Postdoctoral Research Associate in Thermal Management of Semiconductor Devices: Innovation in Materials, Characterization and Heat Extraction

1 JOB DESCRIPTION

Faculty / School or Division: Faculty of Science, School of Physics

Faculty/School or Division Address: HH Wills Physics Laboratory, University of Bristol, Tyndall Avenue, Bristol, BS8 1TL

Job Family:	**Research and Teaching**		
Grade/Pathway:	**Grade I/J** **Pathway 2**	**Salary range:**	**Grade I £ 40,704 – 45,641 per annum** **Grade J £ 45,641 – 51,258 per annum**
Hours of work:	**Full-Time, 35 hours per week**	**Contract type:**	**Open-ended (with fixed funding for 2 years)**
Work pattern:	**Mon-Fri, typically 9am-5pm**	**Vacancy Reference Number: ACAD108783**	

1.1 Main Job Purpose

This is a position in the Centre for Device Thermography and Reliability (CDTR), led by Professor Kuball, with its 35 research members. The CDTR leads the £11M UKRI Innovation and Knowledge Centre REWIRE, aimed at transforming next generation wide and ultrawide bandgap power electronics, as well as AI chips. Furthermore, the CDTR is part of Horizon Europe programmes on innovative cooling solutions for chips including Si based, using diamond in new ways, as well as European Space Agency (ESA) and DARPA programmes including THRUST on high frequency high power RF electronics. Power densities in these devices are ever increasing which requires new ways to spread and manage heat.

This role focuses on transforming thermal management and reliability of novel electronic semiconductor devices/chips (including AI chips), using in part wide and ultra-wide bandgap materials, such as GaN, Ga_2O_3, BN, AlN and diamond. An area of research interest, for example, are novel ways of determining device temperature and thermal conductivity and developing/implementing novel heat sinking approaches; this includes the integration of diamond for heat sinking into electronics, microfluidics as well as the recycling of heat waste energy generated by the electronic chip. You will also assess overall heat transport within the chips, their packaging and systems. You will use new optical laser-based systems to study temperature as well as electric fields with sub-micron spatial resolution; as these limit device performance and reliability. In this context, new material and device structures will be designed and studied. Prior expertise in optical laser-based systems is essential, and knowledge of thermal/thermomechanical simulations is of benefit for this position. You will have the

opportunity to study unique device structures, apply new thermal imaging techniques for nm-scale devices. You will also access the extensive device testing suite available in Bristol, from advanced electrical, thermal to electric field analysis of devices, simulation tools (ATLAS, ANSYS), diamond CVD system, laser micromachining, and a clean room; you will also have the opportunity to collaborate within our 35-member team as well as with our industrial partners.

The CDTR leads numerous UK and international strategic programmes on power and RF electronics, including European Innovation Accelerator (part of Horizon Europe) programme CoolbrAIn for waste heat recycling to improve energy efficiency, EPSRC programme grant ULTRAlGaN on developing vertical solid state circuit breakers using high composition AlGaN materials, and the Innovation and Knowledge Centre REWIRE, focusing on GaN, Gallium Oxide, SiC and diamond power materials and devices, from their fundamental understanding and development, to the commercialization of device technology in part co-designed with industry, a strategic investment of the UK funding agency UKRI in excess of £18M into the CDTR in Bristol. This position also benefits from the Chair in Emerging Technologies awarded to Professor Kuball by the Royal Academy of Engineering (RAEng) in 2020, and various US funded programmes the CDTR is partnered in. This research position will give you the opportunity to make a major impact on future semiconductor device technology.

1.2 Main Statement of Responsibilities

Responsibilities applicable to both Grade I and Grade J:

- Advance wide and ultra-wide bandgap semiconductor materials device as well as AI technology and their understanding.
- Design, build and use optical laser-based systems for device temperature and material thermal characterization.
- Develop and implement new heat extraction/spreading solutions.
- Developing material / device thermal models for device design and to complement experiments, using finite element and other simulation tools.
- Contribute to managing our thermal characterization laboratory and advise junior group members.
- Support short term industrial contract work.
- Support other research activities in the group.
- Write/co-write scientific papers, conference contributions and reports for projects.

Additional responsibilities applicable to Grade J:

- Perform independent research, and lead on research strands of the CDTR, including programme management when needed.
- Working together with/co-supervising PhD students of CDTR.
- Write/co-write scientific research & fellowship proposals.

Administration Responsibilities

Although this post is research focused, necessary administrative tasks relating to the work and the CDTR will also need to be undertaken. This includes ensuring compliance with University, HEFCE and RCUK Open Access publication reporting requirements via Pure and Research fish, research data management requirements, general Health and Safety compliance, ordering of consumables, equipment and other investments as needed. The appointee will also be given other administrative roles within the CDTR.

Teaching Responsibilities

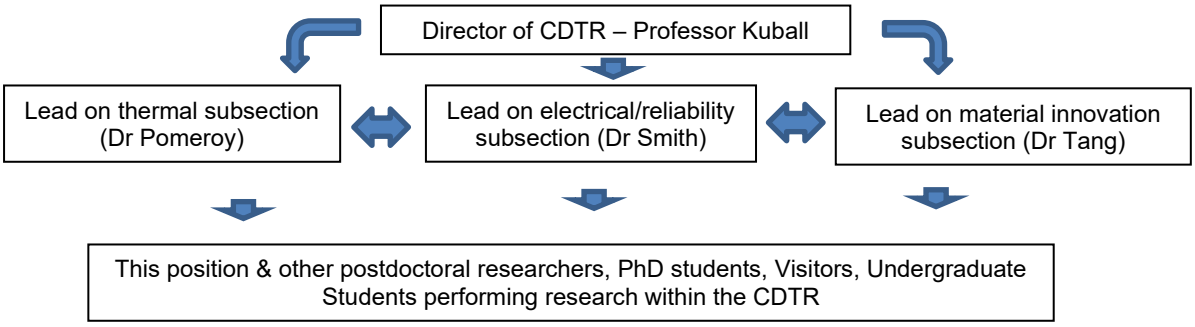
As this role is a Pathway 2 (Research) role, there are no formally specified teaching duties required of the role-holder. However, other commitments permitting, the role-holder may be given development opportunities to undertake activities such as teaching on Masters and Doctoral programmes and/ or supervising MSc dissertations within the School of Physics, as appropriate.

1.3 Relationships

Line manager: Professor Martin Kuball

Line manager to (where appropriate): N/A

1.4 Organisation Charts



1.5 Job Hazards/Safety Critical Duties (Pre-employment health screening)

Not applicable.

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2 PERSON SPECIFICATION

2.1 Relevant Experience, Skills and Knowledge

Essential criteria for appointment at both Grade I and Grade J:

- Experience in semiconductor materials / devices.
- Experience in optical measurement techniques.
- Interest in thermal characterization of materials or devices.

Additional essential criteria for appointment at Grade J:

- Experience in in leading research thrusts of research groups.
- Experience in supervising/co-supervising PhD students.
- Experience in writing/co-writing scientific research & fellowship proposals.

Desirable

- Experience of building optically based materials or device characterization systems.
- Finite element thermal modelling.
- TCAD device modelling.
- Physics based modelling.
- Interfacing and automation of lab equipment using Labview or similar software.
- Experience working with lasers.

2.2 Relevant Qualifications

Essential

- Hold a PhD in Physics, Material Science, Engineering or related discipline, or have submitted a PhD thesis in one of these disciplines by the time of taking up the appointment, or have equivalent professional qualification/experience.

2.3 Communication and Interpersonal Skills

Essential

- Good written and oral communication skills in English.
- Independent and strongly self-motivated.
- Willingness to work co-operatively in a team.

Desirable

- Experience in proposal, project report writing and industrial contract research report writing.
- Good publication record.
- Experience in working together with PhD students.

2.4 Additional Criteria

Essential

- Ability to work independently and develop original approaches to solve problems.
- Ability to manage time and meet deadlines.
- Willingness and motivation to independently learn new techniques.
- Ability to engage in flexible work practices.
- Willingness to travel, both in the U.K. and abroad, and including overnight stays (with suitable notice).

3 CAREER PATHWAY AND OTHER RELEVANT INFORMATION

3.1 Career Pathways

All members of academic staff have a clear career pathway involving a series of levels with distinct role profiles, each with its unique requirements. Each profile sets out what is expected of an academic at the particular level. The role profiles also set out a collection of competencies expected for each level. Progression or promotion to the next level will occur after these competencies have been attained and where a role at the higher level is available.

The academic pathways are as follows:

Career Pathway One - academic roles that combine teaching, research and administrative duties.

Career Pathway Two - academic roles focusing on research and associated administrative duties.

Career Pathway Three – academic roles focusing on teaching and associated administrative pathways

This post is located on Pathway Two. Role Summaries setting out what is expected of an academic at each particular profile level on pathway two can be found below. Please note that an appointment may be made at any level of the pathway.

A schematic diagram of the career pathways can be found at http://www.bristol.ac.uk/hr/grading/academic/.

For Pathway Two roles progression to the next level will only occur where a role has been identified as being eligible for progression, having reached the relevant point on the salary scale and after the relevant competencies have been attained. A progressable role is a role at Level b or Level c that has been determined as being eligible for progression by the Head of Department, based on departmental needs, priorities and funds. Individuals in progressable roles at Level b or Level c are expected to develop their skills, knowledge and experience in order to ultimately progress to Level c or Level d, as applicable. A non-progressable role is one either at Level a (which are not subject to formal progression arrangements, although there may be opportunities to develop into a Level b role, based on departmental needs, priorities and funds), or at Level b or c for which the Head of Department has identified an ongoing need at that particular level. Movement to Level e will be by promotion only.

3.1.1 Role Summaries

Research Associate (Level a)
Role holders at this level are concerned with *assisting* an individual research leader or team to conduct a particular study (or group of studies). They will generally be involved in data generation and/or collection using standard and well-defined methods developed by others. They will be working under close supervision by, and direction from, a more senior researcher, who will be ultimately responsible for the project. This may be the entry level for some staff who are expected to train and/or develop to take on more senior researcher roles. Role holders will be provided with academic and pastoral support within the department (including counselling on realistic career opportunities) and training will be available designed to develop their competences and to prepare them to take on more responsibilities associated with a higher grade.

Senior Research Associate (Level b)
Role holders at this level will be experienced and professional researchers (or have considerable professional experience) and will be specialists in a particular area or methodology, drawing upon knowledge gained from postgraduate research and/or working within a Level a role. They will be *associated* with a particular project (or projects) and will contribute ideas, and/or enhancement of techniques or methodologies. They will be expected to do some writing for dissemination outside the Department. They will still be working under supervision, but will be expected to take significant initiatives in their work and consult with the Principal Investigator over the details of the project.

They may, where practical, contribute to the department's teaching, through supervision of projects, overseeing practical classes, or taking small group classes. They will be provided with academic and pastoral support within the department and training will be available designed to develop their competences (including counselling on realistic career opportunities) and prepare them to take on more responsibilities associated with a higher grade.

Research Fellow (Level c)
Role holders at this level will have substantial experience of research (normally not less than six years). They will initiate and take responsibility for some research projects and may be Principal Investigators or, where a Research Council does not permit this, act as though they were Principal Investigators. They will be involved in administration relevant to their projects (e.g. helping to prepare bids for research funding), managing other researchers and monitoring research budgets. They will be expected to be undertaking research individually and/or collectively and to be advancing the state of knowledge and understanding within their particular area of expertise. They will be publishing regularly in high quality outlets. They are likely to provide some teaching support for the department (consonant with the terms of their funding). They will be expected to be establishing a growing reputation within their particular research field and academic discipline and to be developing and demonstrating intellectual independence.

Senior Research Fellow (Level d)
Role holders at this level will have extensive experience in research and research management. They will normally be Principal Investigators, leading collaborative research bids and research teams, or driving forward innovative research themselves. They will be involved in scholastic projects (e.g. editing journals and academic books), and be making a significant leadership and/or management contribution within their department or the wider university, to be participating in national/international academic networks and conferences. They may be transferring their knowledge through some teaching and/or supervision to undergraduate or graduate students (consonant with the terms of their funding). Role holders at this level will be independent researchers and will have an established national and growing international reputation within their academic discipline generally and research field in particular.

Professorial Research Fellow (Level e)

Role holders at this level will have very extensive experience of research leadership and related management/administration. They will enjoy a wide recognition for their expertise within the academic community internationally (as evidenced by conference invitations, journal editorships, office holding in specialist groupings, associations with appropriate Research Councils etc.). They will have made recognised and significant contributions to the developing knowledge and understanding of their research area. They will already have responsibilities for the creation, initiation, development and overall management of significant research programmes. They will 'profess' their discipline within the Department, as appropriate and consonant with the terms of their funding. They may also carry significant leadership roles within the Faculty or University.