NZ NATIONAL TESTING FACILITIES

Universities, Polytechnics and CRIs

LABORATORY	Industrial Materials Specialist Dr Karnika De Silva - NZ Product Accelerator k.desilva@auckland.ac.nz Phone: 09 923 6614 , Mobile: 021 466 954	KEY CONTACT / FACILITIES

PRODUCT, MATERIAL PERFORMANCE TESTING

DID YOU KNOW

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*

Notched Izod Impact *is a single point test that measures a materials resistance to impact from a swinging pendulum.*

Notched Charpy Impact *- a three-point test that measures a materials resistance to impact from a swinging pendulum*

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*

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*

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*

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.*

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.*

AUT UNIVERSITY

Andy Hilton

- 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

Conrad Lendrum

- 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

Margaret Leonard

- Tensile Tester
- Impact Tester
- Optical Analyser
- Melt flow Index
- Shadow graph
- Accelerated UV tester
- Miniature injection moulder

GNS

John kennedy

- Micro hardness testing system

SCION

Dawn Smith

- Anti-fungal and anti-microbal
- 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

UNIVERSITY OF CANTERBURY

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 CO2 production during exposure to radiant heat fluxes- from 0 - 100 kW/m2.*

***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 with forced condensation. 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. Provide sa radiation spectrum that simulates natural sunlight. No direct*

***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*

***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 the product of TC (k), (p) & (Cp) of the material.*

***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.*

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, Δ Hm = absorbed energy (joules/gram) in melting, Δ Hc = released energy (joules/gram) while crystallizing.

CACM, LMRC, RCSMS and C&M Engineering
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 faciities 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 faciities 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

UNIVERSITY OF WAIKATO

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.*

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.*

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

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

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

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

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

Craig Grant (Director Research and Enterprise) 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 (Director Research and Enterprise) or Rachel Laing (Textile Research)

tensile tester - Instron bench
impact rig
thermal resistance
vapoour resistance
thermal conductance
climate chamber/human testing
abrasion resistance
air permeability
accelerated light aging
dimensional change, crocking test

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

UNIVERSITY OF AUCKLAND

DID YOU KNOW

Scanning Electron Microscopy (SEM) - *effectively achieve magnifications from 200 to 35,000 times.*
EM (STEM) detects thin section analysis of both wet and dry samples.

Energy Dispersive Spectroscopy (EDS) - *high resolution measured in nanometers. Identifis 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.*

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 10^8times & produces 3-D images of the surface. Used to solve processing & materials problems in electronics, telecom, biology and other high-tech industries.*

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.*

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Scanning Electron Microscopy (SEM
Energy Dispersive Spectroscopy (EDS)
Electron Backscatter Diffraction (EBSD)-
X-Ray Photoelectron Spectroscopy (XPS)-
Electron Backscatter Diffraction (EBSD)-
Atomic force microscopy (AFM)-

MATERIALS COMPOSITION AND ANALYTICAL TESTING - 11

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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 products*

Andy Hilton

Rotary Tribometer (high temperature ~800C, humidity control, electrical contact resistance) Block on Ring Tribometer (load carrying capacity and wear preventive properties of lubricants)
Confocal Raman/ Atomic Force microscope (Wintec Alpha 300RA (2))
High Resolution Scanning Electron Microscope with EDS & EBSD (Hitachi SU-70 (2)
Linear Reciprocating Tribometer (high temperature testing up to 600C, high frequency up to 30 Hz, tribocorrosion module)

CALLAGHAN INNOVATION, GRACEFIELD

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, solid)Phase crystal structure (EBSD, XRD)

John Kennedy

GNS	**DID YOU KNOW**	Ion-Beam Analysis (Microprobe)
		Atomic Force Microscope (AFM)
	Resin infusion and RTM light facilities *– Stereo-photogrammetry system for dynamic thickness measurements during flexible mould processes.*	Scanning Electron Microscope (SEM)
		Ion-Beam Analysis (General)
		Ion-Beam Analysis (Air Particulates)
		Hall Effect test system, Four/Two probe system
	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.*	Ion-beam Analysis (Ultra-High Vacuum)
SCION		**Dawn Smith**
		Dielectric Thermal Analysis (DETA)
		Foaming and moulding equipment
		Differential Scanning Calorimetry (DSC),
	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.*	Thermogravimetric Analysis (TGA)
		Micro-imaging
		FE-SEM
		Synchroton
		Melt Flow Index (MFI)
		Dynamic Mechanical Thermal Analysis (DMTA)
	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*	
UNIVERSITY OF AUCKLAND		DMTA - Dynamic Mechanical Thermal Analyser, DSC - Differential Scanning Calorimeter
		FTIR - Infrared Spectrophotometer
		Microscope (with digital camera and heated stage)
		Moisture Content Analysis (Sartorius MA??)
		Starlet 2212 Cryostat Microtome
		Stereo Explorer (used with Leica Microscope)
	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.*	TGA - Thermo Gravimetric Analyser
		Xenon Arc - Fresh Water per hour
		XRF (Contact Geology Dept)
		ICPMS
		Raman Spectrometer
		ESP, EPR
		Laser diffraction particle analysis, Light Scattering
	Permeability and compaction characterisation - (air and liquid) - for fibrous reinforcements for use in liquid resin infusion simulations (based on image analysis or thickness)	Carbon, nitrogen & sulfur analysis
		Size exclusion Chromatography (SEC-MALLS)
		LC-MS
		GC-MS Shimadzu
	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*	QQQ new triple quadropole
		QTOF-MS
		GCMS Agilent 7890, GCMS Thermo Mass Spectrometers
		LCMS Q-Exactive Thermo
		Qstar Mass Spectrometer
		LTQ-FT Mass Spectrometer
		XRD - Single Crystal
		XRD- powder Rigaku
		XRD- powder Siemens
	GC/MS *- combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample.*	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

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DID YOU KNOW

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.*

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*

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 TriboIndenter
MTS XP Nanoindenter
Activelife Technologies Biodent 1000

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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.*

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*

John Duncan

Transmission Electron Microscope, Scanning Electron Microscope
Optical miscroscopy
Material preparation
Materials processing and treatment
Dynamic mechanical analyser
Differential scanning calorimeter
Thermogravametric analyser

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

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

UNIVERSITY OF OTAGO

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.*

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.*

QQQ new triple quadropole 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.*

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

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

Gatan PIPS, dimpler and 3mm ultrasonic specimen cutter

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)

Certification of sucrose adulteration in honey (AOAC 1999 protocol)

Craig Grant (Director Research and Enterprise) or Rachel Laing

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

microscopes/camera

access to SEM, cryo

Craig Grant (Director Research and Enterprise) 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

Certification of sucrose adulteration in honey (AOAC 1999 protocol)

Craig Grant (Director Research and Enterprise) 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)

Shear force measurements of materials (School of Dentistry)

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

Inmmune siganlling (in vitro and in vvivo)

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

Anti-biofilm

Flow cytometry

UNIVERSITY OF OTAGO	**DID YOU KNOW**	Tissue culture facilities
		Bioplex for cytokine/chemokine detection
		Fluorescence microscopy
		PC3 facility for restricted pathogens
		Brian Gabbitas (HOD), Leandro Bolzoni
UNIVERSITY OF WAIKATO	***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*	ESI MS (ElectroSpray Ionisation) with Bruker Daltonics micro TOF for high relostuion 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
	S & H multiple wavelength refractometer *- digital, fully automatic spectral refractometer-Dispersion measurement at 7 wavelengths over the full visible range. Potential applications found inR/D where the exact knowledge of material properties in medical research (plastic &, contact lenses),communication technology (polymer materials, special optical liquids and glues).*	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
	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.*	MALDI-TOF MS (Matrix-Assisted Laser Desorption/Ionisation – Time Of Flight Mass Spectrometer)
		Hoeffer Electrophoresis System
		X-Ray Diffractometer (XRD), UV Spectrophotometers, Thermal Analysis (DSC, DTA/ TGA)

MATERIALS PROCESSING EQUIPMENT

AUT	***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. 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*	**Andy Hilton**
		High Precision EDM Wire Cutter (Makino U3)
		Laser Cutter (Universal X660)
		Water Jet Cutter
		Roll-former, Hydraulic Press
		Welding workshop (friction stir, TIG/MIG)
		3 and 4 axis CNC Machining
CALLAGHAN INNOVATION, GRACEFIELD	***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.*	**Conrad Lendrum**
		wide range of instrument calibrations (via MSL);
		scale-up chemical reactor (up to 100kg capacity);
		magnetic properties (Squid, magnetometer etc.)
CALLAGHAN INNOVATION, PARNELL	***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..*	**Ian Brown**
		Metal/ceramic processing - Ian Brown - for details
		Margaret Leonard
		Machinery
		· Water tower and ring main
		· Compressed Air ring main, Power ring main
		· Blown Film Tower, Blow Moulder
		· Rotational Moulder

CALLAGHAN INNOVATION, PARNELL

GNS

MASSEY UNIVERSITY

SCION

DID YOU KNOW

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

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.*

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.*

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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).*

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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..*

- Single screw Extruder, · Twin Screw Extruder
- Injection Moulder x 80 tonne
- Tumblar 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
- High speed CNC Machinery (this all sits beside the fitting/turning-tool-making section

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

Dawn Smith

Twin Screw Extruder
labtech Film Line (Extrusion), labtech Single Screw Extruder
Larger scale (60mm) extruder with fittings
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 profileextrusions
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

SCION

UNIVERSITY OF AUCKLAND

UNIVERSITY OF AUCKLAND

DID YOU KNOW

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.*

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.*

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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*

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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 micros-analysis of minerals, materials, polymers & ceramics, cells, proteins & forensic trace evidence.*

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.*

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
Biomass processing/pre-treatments reactor equipment
Coatings and adhesive tests
Chemical and polymer extractions

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

UNIVERSITY OF CANTERBURY	*more information about testing functionalities to be added when available from the testing labs*	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 CPLL MS 50K high speed camera Plate heat exchanger Farm milk vat for heat transfer Climbing film evaporator
UNIVERSITY OF OTAGO		**Robert Van Hale** Sample Preparation: 96-place rolling ball mill (120 ml unit volume)
UNIVERSITY OF WAIKATO	*more information about testing functionalities to be added when available from the testing labs*	**Brian Gabbitas (HOD), Leandro Bolzoni** 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**	**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)
UNIVERSITY OF CANTERBURY		**Scott Amies** Full machine shop and 3D printing facilties
OTAGO POLYTECHNIC INNOVATION WORKSPACE		**Craig Grant (Director Research and Enterprise) or Robert Van Hale** 3D printers fusing press, various joining/seaming machines
VICTORIA UNIVERSITY OF WELLINGTON	*more information about testing functionalities to be added when available from the testing labs*	**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

UNIVERSITY OF AUCKLAND

NZ NATIONAL TESTING FACILITIES -PRIVATE LABORATORIES

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*

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, identify*

DID YOU KNOW

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

Patents: *Holmes Solutions has first hand experience licensing patents*

HOLMES SOLUTIONS

Fused Deposition Modelling (Statasys Dimension SST768)

Selective Laser Sintering (EOS Formiga P100)

- 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
- 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

	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 appropraite manner to achieve their goals.*	International standards compliance
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
SGS		http://www.sgs.co.nz/en/Service-by-Type-Path/Testing.aspx