Technology Gateways | Enterprise Ireland

TUS | CISD | PRISM Polymer, Recycling, Industrial, Sustainability and Manufacturing Research Institute

APT

Applied Polymer Technologies

Your Industry Partner Since 2013

Our Facility Is Your Facility

www.apt-gateway.ie

Rialtas na hÉireann Government of Ireland | Arna chomhchistiú ag an Aontas Eorpach Co-funded by the European Union | Tionól Réigiúnach an Deiscirt Southern Regional Assembly | Enterprise Ireland

The Applied Polymer Technologies Gateway (APT) is co-funded by the Government of Ireland and the European Union through the ERDF Southern, Eastern & Midland Regional Programme 2021-27

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What We Can Do For You?
Our Equipment

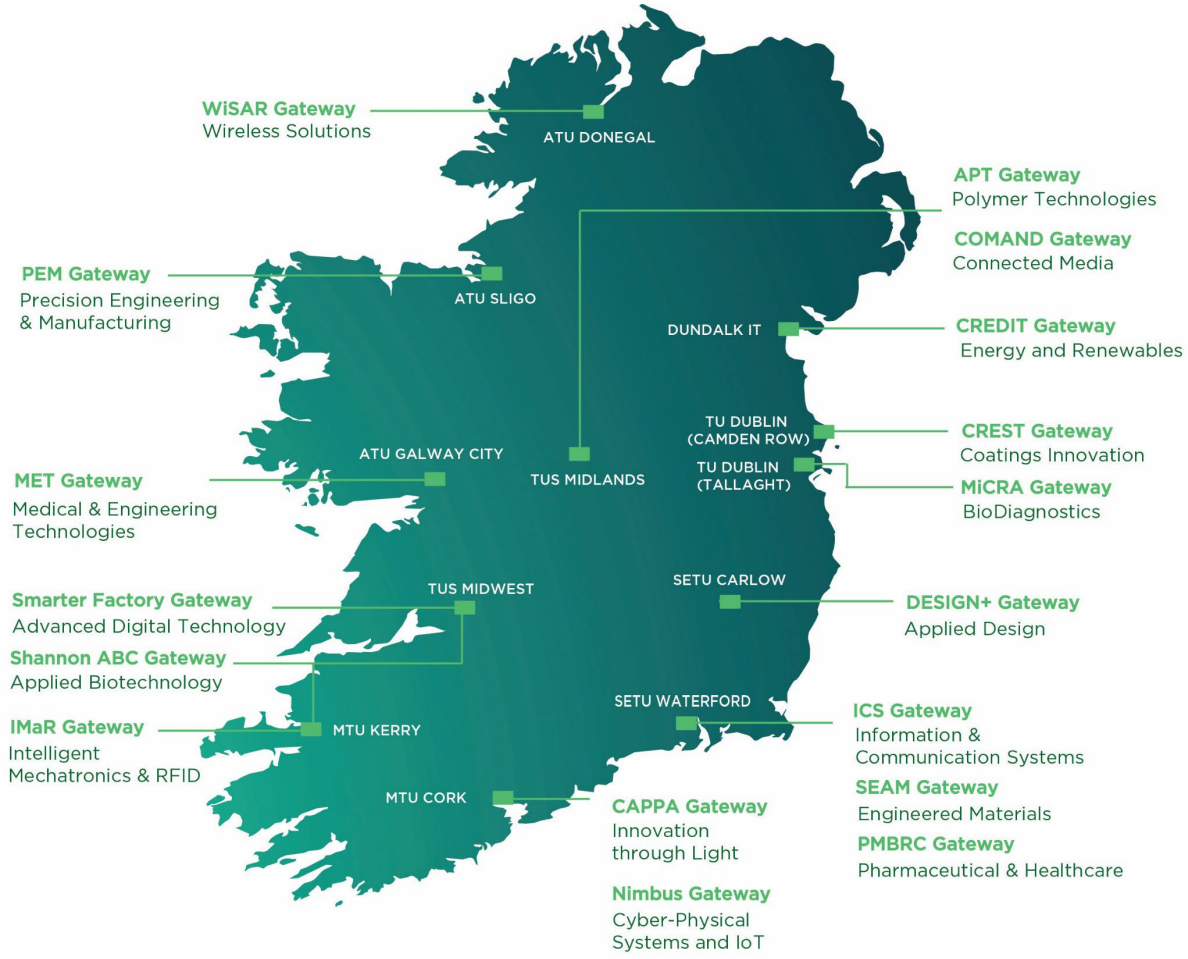
Technology Gateways Network

Enterprise Ireland, in partnership with the Technological Universities and Institutes of Technology, has set up a nationwide network of **17 Technology Gateways** which:

- Deliver technology solutions for Irish industry and their market needs
- Are open access points for industries of all sizes
- Act as local access points to the wider resources in the Irish research ecosystem
- Have a proven track record of delivering for industry

Since 2013, there has been more than 6,000 industrial projects completed, with a total value of more than €60 Million.

- *The Enterprise Ireland Technology Gateway Programme is co-financed by the Government of Ireland and the European Union through the ERDF Southern, Eastern & Midland Regional Programme 2021-27 and the Northern & Western Regional Programme 2021-27.*



TUS Polymer Overview and Capabilities

TUS Midlands research is concentrated in three strategic focus areas based on core competencies built up over many years and are aligned with regional industry needs and national research priorities: namely the domains of **Polymer Materials,** Software and Biosciences.

The **PRISM** Research Institute conducts interdisciplinary research focused on polymer materials science and technology. Its facilities are dedicated to synthesis, processing, manufacture, analysis and testing in the polymer area. To deliver increased levels of high impact applied research outputs over the coming years, and to support an increasing number of industry partners, TUS has recently developed several strategic initiatives to scale its applied research activities predominantly through the Applied Polymer Technologies apt centre (co-funded by the Government of Ireland and the European Union through the European Regional Development Fund (ERDF) under the Southern, Eastern & Midland Regional Programme 2021-27.)

These include:

- TUS has continually invested in facilities utilised by **APT** which includes: 2013-2021 a 300% increase in polymer processing infrastructure with an investment by TUS of ca €2.1M Higher Education Authority and over €1.5M from own funding) in November 2021 for development of a state-of-the-art building to house **APT** personnel, students and equipment
- Sept 2024 Minister Peter Burke officially opened this facility which increases **APT's** footprint from approx. 7000 sq. meters to 12,000 sq. meters. The building will be used to showcase equipment funded both directly by industry and by state funding to act as a centre of excellence for polymer processing nationally.

This support has helped establish the **APT** centre as one of the top-performing technology Gateway centres in the network in terms of value for money and industry engagement. **APT** is critical in enabling TUS to meet its ambitious research strategic goals over the coming years, particularly in allowing the Institute to significantly scale-up it is level of engagements with existing and new industry partners.

Analytical Testing & Investigation Equipment

Waters 2695 Alliance High Pressure Liquid Chromatography (HPLC-UV)
- Routine analysis (quantification and/or comparative identification) of components in mixture
- Cleaning Validation Studies and Trace Analysis
- Purity analysis

Agilent 6870 Gas Chromatography Mass Spectroscopy (GC-MS)
- Routine analysis of components in mixture
- Cleaning Validation Studies and Trace Analysis
- Purity analysis
- Identification of unknown compounds (e.g. – contaminant materials)
- Volatile materials identification in solid and liquid samples by Headspace GC-MS.

ThermoScientific Nicolet iZ10 Fourier Transform InfraRed (FTIR) spectroscopy
- Identification of materials.
- Detection of intermolecular bonding

TOSOH HLC-8321 High Temperature Gel Permeation Chromatography (GPC)
- High Temp. Gel Permeation Chromatography
- Molecular weight determination of polymers
- Molecular Weight Distribution of Polymers
- Comparative Analysis of loss of molecular weight of polymers through degradation

Perkin Elmer 4000 Differential Scanning Calorimetry (DSC)
- Identification of glass transition temperature, crystalline melting temperature and crystallisation temperature.
- Thermal Stability of materials (e.g. – oxidative induction time (OiT) of materials)
- DSC Identification of materials by their Crystalline Melting Temperature (according to IS EN ISO 11357:2003).

Thermogravimetric Analysis (TGA)
- % Inorganic Content (including % Carbon Black and % CaCO3) by TGA (based on ISO 11358).
- Material Thermal Stability.
- Moisture and Volatiles Content.
- Composition of Multi-Component Systems.
- Shelf-Life Studies and Decomposition Kinetics.

Perkin Elmer 8000 Dynamic Mechanical Thermal Analysis (DMTA)
- Mechanical-Thermal Properties of materials

TESCAN MIRA Scanning Electron Microscope System with EDX Detector
- SEM can be utilised to take highly detailed images of areas of interest on a sample (e.g. – fracture surfaces, contamination, etc).
- The EDX detector can be utilised to determine the elemental profile of the area under investigation (e.g. – elements present in material to defined steel type)

Oxford Instruments Jupiter XR Asylum Research Atomic Force Microscope with NanoTA
- Coupled with Scanning Probe Microscope (SPM) is a versatile and powerful tool for characterisation of complex multiphase materials. The additional Scanning Thermal Microscopy (SThM) Application Module generates nanoscale thermal images while simultaneously obtaining contact mode images of the topography.

Packaging barrier and degradation testing.
- Oxygen and water permeability testing
- Respirometer to measure breakdown of polymers in a mimicked environment

Analytical Testing & Investigation Equipment

ThermoScientific Nicolet iZ10 MX Fourier Transform InfraRed (FTIR) Microscope

- Identification of materials.
- Detection of intermolecular bonding

Agilent 1260 Infinity II Gel Permeation Chromatography (GPC)

- Gel Permeation Chromatography
- Molecular weight determination of polymers
- Molecular Weight Distribution of Polymers
- Comparative Analysis of loss of molecular weight of polymers through degradation

Netzsch DSC214 Polyma Differential Scanning Calorimetry (DSC)

- Identification of glass transition temperature, crystalline melting temperature and crystallisation temperature.
- Thermal Stability of materials (e.g. – oxidative induction time (OiT) of materials
- DSC Identification of materials by their Crystalline Melting Temperature (according to IS EN ISO 11357:2003)

Nitsche DSC3500 Sirius Differential Scanning Calorimetry (DSC)

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TESCAN VEGA Scanning Electron Microscope System with EDX Detector

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Extra Solutions Perme H2O Water Vapour Transmission Rate (WVTR) Permeability Tester

- Water permeability testing

Extra Solutions Perme O2 Oxygen Transmission Rate (OTR) Permeability Tester

- Oxygen permeability testing

ECHO Instruments Respirometer

- Respirometer to measure breakdown of polymers in a mimicked environment

Dynisco Capillary Rheometer

- Measures viscosity, shear stress, and shear rate of molten polymers under controlled conditions. It provides data for understanding material flow behaviour

TA DHR30 Parallel Plate Rheometer

- Measure the viscoelastic properties of materials, such as polymers and gels, under controlled temperature and shear conditions. It provides detailed information on viscosity, storage modulus, loss modulus, and other rheological parameters, crucial for material characterization and formulation development

Lovibond RT Series Colourimeter

- Measure the colour of liquids and solids in various industries. It provides accurate colour readings based on standardized scales, such as CIE, RGB, or ASTM, helping ensure consistent product quality and compliance with colour specifications

Rolbatch Density Balance

- To measure the bulk density of powders and granular materials. It provides accurate, reproducible density measurements, helping to optimize material handling, packaging, and processing

Analytical Testing & Investigation Equipment

Zwick / Roell Ceast 6545 Impact Tester

- Measures the impact resistance of materials, such as plastics, metals, and composites, under controlled conditions
- It provides critical data on material toughness and brittleness, helping to assess performance and durability

Llyod TA1 Tensiometer

- Measures the tensile properties of materials, including tensile strength, elongation, and modulus
- It provides critical data for assessing the mechanical performance of materials, helping to ensure quality control and optimize material selection in industries such as textiles, packaging, and polymers

Llyod LRX Tensiometer

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Tenious Olsen Mp1200 Melt Flow Index

- Measures the flow rate of molten polymers under controlled temperature and pressure

Olympus BX53M Polarised Light Microscope

- Provides detailed imaging and analysis of birefringent materials, enabling the study of crystal structures, stress patterns, and fiber orientations in fields such as materials science, geology, and polymer research

Perkin Elmer TMA 7 Thermomechanical Analsyer

- Measures the dimensional changes of materials as a function of temperature, applied force, and time
- It provides key data on thermal expansion, glass transition, and softening points, aiding in material characterization and performance evaluation in industries like polymers, ceramics, and composites

Hot Deflection and Vicat Softening Temperature Testing Machine (Vicat /HDT)

- Determines the thermal deformation and softening points of materials, particularly polymers
- It provides critical data on heat resistance and mechanical performance under elevated temperatures, helping to evaluate material suitability for high-temperature applications

Q Sun Xe-1 Weatherometer

- Simulates the effects of natural weathering, such as UV light, temperature, and moisture, on materials.
- It provides valuable data on the durability and longevity of materials, helping to predict the performance and aging characteristics of coatings, plastics, and other products exposed to outdoor conditions

Analytical Testing & Investigation Equipment

QUV Weatherometer

- Simulates the effects of natural weathering, such as UV light, temperature, and moisture, on materials.
- It provides valuable data on the durability and longevity of materials, helping to predict the performance and aging characteristics of coatings, plastics, and other products exposed to outdoor conditions.

PANalytical AERIS X Ray Diffractometer

- Analyses the crystallographic structure of materials.
- It provides detailed information on phase identification, crystallite size, and lattice parameters, essential for material characterization in industries such as minerals, pharmaceuticals, and materials science

Malvern Zetasizer Pro Dynamic Light Scattering (DLS)

- Measures the size and zeta potential of nanoparticles, proteins, and colloidal suspensions.
- It provides crucial data on particle size distribution and surface charge, essential for applications in drug formulation, nanotechnology, and materials science

Shore Hardness Durometer

- Measures the hardness of materials, typically elastomers, plastics, and rubbers
- They provide a numerical value based on the material's resistance to indentation, helping to assess material durability and performance in various industrial applications

Analytical Testing & Investigation Equipment

Mechanical properties – Tensile, Compression, Flexural and Friction analysis

- ISO testing on standard specimens or custom-made samples.
- Tensile testing to measure material strength and elongation (flexibility).
- Compression testing.
- 3-point bend flexural testing to measure flexural strength and modulus (stiffness).
- Weld strength, tear strength and bond strength.
- Friction testing of materials.
- Impact Resistance.
- Pendulum Impact testing to Charpy and Izod notched and un-notched tests.
- Testing on ISO standard specimens or custom-made samples.
- Customised impact tests to simulate end product exposure.

Product Shelf Life Testing and Lifespan Estimation

- Oven ageing to determine lifespan of product.
- Oven ageing to verify Product Shelf Life stability of Medical Products.
- Humidity chamber also available for more specific environments.
- UV aging.

Melt Flow Rate Analysis (MFR)

- MFR is the viscosity /average molecular weight of the polymer.
- Verification of incoming raw material MFR.

Moisture Analysis

- % Moisture content of liquid and solid samples by Karl Fischer Coulometer.

Imaging Microscope Systems

- Bright light and fluorescence microscope Imaging Systems.
- Confocal microscope.
- Application of digital sizing software to determine the dimensions of samples.

Rheometry

- TA parallel plate rheometer.
- Dynisco Capillary Rheometer.
- Determination of the storage (elastic) modulus, loss modulus, viscosity and shear strength of swollen or molten polymers.

X-Ray Diffraction

- Non-destructive technique - chemical composition and crystallographic structure.

Other tests

- Shore A and Shore D hardness.
- Vicat Softening Point and Heat Deflection Temperature (HDT).
- Optical testing; Colour, light transmission and haze.
- Abrasion testing / Print Integrity.
- Measurement of Chemical Resistance and absorption tests.

Polymer Processing and 3D Design Equipment

3D Printing

- HP Multi Jet Fusion 5200 series
- ProJet 6000 HD SLA 3D Printer
- Markfordged composite printer
- Large FDM 600mm cubed printer (Open source)
- Arburg Freeformer, High Temperature Enabled
- Formlabs 2 with full range of resins
- Formlabs 3 with full range of resins
- 3D Scanner (GOM ATOS CORE)

Injection Moulding

- 75 T. Int Elect Sumitomo Demag with TSM Material Handling System
- 130 T. All Electric Arburg Allrounder 470A Comfort
- Wittmann Battenfeld MicroPower Moulding Machine 15 T
- 6 T Micro-Injection Moulder Babyplast
- LSR (Liquid Silicon Resin) Fanuc All Electric a-s 30ia With Nexus Dosing System Servomix X1

Extrusion and Compounding

- Eurotech Cast Film Co-Extrusion Line, 200mm 3/5 Layer Film System
- ThermoScientific Process 16 TSE Twin screw reactive extruder
- Entex Planetary Extruder
- 40mm Boston Matthews Extrusion Line
- Melt Spinning Fibre Line
- 27mm Co-rotating Leistritz twin screw extruder
- Brabender MetaStation 4E Single screw, twin screw and In line Rheometer
- 22mm E Lab 22 Eurexma High Temperature Enabled

Others

- Zeiss Metrotom CT Scanner
- Fontijne LabEcon 600 Compression Press
- Memmert Climatic Test Chambers x 3
- Carbolite Gero Furnace
- Rapid 150 Granulator
- Ohaus Moisture Analyser

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