using various dedicated characterization techniques.
- Analysis of the research data, preparing reports, presentation at conferences (poster, oral talk), write research papers.
- Contribute to the organization and dissemination of research and practitioner workshops where project findings are presented.

Applicants should fulfil the following requirements:



The successful applicant will hold a Master degree in Physics, Chemistry, Materials Science or a related field. Previous research experience in thin film technologies and material characterization. Excellent team working attitude and communication skills in English (both written and oral) are an essential requirement. Competences in using data analysis and graphing software: Microsoft Office (Word, Excel and PowerPoint), Origin.

We offer:

- 4-year PhD position in the research group focused on emerging PV technologies in Estonia
- The chance to do high-level research in one the most booming emerging photovoltaic field
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of material science

Additional information

For further information, please contact Dr. Sreekanth Mandati (sreekanth.mandati@taltech.ee) and Prof. Ilona Oja Acik (ilona.oja@taltech.ee) or visit <https://taltech.ee/en/laboratory-thin-film-chemical-technologies>



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