

Research Associate

Sustainable Manufacturing of Transparent Conducting Oxide (TCO) Inks and Thin Films

Job Ref: REQ171251

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.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

This post is related to the EPSRC project titled "**Sustainable manufacturing of transparent conducting oxide (TCO) inks and thin films**" that is led by University College London (UCL) in collaboration with three schools at Loughborough University, specifically Mechanical & Manufacturing Engineering, Science (Chemistry) and the Design School.

This project seeks to develop processes and resources towards sustainable and inexpensive high quality transparent conducting oxide (TCO) films (and printed tracks) on float glass, plastics and steel. In particular, replacement materials for Indium Tin Oxide (ITO) and F-doped Tin Oxide (FTO). These materials are used in low-e window coatings (>£5B pa), computers, phones and PV devices. The current electronics market alone is worth in excess of £0.9 Trillion and every tablet PC uses ca 3g of tin. Indium is listed as a critical element, available in limited amounts and often from unstable geopolitical areas. Tin metal has had the biggest rise in price of any metal consecutively in the last four years (valued at >£30K per ton). In this project we will develop sustainable up-scaled routes to TCO materials from precursors containing earth abundant elements (titanium, aluminium, zinc) with equivalent or better figures of merit to existing TCOs. UCL's method uses Aerosol assisted (AA) CVD to develop large-scale coatings and developing new manufacturing approach to printed TCOs using highly uniform nanoparticle dispersions. AACVD has not been upscaled- although the related Atmospheric pressure (AP) CVD is widely used industrially. APCVD was developed in the UK (Pilkington now NSG) for commercial window coating methods- and in the UK glass industry supports >5000 jobs in the supply chain.

Our challenge is to take our known chemistry and develop the underpinning science to demonstrate scale up routes to large area coatings. This will include pilot scale AACVD, nanoparticle dispersions and inks and their successful deposition. Common precursor sets will be utilized in all the techniques. Our focus will be to ensure that the UK maintains a world-leading capability in the manufacturing of and with sustainable TCOs. This will be achieved by delivering two new scale up pathways one based on AACVD- for large area coatings and inks and dispersions for deposition processes.

Nano-dispersions will be formulated for use by the Loughborough team, in jet, spin coating, dip coating and screen printing, advanced microwave processing and TCO application testing. Industry partners will provide engineering support, guidance on the aerosol transport issues, scale up and dynamic coating trials (Pilkington, now NSG), jet and screen printing on glass (Xaar, Akzo Nobel, CPI) and use the TCO targets for Magnetron Sputtering of thin films on plastics (Teer Coatings). The two strands will be overseen by Life-cycle modelling and cost benefit analyses to take a holistic approach to the considerations of energy, materials consumption and waste and, in consultation with key stakeholders and policy makers, identify best approaches to making improvement or changes, e.g. accounting for environmental legislation in nanomaterials, waste disposal or recyclability of photovoltaics. We believe there is a real synergy of having two strands as they are linked by common scale up manufacturing issues and use similar process chemistries and precursors.

Job Description

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose

To carry out research activities to deliver results related to the development and evaluation of deposition processes for novel TCO dispersions, including the characterisation and end use applications of the TCO films.

Job Duties

- Development of aero-sol and spray associated protocols to deposit novel conformal pin-hole free TCO coatings on glass and polymeric substrates.
- Development of low temperature deposition protocols to complement the thermal stability of polymeric substrates.
- Development of protocols to obtain patterned coatings as required.
- Development of advanced microwave based selective post-processing techniques to enhance the materials, optical and mechanical properties of TCO coatings.
- Characterisation of TCO coatings for materials properties (i.e. composition, structure, crystallinity, defect density, surface roughness), optical properties (i.e. transmission, diffuse reflectance, absorption), electrical properties (i.e. dopant concentration, sheet resistance) and mechanical properties (i.e. adhesion, stability, reliability).
- Construction of light harvesting and energy storage devices on glass, metal and polymeric substrates.
- Basic and advanced characterisation of above mentioned devices and individual device components.
- Monitor, review and implement risk and safety protocols.
- Facilitate knowledge transfer as required.
- Design and implementation of experimental programme.
- Preparation of appropriate workflows to minimise/mitigate the risk of delivery of project targets outlined by the programme.
- Prepare manuscripts for publication in high impact scientific journals.
- Working in a team environment to achieve targets within the specified deadlines.
- Attending regular meetings, preparing and presenting technical reports as required.
- Ensuring all relevant permissions are obtained for all research and published information.
- Maintaining awareness and a database of current and emerging research/advances relevant to the project.
- Based on the project outcomes, preparation of material for conference presentations, journal papers, regular reports to sponsors, industrial partners and other parties (i.e. media) as appropriate.
- Prepare progress reports and the final report as required by the sponsor and collaborators.
- Assist with PhD student supervision.
- Assist with teaching and research delivery in laboratories.
- Maintain confidentiality of results and other confidential information.
- Comply with University Health and Safety Policy and with all University Rules and Regulations.
- Willingness to undertake other duties as may be reasonably requested and that are commensurate with the nature and grade of the post.
- Willingness to undertake training as required, fulfilling the requirements of the post.

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 Professor Upul Wijayantha.

Person Specification

Your application will be reviewed with respect to meeting the essential and desirable criteria listed below. 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	Previous research experience	1, 3
	Experience of conformal coatings (i.e. aero-sol, cold-press, electrodeposition, chemical) and construction of light harvesting and energy storage devices	1, 3
	Experience and/or awareness of microwave processing of coatings prepared on glass and polymeric substrates	1, 3
	Experience of writing detailed technical reports and research papers	1, 3
	Experience of delivering industrial projects	1, 3
Skills and abilities	Effective Project Management skills	1, 3
	Excellent written and oral communication skills	1, 3
	Self-motivated with ability to meet deadlines	1, 3
	Excellent interpersonal, and organisational skills	1, 3
	Knowledge of relevant Health & Safety issues	1, 3
Training	Demonstrate evidence of having undertaken further training	1, 3
Qualifications	PhD (or near completion) in Physical Chemistry	1, 3
Other	Commitment to observing the University's Equal Opportunities policy at all times	1, 3

Desirable Criteria

Area	Criteria	Stage
Experience	Strong Physical Chemistry background	1, 3
	Experience and/or awareness of basic and advanced characterisation of light harvesting and energy storage devices and device components	1, 3
	Experience of working in multi-disciplinary teams	1, 3
	Developing proposals for funding from external agencies	1, 3
	Working in a high quality academic research environment	1, 3
	Experience of teaching and / or supervision of students in relevant areas	1, 3
Skills and abilities	Authoring original work, in the highest quality refereed academic journals	1, 3
	A strong publication track record	1, 3
	A flexible approach to new problems/difficulties and new challenges	1, 3

Conditions of Service

The position is full-time and fixed-term until 31 January 2019. Salary will be on Specialist and Supporting Academic Grade 6, £29,799 - £38,833 per annum, subject to annual pay award and 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 Academic and Related 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/>

Informal Enquiries

Informal enquiries should be made to Professor Upul Wijayantha by email at U.Wijayantha@lboro.ac.uk or by telephone on 01509 222574.

Applications

The closing date for receipt of applications is **31 January 2018**.