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ADVANCED MATERIALS **RESEARCH &** INNOVATION

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ABOUT ROYCE

The Henry Royce Institute is the UK's national centre for research and innovation for advanced materials and was set up through an initial investment of **£260m** from the Department for Business, Energy, and Industrial Strategy (BEIS) via the Engineering and Physical Sciences Research Council (EPSRC). Royce was established to ensure that the UK remains at the forefront of materials research and exploitation through collaborations with industry and academia, and by providing access for the UK materials community to state-of-the-art equipment and facilities. Royce's research tackles some of the most pressing challenges facing today's society, from providing energy for future cities to decarbonisation and new recyclable materials. Our materials research facilities and expertise are available to academia and industry alike. We believe that collaboration between our researchers and industry will create real solutions to global grand challenges and provide significant societal and economic benefit to the UK.







Royce brings together world-leading expertise and technical capabilities and works closely with industry to ensure translation and commercialisation of fundamental research. With its hub at The University of Manchester, the Institute is a partnership of nine leading institutions - the universities of Cambridge, Liverpool, Leeds, Oxford, Sheffield, Imperial College London, the UK Atomic Energy Authority and National Nuclear Laboratory, and two associate organisations, Cranfield and Strathclyde. Royce coordinates over 700 academic, technical and research staff and over £200 million of facilities, providing a joined-up framework that can deliver beyond the current capabilities of individual partners or research × O teams. As the Institute transitions from a set-up to operational phase, it has established a clear vision around Advanced Materials for a Sustainable Society.

ROYCE VISION

Royce's vision is founded on national needs and priorities: To be a world-class institute stimulating the innovation of advanced materials research to support sustainable growth and development.

Meeting this ambition demands output of high-impact research achieved through excellent people, cutting-edge infrastructure, and further development of the ecosystem to stimulate the translation of research through the value chain. Our mission is: To support and grow world-recognised excellence in UK materials research, accelerating commercial exploitation, and delivering positive economic and societal impact for the UK.



ROYCE MISSION

Royce delivers its mission through four pillars of activity that support both industry and academia. These activity areas are underpinned by a culture and identity that is flexible, inclusive and collaborative, incorporating both industry and academia in the advanced materials community within and outside of the UK.



Enabling national materials research, collaboration, foresighting and strategy: Working to shape our materials research landscape by convening and connecting the UK materials community, engaging with government and policy-makers, and bridging industrial sectors to ensure maximum impact from the UK's research endeavour.



Providing access to world-leading facilities and research expertise: Providing fast and flexible access for the UK research community to cutting-edge equipment and highly-skilled technical staff to enable high impact research and innovation.



Catalysing industrial collaboration and accelerating translation: Implementing programmes and interventions that meet the challenges of advanced materials translation throughout the value chain, from start-ups to SMEs and corporates.



Fostering materials science skills development, innovation training and outreach: Providing professional development to empower the next generation of materials researchers and leaders with technical and business skills through a comprehensive support and outreach programme.

INFRASTRUCTURE & FACILITIES

Royce funding has supported a significant investment in new advanced materials research infrastructure and equipment across Royce Partner locations. These facilities provide an open and collaborative environment for cutting-edge materials research and innovation. New buildings and equipment in which EPSRC capital has been instrumental include:

ROYCE HUB BUILDING, MANCHESTER

Together the Royce Hub Building and new equipment represents an EPSRC investment of £150 million. Extending over 9 floors, it hosts a range of new lab spaces and equipment including for biomedical materials, metals processing, digital fabrication, and sustainable materials research.

REX RICHARDS BUILDING, OXFORD

The recently refurbished Rex Richards Building is set to be home to ~1000 m² facilities for air-sensitive energy storage materials. Battery materials and modelling research groups will be housed across four dedicated Royce floors. Once commissioned, the new equipment and facilities will significantly enhance the ability to synthesise, test and characterise air-sensitive materials for batteries.

BRAGG CENTRE FOR MATERIALS RESEARCH, LEEDS

Fully operational in 2022, The Bragg Centre for Materials Research will be home to an interdisciplinary laboratory space enabling the discovery, creation, characterisation, and exploitation of materials engineered at the atomic level. The Centre houses the Multi Deposition System; a multi-chamber, multitechnique thin film deposition tool, which allows a range of different materials and growth techniques to be combined.

SIR MICHAEL UREN HUB, IMPERIAL

Royce funding has been invested in Imperial's recently completed Sir Michael Uren Hub building, in which Royce occupies the eighth floor. Royce facilities here will focus on the production and characterisation of thin films and devices and will include a 140 m² clean room.

MAXWELL CENTRE, CAMBRIDGE

Royce facilities at the Maxwell Centre address energy generation, storage, and use. Equipment is available for fabrication of new battery structures, X-ray photoelectron spectroscopy, X-ray tomography, and electrochemical characterisation. It houses the The Ambient Processing Cluster Tool, a series of twelve custom built gloveboxes allowing the design and fabrication of range of battery, PV, LED and other customised materials and devices.

ROYCE DISCOVERY CENTRE & ROYCE TRANSLATIONAL CENTRE, SHEFFIELD

The Royce Discovery Centre is home to the latest technologies in 3D additive manufacturing, digital manufacturing and nanocharacterisation. Researchers at the Royce Translational Centre are evolving novel materials and processing techniques, making them accessible for trial by industry collaborators. The facility features a broad range of Royce equipment to enable research into Advanced Metals Processing.

MATERIALS INNOVATION FACTORY, LIVERPOOL

Royce has invested £10m in Liverpool's new Materials Innovation Factory (MIF) which is dedicated to materials chemistry and formulation. The site houses one of the highest concentrations of materials science robotics in the world, alongside a suite of advanced analytical equipment.

NATIONAL NUCLEAR LABORATORY

Capital funding from Royce has enabled NNL to extend its equipment portfolio for both academic and industrial research on active samples, including for glovebox microraman spectroscopy, plasma FIB with SIMS capability, hot cell optical microscopy and thermogravimetric analysis-mass spectrometry equipment for Pu science.

Advanced Forming Research Centre University of Strathclyde (Associate Partner)

Central Laboratory

Materials Innovation Factory University of Liverpool

Royce Hub Building The University of Manchester

> Rex Richards Building University of Oxford

MATERIALS RESEARCH FACILITY, UK ATOMIC ENERGY AUTHORITY

UKAEA's Materials Research Facility (MRF) at the Culham Science Centre hosts a range of Royce equipment for handling, preparing, processing and analysing radioactive samples, including microscopy and mechanical and thermo-physical testing equipment.



RESEARCH

Royce research work is arranged around eight key thematic areas, each championed by a Research Area Lead and supported by a steering group.

Royce is aligned to the UK government Innovation Strategy which sets out Advanced Materials & Manufacturing as a key technology. Our research has the potential to transform the digital, engineering, energy, and health sectors. Royce's research areas are complementary, and our Partner institutions work collaboratively, sharing facilities and expertise.



Advanced Metals Processing provides state-of-the-art facilities in a collaborative environment to deliver innovative metals processing technologies and novel alloy solutions. This theme underpins the High Value Manufacturing Catapult network to provide the UK with more sustainable metal supply chains and accelerate the UK metal industry's transition to a resource-efficient, zero-carbon, digitalised and agile future.

Biomedical Materials aims to accelerate the discovery, manufacture and translation of biomedical materials, devices and Advanced Therapy Medicinal Products. This encompasses the additive manufacturing of hard and soft implants, biomimetic tissue analogues, nanofibres to devices, bioelectronics for biosensing, monitoring and stimulation, and biomechanical evaluation. Key drivers are curative healthcare, sustaining health in an aging population, agile and bespoke manufacture, antiviral and anti-microbial materials and surfaces for a safer world.





Chemical Materials Design accelerates the formulation of matter with tailored properties (sustainable, electric, magnetic, catalytic, mechanical, etc.). Materials robotics systems focus on automatic synthesis and formulation of molecular, polymeric, composite and inorganic materials, often guided by data-driven or physical models. This theme also aims to rapidly engineer biological systems for the discovery and manufacture of new materials from biology, to design and evaluate sustainable materials, and to develop sustainable packaging solutions.

Electrochemical Systems focuses on fundamental electrochemistry research and device development to underpin scale delivery of batteries in transport and energy systems, and to drive economic supply of green hydrogen and sustainable chemical feedstocks. The research is supported by the continued development of advanced analytical techniques and simulation tools, from atoms to device level.

Material Systems for Demanding Environments delivers new understanding of performance and degradation of structural materials in application-relevant environments. This enables the development of more accurate life prediction and provides a pathway for new structural materials solutions to improve efficiencies and reduce CO_2 emissions in the transport and power generation sectors. The theme also has a particular focus on developing coatings for extending the operation of structural materials to harsher environments.



Nuclear Materials aims to develop the more resilient structural materials needed to withstand the high heat loads and intense radiation environments for fission and fusion; to develop advanced fission fuels more tolerant of severe accidents, both improving safety and allowing simplification of reactor designs; and to develop the materials needed to enable plutonium reuse in fuel and/or disposal as waste.

Two-Dimensional Materials focuses on the smart design of functional materials using atomically thin layers as building blocks, exploiting complementary functionalities of different 2DM layers within a few-nanometre thick heterostructures for high performance electronics and novel devices and systems for low power-consuming ICT systems. It also exploits 2DM in nanocomposites enhancing properties of materials for use in UK's energy, automotive and aerospace sectors.





THE INTERNSHIP SCHEME

OVERVIEW

Each year Royce runs an internship scheme to give researchers the opportunity to host an undergraduate student on a summer research project in materials science. Researchers are invited to apply for funding which will contribute towards the cost of running an internship within their department or research group. The funding from Royce is intended to support an 8-week project, running between June and September 2023.

Project applications will be reviewed by the Royce Training team and funding will be awarded based on the following criteria:

- Strength of project proposal
- Relevance to Royce research area themes
- Benefit to student intern
- Benefit to mentor and/or lab hosting the intern

Before applying, please read through the information below, noting in particular what the funding does and does not cover.

WHO CAN APPLY?

The scheme is open to applications from academic researchers in materials science across all UK HEIs.

We welcome applications from post-doctoral researchers, research fellows, staff scientists, lecturers, and principal investigators. University departments can also submit applications for funding as part of their own internship programmes.

We are eager to support post-doctoral and early-career researchers, for whom this may be their first opportunity to mentor

a student. Senior academics and principal investigators are welcome to apply, but priority will be given to junior researchers.

WHO CAN BECOME AN INTERN?

The scheme is intended for undergraduate students on a course related to materials science or engineering. Students should be moving from their penultimate to final year of study, however exceptions may be considered (gap years, year in industry/abroad) or where integrated Master's courses are offered as the norm. Final year students already accepted onto a PhD programme are not eligible.

WHO BENEFITS?

Student interns will experience in materials science research and learn how an academic research group operates. They will have the opportunity to manage their own work, participate in group meetings, conduct experiments, and develop collaborative working skills. There is also the possibility of their work contributing towards research publications from the group.

The internship is a great taster for what a PhD might involve, before a student begins the application process. This is a positive experience that can guide a student towards a successful PhD application; it also allows a chance for them to reflect and consider if pursuing a post-graduate course is right for them.

Project mentors have the chance to influence and encourage the career development of an undergraduate student, guiding them through the project, and involving them in the work of their research group. For post-doctoral and early-career researchers the projects can be a valuable opportunity to develop mentorship skills and gain experience in scientific leadership. Established group leaders also benefit from an opportunity to engage with the student and share their scientific career experiences with them.

Academic hosts have a chance to work with new students and share career guidance. Running successful internship projects can strengthen the visibility and reputation of a department, making it more attractive to future students.



HOW ARE PROJECTS RUN?

Researchers awarded funding will need to advertise and recruit student interns within their own institute. This happens either by directly offering places to specific students or through departmental or school internship schemes. Wherever possible, consideration should be given to ensure diversity, inclusion and openness in the recruitment process.

During the summer the researcher will work with the student to explain the extent of research project, establish them in the laboratory, and help them work alongside other group members. Following the conclusion of the projects Royce will invite all students and their mentors to join us at a virtual student conference, where they will have an opportunity to share the work they conducted during their project.

HOW DOES THE FUNDING WORK?

The funding awarded by Royce must be used towards the cost of employing an undergraduate student through an existing scheme within their host institution. An intern should work no more than 35 hours a week over the 8 weeks of their project. Funding is capped at £3200 and £3500 in London; each week being equivalent to £400.00 (£437.50 in London), should a shorter project be run.

The applicant, research group or department will need to ensure the full costs associated with the intern are met. The above funding is the maximum that will be provided by Royce for each intern.

Other funding considerations:

- Funding must not be used for material costs, equipment access, or other consumables.
- Funding is awarded for an 8-week project; funds to cover a longer project will not be covered by Royce.
- Interns should be paid as their project progresses, as an employee of the host organisation. Renumeration should not wait until receipt of the Royce funding.
- Funding will be paid retrospectively upon the completion of the project.
- Royce will liaise with hosts and provided financial contacts to resolve claims in October once the project is completed.

Things to note

- Applicants must provide both a principal investigator and a mentor wherever possible.
- Access to equipment or training on specialist facilities can often delay an intern from progressing in a project.



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KEY EVENTS

Mid-December – Applications open

31 January 2023 – Applications close

Late January – Applications reviewed

Early February – Response to all applications sent

- **March-May** Students selected for projects
- Mid-June Kick-off virtual workshop with Royce

Late-June-Early September – Research projects run. As part of the summer programme, Royce will host several workshops for students to ask questions beyond their research

Mid-September – Internship conference

Late September – Student feedback survey

October-November - Reconcile budget with Royce

HOW TO APPLY

Please submit your application to the Royce Undergraduate Internship Scheme via the online form on our website:

https://www.royce.ac.uk/internship-scheme/

Only applications submitted via the online system and completed in full will be accepted.

Applications will close at 23:59 on 31 January 2023.

Responses will be sent to all applicants by the end of February.

For information about the Royce Undergraduate Internship Scheme 2023 please contact Royce Student Engagement Manager Dr George Miller at george.miller@royce.ac.uk



