

# NZ NATIONAL TESTING FACILITIES

## Universities, Polytechnics and CRIs

LABORATORY	<b>Industrial Materials Specialist</b> Dr Karnika De Silva - NZ Product Accelerator <a href="mailto:k.desilva@auckland.ac.nz">k.desilva@auckland.ac.nz</a> Phone: 09 923 6614 , Mobile: 021 466 954	KEY CONTACT / FACILITIES
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## PRODUCT, MATERIAL PERFORMANCE TESTING

	<div style="border: 1px solid red; border-radius: 10px; padding: 5px; display: inline-block;"> <b>DID YOU KNOW</b> </div>	
AUT UNIVERSITY	<div style="border: 1px solid purple; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Tensile tests measure the force required to break a specimen and the extent to which the specimen stretches or elongates to that breaking point. Tensile tests produce a stress-strain diagram, which is used to determine tensile modulus</i></p> </div>	<p><b>Andy Hilton</b>                      Tensile testing (temp. controlled to 1200oC)                      Macro /micro Hardness Testing                      Impact Testing                      Fatigue Testing (MTS 505G2 SilentFlo HPU)                      Metallographic Examination                      Surface Texture Analyser</p>
CALLAGHAN INNOVATION, GRACEFIELD	<div style="border: 1px solid orange; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Notched Izod Impact is a single point test that measures a materials resistance to impact from a swinging pendulum.</i></p> </div>	<p><b>Conrad Lendrum</b>                      Mechanical testing (we also use Quest integrity as a commercial provider of some services in this area).                      Electrochemical (Potentiostat + Quest integrity sub-contracts)                      Electrical/ Magnetic testing (including HV and high B-field. We also use Powerlabs (ChCh-based) as a commercial sub-contractor for some HV work)                      Surface/coatings tests (also includes profilometer and thin-film reflectance )                      Reactivity thermal testing (TGA, DSC, various reactors esp. fluidised bed)                      Materials density, Optical, Wetting behaviours</p>
CHRISTCHURCH POLYTECH INSTITUTE OF TECHNOLOGY	<div style="border: 1px solid blue; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Notched Charpy Impact - a three-point test that measures a materials resistance to impact from a swinging pendulum</i></p> </div>	<p><b>Margaret Leonard</b>                      • Tensile Tester                      • Impact Tester                      • Optical Analyser                      • Melt flow Index                      • Shadow graph                      • Accelerated UV tester                      • Miniature injection moulder</p>
GNS	<div style="border: 1px solid green; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Capillary Rheometry - measures apparent viscosity (resistance to flow) using shear rates at specific temperatures. Useful in mould flow design analysis. processing parameters, for quality control, degradation, thermal stability etc</i></p> </div>	<p><b>John Kennedy</b>                      Micro hardness testing system</p>
SCION	<div style="border: 1px solid red; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Dynamic Mechanical Analysis determines elastic modulus (or storage modulus, G'), viscous modulus (or loss modulus, G'') and damping coefficient (Tan Delta) as a function of temperature, frequency or time</i></p> </div>	<p><b>Dawn Smith</b>                      Anti-fungal and anti-microbial                      Rheometry                      Brookfield Rotational and Cone&amp; Plate Viscometers                      Polymer Labs GPC                      Instron &amp; Zwick Testing Machines                      Impact Tester                      Cyclic Cree/Humidity Testing                      Box/Packaging testing                      QUV                      Biodegradation &amp; Compostability testing                      Injection Moulder</p>
	<div style="border: 1px solid purple; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Melt Flow Rate - rate of extrusion of thermoplastics through an orifice at a prescribed temperature and load. Determines the extent of degradation of plastic as a result of molding</i></p> </div>	
	<div style="border: 1px solid orange; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Brookfield Cone/Plate Viscometer/Rheometer gives researchers a sophisticated instrument for routinely determining absolute viscosity of fluids in small sample volumes. Its cone and plate geometry provides the precision necessary for development of complete rheological data.</i></p> </div>	
	<div style="border: 1px solid blue; border-radius: 10px; padding: 5px; display: inline-block;"> <p><i>Thermogravimetric Analysis- Loss in weight over specific temperature ranges provides an indication of the composition of the sample, including volatiles and inert filler, as well as indications of thermal stability.</i></p> </div>	

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### DID YOU KNOW

**Gas analysis systems-** permeation analyzers of polymers, leak detectors and headspace analyzers of products. For production environments and quality control applications.

**Cone calorimeter** measures heat release rate, total heat released, effective heat of combustion, mass loss rate, time to ignition, specific extinction area, CO and CO<sub>2</sub> production during exposure to

**Paar Physica UDS 200 rotational rheometer** - to measure shear viscosity, viscoelastic functions, creep, and yield stress of materials using different geometries such as cone-and-plate, parallel-plate, and concentric cylinder

**Gas analysis systems-** permeation analyzers of polymers, leak detectors and headspace analyzers of products. For production environments and quality control applications.

**Accelerated Weathering (QUV)** - simulates damaging effects of long-term outdoor exposure of materials & coatings to most aggressive components of weathering - UV radiation, moisture and heat. Moisture is provided by forced condensation, and temperature is controlled by heaters. No direct correlation made between accelerated weathering duration & actual outdoor exposure duration.

**Xenon-Arc - Accelerated weathering** simulates the damaging effects of long-term outdoor exposure of materials & coatings by exposing samples to varying conditions of aggressive components of weathering - light, moisture & heat. A xenon arc light source provide a radiation spectrum that simulates natural sunlight. Moisture is provided by a humidifier & direct spray & temperature is controlled by heaters. No direct correlation between accelerated weathering duration & actual

**Thermal Conductivity:** The TCP advanced / TC-30, is a non-destructive testing - measures the thermal properties. Measurements -TC and Effusivity (VkpCp) Other factors -density (ρ) heat capacity (Cp), sample thickness & temperature. TC- ability of a material to conduct heat while TE is defined as the square root of the product of

**Cryostat Microtome** - a small, portable and convenient instrument with a hand wheel/ lever.. The compact chamber ensures rapid cool-down times, An insulated cover is used to ensure maximum efficiency of the refrigeration system & to reduce frosting when the unit is not in use.

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### Karnika De Silva (may direct to Research Centres)

Impact Tester - Charpy (Ceast Resil 25)  
Impact Tester - IZOD (Drop-weight Impact Tester)  
Instron UTM - Static (Model 5567, 1185, 1186)  
Instron UTM - Dynamic (Model 8802)  
HDT - Heat Deflection Tester  
Hardness Testing, Shore A, D  
Hardness Testing, Barcol, Hardness Testing, Rockwell B, C  
Corrosion test facilities  
Accelerated Ageing Tester (Contherm)  
Capillary Rheometer  
Cone Calorimeter (Mass loss)  
Gas permeation tester  
Linear Thermal Expansion by TMA or Dilatometer  
MFI - Melt Flow Index / MFR - Melt Flow Rate  
QUV Tester (Accelerated Weathering)  
Thermal conductivity tester (TC-30)  
UV Transmission  
Cone and Plate Rheometer  
Environmental Chamber (Contherm)  
Cone & Plate Rheometer

### John Duncan

Acoustic lab facilities include:  
Reverberation room  
Transmission loss suite  
Low noise wind tunnel  
Duct noise wind tunnel  
Anechoic room  
Automotive  
Instrumentation room  
Control and robotics lab  
Thermodynamics and advanced energy and material systems lab  
Industrial aerodynamics lab  
Fire engineering lab facilities include:  
Cone calorimeter  
Lateral Ignition & Flame Transport (LIFT) test apparatus  
Wind tunnel  
Small-scale furnace  
Atrium smoke control and water mist systems  
High Voltage lab  
Power Electronics  
Nanofabrication

### John Duncan or Kevin Stobbs

Hardness testing  
Fatigue testing  
Corrosion test facilities  
Heat flow measurement using Differential Scanning Calorimeter  
Material Characterisation using Dynamic Mechanical Analyser  
Impact testing  
Tensile and Compression testing

UNIVERSITY OF OTAGO

**DID YOU KNOW**

*Large scale forgings and extrusions of alloys can be carried out. Current work is mainly using titanium and titanium alloys.*

*Servo-hydraulic tensile machine enables fatigue pre-crackinmg for fracture toughness testing. fatigue testing in tension and compression with a non-zero mean stress can be done.*

*Batch compounder - used for processing rubber.*

**DSC -differential scanning calorimeter / Tg = Glass Transition Temperature -** amorphous polymer changes state from a hard brittle state to a soft rubbery state. Tm = melting point of crystalline polymer melts, Tc = polymer crystallizes upon heating or cooling, ΔHm = absorbed energy (joules/gram) in melting, ΔHc = released energy (joules/gram) while crystallizing.

**XRD - X-ray diffraction provides most definitive structural analysis information - interatomic distances and bond angles**

**X-ray photoelectron spectroscopy (XPS) -** a surface-sensitive quantitative spectroscopic technique that measures elemental composition. Can be used to analyze surface chemistry of a material with or without fracturing, cutting, scraping in air etc

**Microtome -** is a tool used to cut extremely thin slices of material allowing for the preparation of samples for observation under transmitted light or electron radiation. Microtomes use steel, glass, or diamond blades.

**Craig Grant (Research Office) or Robert Van Hale**

Chem Dept Iso-trace facilities include:

Certification of sucrose adulteration in honey (AOAC 1999 protocol)

Thermal maturity and genetic characterisation of natural gas (Mud gas isotope logging, carbon and hydrogen isotope ratios of C1-C3 hydrocarbons)

Determination of Individual Components in Spark Ignition Engine Fuels by High-Resolution Gas Chromatography (ASTM D6730)

<http://neon.otago.ac.nz/consulting/isotrace/applications.php>

**Craig Grant (Research Office) or Rachel Laing (Textile Research)**

tensile tester - Instron bench

impact rig

thermal resistance

vapour resistance

thermal conductance

climate chamber/human testing

abrasion resistance

air permeability

accelerated light aging

dimensional change

crocking test

visual change/assessment

**Brian Gabbitas (HOD)**

Instron 8801 100 kN Axial Servo-Hydraulic Dynamic Testing System

Instron 33R4205 50kN tensile machine

100 tonne vertical press

300 tonne extrusion press

Vacuum furnace

Charpy impact testing machine

Accelerated weathering tester

Injection moulder

Extruders x 2, Pelletiser

Batch compounder, Compression moulder

Heated press

Differential scanning calorimeter (DSC)

Dynamic mechanical analyser (DMTA)

Raman spectrometer - hyphenated with DSC

Thermal gravimetric analysis

XRD, including heated stage and 3D imaging

BET surface area

Bomb calorimeter

Compression moulder

UNIVERSITY OF WAIKATO

**MATERIALS COMPOSITION AND ANALYTICAL TESTING**

AUT UNIVERSITY

**DID YOU KNOW**

**Atomic force microscopy (AFM)-** a technique for analyzing surface of a rigid material all the way down to the level of the atom. Magnifies surface features up to 10<sup>8</sup>times & produces 3-D images of the surface. Used to solve processing & materials problems in electronics, telecom, biology and other high-tech industries.

**Andy Hilton**

Confocal Raman/ Atomic Force microscope (Wintec Alpha 300RA (2))

High Resolution Scanning Electron Microscope with EDS & EBSD (Hitachi SU-70 (2))

**Conrad Lendrum**

Imaging – ( 2 SEMs + 2 operator FTEs – 1 Hi-res + 1 environmental chamber, + various optical microscopy options)

Chemical elemental (EDS, XRD, FTIR, NMR (liquid and solid) etc.)

Phase crystal structure (EBSD, XRD)

CALLAGHAN INNOVATION, GRACEFIELD

GNS

SCION

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## DID YOU KNOW

**Gel Permeation Chromatography (GPC)** - a high performance liquid chromatography technique for the separation of components based on their molecular size in solution, characterizing the molecular weight distribution of polymers, separation of discrete components

**Humidity testing** - data generated by can be important in planning materials selection, paints and coatings, and expected lifetime of a product

**Humidity Chambers**- continuous measurement of ambient humidity in the natural atmosphere on a stationary platform

**Resin infusion and RTM light facilities** – Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.

**Liquid chromatography-mass spectrometry (LC/MS)** - technique with high sensitivity and specificity. Used to analyze compounds that are too large, too polar, or too thermally labile for the GC technique. Application is oriented towards the detection & identification of chemicals in a complex mixture.

**Fluidized bed reactor**- A device for heterogeneous (multiphase) catalytic reactions in which the fluidized catalyst is allowing extensive mixing in all directions with excellent temperature stability and increased mass-transfer and reaction rates.

**Fatigue Test** - Behaviour of materials under fluctuating axially, in torsion, or in flexure loads

**Hardness testers** - a material's resistance to indentation by measuring the permanent depth or projected area of the indentation.

**Surface Texture Analyser** - evaluate the cohesiveness, spreadability, fracturability, tackiness, gumminess, firmness, pliability, consistency and other texture characteristics of foods, rubber, foams, coatings, grease, asphalt etc.

## John Kennedy

Ion-Beam Analysis (General)  
Ion-Beam Analysis (Air Particulates)  
Ion-beam Analysis (Ultra-High Vacuum)  
Ion-Beam Analysis (Microprobe)  
Atomic Force Microscope (AFM)  
Scanning Electron Microscope (SEM)  
Field Emission system  
Hall Effect test system  
Four/Two probe system

## Dawn Smith

FE-SEM  
FTIR Microscope, LaserConfocal/Flourescent Microscopes  
Dynamic Mechanical Thermal Analysis (DMTA)  
Dielectric Thermal Analysis (DETA)  
Foaming and moulding equipment  
Differential Scanning Calorimetry (DSC)  
Thermogravimetric Analysis (TGA)  
Melt Flow Index (MFI)  
Micro-imaging  
Synchrotron

## Karnika De Silva (may direct to Research Centres)

Ashing furnace  
Colour Spectrometer  
DMTA - Dynamic Mechanical Thermal Analyser  
DSC - Differential Scanning Calorimeter  
FTIR - Infrared Spectrophotometer  
Microscope (with digital camera and heated stage)  
Microtome  
Moisture Content Analysis (Sartorius MA??)  
Starlet 2212 Cryostat Microtome  
Stereo Explorer (used with Leica Microscope)  
TGA - Thermo Gravimetric Analyser  
Xenon Arc  
Xenon Arc - Fresh Water per hour  
Xenon Arc - Lamps per hour  
XRF (Contact Geology Dept)

## Colin Doyle (RCSMS and Chemical and Materials Engineering)

XPS  
XRD (Single crystal, Powder) facilities  
Optical Microscope Facility  
ESEM/EDS - multiple facilities

## Kevin Daish (ASAS)

ICPMS  
Raman Spectrometer  
FTIR  
ESP  
Light Scattering  
Laser diffraction particle analysis  
Carbon, nitrogen & sulfur analysis  
Size exclusion Chromatography (SEC-MALLS)  
EPR  
LC-MS  
GC-MS Shimadzu

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## DID YOU KNOW

**Paar Physica UDS 200 rotational rheometer** - to measure shear viscosity, viscoelastic functions, creep, and yield stress of materials using different geometries such as cone-and-plate, parallel-plate, and concentric cylinder

**Rheosense m-VROC viscosity meter - High Shear, Small Sample Viscometer** -Coatings, Cosmeceuticals, Food & Beverages, Fracking, Conductive inks, Ceramic, Oils & Lubricants, Rechargeable Battery and Fuel Cells etc

**Liquid chromatography-mass spectrometry (LC/MS)** - technique with high sensitivity and specificity. Used to analyze compounds that are too large, too polar, or too thermally labile for the GC technique. Application is oriented towards the detection & identification of chemicals in a complex mixture.

**Permeability and compaction characterisation** - (air and liquid) - for fibrous reinforcements for use in liquid resin infusion simulations (based on image analysis or thickness)

**NMR** - quantitatively analyze mixtures containing known compounds. Can be used in quality control & research for determining the content & purity, molecular structure, match against spectral libraries, infer basic structure directly, molecular conformation, physical properties at molecular level- e.g. conformational exchange, phase changes, solubility & diffusion

**GC/MS** - combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample.

**Gel permeation chromatography (GPC)** - a separation technique based on hydrodynamic volume (size in solution). Molecules are separated based on differences in molecular size and used in polymer molecular weight determination.

**XRF -X-ray fluorescence-** a non-destructive elemental analysis of materials in a broad range of industries & applications; from Positive Material Identification, scrap metal sorting, measuring sulfur in oil, analysing coating thickness of metal finishing & metal alloys to quality control in the electronics & consumer goods industry.

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QQQ new triple quadropole  
QTOF-MS  
GCMS Agilent 7890 Mass Spectrometer  
GCMS Thermo Mass Spectrometer  
LCMS Q-Exactive Thermo  
Qstar Mass Spectrometer  
LTQ-FT Mass Spectrometer  
XRD - Single Crystal  
XRD- powder Rigaku  
XRD- powder Siemens  
NMR 300MHz, 400MHz, 500MHz, 600MHz  
Malvern Mastersizer  
Laser diffraction particle analysis  
Schmidt and Haensch multiple wavelength refractometer  
Wyatt DynaPro Titan Dynamic Light Scattering  
Rheosense m-VROC viscosity meter  
Rudolph DDM 2910 Digital Density Meter  
Dynamic Scanning Calorimeter (DSC)  
Microcal VP-ITC  
Thermo Gravimetric Analysis TGA  
ABI 3130 DNA Sequencer  
ABI 7500HT real time PCR Instrument  
Affymetrix GeneChip microarray Equipment  
Illumina MiSeq sequencer  
ABI Ion Torrent PGM sequencer  
Bio-Rad MyIQ Real Time PCR system  
Crystal Pro HT  
electron microscopes - FEI Tecnai TF20, FEI Tecnai 12, Phillips CM12  
Optical diffractometer  
Gel imaging system -Fujifilm LAS-3000  
Li-Cor Odyssey CLx infrared imaging system  
Perkin Elmer Envision Plate Reader  
Perkin Elmer Enspire plate reader  
Crystal Pro HT  
Crystal Pro HT XCube  
Wyatt DynaPro Titan DLS  
Polymer Standards Service SLD7000 Multi-Angle Laser Light Scattering detector + Dionex HPLC  
  
Li-Cor Odyssey CLx infrared imaging system  
Laser micro dissection system -Leica LMD6000  
BD FACS Calibur Flow Cytometer  
**Michelle Dickinson**  
**Nano-mechanical Research Laboratory**  
Hysitron TI-950 Tribolndenter  
MTS XP Nanoindenter  
Avelife Technologies Biodent 1000  
**John Duncan**  
Analysis labs  
Scanning Electron Microscope  
Transmission Electron Microscope  
Optical microscopy  
Material preparation  
Materials processing and treatment  
Dynamic mechanical analyser

UNIVERSITY OF CANTERBURY

### DID YOU KNOW

**Electron spin resonance (ESR) spectroscopy** is a technique for studying materials with unpaired electrons. The basic concepts of EPR & NMR are similar, but it is electron spins that are excited instead of spins of atomic nuclei. As most stable molecules have all their electrons paired, EPR is less widely used than NMR.

**Electrochemical potentiodynamic reactivation (EPR)**-a test created to evaluate susceptibility to inter-granular or non-uniform corrosion, an effective method of testing alloys & SS. EPR is non-destructive, can identify alloy & SS resistance to inter-granular corrosion, study precipitation & grain boundaries, and examine local changes to structure & composition of alloys

**Colour Spectrometer**- Color is a key indicator of the quality of a product, color consistency & accuracy in paints & coatings, freshness & quality in foods etc. Color measurement can extend past transmitted or reflected spectral data to include CIE L\*a\*b\* Color, Yellowness, Haze & other appearance related attributes.

**Leica Stereo Explorer** -automatically creates 3D data records from two 2D stereo microscope images. From this data, extract profiles. Roughness or undulation can be determined with high precision, fractal dimension & volumetric calculations of depressions and elevation, volume of dents and peaks can be calculated.

**ICPMS** - Inductively coupled plasma mass spectrometry (ICP-MS) - capable of detecting metals & non-metals at very low concentrations. Emerging rapidly growing application areas –: analysis of flue gas desulfurization wastewaters, seawater & characterization of engineered nanoparticles

**Raman Spectrometer**- a technique used to observe vibrational, rotational, and other low-frequency modes in a system used to characterize materials, measure temperature, crystallographic orientation etc. Water does not interfere with analysis. Thus, suitable for micro-analysis of minerals, materials, polymers & ceramics, cells, proteins & forensic trace evidence.

**Laser diffraction particle analysis** - a widely used particle sizing technique for materials ranging from hundreds of nanometers up to several millimeters in size.

UNIVERSITY OF OTAGO

Differential scanning calorimeter  
Thermogravimetric analyser

#### John Duncan or Mike Flaws

DMTA - Dynamic Mechanical Thermal Analyser  
DSC - Differential Scanning Calorimeter  
FTIR - Infrared Spectrophotometer  
Microscope (with digital camera and heated stage)  
Microtome  
TGA - Thermo Gravimetric Analyser  
XRD (Contact Chemistry Dept)  
XRF (Contact Geology Dept)

Electron Microscope Facility

1) SEM (Scanning Electron Microscopes): JEOL 7000F with EDS and Cathodoluminescence 2) JEOL 6100 with Oxford EDS and EBSD 3) Leica 1440

TEM (Transmission Electron Microscope): 1) Philips CM200 with EDS and 2) Philips CM120

Gatan PIPS, dimpler and 3mm ultrasonic specimen cutter

Various coaters

#### Craig Grant (Research Office) or Robert Van Hale

Certification of sucrose adulteration in honey (AOAC 1999 protocol)

C,N,H,S elemental analysis (Dumas combustion method)

C,H,O,N,S Light stable isotope ratio measurement of most solids, liquids or gases

Gas Chromatography with FID detector (GC-FID)

High pressure liquid chromatography with UV, fluorometric, E.L.S. or refractive index detectors (HPLC)

<http://neon.otago.ac.nz/consulting/isotrace/applications.php>

#### Craig Grant (Research Office) or Rachel Laing

moisture content analysis/change, Clothing/Textiles: Moisture content analysis

microscopes/camera

access to SEM, cryo

#### Craig Grant (Research Office) or Dave Prior

Microchemical analysis using high- speed energy dispersive X-Ray microanalysis (EDX). Oxford instruments Xmax 20 detector mounted on a Zeiss Sigma field emission gun SEM (FEGSEM). Oxford instruments AZTEC & INCA operating software.

Crystallographic mapping using electron backscattered diffraction (EBSD). Oxford instruments Nordlys F detector mounted on a Zeiss Sigma field emission gun scanning electron microscope (FEGSEM). Oxford instruments AZTEC operating software.

Particle searching based on backscatter imaging coupled to energy dispersive X-Ray microanalysis (EDX). Uses oxford instruments "Feature" software within INCA platform

Confocal Microscopy, MicroCT scanning

Laser mass spectrometry

Magnetic properties and palaeomagnetism

XRD

Raman

#### Craig Grant (Research Office) or Chris Button

Flume [Size accessible water channel: L10m x W2.5m x D2m, Flow rate (0-5 m/s, approx. 10 knots), Temp range (5-35 deg C). Automatically triggered cut-out function for engines, numerous options for video camera and load cell placement (e.g. 4 underwater viewing windows (~1.5 x 1.5m), a portable steel gantry)-Separate cylindrical plunge tank (1.5m radius, 3 m depth)

#### Centre for Trace Element Analysis, Chemistry

Multiple-Collector Inductively Coupled Plasma Mass Spectrometer (MC-ICPMS) (Nu Plasma-HR, Nu Instruments Ltd, UK)

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DID YOU KNOW

**(SEC-MALLS) - Size-Exclusion Chromatography Combined with Multiangle Laser Light Scattering** -Fractionation of samples delivered to three detection systems: UV/Visible, Refractive Index (RI) & Light Scattering (LS). Directly determine molar mass, radius size & aggregation state, diffusion coefficients, hydrodynamic sizes & molecular weights, characterises biomolecules.

**QQQ new triple quadrupole mass spectrometer**- is a tandem mass spectrometer consisting of two quadrupole mass spectrometers in series, with a (non mass-resolving) radio frequency (RF)-only quadrupole between them to act as a cell for collision-induced dissociation. The first (Q1) and third (Q3) quadrupoles serve as mass filters.

**LTQ-FT Mass Spectrometer** - combines the most advanced Ion Trap and Fourier Transform Ion Cyclotron Resonance technologies into a single instrument with unprecedented analytical power & versatility. For the first time, high resolution, accurate mass determinations, and MSn are available for routine high-throughput analysis.

**Quadrupole Time-of-flight Mass Spectrometry (QTOF-MS)**- provides the highest UPLC (Ultra performance Liquid Chromatography)/MS/MS performance of challenging qualitative & quantitative applications. Combines physical separation of liquid chromatography with mass spectrometry.

**Malvern Mastersizer - particle size analyser** - automated sample dispersion units for the measurement of wet & dry samples (options for emulsions, suspensions & dry powders) controlled through SOPs, providing ease of method development and transfer.

**Wyatt DynaPro Titan Dynamic Light Scattering (DLS)**- Determine sizes of metallic nanoparticles or quantum dots, quantify self-assembly processes of polypeptides, estimate populations of aggregates large & small, analyze thermal stability, differentiating pure unfolding from aggregation, assess colloidal stability as a precursor to aggregation, precipitation etc

**S & H multiple wavelength refractometer** - digital, fully automatic spectral refractometer-Dispersion measurement at 7 wavelengths over the full visible range. Potential applications found in R/D where the exact knowledge of material properties in medical research (plastic &, contact lenses), communication technology (polymer materials, special optical liquids and glues).

UNIVERSITY OF WAIKATO

Quadrupole Inductively Coupled Plasma Mass Spectrometer (Q-ICP-MS) (Agilent 7500 cs/ce, Agilent Technologies, U.S.A.)

193 nm Excimer Laser Ablation System (Resonetics Resolution system, Resonetics Ltd, U.S.A. with Lauren Technics Ltd, Australia laser ablation cell)

213 nm Laser Ablation System (New Wave Ltd, U.S.A.)

Sector-Field Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS) (Nu Attom, Nu Instruments Ltd, UK, to be installed in late 2014)

Otago Centre for Electron Microscopy (Dept Anatomy): Range of scanning (SEM) and transmission (TEM) electron microscopy capabilities and microCT (see: see [http://ocem.otago.ac.nz/em\\_techniques.html](http://ocem.otago.ac.nz/em_techniques.html))

Shear force measurements of materials (School of Dentistry)

**Performance testing of medical devices and textiles (UOW Centre for Translational Physiology)**

Immune signalling (in vitro and in vivo)

Anti-bacterial, anti-fungal, anti-viral testing

Anti-biofilm

Flow cytometry

Tissue culture facilities

Bioplex for cytokine/chemokine detection

Fluorescence microscopy

PC3 facility for restricted pathogens

**Brian Gabbitas (HOD)**

Waikato Mass Spectrometry Facility

MALDI-TOF MS (Matrix-Assisted Laser Desorption/Ionisation – Time Of Flight Mass Spectrometer)

ESI MS (ElectroSpray Ionisation) with Bruker Daltonics micro TOF for high resolution or with Fisons VG Platform quadrupole for lower resolution

ICP MS (Inductively Coupled Plasma):

GC MS (Gas Chromatography): HP 6890 GC with HP 5973 quadrupole

SPR (Surface Plasmon Resonance): Biacore 3000

LC MS (Liquid Chromatography): Bruker amazon X (ESI or APCI)

FPLC (Fast Protein Liquid Chromatography): AKTA and LCC

Electron Microscope Facility

SEM (Scanning Electron Microscope)

TEM (Transmission Electron Microscope): Philips CM30

Stable Isotope Research Facilities

Isotope Abundance Analyser: Europa Scientific 20/20

Isotope Ratio Mass Spectrometer: Europa Scientific Penta 20/20

Waikato Radiocarbon Dating Laboratory

Liquid Scintillation Spectrometer: Perkin Elmer 1220 Quantulus

Accelerator Mass Spectrometer

Others

- X-Ray Diffractometer (XRD)

- Thermal Analysis (DSC, DTA/ TGA)

- UV Spectrophotometers

- Hoeffer Electrophoresis System

# MATERIALS PROCESSING EQUIPMENT

AUT

CALLAGHAN INNOVATION, GRACEFIELD

CALLAGHAN INNOVATION, PARNELL

GNS

## DID YOU KNOW

**Microcal VP-ITC** -isothermal titration calorimeter - investigate biomolecular interactions. Measures binding affinity & thermodynamics & the measurement of the heat change determines the binding constants (KD), interaction stoichiometry (n), enthalpy ( $\Delta H$ ) & entropy ( $\Delta S$ ), provides TD profile of molecular interaction in a single experiment.

**Rudolph DDM 2910 Digital Density Meter** -designed to meet the requirements of your laboratory applications in Chemical, Petroleum, Pharmaceutical, and Beverage industries

**Resin infusion and RTM light facilities** – Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.

**Brabender** -Melt Rheology characteristics -of materials - to the combined influence of temperature & shear. Twin screw combination measures both heat & drive information which is continuously exchanged. The records of torque, time & temperature are displayed on plastogram graphical data software. Statistical data evaluates fusion behaviour, heat & shear stability, flow-curing behaviour of crosslinking, liquid absorption. Twin screw provides data of plastifying, compounding, alloying of polymers, chemical reactions, dispersion of pigments & additives etc

**The Dumas combustion method** enables quantification of the elements C,N,H,S in organical substances. C,H,O,N,S Light stable isotope ratio measurement of most solids, liquids or gases.

**Multiple-Collector Inductively Coupled Plasma Mass Spectrometer** enables the detection of minute variations in the isotopic makeup of metals, allowing questions as diverse as the migration history of commercially-sensitive fish stocks, the fate of metal contaminants in NZ's waterways and ecosystems, and the pace and amplitude climate change to be investigated..

**Gas chromatography with FID** can be used for the detection of organic molecules in gases.. E.g. HPLC measurements using UV, fluorometrics, E.L.S. or refractive index detectors allows identification of separate components in a chemical mixture, such as biological fluids.

## Andy Hilton

3 and 4 axis CNC Machining  
High Precision EDM Wire Cutter (Makino U3)  
Laser Cutter (Universal X660)  
Water Jet Cutter  
Roll-former, Hydraulic Press  
Welding workshop (friction stir, TIG/MIG)

## Conrad Lendrum

scale-up chemical reactor (up to 100kg capacity);  
wide range of instrument calibrations (via MSL);  
magnetic properties (Squid, magnetometer etc.)

## Ian Brown

Metal/ceramic processing - Ian Brown - for details

## Margaret Leonard

Machinery

- Water tower and ring main
- Power ring main
- Compressed Air ring main
- Blown Film Tower
- Blow Moulder
- Rotational Moulder
- Single screw Extruder, • Twin Screw Extruder
- Injection Moulder x 80 tonne
- Tumbler Mixer
- Die Tool Heater
- Small Conveyor System
- Hopper Dryers x 1
- Ultrasonic Welder
- Rotational Frictional Welder
- Thermoformer
- Extruder Dryer and Water Cooler
- Master Batching Grabametric
- Granulators x 2
- Miscellaneous small machinery
- Surface Modifier
- Printing Press
- High speed CNC Machinery (this all sits beside the fitting/turning-tool-making section)
- o Machine centre
- o Spark eroder

## John Kennedy

Fabrication Facilities  
Metal Ion-Implanter  
High Energy Ion-Implanter  
Triple-beam Ion-Implanter  
Ion-beam Sputtering System  
High vacuum Electron Beam Annealer  
Old Arc-discharge Chamber  
New Arc-discharge Chamber  
Direct Ion beam deposition chamber  
Pipeline Coating System  
Multi-metal Evaporator system  
Sputter coater system



MASSEY UNIVERSITY

OTAGO POLYTECHNIC INNOVATION WORKSPACE

SCION

## DID YOU KNOW

**Quadrupole Inductively Coupled Plasma Mass Spectrometer** enables the detection of metals and some non-metals to very low concentrations, for example, to 'fingerprint' New Zealand's commercially-sensitive export produce, and to understand how essential nutrients are utilized within the human body.

**Visual change assessment** covers the standard procedures for determining change in appearance of fabrics or garments.

The **flume is an aquatic treadmill**, with excellent laminar flow. This purpose-built circulating water channel has variable water speed (0 - 5.0 m/s; up to 10.0 knots). Although originally built for testing and training of swimmers & other aquatic sports, it can also be used for testing properties of **water flow, boat hull design & other underwater equipment**. For analysis and feedback, data is displayed live and relayed onto a large screen using portable cameras & load cells.

The **thermal maturity and genetic character** of natural gas can be determined by measuring the carbon and hydrogen isotope ratios of C1-C3 hydrocarbons (Mud gas isotope logging).

An **Instron Bench** can be used to evaluate the mechanical properties of materials and components including fibres, yarns, fabrics, using tension, compression, flexure, fatigue, impact, torsion and hardness tests..

The **climate chamber** can be used to determine the effects of apparel systems on human performance.

An **impact rig** is used to determine resistance to impact events..

**193 nm Excimer Laser Ablation System** enables the detection of metals in very small solid samples, for example, in unravelling the complex evolution of New Zealand, including its tectonic and climatic history, and the development of its economic minerals.

## Johan Potgeiter

Ancillary manufacturing equipment

Complete Engineering workshop and infrastructure

Laser cutters

CNC

Finishing equipment

## Eva Gluyas

Epilogue Laser

Bed size 600x450mm

Cuts thin plastics (6mm) and ply/mdf (4mm), paper card etc

High resolution etching (600dpi)

Global laser

Bed Size 1800x1200mm

Cuts timber/mdf (8mm) and plastics (10mm)

Omax water Jet

Bed size 620X620mm

Cuts most materials of reasonably consistent thickness. (metals, plastics, stone, ceramic, glass, timber, eps) max thickness approx 150mm.

Record 120 router

Bed size 2700x950mm (z=250mm), For machining of timber and plastics.

## Dawn Smith

Twin Screw Extruder

labtech Film Line (Extrusion)

labtech Single Screw Extruder

Larger scale (60mm) extruder with fittings

Drier/feeders: extrusion accessories - various

Cross head die extrusion

Extrusions: cast Film and profile extrusions

Driers/feeders: extrusion accessories -various

Cross head die extrusion: cable coating; long fibre reinforced plastics

Extrusions: cast film and profile extrusions

Die Face (air cooled) Pelletiser

Batch Pre-mixers, 5 and 20 litre

Laboratory Thermoformer/lamination

Boy 35t and 15t Injection Moulding Machine

Weverk Press - fully automated

Siempelkamp Press-fully automated

Polymer foaming – various types and scales of equipment for various foams (urethane, phenolic, polyester etc.)

Diaphragm/resin infusion/vacuum assisted composite moulding apparatus

Mechanical Fibre Processing Pilot Plant (pulp and MDF manufacture plant)

Chemical pulping equipment - various

Fibre mat making

Continuous fibre impregnation line

Fibre treatments

Composite manufacturing - various

Maxi-blender fibre coating and dispersion equipment

Paper-making, coating and paper testing equipment -various

Fibre-cement manufacturing equipment

Choppers/Pelletisers

Hammer mill

Large sieving apparatus

Freeze driers

SCION

### DID YOU KNOW

*Thermal and vapour resistance, and thermal conductance of materials including textiles provide information on properties relating to warmth, the transfer of moisture, or the transfer of heat (the latter typically in damp fabric). Such information enables manufacturers to optimise the desired material properties, or make informed choices for specific materials.*

*Dimensional changes may occur in fabric, typically with cleaning or heat exposure.*

*Abrasion resistance refers to the fabric properties under the influence of rubbing.*

*Air permeability of a fabric measures the passage of air through it. This may be relevant for outdoor clothing or sails..*

*Sucrose adulteration (adding sugars like fructose to honey) can be detected by stable isotope ratio mass spectrometry*

*Accelerated light aging uses aggravated conditions of (sun)light to speed up the normal aging processes of items to help determine the long term effects of expected levels of (light) stress in a shorter time.*

UNIVERSITY OF AUCKLAND

UNIVERSITY OF CANTERBURY

Supercritical drying  
Spray driers/encapsulation and microencapsulation  
Emulsion (1L) and various aqueous/polymerisation reactors (up to 20L)  
Polymerisation and polycondensation reactors  
Bioreactors and microbial polymerisations  
Supercritical Fluids Reactor and Supercritical Fluids(CO2) Extraction - various  
CO2 mediated processing of polymers and composites  
Film casting equipment  
Steam explosion apparatus  
Wood drying/processing/impregnation  
Coating and adhesive preparations  
Coatings and adhesive tests  
Chemical and polymer extractions  
Aqueous and solvent extractors  
Biomass processing/pre-treatments reactor equipment  
High speed mixer  
Laboratory-scale thermoformer  
Large drying apparatus

#### **Karnika De Silva (may direct to Research Centres)**

Brabender Plasticorder  
Extruder - Single screw  
Henschel Mixer  
Injection Moulder 50 ton Arburg  
Injection Moulder 50 ton Boy  
V-Cone dry blender  
CNC Milling Machine

#### **Kevin Daish (ASAS)**

Critical Point Drier  
Sputter Coater  
Freeze Fracture  
Live cell imaging confocal microscope -Andor Revolution  
Ultramicrotome -Leica EM UC6  
Glass knife maker -LKB 7800  
Tissue processor for wax embedding -Tissue-Tek VIP  
Wax embedding station -Leica EG1150H  
Slide staining station -Tissue-Tek II  
Cryomicrotome -Leica CM1850  
Wax microtome -Microm HM 330  
Sliding microtome  
Vibratome  
Freeze dryer -Edwards EPD3  
Critical point dryer -Polaron E3000  
Sputter coater -Polaron E5000  
Dimpling grinder -Fischione Model 200  
Ultrasonic disc cutter -Fischione Model 170  
Grinding Room Facility

#### **John Duncan**

Differential scanning calorimeter  
Biomass integrated gasification combined cycle (BIGCC) system  
Reactor/distillation column with fieldbus control system  
MegaSpeed CPL MS 50K high speed camera  
Wood drying tunnel  
Agilent micro gas chromatograph for gas analysis  
Niro Spray drier

UNIVERSITY OF CANTERBURY	<p style="text-align: center;"><b>DID YOU KNOW</b></p> <p><i>Faro platinum arm with 3D scanner. 3D scanner -Scan area approximately 1m x 1m x 1m (surface scan up to 3m x 1.5m approx.) - Produces point cloud data of an object</i></p> <p><b>Sample Preparation:</b> 96-place rolling ball mill (120 ml unit volume)- A <b>rolling ball mill</b> is a grinder. The 96-place mill can grind up to 96 samples of up to 120 ml simultaneously, and is typically used for size reduction of organic materials.</p> <p style="text-align: center;"><i>more information about testing functionalities to be added when available from the testing labs</i></p>	<p>Munster fluidised bed drier</p> <p>Large and small freeze driers</p> <p>Microtrac X-100 Particle size analyser</p> <p>Fermentation equipment for aseptic work</p> <p>MegaSpeed CPLL MS 50K high speed camera</p> <p>Plate heat exchanger</p> <p>Farm milk vat for heat transfer</p> <p>Climbing film evaporator</p>
UNIVERSITY OF OTAGO		<p><b>Robert Van Hale</b></p> <p>Sample Preparation: 96-place rolling ball mill (120 ml unit volume)</p>
UNIVERSITY OF WAIKATO		<p><b>Brian Gabbitas (HOD)</b></p> <p>Testing and preparation</p> <p>Twin screw extruder</p> <p>Injection moulder</p> <p>Cold and hot isostatic presses</p> <p>Medium scale high energy mechanical milling machine</p> <p>Laboratory scale high energy ball mills</p> <p>Instron and Lloyd tensile testers (100 kN- 5 N)</p> <p>Automatic grinding and polishing facilities</p> <p>Vicker's hardness testers</p> <p>Laser particle size analyser</p> <p>Fermentors (ChemMap 40 L, LG 4L)</p> <p>Protein Digestion Robot (Bruker Proteineer)</p> <p>SuperPro Designer Bioprocess Simulation Software</p>

**ADDITIVE MANUFACTURING/3D PRINTING**

AUT	<p style="text-align: center;"><b>DID YOU KNOW</b></p> <p style="text-align: center;"><i>more information about testing functionalities to be added when available from the testing labs</i></p>	<p><b>Andy Hilton</b></p> <p>Fused Deposition Modelling (Statasys Dimension SST768)</p> <p>Selective Laser Sintering (EOS Formiga P100)</p> <p>Selective Laser Melting (Renishaw AM250, 400W)</p> <p>3D Printer (Z-Corp 310)</p>
OTAGO POLYTECHNIC		<p><b>Eva Gluyas</b></p> <p>Print size: 260x260x200mm</p> <p>Print material: ABS like resin in white or blue.</p> <p>Zcorp 3D printer, print size: 254x381x203mm</p> <p>Print material: gypsum based powder &amp; binder -Can print on surfaces in full RGB colour.</p> <p>Objet Eden 3D printer</p>
UNIVERSITY OF CANTERBURY		<p><b>Scott Amies</b></p> <p>Full machine shop and 3D printing facilities</p>
OTAGO POLYTECHNIC INNOVATION WORKSPACE		<p><b>Craig Grant (Research Office) or Robert Van Hale</b></p> <p>3D printers</p> <p>fusing press, various joining/seaming machines</p>
VICTORIA UNIVERSITY OF WELLINGTON		<p><b>Tim Miller</b></p> <p>Photo-curable Polymer Printers</p> <p>Poly Jet 3D printer (Objet), Poly Jet Multimaterial printer (Objet)</p> <p>FDM – single filament (UP plus, UP Mini), FDM – dual filament BFB Touch)</p>
UNIVERSITY OF AUCKLAND		<p><b>Xun Xu</b></p> <p>Design Lab Infrastructures</p> <p>14x UP! 3D Printers , 4x Mini 3D Printers</p>

PRODUCT, MATERIAL PERFORMANCE TESTING

HOLMES SOLUTIONS

DID YOU KNOW

**Wind load testing:** Holmes Solutions can perform wind load testing on anything from sculptures to full scale buildings to verify compliance to New Zealand and International codes.

**Destructive Testing:** Holmes Solutions has a wealth of experience in conducting full scale destructive testing on a variety of products at any scale, from railway sleepers to full scale buildings.

**Roadside Hardware Testing:** Holmes Solutions is the only US Federal Highways accredited crash test (roadside hardware) facility in the Southern Hemisphere. Conducting full scale, dynamic testing of a range of vehicles up to 12 tonne trucks travelling in excess of 100kph.

**Seismic Testing:** Holmes Solutions has a range of test apparatus purpose built for seismic testing. The largest testing apparatus has the capacity to test full scale braces up to 5MN in capacity, with a stroke

**Product Refinement:** Holmes Solutions can provide clients with key insights into how they can refine their product improving product performance while reducing costs. This provides the client with a superior product while building intellectual property.

**Product Compliance:** Obtaining compliance of a product is often the final stage in a development process, however requires early consideration and planning to ensure the product can achieve the desired outcomes. To assist this process, Holmes Solutions works with clients to review New Zealand and International Standards, identify Regulatory requirements, assist with product compliance documentation; and can liaise with regulatory bodies on behalf of

HOLMES SOLUTIONS - TIM PORTER

ISO 17025 certified testing

- Materials testing (tensile, compression, bending, flexural)
- Concrete testing
- Steel testing
- Reinforcing bar testing
- Carbon fibre testing
- Timber testing
- Metallurgy testing
- Mechanical testing
- Building Product testing
- Building sub-assembly testing
- Building component testing
- Bracing testing
- Wall panel testing
- Mechanical coupler testing
- Buckling restrained brace testing
- Viscous damper testing
- Seismic damper testing
- Full scale building testing
- Building failure investigation
- Forensic Engineering
- Hardness testing
- Earthquake loading simulation and testing
- Impact testing
- Fatigue testing
- Durability testing
- Abrasion testing
- Fire testing
- Fall protection equipment
- Amusement rides and equipment
- Mechanical products and system testing (full scale)
- Earthquake loading simulation and testing
- Engineering Product testing
- Integrated system testing
- Accident investigation and testing
- Dynamic impact testing
- Roadside hardware testing
- Security product testing
- Vehicle dynamics testing
- Safety equipment testing
- Rail system testing
- Aerospace product and material testing
- Aerodynamic testing
- Fall protection equipment testing
- Environmental testing
- Load measurement
- Wind turbine testing
- Composite structures

HOLMES SOLUTIONS

DID YOU KNOW

**Freedom to Operate:** Holmes Solutions works with a number of clients identifying new opportunities and raising caution over potential infringement with patents already issued or pending patent applications, globally.

**Patents:** Holmes Solutions has first hand experience licensing patents globally. As such, we share our knowledge and experience to ensure clients can secure their intellectual property, then leverage it in the most appropriate manner to achieve their goals.

- Vibration testing
- NDT and Destructive testing
- Anti terrorist product testing
- Temperature monitoring and measurement
- Mechanical product testing
- Hydraulic test system
- <http://www.holmessolutions.com/>
- Finite Element Analysis (linear and non-linear)
- Failure mode and effects analysis
- Root Cause Analysis
- Design for manufacture
- Forensic failure investigation
- Computation Fluid dynamics
- Magnetic modelling
- Dynamic impact modelling
- Material behaviour characteristics
- Reinforcing steel characteristics
- Structural dynamics
- Fire behaviour and modelling
- Structural mechanics
- Mechatronics
- Mechanical product and system modelling
- Fatigue modelling
- Virtual prototyping
- International standards compliance
- Freedom to operate
- Patents - Hydraulic system modelling

BUILDING ELEMENT ASSESSMENT LABORATORY LTD (BEAL) (Colin Prouse)

<http://www.beal.co.nz/why-use-beal.html>

BRANZ

[http://www.branz.co.nz/cms\\_display.php?sn=63&st=1](http://www.branz.co.nz/cms_display.php?sn=63&st=1)

SGS

<http://www.sgs.co.nz/en/Service-by-Type-Path/Testing.aspx>