

# 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

LABORATORY	INDUSTRIAL MATERIALS SPECIALIST	KEY CONTACT / FACILITIES
AUT UNIVERSITY	<div style="border: 1px solid red; padding: 5px; color: red; font-weight: bold;">DID YOU KNOW</div> <div style="border: 1px solid purple; padding: 5px; margin-top: 10px;"> <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> </div>	<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
CALLAGHAN INNOVATION, GRACEFIELD	<div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <i>Notched Izod Impact is a single point test that measures a materials resistance to impact from a swinging pendulum.</i> </div> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <i>Notched Charpy Impact - a three-point test that measures a materials resistance to impact from a swinging pendulum</i> </div>	<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
CHRISTCHURCH POLYTECH INSTITUTE OF TECHNOLOGY	<div style="border: 1px solid green; padding: 5px; margin-top: 10px;"> <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> </div> <div style="border: 1px solid red; padding: 5px; margin-top: 10px;"> <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> </div>	<b>Margaret Leonard</b> <ul style="list-style-type: none"> <li>• Tensile Tester</li> <li>• Impact Tester</li> <li>• Optical Analyser</li> <li>• Melt flow Index</li> <li>• Shadow graph</li> <li>• Accelerated UV tester</li> <li>• Miniature injection moulder</li> </ul>
GNS	<div style="border: 1px solid purple; padding: 5px; margin-top: 10px;"> <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> </div>	<b>John Kennedy</b> Micro hardness testing system
SCION	<div style="border: 1px solid red; padding: 5px; margin-top: 10px;"> <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> </div> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <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> </div>	<b>Dawn Smith</b> Anti-fungal and anti-microbial Rheometry Brookfield Rotational and Cone& Plate Viscometers Polymer Labs GPC Instron & Zwick Testing Machines Impact Tester Cyclic Cree/Humidity Testing Box/Packaging testing QUV Biodegradation & Compostability testing Injection Moulder

UNIVERSITY OF AUCKLAND

### 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

**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

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

UNIVERSITY OF CANTERBURY

### 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-cracking 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

*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.*

UNIVERSITY OF WAIKATO

**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

**MATERIALS COMPOSITION AND ANALYTICAL TESTING - 1**

RESEARCH CENTRE FOR SURFACE AND MATERIALS SCIENCE -RCSMS -UoA

**DID YOU KNOW**

**Scanning Electron Microscopy (SEM)** - effectively achieve magnifications from 200 to 35,000 times.

SEM (STEM) detects thin section analysis of both wet and dry samples

**Dr Colin Doyle (RCSMS and Chemical and Materials Engineering)**

Technical Manager

Email: [c.doyle@auckland.ac.nz](mailto:c.doyle@auckland.ac.nz)

Phone: +64 (0) 9 923 5813

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EDS (SEM) detects thin section analysis of both wet and dry samples.

**Energy Dispersive Spectroscopy (EDS)** - high resolution measured in nanometers. Identifies the elemental composition of samples, contaminant particles in food, concentration variations across interfaces, segregation of alloying elements at metal grain boundaries etc useful to the industry

**Electron Backscatter Diffraction (EBSD)**- quantitative analysis of microstructural parameters and to determine changes in crystal orientation during deformation processes, phases present in samples.

**X-Ray Photoelectron Spectroscopy (XPS)**- surface chemical analysis technique used to analyse the surface chemistry of a material for identification of elements at concentrations > 0.1 at%, determination of elemental composition, oxidation state etc.

**Atomic force microscopy (AFM)**- 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.

**Ultraviolet Photoelectron Spectroscopy (UPS)** - analysis of corrosion products, composition of coating materials, diamond like carbon films

**MATERIALS COMPOSITION AND ANALYTICAL TESTING - 11**

AUT UNIVERSITY

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

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

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

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GNS

**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)

**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)

SCION

**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.

### 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)

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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

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

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(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.

### 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 foos etc. Color measurement can extend past transmitted or reflected spectral data to include CIE L\*a\*b\* Color, Yellowness, Haze & other appearance related attributes.

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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  
Activelife Technologies Biodent 1000

#### John Duncan

Analysis labs  
Scanning Electron Microscope  
Transmission Electron Microscope  
Optical microscopy  
Material preparation  
Materials processing and treatment  
Dynamic mechanical analyser  
Differential scanning calorimeter  
Thermogravametric 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

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**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.

**(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.

### DID YOU KNOW

**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

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/isotracer/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 mouned on a Zeiss Sigma fieled emission gun SEM (FEGSEM). Oxford instruments AZTEC & INCA operating software.

Crystallographic mapping using electron backscattered diffraction (EBSD). Oxford instruments Nordlys F detector mouned on a Zeiss Sigma fieled 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)

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.)

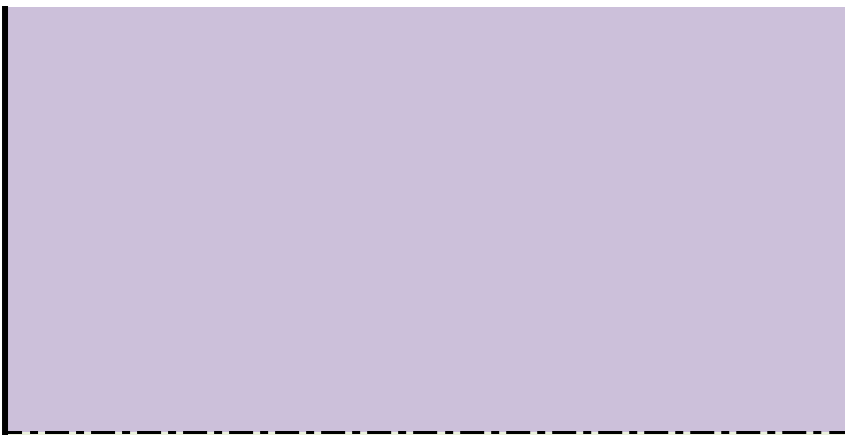
Sector-Field Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS) (Nu Attom, Nu Instruments Ltd, UK, to be installed in late 2014)

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 siganlling (in vitro and in vvivo)



UNIVERSITY OF WAIKATO

first time, high resolution, accurate mass determinations, and more 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).

- 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

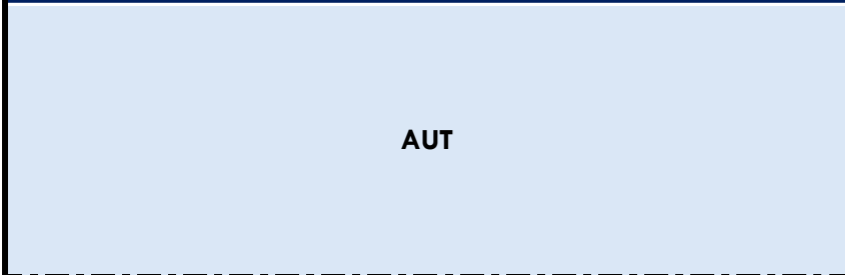
Accelerator Mass Spectrometer

Others

X-Ray Diffractometer (XRD), UV Spectrophotometers, Thermal Analysis (DSC, DTA/ TGA)

Hoeffer Electrophoresis System

**MATERIALS PROCESSING EQUIPMENT**



AUT

**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 (ΔH) & entropy (ΔS), 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



CALLAGHAN INNOVATION, GRACEFIELD

- 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



CALLAGHAN INNOVATION, PARNELL

GNS

MASSEY UNIVERSITY

OTAGO POLYTECHNIC INNOVATION WORKSPACE

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.

### 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

- 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

### 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

SCION

SCION

*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.*

### 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.*

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

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

UNIVERSITY OF AUCKLAND

*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.*

**DID YOU KNOW**

*Faro platinum arm with 3D scanner. 3D scanner -Scan area approximately 1mx1mx1m (surface scan up to 3m x 1.5m approx.) -Produces point cloud data of an object*

*Sample Preparation: 96-place rolling ball mill (120 ml unit volume)- A rolling ball mill 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.*

*more information about testing functionalities to be added when available from the testing labs*

UNIVERSITY OF CANTERBURY

UNIVERSITY OF CANTERBURY

UNIVERSITY OF OTAGO

UNIVERSITY OF WAIKATO

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

Munster fluidised bed drier

Large and small freeze driers

Microtrac X-100 Particle size analyser

Fermentation equipment for aseptic work

MegaSpeed CPL MS 50K high speed camera

Plate heat exchanger

Farm milk vat for heat transfer

Climbing film evaporator

**Robert Van Hale**

Sample Preparation: 96-place rolling ball mill (120 ml unit volume)

**Brian Gabbitas (HOD)**

Testing and preparation

Twin screw extruder

Injection moulder

Cold and hot isostatic presses

Medium scale high energy mechanical milling machine

Laboratory scale high energy ball mills

Instron and Lloyd tensile testers (100 kN- 5 N)

Automatic grinding and polishing facilities

Vicker's hardness testers  
 Laser particle size analyser  
 Fermentors (ChemMap 40 L, LG 4L)  
 Protein Digestion Robot (Bruker Proteineer)  
 SuperPro Designer Bioprocess Simulation Software

### ADDITIVE MANUFACTURING/3D PRINTING

AUT

**DID YOU KNOW**

*more information about testing functionalities to be added when available from the testing labs*

OTAGO POLYTECHNIC

UNIVERSITY OF CANTERBURY

OTAGO POLYTECHNIC INNOVATION WORKSPACE

VICTORIA UNIVERSITY OF WELLINGTON

UNIVERSITY OF AUCKLAND

**Andy Hilton**

Fused Deposition Modelling (Statasys Dimension SST768)  
 Selective Laser Sintering (EOS Formiga P100)  
 Selective Laser Melting (Renishaw AM250, 400W)  
 3D Printer (Z-Corp 310)

**Eva Gluyas**

Print size: 260x260x200mm  
 Print material: ABS like resin in white or blue.  
 Zcorp 3D printer, print size: 254x381x203mm  
 Print material: gypsum based powder & binder -Can print on surfaces in full RGB colour.  
 Objet Eden 3D printer

**Scott Amies**

Full machine shop and 3D printing facilities

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

3D printers  
 fusing press, various joining/seaming machines

**Tim Miller**

Photo-curable Polymer Printers  
 Poly Jet 3D printer (Objet), Poly Jet Multimaterial printer (Objet)  
 FDM – single filament (UP plus, UP Mini), FDM – dual filament BFB Touch)

**Xun Xu**

Design Lab Infrastructures  
 14x UP! 3D Printers , 4x Mini 3D Printers

### NZ NATIONAL TESTING FACILITIES -PRIVATE LABORATORIES

#### PRODUCT, MATERIAL PERFORMANCE TESTING

**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.

**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  
 Building Products, sub-assembly and component testing  
 Bracing testing  
 Wall panel testing  
 Buckling restrained brace testing  
 Viscous and Seismic Damper testing  
 Full scale building testing  
 Building failure investigation

HOLMES SOLUTIONS

**Seismic Testing:** Holmes Solutions has a range of test apparatus purpose built for seismic testing. The largest testing apparatus has

**Product Refinement:** Holmes Solutions can provide clients with key insights into how they can refine their product improving product

**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,

**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.

HOLMES SOLUTIONS

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

**BRANZ**

**SGS**

- Forensic Engineering
- Earthquake loading simulation and testing
- Durability testing
- Abrasion testing
- Fire testing
- Fall protection equipment
- Amusement rides and equipment
- Engineering Product testing
- Integrated system testing
- Roadside hardware testing
- Security product testing
- Vehicle dynamics testing
- Safety equipment testing
- Rail system testing
- Aerospace product and material testing
- Aerodynamic testing
- Environmental testing
- Wind turbine testing
- Vibration testing
- NDT and Destructive testing
- Anti terrorist product testing
- Temperature monitoring and measurement
- Hydraulic test system
- Finite Element Analysis (linear and non-linear)
- Root Cause Analysis
- Design for manufacture
- Forensic failure investigation
- Computation Fluid dynamics
- Magnetic and Dynamic impact modelling
- Mechatronics
- Mechanical product and system modelling
- Virtual prototyping
- International standards compliance

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

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

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