ADVANCED MATERIALS

World-leading research expertise,
new technologies and facilities

THE UNIVERSITY *of* EDINBURGH

EDINBURGH INNOVATIONS

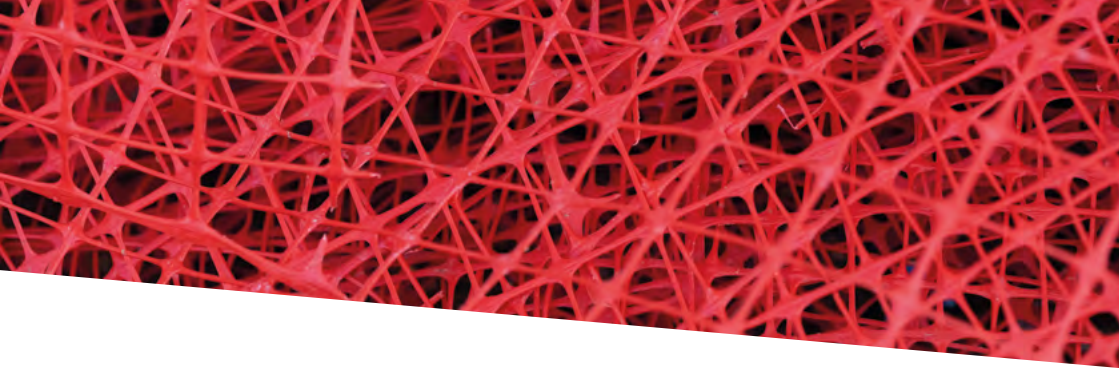
The University of Edinburgh is one of the world's top research-intensive universities, ranked 1st in the world for industry, innovation and infrastructure and 4th in the UK for quality and breadth of research. We are Scotland's top ranked institution.*

There has never been a better time to work with the University of Edinburgh, particularly in the development and application of existing and novel advanced materials. We have a rich variety of research expertise, from materials development and testing, and identifying green alternatives to existing materials, through to the use of functional materials, and modelling and simulation to support the development of high-value materials.

- Engineering materials
- Sustainable materials
- Formulation and complex fluid expertise
- Functional materials
- Synthetic biology materials
- Product and process design for performance optimisation
- Facilities for Advanced Materials characterisation available for businesses

As well as enabling access to significant funding from the UK Government to support innovative collaborations, companies can directly commission research, accessing the University's facilities and expertise. Edinburgh Innovations, the University's commercialisation service, partners with businesses to access the most relevant experts and facilities, identifying the most appropriate funding streams for each organisation and enabling each individual company to take advantage of our world-class research and knowledge base.

* Sources: QS Rankings 2025, THE Impact Rankings 2024 and REF 2021.



Engineering materials

Our world-leading researchers are advancing the applications of materials, fluids and new processes, for our industrial clients. We provide a range of research expertise to support your business including:

- Novel composites for applications in structural engineering, aerospace, off-shore and on-shore wind, marine tidal energy systems, automotive, hydrogen and CCUS
- Structural performance in fire and at elevated temperature environments
- Strengthening and repair of infrastructure, silos and thin-walled structures
- Dynamic effects in structures and materials
- Understanding dynamic, impact and ballistic performance of advanced materials
- Biomechanical applications
- A range of mechanical testing from microstructure to large scale structure

Formulation and complex fluid expertise

Our multidisciplinary team of physicists, biologists, chemists and engineers work seamlessly with industry partners to deliver rapid and meaningful results for commercial benefit.

Using a suite of bespoke techniques and equipment, we work on the full spectrum of fundamental and applied research projects, studying products, materials and their formulation that have complex flow properties, including gels, pastes, suspensions and composites.

The Edinburgh Complex Fluids Partnership supports product development in a variety of sectors including household products, cosmetics, food and drink, paints, agrochemicals, adhesives, lubricants, and pharmaceuticals.

The capabilities of our facilities that are available to companies include:

- Understanding the flow and microstructure of dense suspensions
- Studying the physical stability of dispersions and emulsions
- Determining the stabilisation mechanism of interfacially-active components
- Controlling the behaviour of colloidal protein aggregates
- Mechanically robust, high-surface-area materials for energy applications
- Understanding composite structure and processing performance
- Preparation of liquid crystals and studying their behaviour under confinement and flow
- Understanding the behaviour of biofilms and their interactions with substrates
- Formulation development with sustainable alternative components

Functional materials

The use of functional materials offers endless opportunities to innovate and improve your products. Work with us to take advantage of both the use and application of new and existing functional materials, for the creation of innovative new products, including:

- Crystalline molecular and network solids
- Electronic and magnetic materials
- Polymers and amorphous materials
- New polymers from sustainable feedstock
- Bio-sensing polymers
- Applications of graphene oxides
- Catalysis/surface chemistry
- Biocompatible polymers
- DAINtech technology
- Water purifying polymers
- Earth abundant initiators
- New materials for emerging solar photovoltaic technologies
- Phase-change materials for heat storage
- Separation of gases and utilisation of waste CO2
- New materials for efficient hydrogen production
- Composite materials from waste plastics
- Negative or zero thermal expansion materials
- High-pressure synthesised novel functional materials

Synthetic biology materials

Research into materials relevant to the medical and healthcare sector is an area of specialism at the University of Edinburgh, from the modelling of materials and structures used in surgical implants to orthopaedic engineering and tribology.

Biomedical implants can improve quality of life by enhancing the functionality of essential body systems, supporting damaged biological structures, or even replacing human organs. Research into the application of polymers and nanotechnology to modify the surface of implants for enhanced mechanical properties and biocompatibility is an area of research at the University available to be harnessed by companies in the healthcare sector.

Product and process design for performance improvement

Our research capabilities don't just stop at materials innovation. We have full end-to-end world-class expertise across disciplines to support businesses to develop optimum solutions.

Our wide range of capabilities supports all stages of product and business development:

CONCEPT AND SPECIFICATION

- Co-create with our subject specialists in developing proof of concepts, digital prototyping, and feasibility studies
- Manufacturing process design, including process automation and robotics, to enhance performance and reduce waste
- Product life cycle analysis and management (LCA, PLM)

DESIGN AND DEVELOPMENT

- Data-driven innovations, e.g. process simulations and developing digital twins for product design and development, production and supply chain, operational assets and product life cycle
- Developing AI tools to plan and implement product roll-out, forecast product demand, continuous product analysis and improvement, create databases and reduce time-to-market
- Applied and computational mathematics

PRE- AND POST-LAUNCH

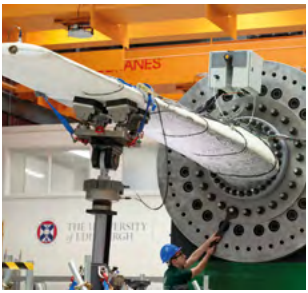
- Multiscale product behaviour characterisation and testing using state-of-the-art facilities
- Circular economy studies
- Business and social studies on demands and trends, including development of policies

INFRASTRUCTURE & ENVIRONMENT

- Cybersecurity and information technologies
- Finance, economic and logistics analysis and probability studies
- Sustainable solutions to meet global challenges

Facilities for Advanced Materials available for businesses

The University of Edinburgh is home to an extensive range of state-of-the-art facilities. Take advantage of these capabilities for physical testing, analysis, characterisation, structural and mechanical testing, non-destructive testing and processing of a wide range of materials and structures.



STRUCTURAL COMPOSITES RESEARCH FACILITY – FASTBLADE

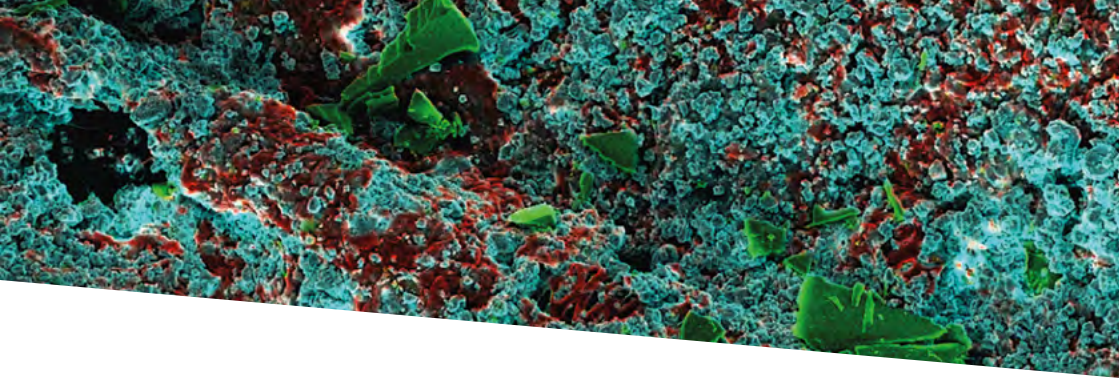
This innovative £1.8m research facility, the first of its kind in the world, is dedicated to the test and assessment of the mechanical performance of large structures under simulated fatigue loading. The facility enables faster fatigue or cyclic load testing of large structures and accelerated research into fundamental engineering options for new materials technology and quicker evaluation leading to more rapid certification and deployment to market.

STRUCTURAL TEST FACILITIES

The Structures Test Hall is our high-headroom lab for testing large and unusual structural assemblies. We offer a wide range of tests including strength, shear-friction, creep tests on concrete and steel specimens at high temperatures, or beam tests, inspection of failure surfaces and, structural testing under heat and fire. Analysis is made with high-speed data acquisition systems. We use digital image correlation for displacement measurement, structural health monitoring equipment, and non-destructive testing methods.

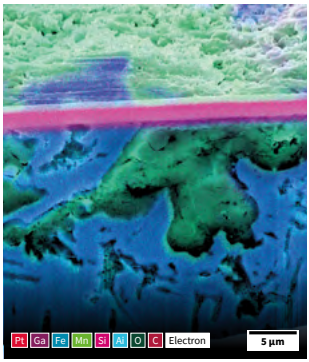
MATERIALS PROCESSING LABORATORIES

- The Composite Processing laboratory offers the novel processing of fibre reinforced polymer composites, including thermoplastic and thermosetting polymers, using powder processing, liquid moulding, press moulding, in-situ polymerisation of thermoplastics and novel pre-pregging facilities.
- The Advanced Adsorption Lab houses equipment such as zero length column systems, dual piston pressure swing adsorption system, membrane permeation cells and high pressure static volumetric adsorption rig for adsorption characterisation of porous/membrane materials.
- The Membrane Technology Lab offers a controlled environment room for high precision experiments, radiotracer facility, water purification system, cross-flow, stirred cell, submerged and electrodialysis membrane filtration systems and field-scale reverse osmosis and electrodialysis systems for larger-scale applications using our pilot systems.



MATERIALS TESTING AND CHARACTERISATION INSTRUMENTS

- Cryogenic Focussed Ion Beam Scanning Electron Microscopy (CryoFIB-SEM): This is one of only a few such instruments in the UK for imaging both soft and hard materials to nanometer resolution including obtaining elemental information. The focussed ion beam (FIB) enables micron-scale milling for slice and sectioning, patterning and TEM lift-out.
- Rheo-imaging with a fast confocal microscope (up to 100 fps at micron resolution) coupled to an Anton-Paar rheometer.
- Atomic Force Microscopy JPK NanoWizard 4XP: This advanced inverted Optical Microscope combines with a new-generation AFM enables soft/biological matter and material interfaces characterisation.



Overlay images of EDX (elemental identification) results on top of SEM image

- Centre for Science at Extreme Conditions (CSEC) has a range of instruments that enable research experiments under extreme conditions not available elsewhere. These include:
  - **Shielded X-ray Laboratory** containing a Rigaku Smartlab diffractometer with attachments for low and high T studies (12-620 K) simultaneous DCS/XRD studies, and a Photonic Crystal Orientation Lau diffractometer.
  - **Gas-loading Laboratory** for loading under pressure into diamond anvil cells.
  - **Laser Heating Laboratory** has the double-sided laser heating system for extreme pressure and temperatures studies with thermal conductivity measurements.
  - **Magnetism Laboratory** houses all the equipment concerned with magnetic and transport property measurements: 9 Tesla Physical Properties Measurement Systems (QD PPMS) with electro-transport, vibrating sample magnetometry, heat capacity, 3He low-temperature options and other low-temperature transport measurement equipment. The laboratory also has 7 Tesla and 1 Tesla Magnetic Property Measurement Systems (QD MPMS) and a Closed Cycle Refrigerator system adapted for a variety of measurements.
- Static and dynamic mechanical testing machines (50kN-300kN) for specialised testing of advanced composite materials with environmental chamber (-70°C to 300°C), non- contact video extensometer and Digital Image Correlation.

For more information:
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Edinburgh Innovations is the University of Edinburgh's commercialisation service.

We bring the University's world-class research to industry, working to identify ideas with value, and facilitating the process of bringing them to life in real-world applications.

WE MAKE IDEAS WORK FOR A BETTER WORLD

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