

## **Postdoctoral Research Associate – Quasi-ambient bonding to enable cost-effective high temperature Pb-free solder interconnects**

**Job Ref: REQ180403**

**As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.**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 research group relevant to the advertised post consists of researchers involved with a significant number of current governments and industrially funded research projects for advanced materials and manufacturing processes for heterogeneous integration of high temperature and power/hybrid electronics. Loughborough University has outstanding research expertise and relevant facilities for advanced multifunctional materials and electronics manufacturing research including advanced materials deposition, bonding/ joining and associated materials characterisation and testing based at Loughborough Materials Characterisation Centre (LMCC).

This is an exciting opportunity for researchers to join a UK strong research group investigating and developing advanced technologies for high temperature electronics and optoelectronics integration. The work will be funded through EPSRC in collaboration with Imperial College London and the University of Manchester, with an explicit aim to enable future generation design and manufacture of high value electronic products through the use of quasi-ambient bonding (QAB) with reactive nanofoils as a route to lowering the process time and thermal load during packaging of high-temperature electronic devices.

The Postdoctoral Research Associate (PDRA) will be primarily based in the Wolfson School of Mechanical, Electrical and Manufacturing Engineering, with certain laboratory work conducted elsewhere at the University and at collaborating organisations.

The work entails, primarily, the following activities under the direction and supervision of Professor Changqing Liu, or his nominee.

### **Job Description**

**Job Grade:** Specialist and Supporting Academic Grade 6

### **Job Purpose**

The integration of the next generation wide-band gap (WBG) such as SiC power devices has been bottlenecked by prevailing manufacturing technologies, which are unable to offer a cost-effective approach to robust interconnects, addressing the associated thermal management and offering a more reliable packaging solution. In this project, quasi-ambient bonding (QAB) will be applied to a range of low-cost, lead-free high-temperature alloys, with the primary aim to the tailored applications in high-temperature power electronics and optoelectronics for sealing of hermetic packages. The processes developed will be evaluated in terms of bonding strength and in-service reliability, and benchmarked against alternative processes based on lead- and gold-based solders. Alongside, extensive modelling and characterisation will be carried out aiming at gaining an improved understanding of the interfacial interactions in the QAB bonding process. The proposed research has the potential to provide a low-cost,

sustainable joining technology for electronics manufacturing that can continue to meet the operating temperature requirements of high-temperature electronics for many years to come. At the same time it will yield new fundamental insights into processes involving rapid solidification of complex alloys that will be of wide interest to the materials science and manufacturing research communities. Successful candidates will join an interdisciplinary team with substantial industrial exposure and academic collaborations in the UK and worldwide, as such they will be able to continue their career in this exiting field delivering future high value added products, likely utilised in electric and hybrid vehicles (EHV), aerospace crafts, renewable power components and traction control systems.

## **Job Duties**

### **Research**

- To carry out literature survey on high temperature electronic materials and QAB bonding process, in particular, the applications in electronics/optoelectronics packaging or assembly.
- To apply numerical analysis and establish suitable models to understand the performance and interfacial interaction and evolution during and post QAB bonding.
- To conduct scientific and technological research into developing suitable high temperature solder alloys and deposition processes viable for QAB bonding.
- To design and optimise the QAB bonding structures to achieve optimal bonding integrity and bonding strength with minimal detrimental defects.
- To set up instrument/rig of QAB bonding process viable for bonding industrial components or devices.
- To develop novel and controllable ignition methods and techniques incorporating with the QAB bonding with the QAB bonding instrument.
- To undertake various materials characterisation and testing on the QAB bonded structures to elaborate the underlying fundamentals of reliability physics.
- To optimise the solder alloy materials, QAB processing parameters for further enhancements of the bonding properties and reliability.
- To conduct various experimental studies through collecting, managing and analysing the obtained experimental data, and to support other team members who may need to use the data as required.
- To assist in other related engineering research projects as required.
- To engage with academic partners as well as industrial partners of the working group.
- To contribute, attend and present the scientific findings in relevant international conferences.
- To manage the progress of the project and work with the other team members for the deliverables required according to the time scale.
- To write and publish high quality and high impact journal papers based on the research outcomes and make presentations on the work to present to academic and related partners.
- To write technical reports and present research findings to the partners in the project phase review meeting.
- To contribute and present the results to EPSRC, academic and industrial collaborators.
- To plan, manage and conduct the work according to agreed deadlines.
- To assist in research grant applications where appropriate.

### **Teaching**

- Teaching is not the primary purpose of this post and teaching load will be small relative to the typical load of a member of academic staff in the School, but the Postdoctoral Research Associates will be expected to contribute to taught programmes and student projects, at any level, if appropriate and if requested to do so.

### **Other Related Activities and Functions**

- To engage in training programmes in the University (e.g. through Professional Development) and elsewhere as required.
- To undertake such other duties as may be reasonably requested and that are commensurate with the nature and grade 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 the Project Principal Investigator, Professor Changqing Liu.

## 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	Significant postgraduate research experience in advanced materials and bonding processes.	1, 3
	Skills and experience of utilising advanced materials characterisation techniques.	1, 3
	Skills and previous experience of numerical modelling.	1, 3
	Experience and strong track records in publishing high impact journal papers.	1, 3
Skills and abilities	Excellent inter-personal and communication skills - both written and oral presentations.	1, 2, 3
	Ability to work independently and as part of a team, and able to interact and collaborate with different academic and industrial partners.	3
	Excellent academic writing skills for publications.	3
	Excellent experimental and analytical skills	1, 3
	Highly-motivated with the ability to set and meet deadlines appropriate to the progress of the project.	1, 3
Training	A willingness to undertake further training as appropriate and to adopt new procedures as and when required.	3
Qualifications	Hold a PhD degree (or approaching completion of a PhD) in materials science, engineering, physics, chemistry or other relevant subject.	1
Other	Willingness to travel for meetings and conferences sometimes internationally.	3
	Commitment to observing the University's Equal Opportunities policy at all times.	3
	A strong publication track record.	1, 3

### Desirable Criteria

Area	Criteria	Stage
Experience	Experience of developing high temperature electronics materials and manufacturing processes for electronics packaging.	1, 3
	Experience of analysing the reliability of electronic interconnects under harsh service environments, such as high temperature, large current density.	1, 3
	Experience in QAB numerical/modelling techniques and experimental work.	1, 3
Skills and abilities	Knowledge of electronic materials, bonding processes and reliability analysis under harsh environment.	1, 3

	Strong scientific writing skills for academic journals.	1, 2, 3
	Effective communication and working on research projects in a team.	1, 3
	Strong initiative learning and problem solving skills.	1, 3
Qualifications	Relevant PhD in a subject related to electronic materials, electronics manufacturing or mechanical engineering.	3
Other	N/A	

## Conditions of Service

The position is full-time and fixed term for 24 months (this term will be reduced if appointed after April 2019 due to funding limitations). Salary will be on Specialist and Supporting Academic Grade 6 (£29,799 - £38,833 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/>

## Informal Enquiries

Informal enquiries are welcomed and should be directed to Professor Changqing Liu, Professor of Electronics Manufacture, Wolfson School of Mechanical, Electrical and Manufacturing Engineering, Tel: +44 (0)1509 227681, [C.Liu@Lboro.ac.uk](mailto:C.Liu@Lboro.ac.uk).

## Applications

The closing date for receipt of applications is **20 June 2018**.