

Fast-track your innovation

**With Cranfield's Centre
for Materials facilities
and expertise**

"The turbine coatings lab in Cranfield has led directly to new coating technologies being applied to our civil airline engines in recent years. And so that's an example of something being almost fast-tracked through university research and into the engine."

Ash Owen, Chief Engineer for Civil Technology
and Future Programmes, Rolls-Royce

Materials discovery, testing and analysis for quality control, fault finding and problem solving

Cranfield's Centre for Materials is home to world-leading, industrial-scale research facilities built in partnership with industry and underpinned by Government investment. We deliver a range of technical materials solutions to both SMEs looking to innovate or solve business-critical material challenges, and large organisations working together on major initiatives of national and international significance.

Our insight and expertise enable us to support projects from concept through to high-technology readiness applications. We work at pace, with clear deliverables, protecting your IP. From initial concept through to high-technology readiness, our academics, technicians and engineers become an extension of your team.

Developing multifunctional materials: coatings and films

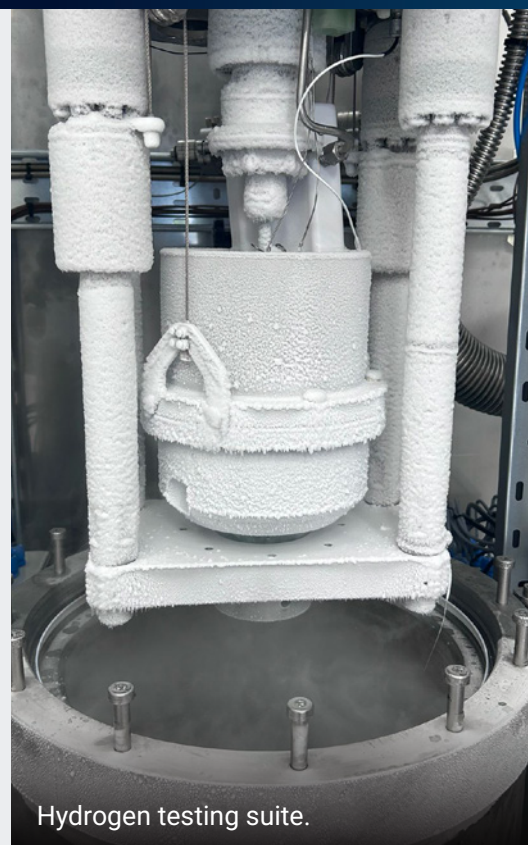
Our Centre for Materials is home to unique deposition equipment:

- Multi-element large area RF plasma deposition system for advanced thin-film coating research and development across a wide range of substrate materials and geometries.
- Combined physical vapour deposition and atomic layer deposition (PVD/ALD) facility to develop unique functional coatings.
- Electron beam physical vapour deposition (EB-PVD) equipment for thermal barrier coatings.

New facilities support the growing hydrogen economy

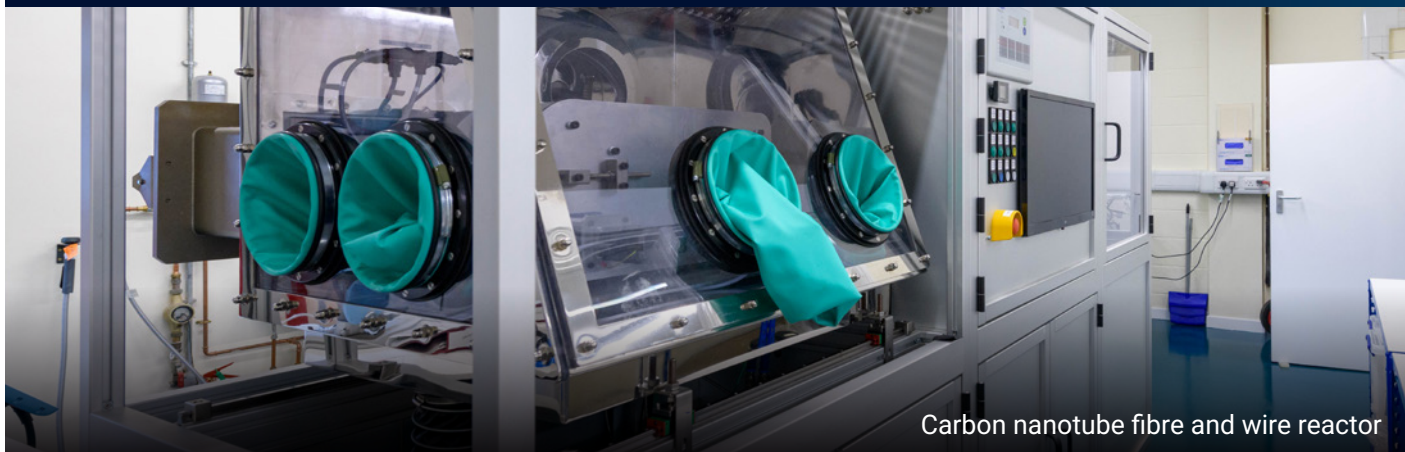
Cranfield provides a UK-leading hydrogen testing suite, including mechanical and permeation testing, and spanning multiple materials and conditions. Access this facility for robust permeation data to inform material down-selection, qualification, barrier assessment and validate modelling approaches under realistic service conditions. The suite comprises:

- **The only UK custom-built servo-hydraulic mechanical testing rig** dedicated to assess material behaviour in direct liquid hydrogen immersion. The rig can test metals, ceramics and polymers, for tensile, fatigue, and fracture mechanics in contact with liquid hydrogen (20K).
- **A manometric/spectrometric gaseous hydrogen permeability tester** characterises polymeric films, coatings, laminates, and similar barrier materials to international standards ISO 15105-1, ISO 2782, and ASTM D1434. It measures hydrogen permeability up to a pressure of 6 bar and 70°C temperature. Three diffusion chambers allow parallel testing, precise temperature control of the sample environment, and an integrated vacuum system to establish low-pressure conditions.
- **A high pressure/temperature hydrogen permeability tester** measures hydrogen permeability in ultra-low permeability materials: metals and ceramics, including coated components, at conditions up to 150 bar and 1,100°C. The rig uses quadruple mass spectrometry to detect permeated hydrogen.



Hydrogen testing suite.

From nanomaterial development and characterisation to component testing and analysis across the materials life cycle



Carbon nanotube fibre and wire reactor

Electrical testing suite

Emulates a power network or micro smart grid system. Used for electric component tests, high voltage, high current and high frequency materials testing.

Electron microscopy suite

Using our nanomaterial characterisation expertise, we investigate the root cause of corrosion or adhesion failures in coatings and support the safe development of novel nanomaterials. Equipment includes: Scanning Electron Microscopy (SEM) Imaging, Energy Dispersive X-ray spectroscopy, Electron Backscatter Diffraction (EBFD) Imaging, Focused Ion Beam (FIB), Time of Flight Ion Mass Spectroscopy (ToF-SIMS) and Transmission Electron Microscopy (TEM).

Metallography laboratory

Surface preparation is crucial for accurate sample test results, be it for corrosion, hydrogen permeation or electrical testing. We offer precision sample preparation, such as sectioning, mounting, grinding, polishing and etching, for optical microscopy and Vickers hardness testing.

Extreme temperature mechanical testing suite

For structural integrity testing forces from 2 kN to 250 kN, this suite includes environmental chamber testing from -253°C to 1,000°C, essential for aerospace and energy sector applications. Using this equipment we worked with a consortium of 14 industrial and Government organisations including Centrica Renewables, EDF, E.ON, Siemens and The Department for Energy and Climate Change to calculate the structural integrity of wind turbine support structures. This project informed new design standards for offshore wind turbine support structures.

This facility includes a graphitisation furnace capable of processing carbon materials at up to 2,200°C.

Environmental testing (temperature-humidity-UV) suite

Accelerated weathering and durability testing across combined temperature, humidity and UV exposure, replicates years of real-world conditions in days.

Metrology and atomic force microscopy

The ultraprecision machining laboratory includes dimensional and geometric precision measurement using the Leitz PMM-F – a high-accuracy (1.9µm+L/400) coordinate measuring machine with a large volumetric capacity of 3m x 2m x 1m. Supporting tight-tolerance component validation, quality control and manufacturing assurance for large-scale parts.

Spectroscopy suite

Materials characterisation and compositional analysis to support novel material development, quality assurance and failure investigation, including Raman Spectroscopy, Fourier transform infrared spectroscopy (FTIR) and UV-Vis-NIR (Ultraviolet-Visible-Near Infrared) spectroscopy.

THERMMAT - Thermal rheological mechanical analysis suite

For accurate data on how composite, metal, ceramic and polymer materials deform and flow under applied force. We have supported businesses characterise viscoelastic properties of a new generation of sustainable rubber formulations, measure glass transition temperatures, evaluate conductivities of thermal barrier coatings for automotive engines, and much more. The suite includes Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), Simultaneous Thermal Analyser (SDT), Thermomechanical Analyser (TMA), Dynamic Mechanical Analyser (DMA), Laser Flash Analyser (LFA) and Rheometer.

Working with us

We have extensive experience in supporting businesses research and development, and will work with you to understand your challenge, define a programme of work and recommend one of our common contracts ranging from a three-four month master's exploratory project to a Knowledge Transfer Partnerships (KTP), and we can create a bespoke solution enabling you to hire our facilities and access specific expertise.

"Uplift360 has been developing advanced chemical recycling solutions for high-performance polymers, including para-aramids (e.g. Kevlar®/Twaron®).

"Through understanding the current construction and material composition of body armour, we can implement sustainable design principles without impacting the performance of the equipment, simultaneously gathering important knowledge on materials separation and reusability/recyclability for the current deployed equipment.

"This has been an important steppingstone, from initial ideation to a more developed feasible idea that we can be confident can be taken forward. Having this assurance in your idea as a small company is vital."

Chris Jenkins, Head of Research and Innovation, Uplift360
(accessed THERMMAT)



"We've been able to commercialise the findings from the Knowledge Transfer Partnership and this is already seeing value with our customers who are using our software analytical tools to change their maintenance activities. We found a fantastic Associate who's joining the company afterwards.

"So next for CorrosionRADAR is to continue our work with Cranfield University, we're already looking at whether there are further opportunities for KTPs and other funding under Innovate UK programmes."

Andy Pidcock, Senior Project Engineer, CorrosionRADAR
(Accessed electrical testing suite and extreme temperature mechanical testing suite – corrosion laboratory).



Funding and access support

As an Associate Partner of the Henry Royce Institute for Advanced Materials, Cranfield can help you navigate Royce-funded industrial collaboration programmes and equipment access schemes.

For more information on funded equipment and the latest opportunities, visit: www.cranfield.ac.uk/royceinstitute

Contact us to discuss your materials challenge:

Email: k.koziol@cranfield.ac.uk

www.cranfield.ac.uk/centreformaterials

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