



FACILITIES AND CAPABILITIES

Advanced materials analysis, testing and R&D for industry

What our laboratories and specialists can do for your products, processes and problems.

WELCOME

Science and engineering support for industry

The Bridge is the University of Lincoln's advanced materials and engineering R&D centre. We help companies of every size solve technical problems, develop new products and processes, and build the evidence they need to make decisions, using specialist laboratories run by experienced instrument scientists.

This guide is organised around the questions companies bring to us, not just the equipment we have. Each section explains what the techniques tell you and where they are typically used. If you are not sure which technique you need, that is fine: tell us about the problem and we will advise.

30+

specialist instruments

8

capability areas, from composition to AI and automation

8

industry member companies

All sizes

of business, from SMEs to multinationals

Sectors we work with

Advanced materials and engineering · Chemicals · Pharma and healthcare · Manufacturing · Energy and net zero · Packaging · Sustainability and circular economy

Areas of expertise

Surfaces and interfaces

Formulated materials and ingredient interactions

Crystallisation and structure control

Materials for energy capture and storage

Green chemistry, waste valorisation and circular processes

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WORKING WITH US

How we work with you

From a single sample to a multi-year collaboration, you can engage with us in the way that suits your business. Every project is quoted individually, so talk to us about what you need.

01

Start with a conversation

Tell us about the problem. We will suggest the right techniques and approach, and whether it is a quick measurement or a larger project.

02

Analytical testing and investigation

Samples analysed by our instrument scientists, with expert interpretation and a written report. Ideal for quality problems, failures and unknowns.

03

Contract R&D and consultancy

Defined projects to develop or improve products and processes, drawing on the Bridge team, the wider University and our industry partners.

04

Bridge membership

A membership agreement for companies that want a continuing relationship, with regular access to our team, laboratories and network.

05

Training and CPD

At-instrument training for your staff, and specialist courses led by academic and industry experts, on site or remote.

06

Funded collaboration and students

Knowledge Transfer Partnerships (KTPs), Innovate UK and other funded projects, and student projects from short paid projects to year-long placements.

From first call to final report

1

Talk to us

A short call or visit to understand what you need.

2

Scope and quote

We agree the work, timescales and cost with you.

3

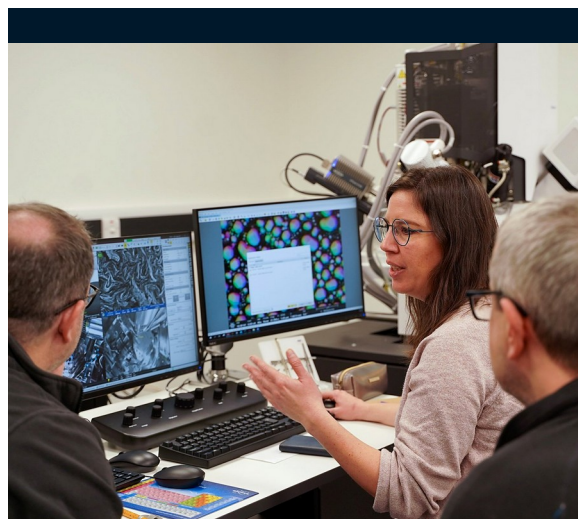
Deliver

Our scientists run the analysis or project and keep you updated.

4

Report and next steps

Clear results, what they mean, and where to go next.



Who you will work with

Our instrument scientists run the analysis and sit down with you to explain what the results mean. Behind them are academics across the University's schools and a network of industry partners, so if the answer needs expertise we do not hold in the Bridge, we know where to find it.

01

COMPOSITION AND TRACE ANALYSIS

What is it made of?

Know exactly what is in a material, product or process stream, down to trace levels. We identify and measure elements, organic compounds and ions in solids, liquids and gases, for quality control, contamination problems, regulatory checks and benchmarking.

QUESTIONS WE HELP ANSWER

- **Is there a contaminant, and where has it come from?**
- **Does this batch meet specification?**
- **Which metals or ions are present, and at what level?**

Elemental analysis (ICP-OES)

Thermo Scientific iCAP PRO X with Milestone Ethos UP microwave digestion

WHAT IT TELLS YOU Measures dozens of elements in one run, from major constituents down to low parts-per-billion levels for many elements, after complete microwave digestion of solid samples.

TYPICAL USES Metals in effluents and water, catalyst and residue composition, raw material verification, heavy metal screening.

Gas chromatography mass spectrometry (GC-MS)

Agilent 5977C GC/MSD

WHAT IT TELLS YOU Separates volatile and semi-volatile organic compounds and identifies them from their mass spectra against reference libraries.

TYPICAL USES Solvent residues, odours and taints, additives and their breakdown products, outgassing.

Ion chromatography (IC)

Thermo Scientific Dionex ICS-1100

WHAT IT TELLS YOU Measures dissolved anions and cations such as chloride, fluoride, nitrate and sulphate in aqueous samples.

TYPICAL USES Water and process liquor quality, corrosion investigations, cleaning validation, product extracts.

Nuclear magnetic resonance (NMR)

Bruker Avance III HD 500 MHz with solid-state CP-MAS probe

WHAT IT TELLS YOU Gives detailed molecular structure of organic compounds in solution and in solids, and the quantitative composition of mixtures.

TYPICAL USES Identifying unknown residues, confirming chemical structure, polymer composition, quantifying components.

UV-visible spectroscopy

Shimadzu UV-1800 and Analytik Jena Specord 210

WHAT IT TELLS YOU Measures how a sample absorbs ultraviolet and visible light, for concentration, colour and optical properties.

TYPICAL USES Concentration assays, reaction monitoring, routine quality checks.

Not sure which technique you need?

Most problems need more than one method. Tell us what you are trying to find out and our instrument scientists will recommend the quickest route to an answer.

bridge@lincoln.ac.uk

02 MOLECULAR FINGERPRINTING AND SPECTROSCOPY

What is it, and has it changed?

Vibrational and optical spectroscopy give a fast, often non-destructive fingerprint of a material. We use it to identify polymers and contaminants, check incoming materials, follow ageing and degradation, and map chemistry across a surface or defect.

QUESTIONS WE HELP ANSWER

- What polymer is this part made from?
- What is this particle, fibre or film defect?
- Has the material oxidised or degraded?

FTIR spectroscopy

Bruker Vertex 70v with ATR, DRIFTS and gas cell

WHAT IT TELLS YOU Identifies organic and many inorganic materials from their infrared fingerprint. Vacuum optics remove interference from water vapour.

TYPICAL USES Polymer and additive identification, oxidation and degradation, coatings, gas analysis.

Combined FTIR and Raman

Thermo Scientific Nicolet iS50 with Raman module

WHAT IT TELLS YOU Infrared and Raman spectra on one platform, giving complementary information from the same sample.

TYPICAL USES Rapid identification of raw materials, fillers and pigments, formulation checks.

FTIR microscopy

Thermo Scientific Nicolet iN10

WHAT IT TELLS YOU Infrared analysis of features down to tens of microns, with chemical maps across a sample.

TYPICAL USES Particle and fibre contaminants, multilayer film cross-sections, defects in mouldings.

Raman microscopy

Bruker Senterra II and Horiba LabRAM

WHAT IT TELLS YOU Chemical and structural information at the micron scale, with mapping. Particularly sensitive to carbon structure, crystal form and stress.

TYPICAL USES Carbon materials and graphene, pigments and minerals, polymorphs, inclusions.

Photoluminescence spectroscopy

Edinburgh Instruments FLS980

WHAT IT TELLS YOU Steady-state and time-resolved fluorescence and phosphorescence, including emission lifetimes.

TYPICAL USES Phosphors and display materials, quantum dots, fluorescent tracers and sensors.

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Most problems need more than one method. Tell us what you are trying to find out and our instrument scientists will recommend the quickest route to an answer.

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Analysis on your site

Our portable instruments can come to you, for checks on large parts, goods inwards or materials that cannot easily be moved.

Handheld XRF

Thermo Scientific Niton XL3t

Non-destructive elemental composition in seconds.

USES Alloy grade checks, restricted metal screening, scrap sorting.

Handheld FTIR

Agilent 4300

Infrared identification directly on the surface of a part.

USES Polymer and coating identification on large or installed items.

Handheld Raman

Agilent Resolve

Identifies chemicals through sealed, opaque containers.

USES Checking raw materials in sacks and bottles without opening them.

03 MICROSCOPY AND SURFACE ANALYSIS

What does it look like up close?

See structure from millimetres down to atoms. Our electron, probe and optical microscopes show how a material is built, where and why it has failed and how its surface behaves, with elemental mapping to show what is where.

QUESTIONS WE HELP ANSWER

- Why did this part crack or fail?
- How thick and uniform is this coating?
- What size and shape are these particles?

Scanning/transmission electron microscopy (S/TEM)

Thermo Scientific Talos F200i with dual EDS detectors

WHAT IT TELLS YOU Images down to the atomic scale, with elemental maps at nanometre resolution.

TYPICAL USES Nanoparticles and pigments, catalysts, thin films, degradation and failure mechanisms.

Focused ion beam SEM (FIB-SEM)

Thermo Scientific Scios 2

WHAT IT TELLS YOU High-resolution electron imaging, plus an ion beam to cut site-specific cross-sections, prepare TEM samples and build 3D slice-and-view reconstructions.

TYPICAL USES Coatings and interfaces, buried defects, crack initiation, 3D microstructure.

Scanning electron microscopy with EDX

Tescan Vega with Bruker EDX

WHAT IT TELLS YOU Surface imaging and elemental analysis of larger samples.

TYPICAL USES Fracture surfaces, particle contamination, corrosion products, routine quality checks.

Atomic force microscopy (AFM)

AFMWorkshop HR-AFM, LS-AFM and NP-AFM

WHAT IT TELLS YOU 3D surface topography at nanometre resolution, with roughness and phase contrast that distinguishes different materials at the surface.

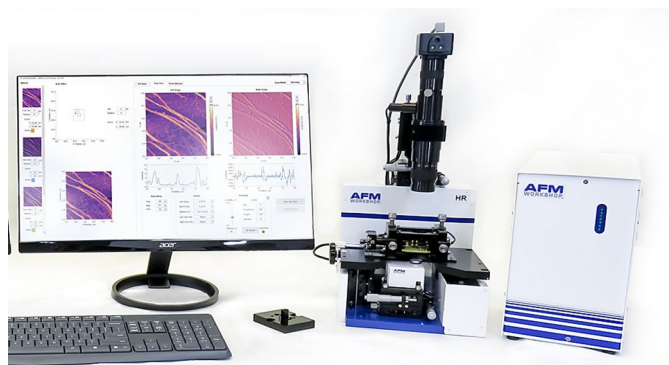
TYPICAL USES Surface finish and roughness, coatings and films, wear surfaces, nanostructures.

Optical microscopy with hot and cold stage

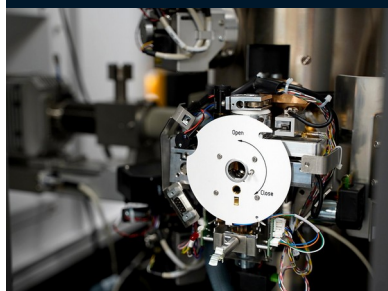
Zeiss Axio Imager.M2m, -150 to +600 °C

WHAT IT TELLS YOU Reflected and transmitted light imaging, including watching melting, crystallisation and phase changes as they happen.

TYPICAL USES Polymer crystallisation, inclusions, metallography, thermal behaviour.



Sample preparation in house: precision cutting and polishing, sputter and carbon coating, and plasma cleaning.



CASE STUDY SIEMENS ENERGY

Understanding crack growth in turbine blade alloys

FIB-SEM and EDX-STEM traced how microcracks grow in a nickel superalloy and how corrosive elements travel along them, supporting the mechanism of sulphur-induced environmentally assisted cracking and informing blade design and operating conditions.

04

CRYSTAL STRUCTURE AND PHASE

How is it structured?

Many properties depend on crystal structure, not just composition. X-ray diffraction identifies crystalline phases, polymorphs and crystallinity, and solves full molecular structures from single crystals.

QUESTIONS WE HELP ANSWER

- Which crystalline phases are present?
- Has the crystal form changed in processing?
- What is the structure of this new compound?

Powder X-ray diffraction

Bruker D8 Discover

WHAT IT TELLS YOU Identifies and quantifies crystalline phases in powders and solids, and measures crystallinity, crystallite size and phase changes.

TYPICAL USES Residue and mineral identification, polymorph screening, plaster and cement phases, battery and catalyst materials.

Single crystal X-ray diffraction

Bruker D8 Venture, dual Cu/Mo source with cryo-cooling

WHAT IT TELLS YOU The full three-dimensional molecular and crystal structure from a single crystal.

TYPICAL USES Confirming new compounds, salts and polymorphs, structure-property studies.

CASE STUDY BRIGG RENEWABLE ENERGY PLANT

Stopping residue blockages in a biomass power plant

X-ray diffraction and other materials analysis identified the composition of solid residues that were building up after combustion and causing blockages and unplanned shutdowns, giving the plant the evidence to choose remedial measures.

05

THERMAL AND CALORIMETRIC ANALYSIS

How does it behave with heat?

Heat reveals composition, stability and processing windows. Our thermal methods measure mass loss, energy changes, stiffness and damping across temperature, and identify the gases given off.

QUESTIONS WE HELP ANSWER

- How much filler, moisture or ash does it contain?
- At what temperature does it start to degrade?
- How much energy does this fuel contain?

Simultaneous thermal analysis with mass spectrometry

Netzsch STA 449 F3 with QMS 403 D, -150 to 1500 °C

WHAT IT TELLS YOU TGA and DSC in one run, with the gases evolved identified by mass spectrometry.

TYPICAL USES Filler and ash content, thermal stability and decomposition, moisture and volatiles.

Dynamic mechanical analysis (DMA)

Netzsch DMA 242 E Artemis with humidity control

WHAT IT TELLS YOU Stiffness and damping against temperature, frequency and humidity, including glass transition.

TYPICAL USES Elastomers and polymers, composites, cure state, effect of moisture.

Bomb calorimetry

Parr 6200 isoperibol calorimeter

WHAT IT TELLS YOU The gross calorific value of solid and liquid samples.

TYPICAL USES Fuels, biomass, refuse-derived fuel, waste valorisation.

Isothermal titration calorimetry (ITC)

TA Instruments Nano ITC

WHAT IT TELLS YOU Measures the heat of interactions in solution to give binding strength, stoichiometry and enthalpy in a single label-free experiment.

TYPICAL USES Ingredient interactions in formulations, binding and sorbent performance, biomolecules.



CASE STUDY MURFITS INDUSTRIES

Quality methods for recovered carbon black

S/TEM with EDX and simultaneous thermal analysis with evolved gas mass spectrometry were used to characterise carbon black recovered from tyre pyrolysis, supporting quality control where chemistry, morphology and structure determine performance.

06

MECHANICAL, WEAR AND FLOW TESTING

How will it perform?

Find out how materials will behave in service before committing to production trials. We measure friction and wear, strength, flow and stiffness, and condition samples under controlled temperature and humidity.

QUESTIONS WE HELP ANSWER

- Will the new formulation wear better?
- Does it meet the strength specification?
- How will it flow during processing?

Tribology

Rtec MFT-2000, up to 200 N and 500 °C

WHAT IT TELLS YOU Friction and wear under rotating and reciprocating contact, at room and elevated temperature.

TYPICAL USES Wear of elastomers, coatings and lubricants, benchmarking reformulated products.

Universal mechanical testing

Metrotec MTE-100, 100 kN, with tensile and compression fixtures

WHAT IT TELLS YOU Tensile and compression strength and stiffness up to 100 kN, with force and deformation recorded throughout the test.

TYPICAL USES Metals, plastics, rubber and composites, specification checks, comparing materials and components.

Rheology

TA Instruments Discovery Hybrid Rheometer (DHR)

WHAT IT TELLS YOU Viscosity and viscoelastic behaviour of liquids, pastes and melts, and how they change with time, temperature and cure.

TYPICAL USES Processing behaviour, formulation stability, cure profiles.

Environmental conditioning

Kambic KK-105 CHLT climatic chamber

WHAT IT TELLS YOU Controlled temperature and humidity for conditioning and ageing samples.

TYPICAL USES Accelerated ageing, conditioning before testing, stability studies.

See also dynamic mechanical analysis under thermal analysis.

CASE STUDY FENNER PRECISION POLYMERS

Improving elastomer wear resistance without production trials

Tribometry benchmarked existing conveyor belt elastomers against reformulated alternatives, helping Fenner improve wear resistance and extend its product offering while saving the time and cost of full production trials.

07

MODELLING, PROTOTYPING AND CLEAN MANUFACTURE

Design, model and make

Alongside measurement, we model materials before they reach the laboratory, turn ideas into physical parts quickly and work in clean conditions.

QUESTIONS WE HELP ANSWER

- Which chemistry is worth testing first?
- How is internal structure affecting performance?
- Can we test a physical prototype quickly?

Molecular modelling

Density functional theory (DFT)

WHAT IT TELLS YOU Predicts molecular properties and interactions before work starts in the laboratory.

TYPICAL USES Screening chemistries, interpreting spectra, understanding mechanisms.

Image-based microstructure analysis

3D imaging with quantitative image analysis

WHAT IT TELLS YOU Quantifies internal structure such as porosity and phase distribution, and simulates how new material designs will perform in use.

TYPICAL USES Porous materials, composites, coatings, structure-property relationships.

Rapid 3D printing

Construct3D Construct 1

WHAT IT TELLS YOU High-speed industrial fused filament printing.

TYPICAL USES Prototypes, jigs and fixtures, test specimens.

Clean room

ISO Class 6

WHAT IT TELLS YOU A controlled, low-particulate environment.

TYPICAL USES Contamination-sensitive preparation, assembly and testing.

This section is growing as we bring in modelling, simulation and engineering capability from across the University. If your work needs something not listed here, ask us what is available.

08

AI, AUTOMATION AND INDUSTRIAL DATA

Can it be automated, monitored or inspected?

Our engineering and AI specialists apply machine vision, industrial control and sensing to manufacturing problems, typically starting with a feasibility study or proof of concept and working towards a prototype system.

QUESTIONS WE HELP ANSWER

- Could machine vision take over a manual inspection?
- Can we automate this task without replacing the machine?
- Can we see what our equipment is doing in real time?

AI, computer vision and image analysis

Applied Vision and AI Lab (AVAIL), School of Engineering and Physical Sciences

WHAT IT TELLS YOU Bespoke deep learning and computer vision that detect, measure and classify features in images and video, from production line cameras to microscope images.

TYPICAL USES Automated visual inspection and defect detection, image-based measurement, object counting and tracking, faster analysis of microscopy data.

Predictive modelling and data analytics

Machine learning and generative AI, including large language models

WHAT IT TELLS YOU Finds patterns in process, product and test data to predict outcomes, and builds tools that pull information out of documents, images and data together.

TYPICAL USES Predicting quality or performance, decision support, intelligent document processing, automated reporting, AI feasibility studies.

Industrial automation and control

Creative Automation Lab (CALLIX): Siemens S7-1200 and S7-1500 and Rockwell PLCs, embedded controllers

WHAT IT TELLS YOU Design, troubleshooting and upgrading of control systems using PLCs, sensors, actuators and motor control.

TYPICAL USES Automating repetitive tasks, improving process consistency, upgrading existing machinery rather than replacing it.

Industrial sensing, monitoring and dashboards

Creative Automation Lab (CALLIX): sensors, data acquisition, edge computing and industrial IoT

WHAT IT TELLS YOU Captures machine and process data such as motor speed, electrical current, energy use and environmental conditions, and presents it on live dashboards.

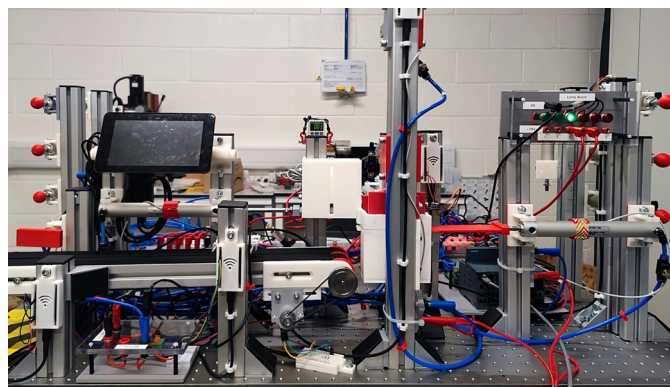
TYPICAL USES Equipment and energy monitoring, establishing process baselines, spotting abnormal behaviour.

Digifactoring demonstration line

CALLIX lab-scale production line: Siemens PLCs, conveyors, camera inspection, HMI

WHAT IT TELLS YOU A working small-scale production line used to develop and show camera-based inspection, retrofit sensing and real-time monitoring before anything is applied to your own equipment.

TYPICAL USES Seeing what is feasible for your process, trialling inspection and monitoring approaches, low-cost ways to connect older machines.



CASE STUDY THERMAL-LIFE PILOT

AI that reads a component's thermal history from its microstructure

With an industrial partner, AVAIL used deep learning on SEM images to recognise subtle microstructural changes caused by long exposure to high temperature. Early results matched established analytical methods, pointing to faster, more consistent assessment of component operating history with less manual inspection.

RESULTS FOR INDUSTRY

Case studies and what clients say



MICRONCLEAN

Identifying an unknown residue

NMR spectroscopy identified an unexpected residue found during a washing process, including its molecular weight and concentration, so the company could trace its origin in a tightly controlled clean room operation.

Further case studies appear through this guide: Siemens Energy (page 6), Brigg Renewable Energy Plant (page 7), Murfitts Industries (page 8) and Fenner Precision Polymers (page 9).

More case studies at thebridge-lincoln.org/why-bridge/exemplar-studies

“The Bridge team have been invaluable in helping us understand material characteristics of our products.”

John Gueritz, Senior Development Engineer, Eminox

“The facilities offer access to cutting edge analytical techniques coupled with knowledge rarely accessible in materials science.”

Dr Chris Norris, Technical Director, Murfitts Industries

“We are really impressed by the exceptional quality of the TEM images and the EDX analyses.”

Dr Khursand Yorov, Senior Product Developer, Quantum Solutions

Our members

Companies that work with us through a Bridge membership agreement:

Siemens Energy	Fenner Precision Polymers	Micronclean	Eminox
Saint-Gobain Formula	Puraffinity	iBoxit	AFMWorkshop

QUICK REFERENCE

Instrument index

TECHNIQUE	INSTRUMENT	SECTION
Elemental analysis (ICP-OES)	Thermo Scientific iCAP PRO X with Milestone Ethos UP microwave digestion	01 Composition
Gas chromatography mass spectrometry (GC-MS)	Agilent 5977C GC/MSD	01 Composition
Ion chromatography (IC)	Thermo Scientific Dionex ICS-1100	01 Composition
Nuclear magnetic resonance (NMR)	Bruker Avance III HD 500 MHz with solid-state CP-MAS probe	01 Composition
UV-visible spectroscopy	Shimadzu UV-1800 and Analytik Jena Specord 210	01 Composition
FTIR spectroscopy	Bruker Vertex 70v with ATR, DRIFTS and gas cell	02 Spectroscopy
Combined FTIR and Raman	Thermo Scientific Nicolet iS50 with Raman module	02 Spectroscopy
FTIR microscopy	Thermo Scientific Nicolet iN10	02 Spectroscopy
Raman microscopy	Bruker Senterra II and Horiba LabRAM	02 Spectroscopy
Photoluminescence spectroscopy	Edinburgh Instruments FLS980	02 Spectroscopy
Handheld XRF	Thermo Scientific Niton XL3t	02 Spectroscopy
Handheld FTIR	Agilent 4300	02 Spectroscopy
Handheld Raman	Agilent Resolve	02 Spectroscopy
Scanning/transmission electron microscopy (S/TEM)	Thermo Scientific Talos F200i with dual EDS detectors	03 Microscopy
Focused ion beam SEM (FIB-SEM)	Thermo Scientific Scios 2	03 Microscopy
Scanning electron microscopy with EDX	Tescan Vega with Bruker EDX	03 Microscopy
Atomic force microscopy (AFM)	AFMWorkshop HR-AFM, LS-AFM and NP-AFM	03 Microscopy
Optical microscopy with hot and cold stage	Zeiss Axio Imager.M2m, -150 to +600 °C	03 Microscopy
Powder X-ray diffraction	Bruker D8 Discover	04 Structure
Single crystal X-ray diffraction	Bruker D8 Venture, dual Cu/Mo source with cryo-cooling	04 Structure
Simultaneous thermal analysis with mass spectrometry	Netzsch STA 449 F3 with QMS 403 D, -150 to 1500 °C	05 Thermal
Dynamic mechanical analysis (DMA)	Netzsch DMA 242 E Artemis with humidity control	05 Thermal
Bomb calorimetry	Parr 6200 isoperibol calorimeter	05 Thermal
Isothermal titration calorimetry (ITC)	TA Instruments Nano ITC	05 Thermal
Tribology	Rtec MFT-2000, up to 200 N and 500 °C	06 Performance
Universal mechanical testing	Metrotec MTE-100, 100 kN, with tensile and compression fixtures	06 Performance
Rheology	TA Instruments Discovery Hybrid Rheometer (DHR)	06 Performance
Environmental conditioning	Kambic KK-105 CHLT climatic chamber	06 Performance
Molecular modelling	Density functional theory (DFT)	07 Modelling
Image-based microstructure analysis	3D imaging with quantitative image analysis	07 Modelling
Rapid 3D printing	Construct3D Construct 1	07 Modelling
Clean room	ISO Class 6	07 Modelling
AI, computer vision and image analysis	Applied Vision and AI Lab (AVAIL), School of Engineering and Physical Sciences	08 Automation
Predictive modelling and data analytics	Machine learning and generative AI, including large language models	08 Automation
Industrial automation and control	Creative Automation Lab (CALLIX): Siemens S7-1200 and S7-1500 and Rockwell PLCs, embedded controllers	08 Automation
Industrial sensing, monitoring and dashboards	Creative Automation Lab (CALLIX): sensors, data acquisition, edge computing and industrial IoT	08 Automation
Digifactoring demonstration line	CALLIX lab-scale production line: Siemens PLCs, conveyors, camera inspection, HMI	08 Automation

Supporting equipment, including sample preparation, coating and polishing, is listed on our website.



TALK TO US

Tell us what you are trying to find out

We will recommend the right techniques, give you a clear quote and keep you informed from first sample to final report.

Email bridge@lincoln.ac.uk

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Web thebridge-lincoln.org

Visit Joseph Ruston Building, 4 Edgewest Road, Lincoln LN6 7EL, UK

Full equipment list thebridge-lincoln.org/what-we-offer/instrumentation/equipment

Case studies thebridge-lincoln.org/why-bridge/exemplar-studies



The Bridge Advanced Materials and Engineering R&D Centre, University of Lincoln. This guide is updated regularly as our capabilities grow. Edition 2, October 2026.

