UNIVERSITY OF LEEDS

THE BRAGG CENTRE

for Materials Research

www.leeds.ac.uk/bragg

THE BRAGG CENTRE FOR MATERIALS RESEARCH

The Bragg Centre for Materials Research will enable the discovery, creation and characterisation and exploitation of materials engineered at the atomic level. The Centre's research brings together the fundamental understanding, design and fabrication of materials with the potential for their exploitation in new devices, systems and applications.

Named in honour of the Nobel Prizewinning father-and-son physicists whose work made Leeds pre-eminent in x-ray crystallography, the Centre provides an outstanding environment for the training of the next generation of scientists and engineers, and for internationally leading research to support the long-term needs of UK industry by catalysing growth in societal and economic impact beyond academia.

Physical co-location of the Engineering and Physical Sciences Schools, and the creation of new, shared and future-proofed laboratories removes the physical boundaries between the key disciplines, enabling new ways of working, collaborating, and interdisciplinary thinking. This will lead to new funding opportunities, as well as protecting and developing our existing strengths.

DRIVING SCIENCE AND INNOVATION

Materials are critical drivers of science and innovation, essential for the growth of a wide range of industrial and manufacturing sectors. With the global market in advanced materials expected to double over the next seven years, there is a significant opportunity for the UK to develop new materials technologies with identifiable commercial opportunities building on the UK's distinctive scientific and engineering excellence in the field.

The UK Government's £4.7 billion Industrial Strategy Challenge Fund to invest in research and development across six key areas including manufacturing materials of the future, and the £235 million Henry Royce National Centre for Research and Innovation of Advanced Materials, support this ambition.

The Bragg Centre for materials research provides the University with a platform and presence to support significant outward facing leadership and engagement opportunities, both nationally and internationally, including with the research councils, national and international research facilities, industry, and initiatives such as the Royce Institute.

The global market for Advanced Materials is predicted to double by 2024.

THE VISION

The £96m investment by the University of Leeds into Engineering and Physical Sciences infrastructure provides the physical space, specialist knowledge and facilities to transform the impact of collaborative research.

This provision of cutting-edge shared laboratory facilities and the balance of blue-sky research alongside challenge-led innovation are key to the approach for the Bragg Centre for Materials Research.

Our objectives are:

- **To create a culture of inter-disciplinary collaborative working in the invention, development and understanding of materials to address 21st century challenges in multiple sectors across science and engineering.**
- **To carry out both fundamental and applied interdisciplinary research in electronics, photonics, bionanotechnology & soft condensed matter, and structural & functional materials.**
- **To develop and translate new analytical tools and techniques for the study and characterisation of materials.**
- **To create internationally-leading, future-proofed, integrated suites of shared specialist experimental facilities, supported by dedicated staff, consolidating currently isolated equipment and activities from across the University.**
- **To attract substantial public and private sector funding by exploiting the interdisciplinary research capabilities of the Centre and by consolidating existing and forming new, national and international research collaborations and networks.**
- **To create a vibrant interdisciplinary research community, and nurture the academic and leadership potential of all researchers irrespective of career stage.**
- **To attract and retain internationally leading researchers to work at the forefront of these interconnected fields, and who will deliver our ambitious research priorities and aspirations.**
- **To deliver outputs of the highest academic quality.**
- **To catalyse rapid growth in societal and economic impact of our research beyond academia both nationally and internationally.**

RESEARCH EXCELLENCE

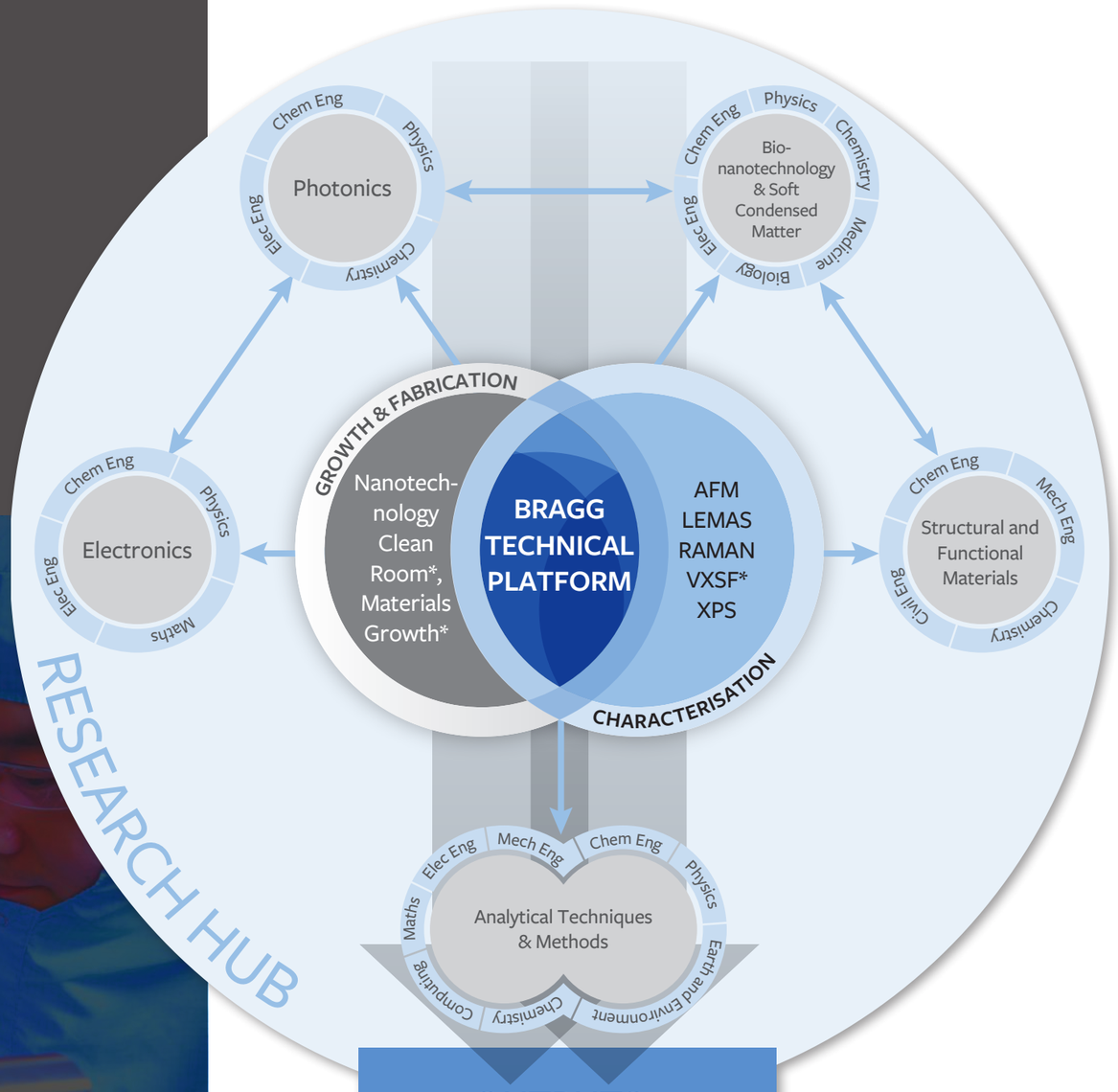
The University of Leeds has a long-standing reputation for excellence in real world challenge-led interdisciplinary research. The best research staff and postgraduate students are drawn by an exceptional experience, outstanding facilities and mutually beneficial links in the UK and overseas.

Since 2010, engineering and physical sciences research at the University of Leeds has generated:

- Over 350 filed patents
- £225m in research income
- Active research collaborations, including with overseas institutions in more than 50 countries, across six continents.
- Research collaborations with 34 of the world's top 50 institutions
- Nine spin-out companies (Leeds has spun out over 100 companies since 1995)
- Six companies listed on AIM – the London Stock Exchange's international market for smaller growing companies – more than any other UK University.

The Bragg Centre for Materials Research builds on our excellent reputation by bringing materials growth, fabrication and characterisation capability together to create a technological platform that promotes interdisciplinary research.

The Centre acts as a focus for research across campus, bringing together the University's internationally leading strengths in III-V semiconductors, optoelectronics, and high frequency devices; crystallisation & materials chemistry; functional oxides & glasses; ferroelectric, magnetic & spintronic materials; bionanotechnology; soft condensed matter systems; and, functional surfaces & corrosion.



OUTPUTS

- 4* research and impact
- Leadership development
- Spin-outs
- Patents
- Licences
- Training

COLLABORATORS

Diamond Light Source, Future Manufacturing Hubs, Industry & Academic partners, National and International Facilities, Quantum Technology Hubs, Royce Institute

* Royce contributed facility

MAKING A MATERIAL DIFFERENCE

ADDRESSING GLOBAL CHALLENGES

The Bragg Centre will allow us to produce completely new materials built up atom-by-atom to address global challenges including energy wastage in electronic devices, and next generation quantum technologies.

"The Bragg Centre brings together the best scientists and engineers from across engineering and physical sciences in an environment hosting a suite of advanced instrumentation."

PROFESSOR ANNE NEVILLE OBE, FRS, RAENG
Chair in Emerging Technologies and Professor of Tribology and Surface Engineering

ADVANCING KNOWLEDGE ACROSS THE SPECTRUM

Terahertz radiation lies in the electromagnetic spectrum between infrared and microwaves, and has a range of applications, including chemical analysis, security scanning, telecommunications and medical imaging.

The Leeds team is central to a project funded by the UK and European Space agencies to develop a satellite-based laser to quantify key gases involved in climate change in parts of the atmosphere that other technology cannot reach.

"The specialised growth and fabrication equipment in the Bragg Centre cleanroom will enable us to develop new laser-based sensing instruments, unavailable elsewhere internationally, for application in studies of climate change and other areas of societal importance."

PROFESSOR GILES DAVIES FREng
Professor of Electronic and Photonic Engineering

FROM ATOMIC TO OPERATIONAL

Leeds researchers are examining the use of oxide materials in electronic components, focusing on piezoelectric materials and devices. The devices, which are used as actuators and sensors in applications as wide ranging as ultrasonic medical imaging, naval sonar and automotive fuel injectors, make up a total world market exceeding £20bn p.a.

"We are creating a range of proprietary high performance piezoelectric materials that can operate in high temperature, high work environments, which address applications and markets not accessible to existing piezoelectric systems."

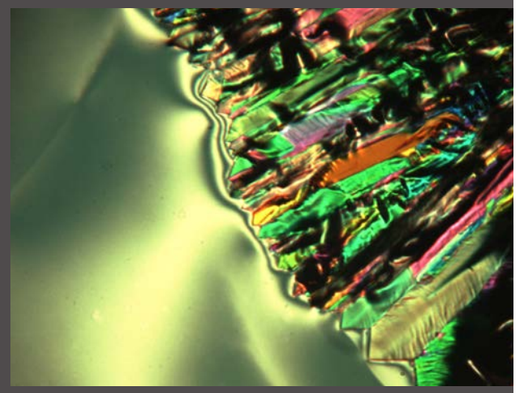
PROFESSOR ANDREW BELL FREng
Professor of Electronic Materials

BIONANOTECHNOLOGY

Our research activities in this field are wide-ranging, and include: biosensor development for clinical diagnostics; nanobubbles for targeted drug delivery; enzymatic fuel cells; synthetic biology and more, spanning the whole spectrum from fundamental to translational research.

"The Bragg Centre will create a comprehensive, world-class suite of tools for experimental bionanotechnology, which in combination with other proposed facilities will form a compelling propostion for potential industrial users as well as academia."

PROFESSOR CHRISTOPH WÄLTI
Professor of Bionanotechnology



The University of Leeds is a founding partner of the Henry Royce Institute, the UK National Centre for Research and Innovation of Advanced Materials.

UNDER THE MICROSCOPE

Electron microscopy underpins a wide range of advanced materials and biological research, with extensive industry applications. The Bragg Centre will create the perfect UK electron microscopy facility for atomic and molecular scale analysis of both hard and soft materials.

"The Bragg Centre is the next stage in our strategic ambition to create a clear UK specialism on a par with our leading international competitors, tackling challenging materials systems for next-generation products. It will dramatically accelerate research and development into complex formulated products used across the healthcare, food, energy, chemical and information technology sectors."

PROFESSOR RIK BRYDSON
Professor of Nanoscale Materials Characterisation

TAKING THE LEAD

With Sir Henry Royce Institute funding, a state-of-the-art facility for materials analysis by X-ray photoelectron (XPS) and X-ray emission (XES) spectroscopies has been established. It complements Leeds' strategic partnership with Diamond, the national synchrotron radiation facility, on ambient pressure soft X-ray absorption spectroscopy. It establishes Leeds as the leading UK centre for in situ and operando studies of materials.

"Global industrial partners are already coming to Leeds to develop future technologies for manufacturing of products with high added value. The Bragg Centre will enable us to build further on our track record to establish a global lead in product formulation research."

PROFESSOR SVEN SCHROEDER
Royal Academy of Engineering Bragg Centenary Chair

CROSSING PHYSICAL BOUNDARIES

Soft Matter Physics is a truly multidisciplinary subject. The state-of-the-art facilities available in the Bragg Centre will allow us, for example, to develop new soft matter systems to improve manufacturing processes in collaboration with the School of Chemical and Process Engineering and work with electrical engineers to template with self-assembled structures to produce new photonic systems.

"This represents a unique opportunity to apply fundamental physics to important problems at the interface of disciplines, spanning healthcare, and novel electronic and photonic devices."

PROFESSOR HELEN GLEESON OBE
Cavendish Professor of Physics and Head of the School of Physics and Astronomy

FUNCTIONAL AND STRUCTURAL MATERIALS

Tribo-corrosion relies on advanced microscopy, spectroscopy and diffraction to probe reactions at surfaces and interfaces. Merging those multiple measurement modalities across length scales has enabled us to make significant advances in developing mechanistic corrosion and tribology models.

Researchers in the School of Civil Engineering have a unique understanding of cementious materials. Future research will develop links between current experts in nano-/micro-structure and those in long-term macroscale performance in order to drive innovation and research-led education in cement and concrete.

"The Bragg Centre materials characterisation suite is crucial to the challenge of predicting and controlling the macroscale properties of concrete in order to deliver future materials that can withstand the climate changes expected in the next 100 years."

PROFESSOR IAN RICHARDSON
Professor of Civil Engineering Materials

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University of Leeds
Leeds, United Kingdom
LS2 9JT
Tel. +44 (0)113 243 1751
www.leeds.ac.uk/bragg