

Research Associate in Solution Processed Thin Film Solar Cells (SolPV)

REQ210323

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

Project Description

The Centre for Renewable Energy Systems Technology (CREST), at Loughborough University, in collaboration with the University of Bristol, University of Northumbria and the Centre for Process Innovation (CPI) have been awarded funding from the EPSRC to undertake a program of research to develop thin film solar cells using solution processing techniques. Specifically, the project will focus on the development of thin film solar cells based on copper indium gallium diselenide (Cu(In,Ga)Se_2 or CIGS) and copper zinc tin selenide ($\text{Cu}_2\text{ZnSnSe}_4$, or CZTS). The project entitled "Solution-Processed Inorganic Thin-Film Photovoltaic Devices (SolPV)" aims to develop solution processed CIGS and CZTS solar cells to above 15% power conversion efficiency, using scalable manufacturing routes, and cadmium free architectures. Some of the key strategies include:

- Optimisation of the absorber precursor formation to implement scalable manufacturing methods based on solution processing (such as spray coating, slot die, etc).
- Design thermal processing strategies to achieve controlled recrystallisation and compositional grading of the absorber.
- Interface engineering of the absorber/buffer interface to improve solar cell performance, including the ultimate removal of cadmium containing compounds.

The main areas of research to be performed at CREST relate to the development of solution processed CIGS solar cells specifically. The Research Associate will focus on improving reproducibility, enhancing grain growth, improving device interfaces, and improving device performance through the use of alkali surface treatments. A range of different characterisation techniques will be used to support the development of the project.

Job Description

Job Grade: Specialist and Support Academic Grade 6

Job Purpose

The key role of the Research Associate will be to develop Cu(In,Ga)Se_2 thin film solar cells using an amine-thiol solvent system in combination with metal chalcogenide precursors (such as Cu_2S , In_2S_3 , Ga and Se). The solvent system, which has been developed at Loughborough, has already proven to produce ~12% solar cells, and the Research Associate will be required to develop processes and techniques to increase the efficiency of these devices to above 15%, as well as improve the reproducibility of the process. The Research Associate will also develop processes to fabricate cadmium free buffer layers to implement into high efficiency devices, and finally will also work on developing scaling processes, to fabricate 5cm x 5cm mini-module sized devices, using monolithic integration, towards the end of the project. To accomplish these goals, the Research Associate will use a variety of measurement techniques, including structural, composition and opto-electronic characterisation to understand the limiting factors in the device processing, to enable the fabrication of high efficiency solar cells.

Job Duties

To be responsible for undertaking the main research activities as follows:

- To fabricate thin film CIGS solar cells using solution processing, based on the dissolution of metal chalcogenides in amine-thiol solvent systems.
- To develop alternative selenisation processes including the design and build of new furnace systems for small device area processing (up to 50mmx50mm) to enable enhanced and reproducible grain growth.
- To develop robust back contact architectures which reduces the degree of MoSe₂ formation present in solution processed CIGS films.
- To develop prototype mini-modules up to 50mmx50mm.
- To develop alternative buffer layers for CIGS solar cells (such as Zn(O,S,OH) and (Zn,Mg)O thin films).
- To implement alkali surface treatments and band gap grading to the CIGS absorber to improve device performance.
- To use a range of techniques to identify efficiency limiting processes seen in these devices in an effort to improve device performance, including but not limited to SEM-EDX, TEM, XRD, XPS, J-V, EQE, LBIC, EL, PL, Hall, and admittance spectroscopy.
- To develop house-built measurements techniques to supplement those mentioned above to identify limiting factors in solution processed CIGS solar cells.
- To utilise modelling software packages (such as SCAPS, wxAMPS, etc) to aid in the understanding of the limiting processes seen in solution processed CIGS solar cells.
- To support the day to day operation of the research laboratory including maintenance of fabrication and measurement equipment
- To report to and discuss results and analysis with the Loughborough University principal investigator.
- To assist in the dissemination of results arising out of the project.
- To travel to collaborators' locations within the UK and report on the progress of the project.
- To provide feedback to the project team on progress and assist in preparing interim and final project reports.
- To work together with academic and industrial partners of the project team.
- To make presentations to industry and academia at project meetings and international conferences.
- To publish the outcomes of research in high impact journals and international conferences.
- To assist in co-supervision of undergraduate and postgraduate project students, and PhD students where required.

Points To Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to Dr Jake Bowers.

Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

- 1 – Application
- 2 – Test/Assessment Centre/Presentation
- 3 – Interview

Essential Criteria

Area	Criteria	Stage
Experience	Background in an Engineering or Science related discipline related to thin film photovoltaics or similar	1, 3
	Experience in preparation of thin film inorganic materials using solution chemistry processes such as spray coating, spin coating, slot die coating, chemical bath deposition etc	1, 3
	Experience in using physical vapour deposition techniques for thin film growth such as sputtering, e-beam, thermal evaporation, ALD etc	1, 3
	Experience in opto-electronic characterisation of solar cells	1, 3
	Experience of material characterisation techniques such as SEM, TEM, XRD, XPS, AFM etc	1,3
	Experience of successfully designing and undertaking a complex programme of experimental work	1, 3
	Experience of having produced technical reports and journal/conference papers and / or guidance materials on engineering or science topics	1, 3
	A journal and conference publication record commensurate with current career path and stage	1, 3
Skills and abilities	Knowledge of semiconductor and/or solar cell physics	1, 3
	Knowledge of materials chemistry and/or solid state physics	
	Knowledge of materials science methods related to inorganic thin film processing and analysis	
	Knowledge of experimental techniques associated with solar cell analysis	1, 3
	Excellent written and oral communication, and IT skills	1, 3
	Self-motivated with ability to meet deadlines	1, 3
	Ability to work independently and as part of a team, interacting with different academic and industrial partners	1, 3
	Excellent interpersonal, and organisational skills	1, 3
Training	Demonstrate evidence of having undertaken further training	1, 3
Qualifications	Relevant PhD (or submitted and awaiting viva/defence) in an Engineering or Science discipline, preferably related to thin film solar cells or a similar area (or equivalent experience)	1, 3

Desirable Criteria

Area	Criteria	Stage
Experience	Current or recent relevant work experience at post-doctoral level in an academic or industrial environment	1, 3
	Experience working with amine-thiol solution chemistry	1, 3

	Experience working with CIGS or related chalcogenide PV materials	1, 3
	Experience of developing measurement systems (such as but not limited to Labview controlled hardware)	1, 3
	Experience of developing fabrication hardware such as deposition systems or annealing furnaces	1, 3
	Experience of using advanced PV optical and electronic characterisation	1, 3
Skills and abilities	Ability to assist in teaching of undergraduate or postgraduate students	1, 3
	Previous experience of successfully undertaking a detailed experimental test campaign and data analysis	1, 3
	Previous experience of design of experiments such as Taguchi analysis.	1, 3
	Previous experience of using a programming language to develop tools to aid in advanced data analysis (such as MATLAB, Python, CFD etc)	1, 3
Qualifications	Appropriate postdoctoral experience	1, 3

Conditions of Service

The position is **full time** (1.0 FTE) and **fixed term** for 3 years. Salary will be on Specialist and Support Academic Grade 6, (£30,942 - £40,322 per annum), at a starting salary to be confirmed on offer of appointment.

The appointment will be subject to the University's normal Terms and Conditions of Employment for Grade 6 and above staff, details of which can be found [here](#).

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which are available at <http://www.lboro.ac.uk/services/hr/a-z/family-leave-policy-and-procedure---page.html>.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: <http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html>

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see <http://www.lboro.ac.uk/services/hr/athena-swan/>