ROYCE

ADVANCED MATERIALS RESEARCH & INNOVATION

UNDERGRADUATE RESEARCH INTERNSHIP SCHEME

2022

Contents

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 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.

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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.

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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 m^2 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, multi-technique 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 m^2 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 micro-raman spectroscopy, plasma FIB with SIMS capability, hot cell optical microscopy and thermogravimetric analysis-mass spectrometry equipment for Pu science.

MATERIALS RESEARCH FACILITY, UK ATOMIC ENERGY AUTHORITY

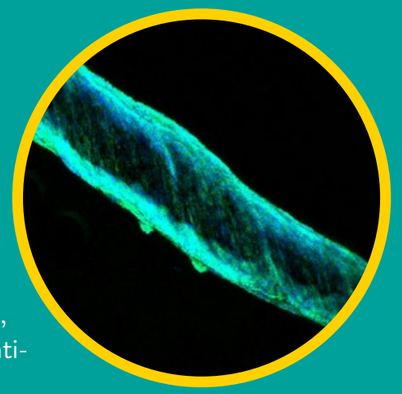
UKAEA's Materials Research Facility (MRF) at the Culham Science Centre hosts a range of Royce equipment for handling, preparing, processing and analysing radioactive samples, including microscopy and mechanical and thermo-physical testing equipment.

RESEARCH

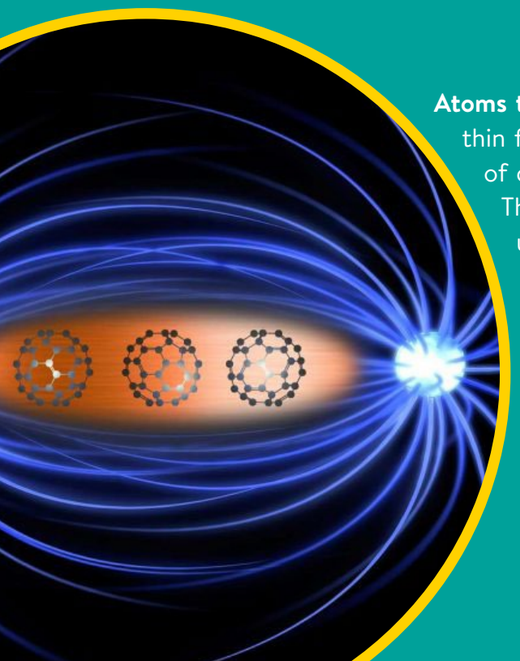
Royce research work is arranged around eight key thematic areas, each championed by a Research Area Lead and supported by a steering group.

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, anti-viral and anti-microbial materials and surfaces for a safer world.



Atoms to Devices focuses on fundamental research into functional thin film materials. This class of material comprises a rich source of components for consumer electronics and communications. They enable devices for generating energy and reducing energy usage; sensors for the Internet of Things and healthcare; and underpin future implementations of quantum technologies. New materials solutions identified also consider viable pathways for scale-up through prototyping to manufacture.

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.

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THE INTERNSHIP SCHEME

OVERVIEW

Each year Royce runs a scheme to enable undergraduate students to participate in paid summer internships to engage in materials science research at their university of study. Researchers are invited to apply for funding to support a student within their research group, department, or school. Research projects normally last 8 to 10 weeks and are run over the summer between June and September.

Project applications will be reviewed by Royce research area leads and 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

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.

WHO CAN PARTICIPATE?

The scheme is intended for undergraduate students on a course related to materials science or engineering. Students should ideally be moving from their penultimate to final year of study, however exceptions may be considered (gap years, year in industry/abroad). Final year students already accepted onto a postgraduate course (Masters or PhD) are not eligible.

WHO BENEFITS?

Student interns will experience 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 contributing towards research that will lead to future publications.

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

Academic hosts have the chance to mentor an undergraduate student, guide them through a short project, and involve them in the work of a research group. For early-career researchers the projects can be a valuable opportunity to develop mentorship skills and gain experience in guiding others in conducting research. Established group leaders also have a chance to work closely with students and impart 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?

Successful bursary holders will need to advertise and recruit student interns within their local institute. In previous years this has happened in several ways; either by directly offering places to specific students or by asking undergraduates to apply internally within their department or school for a funded project.

Over the summer the researcher will work with the student to explain the extent of research project, get them set up in the laboratory, and working alongside other group members. Following the conclusion of the internship we will invite students and their mentors to join us at a student summit to share the work they undertook during their project.

HOW DOES THE FUNDING WORK?

- The funding awarded by Royce is to be used as bursaries to cover the National Living Wage cost of an undergraduate student working 37.5 hours a week, for a maximum of 10 weeks.
- The bursary is capped at £3,562.50 (£4,143.75 in London); each week is equivalent to £356.25 (£414.38 in London).
- The payment is exclusive of VAT.
- The bursary does not include National Insurance Contributions or holiday pay; it is up to each host institute to make their own arrangements to cover these if required.
- Funding cannot be used for material costs, equipment access, or other consumables.
- Projects should be planned to last 8-10 weeks, but funding for shorter projects (minimum 5 weeks) might be considered.
- Funding will be paid retrospectively following the completion of the project.
- Royce will raise purchases orders in October of each year.

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KEY EVENTS

Mid-January –	Applications open
End of February –	Applications close
Early March –	Applications reviewed
By end of March –	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. Royce may offer several short drop-in workshops for students during this time
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 Friday 25th February.

Responses will be sent to all applicants by the end of March, or earlier.

For information about the Royce Undergraduate Internship Scheme 2022 please contact Royce Skills and Training Manager Tom Hancocks at tom.hancocks@Royce.ac.uk

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