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IN NEW ZEALAND

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UP FRONT ...

Chemistry IN NEW ZEALAND

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The New Zealand Institute of Chemistry Incorporated
P O Box 12-347, Wellington, New Zealand
Ph +64-4-4739444, Fax +64-4-4732324
President: N Pritchard, Hon Treasurer: D P Karl
General Secretary/Executive Officer: Alan A Turner

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2/17 Olive Road, Penrose
P O Box 12 909, Penrose, Auckland, New Zealand
Ph +64-9-579 0842, Fax +64-9-579 0843
Email ancat@ihug.co.nz

Editorial Board:
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Managing Editor & Advertising Sales:
Robert B Lyon • BSc, MNZIC
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March 1996 - Focus on Food and Beverage Manufacturing

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The Editor,
Chemistry In New Zealand,
P O Box 12 909
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COVER STORY

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LOCAL NEWS

SHIMADZU IS NOW DIRECT

Shimadzu Corporation, manufacturer of quality scientific instruments, is now operating directly in New Zealand.

The move to direct representation provides Shimadzu's present and future customers with greater support through the combined resources of the local and Australian organisations. This will yield tangible long term benefits in the form of more competitive supply and enhanced support for your on-going Shimadzu instrument purchases.

Shimadzu's northern and southern regional offices will continue to operate out of Douglas Pharmaceuticals until new premises are completed. New direct phone numbers (listed below) have been organised so that you can contact Shimadzu more easily.

A number of the Douglas Scientific agencies that support and complement Shimadzu instrumentation will continue to be represented in New Zealand by Shimadzu including ISCO and J & W Scientific.

Meet the People of Shimadzu in New Zealand:

Chris Nipper (Regional Manager - Northern): Chris has 7 years sales experience, 4 of those involved directly in selling Shimadzu analytical instrumentation. Chris also has extensive laboratory experience being qualified as a Medical Laboratory Technologist and working for 11 years in hospital medical laboratories. Chris specialises in gas chromatography systems.

Bruce Fraser (Regional Manager - Central): Bruce's background is in analytical chemistry with an emphasis in chromatographic techniques. He has been associated with Shimadzu in New Zealand in various roles since 1980, apart from four and a half years at Auckland Institute of Technology where he lectured in chemistry and was involved in the development and running of analytical workshop courses.

Bob Foulkes (Regional Manager - Southern): Bob has a decade of experience in analytical instrument laboratories and wide applications and sales/marketing experience spanning 22 years, including several years in the computer network industry, and as a project manager. His speciality is in HPLC methods development.

Nigel Beardsworth (Service Manager): Nigel is a qualified engineer with 12 years experience including 5 years direct experience with Shimadzu instrumentation and extensive Shimadzu factory training. Nigel can be contacted by phoning 0800 735725 when service for instruments represented by Shimadzu is required.

Clare Hodgson (Sales and Marketing Support): Clare has a dual science and marketing background and four years experience in the instrumentation industry. Clare can be contacted at the head office and will provide you with prompt pricing and technical information or quickly get the information or assistance you need.

Contact details for Shimadzu are:-

Head Office (Northern Region)	P O Box 45027, Auckland 8 Ph: (09) 8360673, Fax: (09) 8360668 Freephone: 0800 735725
Central Region:	19 Ngatiawa St, Nelson Ph: (03) 5456016, Fax: (03) 5457017 Mobile: 021 904047
Southern Region:	P O Box 8299 Riccarton, Christchurch Ph: (03) 3488202, Fax: (03) 3481202 Mobile: 021 904046

Perkin-Elmer Achieves ISO Accreditation

Perkin-Elmer's New Zealand branch has recently received Telarc and NATA accredition to AS/NZS ISO 9002 (1994) quality standards. The accreditation covers supply, service and technical support for analytical instrumentation in the general areas of atomic and molecular spectroscopy, chromatography, mass spectrometry, and biotechnology.

FIRST ROUND OF MARSDEN FUND AWARDED

Sixty grants have been awarded to scientists in the first round of the new Marsden Fund, which will support excellent research and researchers on the basis of scientific merit. Of the $4,448,172 allocated, university researchers got the major share with 50 grants worth $3,602,485. Researchers in CRIs received nine grants. Scientists working in the agricultural, medical, and life sciences area received 28 grants, and in the mathematics and information sciences 10 grants. Researchers in physical sciences and engineering, and in social sciences areas, received eight grants each, six grants went to earth sciences and astronomy. More than 1000 initial applications were made to the Fund. Announcing the first recipients, the Minister for Research, Science and Technology, Hon. Simon Upton, said the Fund was the most tangible commitment ever made to science for science's sake in New Zealand. "The Government has established this Fund with two prime objectives in mind: to enhance the underpinning of our scientific knowledge-base and to broaden and deepen our research skill-base," he said. "For the first time, Government funding has been made available for research, not on the basis that the research will be useful (though it may be) or that it will solve an urgent problem (although it could do), but on the basis of its ingenuity and the likelihood of generating some first-class science." The Royal Society is to take over responsibility for administration of the Marsden Fund from the Foundation for Research, Science and Technology. The successful Marsden Fund applicants are listed below:

University of Auckland:
Dr Judith Simon, Dr Alexandra Brewis, Professor John Butcher, Professor Marston Conder, Professor Vaughan Jones, Professor Gaven Martin, Professor Alistair Scott, Professor Daniel Walls, Professor Warren Roper (awarded two separate grants), Professor Arthur Marshall, Dr Philip Yock, Dr Geoffrey Krissansen, Dr David Lambert, Gregory Funk, Dr Peter Thorne, Dr Gary Housley, Professor Joerg Kistler.

University of Canterbury:
Associate Professor Andrew Carstairs-McCarthy, Dr Gillian Rhodes, Professor Geoffrey Stedman, Dr Andrew Abell, Dr James Sneyd, Dr Mike Steel, Professor Robert Jackson.

Massey University:
Dr Alex McNabb, Dr Michael McManus, Dr M Hedley, Professor Edward Baker, Mrs Isabel Castro, Professor David Penny, Dr Peter Lockhart.

University of Otago:
Dr Charles Higham, Professor Dorian Owen, Dr Elaine Reese, Professor Richard Dowden, Professor Christine Winterbourn, Associate Professor J Bastow Wilson, Dr Craig Marshall, Dr Samuel Hou, Dr Julian Eaton-Rye, Dr Clive Trotman.

Victoria University:
Dr Eric Jones, Dr Rodney Downey, Dr Charles Daugherty.

University of Waikato: Professor Richard Bedford, Dr John Cleary, Professor J John, Professor Campbell Nelson, Professor R Wilkins.

Institute of Geological and Nuclear Sciences:
Dr John Haines, Dr Alan Beu.

HortResearch:
Dr Keith McNaughton, Dr Grattan Roughan, Dr Richard Forster.

Industrial Research:
Dr Jeffrey Tallon.

Landcare Research:
Professor David Lloyd.

AgResearch:
Dr David Wardle, Dr Nigel Barlow

Private:
Dr R Speedy.

More complete details of the grants are available on Internet through the Royal Society's Gateway to New Zealand Science on World Wide Web (http://www.rsnz.govt.nz/).

PASSWORD FOR WEB SCIENCE

The Royal Society's *Science Digest* is available on the Internet through the Society's Gateway to New Zealand Science web server: http://www.rsnz.govt.nz, which also contains an event database, a directory of New Zealand scientists, science news, and more. If you wish to access the news service on the Internet web pages Gateway to New Zealand Science, you will need to be a member of the Royal Society and have a password. Individual members of the Society will have received a slip with last month's Science Digest that contains your user name and password. Keep it in a safe place, because in future you will also be able to use it to update your details on the Royal Society membership database.

COW MANURE FRIENDLY TO ENVIRONMENT

A biodegradable chemical could be used by dairy farmers to stop potentially toxic nitrates in cow manure being washed into groundwater while at the same time turning the effluent into a valuable resource, Landcare Research environmental researcher Dr Julie Williamson says. Intensive dairying areas such as the Waikato have been registering high levels of nitrate in groundwater, including bores for water supplies. Environment Minister, Hon. Simon Upton, said earlier this year that the potential for nitrate contamination of groundwater had to be taken seriously. The 50 million sheep, 8 million dairy and beef cattle, 750,000 goats, and 500,000 pigs in New Zealand produced effluent equivalent to a population of 150 million people. Dr Williamson says researchers have found that dairy farmers can use a nitrification inhibitor, dicyandiamide, when spreading effluent onto land. When they do, the nitrogen in manure will be tied up in the soil and released slowly, rather than being washed straight through the soil and into groundwater. Organic nitrogen in manure is transformed normally into ammonium ions and then to nitrate ions. Nitrification inhibitors slow the second step, resulting in the nitrogen being retained in the soil as ammonium ions. The inhibitors are used in many European countries. Dr Williamson is about to begin larger field-scale studies on the effects of nitrification inhibitors under New Zealand conditions.

NEW DAIRY LABORATORY AT RUAKURA

A new dairy research laboratory operated by AgResearch at Ruakura was recently opened by Hon. Simon Upton, Minister of Research, Science and Technology. Mr Upton said that unlike some other primary sectors, the dairy industry has invested heavily in research to develop a wide range of value-added products. That investment has paid off handsomely. The dairy industry had invested $55 million — 1.1% of its gross revenue in research in the past financial year, similar to major international food companies. "The dairy industry's vertically integrated structure ensured it gained maximum benefit from the money it spent on research", Mr Upton said. Dairy research had environmental benefits such as turning whey, once an environmental hazard when poured by dairy factories into rivers, into a $100 million a year protein-from-whey industry. Meanwhile a dairy nutrition and health programme has been established by Massey University, the Dairy Research Institute and the Dairy Board. The five-year co-operative research alliance will focus on examining the nutritive and health value of dairy foods and other milk-derived products.

NEW ZEALAND SCIENCE BACK IN FIELD

New Zealand is ranked the eighth most competitive nation in the world, but in science and technology it was only 22nd, according to an annual World Competitiveness Report survey. The survey, compiled by the Swiss-based World Economic Forum and International Institute for Management Development, says New Zealand continues to be impressive with its remarkable comeback from 18th position in 1991. The survey, which assesses 48 countries' abilities to generate wealth in international markets, says areas which "needed more work" included science and technology and domestic economic strength.

HIGH HONOUR FOR DR F B SHORLAND

Dr Brian Shorland, FNZIC, of Wellington was recently awarded an International Order of Merit for his long and distinguished contribution to scientific knowledge. His was one of only 500 names selected by a special committee of the International Biographical Centre, Cambridge, UK, from more than 30,000 entries in the Dictionary of International Biography, which lists persons concerned with education, the arts and sciences. He was presented with the award at a civic awards dinner by Wellington mayor Fran Wilde.

A short article on Dr Shorland and his work appeared in *Chemistry in New Zealand*, **59,** No. 4 (July 1995).

* * * * *

FIBRE REINFORCED THERMOPLASTIC (FRTP) COMPOSITES AND THEIR APPLICATIONS

S J Mander, R J Dykes, D Bhattacharyya
Composites Research Group, School of Engineering, University of Auckland
Private Bag 92019, Auckland

Modern fibre reinforced (FR) composites have been established as a material for over 50 years. The low weight, high strength, corrosion resistance of FR composites, coupled with their unique design flexibilty and parts consolidation, are all properties which will continue to make this class of material the choice for a growing number of engineering applications. This paper outlines the recent trends (and applications) in FR composites and details the more recent moves towards FRTP composites. Several high volume production methods, suitable for future use with FRTP composites are discussed as well as the projected usage of these composites are given.

Introduction

A composite material is produced by the combination of two or more constituents differing in form, or material composition, that are essentially insoluble in each other. The purpose is to produce a material with mechanical properties which are more desirable than those of the individual constituents. Of all composite materials, the fibre reinforcement type has evoked the most interest among engineers concerned with structural or component design.

A fibre reinforced (FR) composite is a material that consists of reinforcing fibres and a matrix which is generally a polymer resin. The matrix is the body constituent, serving to enclose the composite and give its bulk form. The fibres act as the reinforcing elements. The stiffness and strength of the resin is usually low in comparison to that of the fibres, a factor of 100 between fibre and resin moduli is common, but the resin plays a vital role both in determing the serviceability and the processability of the material.

FR composite materials offer many advantages over traditional engineering materials, eg. steels and aluminium alloys. The main advantages of FR composites can be summarised as follows;

1. Low Weight
2. High Strength
3. Toughness
4. High Specific Flexural Stiffness
5. Corrosion Resistance

It is for these reasons that FR composites are being increasingly used by present day designers. Compared to metals, composite materials have relatively low densities: as indicated by Table 1, an outstanding property of carbon fibre reinforced plastics is the stiffness per unit weight.

The low density of FR composite materials increases the thickness of the panel. This further increases the stiffness, allowing composites to achieve 30% weight-saving in comparison to aluminium structures of the same flexural stiffness.[1]

As previously mentioned the resin matrix plays an important part in the FR composite. There are two main types of polymer resin matrixes used;

1. Thermoset (TS) e.g. polyesters, epoxies.
2. Thermoplastic (TP) e.g. Nylons, Polyethylene (PE), Polypropylene (PP), Polyurethane (PU), Polyether-ether-ketone (PEEK).

Table 1. Comparative weights of panels with same bending stiffness[1]

Material	Modulus GN/M²	Relative Thickness	Specific Gravity	Relative Weight
Metal				
Steel	210	1	7.8	7.8
Aluminium	73	1.4	2.7	3.8
Aircraft grade composite				
Quasi-isotropic	40	1.7	1.6	2.7
Uniaxial	120	1.2	1.6	1.9
Space grade composite				
Uniaxial	300	0.9	1.6	1.4

Thermosetting resins are plastics which, when cured by the application of heat or chemical means, change into a substantially infusible and insoluble material. Before curing they generally take the form of a viscous liquid.

Thermoplastics are plastic resins, normally solids at room temperature, which are capable of being repeatedly softened by the increase of temperature and hardened by a decrease in temperature. The term is applicable to those materials whose change upon heating is substantially physical rather than chemical. There are four families of thermoplastic polymers which have the potential for use as matrix resins; linear chain extendable polymers, fully polymerised amorphous polymers, liquid crystalline polymers and fully polymerised semi-crystalline polymers. Of these, the fully polymerised semi-crystalline polymers are the most common.

Traditionally FR composites have been fabricated from thermosetting plastic materials which have suffered from two main deficiencies. First, the relatively high processing costs of thermosets have resulted in limiting the range of components to which they can be applied. Second, the low resistance to damage from through-thickness impact of brittle matrix laminates has reduced confidence in their post-impact performance. By replacing the brittle thermosetting resin matrix with a thermoplastic one, both of these main problems may be mitigated. A comparison between thermoplastic and thermoset resins is given in Table 2.

In addition, thermoplastics offer an even bigger advantage over their thermosetting cousins: the potential of low-cost manufacturing. By taking advantage of the inherent nature of thermoplastics to undergo thermally induced flow, shaped articles can be fabricated at elevated temperatures by relatively fast processing methods.

The orientation, length, and composition of the fibres in the composite have a significant effect on the engineering performance of the composite. Fibre orientation (how the individual strands are positioned) determines the mechanical strength of the composite, and the direction in which the strength will be greatest. There are three types of fibre orientation;

1. One-dimensional reinforcement - maximum composite strength in the direction of fibre axis e.g. uni-directional.
2. Bi-directional or planar - different strength in each direction of fibre orientation e.g. clothweave.
3. Three-dimensional - isotropic, all three dimensions are reinforced, but only to about one third of the one-dimensional value. The mechanical properties in any one direction are proportional to the amount of the fibre volume in that direction.

Table 2. Comparison between Thermoplastic and Thermoset matrix material

Thermoplastics	Thermosets
Tough	Brittle
High Temperature use	Lower high temperature limitations
Mass production techniques	Labour intensive
Long shelf life	Limited shelf life
Recyclable	Non recyclable
Rapid cure time	Long cure time
- temperature dependent only	- time and temperature dependent
Impervious to moisture	Absorb moisture
Dimensionally stable	Shrinkage upon curing
Non Toxic	Toxic in uncured state

Fibre length is also found to contribute greatly to the composites' mechanical strength. Initially composites were made with relatively short fibres as these are generally easier to process, but as shown in Figure 1, superior performances are obtained in all mechanical properties of the composite by increasing the fibre length.

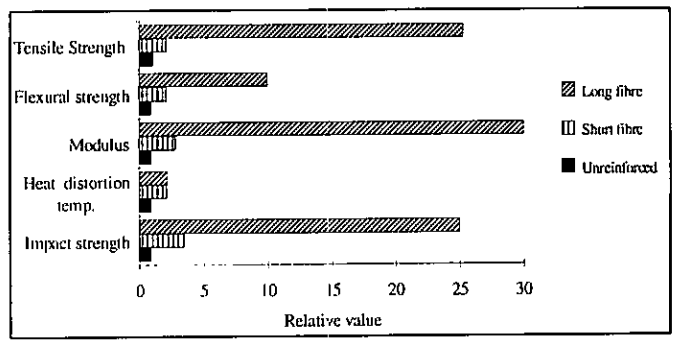


Figure 1. Nominal relative properties of plastic resin matrix with differing fibre length reinforcing.

Processability and Formability

The relatively recent introduction of thermoplastic polymer matrices offers the potential to develop manufacturing methods for these new composite materials that bear close relationship to conventional manufacturing methods. Unreinforced thermoplastics, by their very nature, can easily be made into sheet form and processed into a variety of formed shapes by various pressure assisted thermoforming means. Thermoplastic polymers undergo a reversible phase change from solid to liquid, thereby enabling the development of shaping and joining methods analogous to those for conventional metallic materials. Because of the collimated fibre architecture, these materials exhibit anisotropy ratios in the melt state as high as 10^6, hence the term hyper-anisotropy. Thus the potential processing advantages of thermoplastics have led to the development of the thermoforming process and to the adoption of sheet forming techniques typical to those used with metallic materials - one of

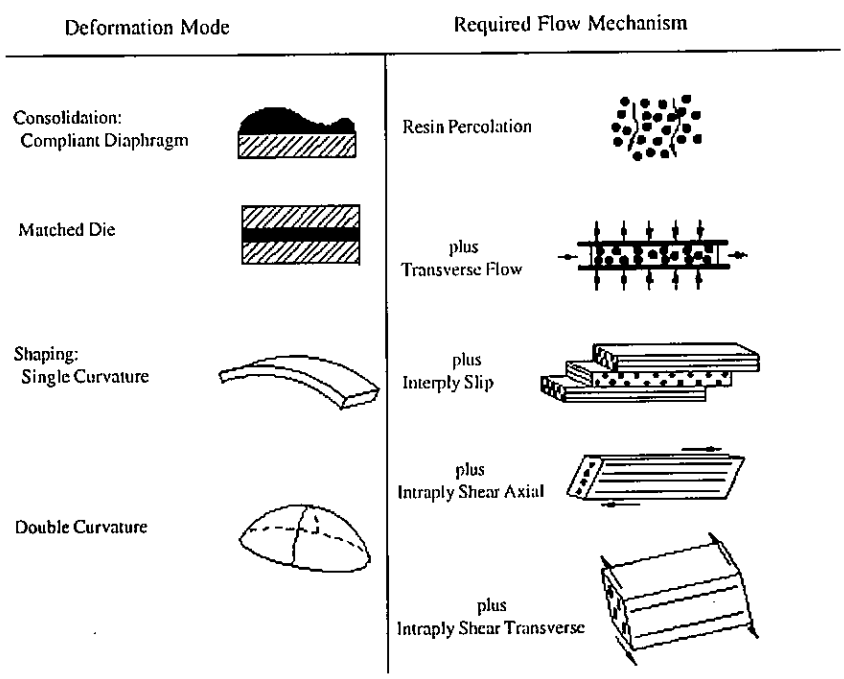


Figure 2. Modes of deformation and related flow mechanisms in pre-impregnated products.

the most pervasive methods in contemporary manufacturing technology.[1,2]

Unlike monolithic metallic sheet, continuous fibre composites are essentially inextensible in the fibre direction. For these material systems, the dominant mode of deformation, parallel to the fibres, during sheetforming is therefore shearing within and between the individual plies, i.e. intra- and inter-ply slip. Additional flow mechanisms that have to be considered are:

1. resin flow transverse to the fibres
2. rotation of one ply relative to the others.

A schematic diagram of these processes is shown in Figure 2. All of these process mechanisms are influenced by the resin viscosity at the process temperature. For thermoplastic polymer resins this is primarily a function of the process temperature as well as shear rate. The consideration of resin viscosity must also take into account the time scales of the process. If the time scale is long and the resin viscosity is low, then shaping flows may cause resin to be squeezed out. By contrast, too high a viscosity and too short a time scale mean that the reinforcing fibres are unable to adjust to the flow and may become buckled or distorted. Correct tailoring of matrix viscosity and control of resin fibre distribution, as well as process times, allow inter-ply slip to occur and the composite microstructure to be preserved as in Figure 3c. It can be seen from this that the formability of FRTP composites requires an optimisation of resin viscosity and fibre distribution in the material.

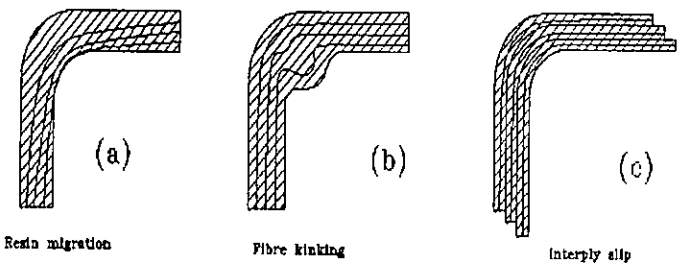


Figure 3. Influence of viscosity on microstructure after flow: (a) too low, (b) too high, (c) optimised.

Besides mechanical properties, fibre length has a bearing on the ability of the fibre composite to be processed. In general, continuous fibres are easier to handle but are more limited in the design possibilities than short fibres due to their processing problems, (Figure 4). However the large structural performance gained by using long fibres makes their use extremely desirable. Due to fibre inextensibility, however, the processability is reduced with long fibres.

Besides the constraints imposed by the material, there are certain geometries that cannot be formed from continuous fibre composites. It is generally assumed that a hierarchy of deformation processes exists of increasing complexity, with each additional mode of deformation requiring a more complex mode of resin flow, (Figure 2).

Recently Du Pont has come up with an innovative idea of using relatively long, aligned discontinuous fibres (LDF™) (REF) with a nominal length of 50 mm or longer to give improved processability over continuous fibres with negligible adverse effect on mechanical properties. Quasi-static mechanical properties of LDF™ and continuous fibre Carbon AS-4/PEEK (58.5% fibre volume) including tensile, compressive, flexural and shear strengths are summerised in Table 3.

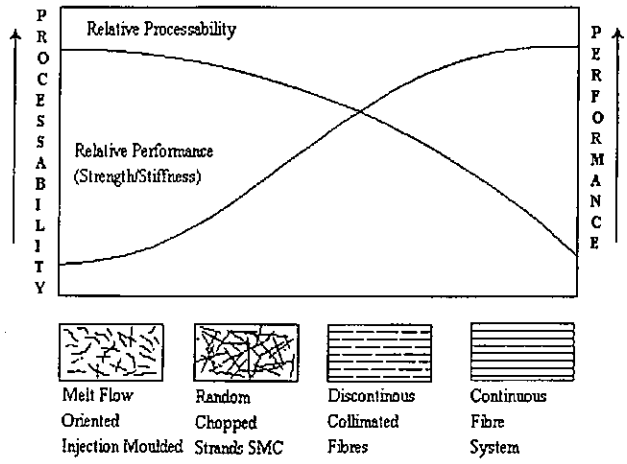


Figure 4. Relative Strength and processability of various composite material forms.

Table 3. Comparison of mechancial properties of LDF and continuous reinforced Carbon AS-4/PEEK composite[4]

Property	LDF™	Continuous
Tensile		
Strength (0 °) MPa	1615	1677
Modulus (0 °) GPa	123.5	129.6
Strength (90 °) MPa	91	73
Modulus (90 °) GPa	10.3	8.3
Compressive		
Strength (0 °) MPa	1263	1394
Modulus (0 °) GPa	110.4	121.4
Flexural		
Strength (0 °) MPa	1656	1932
Modulus (0 °) GPa	124.1	127.5
Shear		
Inplane Strength MPa	146	142
Inplane Modulus GPa	5.5	5.5
Short Beam Strength MPa	110	117

Manufacturing Processes for FRTP

It is important to note that the development of manufacturing processes for the forming of FRTP composites includes the development of sheet preform architecture and choice of constituent materials. The polymer properties influence the processing temperature, the viscosity of the sheet system and the heat transfer characteristics. The fibre phase architecture can be configured as a woven fabric, continuous collimated fibre laminae, discontinuous random fibre mat, or continuous random fibre mat. Multiaxial laminates are configured from these laminae to tailor the sheet preform to the product requirements, there are numerous texts which offer the designer assistance in this area[5,6,7] and most make use of the laminate theory developed by Haplin and Tsai.[8] More recent research[2,4,9] focuses on the elevated-temperature thermoplastic polymers and fibre architectures that consist of collimated continuous- and discontinuous-fibre laminae.

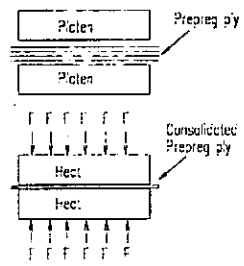
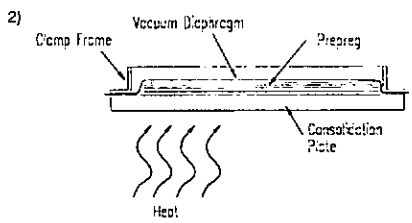
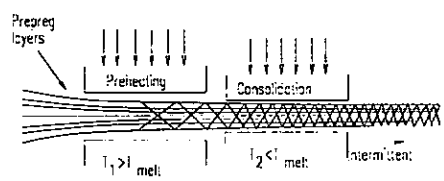
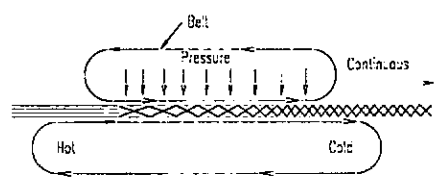
While it is generally recognised that FRTP composite material costs are higher than fibre reinforced thermoset (FRTS) composites;[10] it has been clearly demonstrated that the reduced labour costs associated with the use of FRTP composites, particularly preconsolidated sheet preforms more than offset this additional material cost.[11,12] Significant cost savings are achievable with production quantities as low as 200 units when using preconsolidated FRTP composite sheet as opposed to FRTS layups.

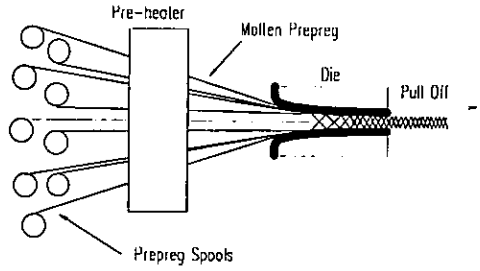
Forming Methods and Tools

The processing stage of FR composites is the operation which distinguishes thermoplastic composites from thermosetting ones. It is important to remember that thermosets undergo an irreversible curing process when fabricated into parts. This process can take from several minutes to 36 hours during which time the fabricated component must be constrained to its desired shape. The reversible phase change of TP from solid to liquid allows the formation of components using a variety of methods often not available to processing with thermoset composites. The TP composite needs only to be heated to above the T_m of the matrix, transferred to the forming tool and forced to conform to the tool shape while still molten. The TP composite is then simply cooled, until the matrix has solidified and removed from the tooling. The only constraint, compared to thermosetting composites, being the time to melt and resolidify the matrix.

There are various processes available for the production of FRTP parts, these are briefly described in Table 4. Foley[11] *et al.* have shown that the full economic benefits of FRTP are achieved through the application of automation and that the use of pre-consolidated sheets in these processes is advantageous. It is perhaps not surprising that the potential processing advantages of thermoplastics have led to the development of the thermoforming process and to the adoption of sheet forming techniques typical to those used with metallic materials - one of the most pervasive methods in contemporary manufacturing technology.[2,3]

Table 4. Forming Processes for the Manufacture of FRTP Parts

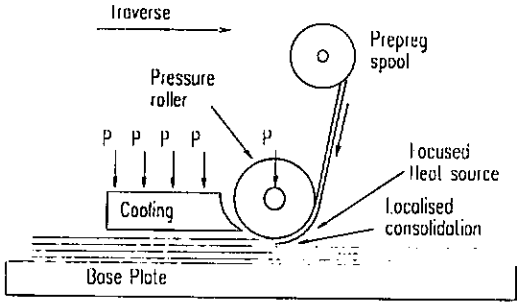
Consolidation Processes	
1)  2) 	Flat Sheet - Batch Production Flat sheets can be consolidated into laminates in various ways: 1. Press formed 2. Vacuum formed. In both instances the FRTP prepregs are placed in the desired stacking sequence, heated above the T_m of the TP matrix and consolidated under pressure. Consolidation pressure is applied normal to the sheet either by external mechanical means e.g. press, or by drawing a vacuum. Matched die or autoclave moulding of simple shapes are obvious extensions of simple consolidation/lamination. Sizes of parts produced using an autoclave are only limited by the physical size of the available autoclave. The consolidation process has been studied by many groups.
1) Step pressing  2) Double Belt 	Flat Sheet - Continuous Production A natural extension of press forming of sheets in batches is a step pressing process. Pre-assembled prepreg laminates are fed through a preheating oven or press and subsequently through a cold consolidating press. Alternatively, the sheets may be consolidated through a double belt process. The main constraint on continuous sheet consolidation is the automatic lay-up of the prepreg tape in the required stacking sequence.



Pultrusion

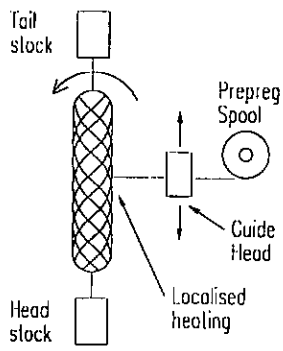
Pultrusion is most simply carried out with uniaxial product. The composite (in the form of prepreg tows) is introduced into the forming die through a preheating oven, such that the prepreg is in a molten condition. Consolidation of the tows occurs within the die, whereafter the consolidated form is cooled.

Continuous Forming



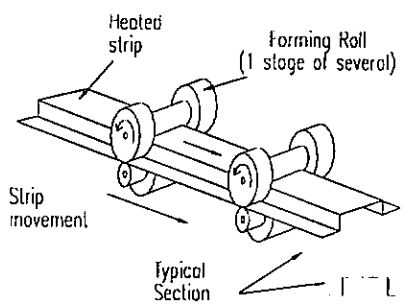
Tape Placement/Tape Laying

Flat sheets with different fibre orientations can be produced by laying prepreg tapes onto a base plate while heat and pressure are applied to consolidate the laminate. This process is generally used for flat sheet production although shaped panels have been manufactured using FRTS. A recognised drawback of this process is the relatively low levels of consolidation that are achieved although in some cases this is seen as an advantage for secondary forming operations.



Filament Winding

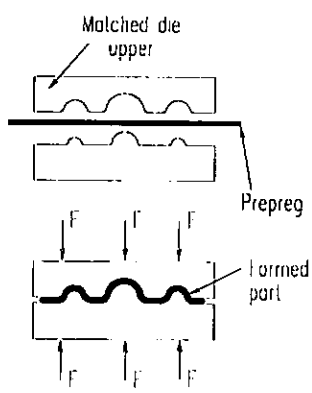
Filament winding is one of the classic techniques for fabricating FR parts. As the name implies, the technique consists of mechanically winding single or multiple continuous strands (rovings) on a suitable mandrel in a pattern specified by the designer for the required strength or stiffness in the final product. The strands are effectively melted together by local application of heat. A range of heating technologies including laser, hot shoe, infrared and gas flame have been used. Due to the nature of TP, parts formed by this method can be reformed later - a box section can be formed into an I beam for example.



Roll Forming

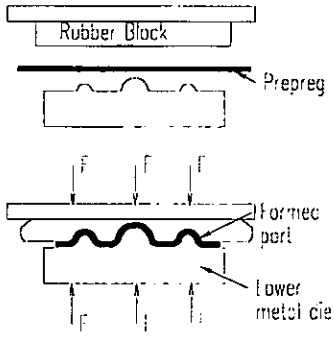
Apart from pultrusion, the only continuous forming process for FRTP is the adaptation of the well established sheet metal roll forming process. In this process a pre-consolidated sheet stock is preheated above Tm of the TP matrix and fed into a series of rolls arranged in parallel pairs. These rolls progressively form the strip into the desired section and then the strip is allowed to cool in this stabilised form.

Other Forming Operations



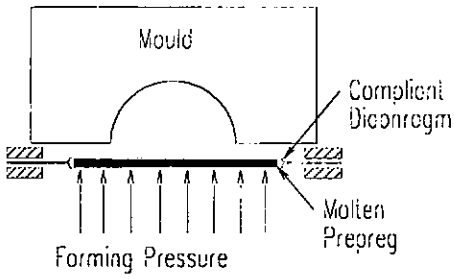
Stamp Forming - Matched Die

Matched-die press forming utilises conventional sheet-metal forming presses. For simple forming operations, standard heated platen presses that are generally used for flat panel moulding have proven to be adequate. However, for operations where control of deformation rate and pressure are important, high quality stamping presses are required. The dies are generally made of metal, which can be internally heated and/or cooled. High pressures can easily be applied to the sheet preform.



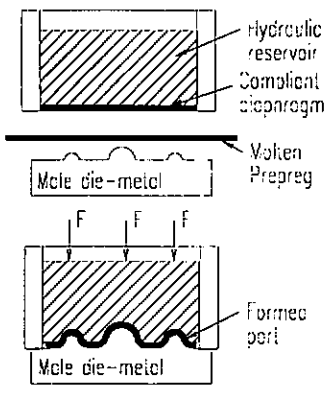
Rubber Block

In rubber block forming, one tool half is replaced by a thick pad of rubber that conforms to the solid tool half under pressure in a forming press. The rubber pad can be profiled to the tool geometry but is permanently attached to the platen and is generally much larger than the tool. This contrasts with the rubber-match die tooling, where the rubber is matched to the metal tool half. This provides high forming pressures, but they are not uniform over the work piece.



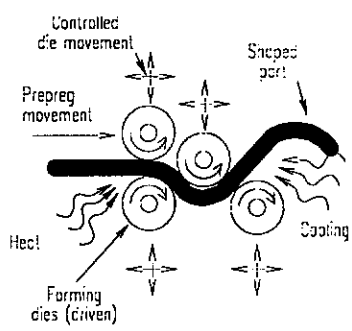
Diaphragm Forming

For diaphragm forming, the sheet preform is held between two deformable diaphragms, which are then clamped, heated with sheet preform to the processing temperature and deformed over a tool. This process was originally developed to utilize superplastic aluminium diaphragms but recently more emphasis has been placed on the use of polymeric diaphragms. This technology has proved especially valuable in forming large double curvature structures.



Hydro-Rubber Forming

Hydro-forming is similar to diaphragm forming in that a fluid medium behind a flexible diaphragm is used to deform the sheet preform against a male or female tool. The tool is usually made of metal but wooden tooling is not uncommon. The primary differences between hydro-forming and diaphragm forming are that (i) the diaphragm in hydro-forming is a permanent part of the forming system, (ii) the diaphragm is usually much larger than the workpiece, and (iii) only one diaphragm is required.



Incremental Forming

In this process the FRTP sheet is heated locally above the matrix T_m and then incrementally formed in this region with forming dies which are normally rollers. An adjacent area is then heated locally and formed. This process has been demonstrated and has potential for forming large complex shapes.

Fabrication of FRTP Components

Due to the relatively recent availability of continuous fibre reinforced thermoplastic (FRTP) sheets, a large amount of commercial interest has been generated for the development of low-cycle time manufacturing techniques. It is generally accepted that thermoplastic composites lend themselves to mass production methods, due to their ability to be "reshaped" simply by the application of heat and relatively low forces. The other benefits such as long shelf-life, ease of handling and the potential for recycling are also well recognised. However until manufacturing techniques have become more conducive to mass production, the benefits of FRTP composites are unlikely to be fully realised. Two fabrication methods that go some way to achieving this, are roll forming, and diaphragm forming, both of which have received particular attention at the University of Auckland.

Roll Forming

Recent efforts in forming FRTP sheets have centred on variations of pressure forming and diaphragm forming techniques. Other methods have transposed standard sheet metal forming processes, such as matched die stamping and incremental forming, to these materials. Despite an abundance of available forming methods, there remains a well recognised demand for

the ability to produce long narrow profiles such as top-hat and channel sections from FRTP sheets. An obvious manufacturing method offering high production rates for such sections is the well known method of semi-continuous roll forming widely used in the sheet metal industry. It involves the passing of a flat metal strip through a succession of rolls arranged in tandem, progressively deforming the strip into the desired final cross-sectional shape, as shown in Figure 5.

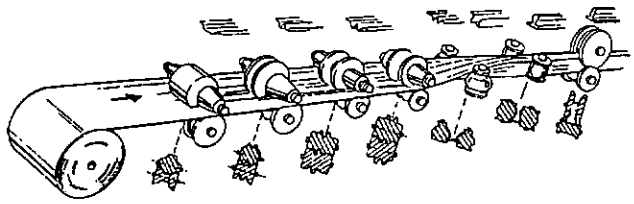


Figure 5. A typical continuous roll forming operation.

Whilst the practice of roll forming is fairly well established, the deformation mechanism that involves three-dimensional bending and stretching, is not yet fully understood. The authors believe that this process, with some modifications, lends itself to be used in the production of narrow and wide profile FRTP composite sections and goes some way towards realising their full benefits.

To date, efforts have focused on the roll forming of glass fibre reinforced polypropylene materials, however a degree of success has also been achieved in rolling nylon based composites. Crucial to the success of the roll forming process is maintaining the deforming strip's temperature above that of the resin's molten temperature, T_m. Not suprisingly however, the conformance of the final part relies heavily on the temperature of the strip being below T_m prior to it emerging from the last roll stand. Failure to ensure this results in the undesirable viscoelastic effect of strain recovery, commonly associated with these types of materials in their molten state. One way around this problem has been to adopt a two stage rolling schedule where the strip is initially passed through a series of shaping rolls before being subjected to a number of rolls that maintain the final profile of the desired section. These final rolls allow the strip to cool and solidify with minimal adverse recovery effects. Alternatively, external cooling devices may be positioned prior to the last roll so that solidification of the strip is timed to coincide with its emergence from the last roll stand. It has been shown that by adopting either of these two methods a significant increase in rolled part conformance may be achieved.

Line speeds of up to 10 m/min have been achieved in rolling FRTP materials, while it is believed that potential exists for this to be increased. Other process variables such as laminate architecture and rolling schedules have also been studied, but have been found to be less important than that of the strip temperature. It has been observed that the strip temperature, more than any other forming variable, effects the reliability of the process. For strips rolled at too high a temperature, the viscosity of the matrix becomes too low to support the forming loads, and high rates of failure ensue. On the other hand, strips rolled too close to the solidification range have been found to experience premature freezing prior to completion of deformation. An optimum inlet temperature range for the particular machine has thus been established for rolling glass fibre/PP of between 140 and 150 °C. Failure rates for this regime have been found to be typically less than 5%.

Diaphragm Forming

Unlike roll forming, diaphragm forming techniques remain a relatively well established method for producing geometrically complex 3-dimensional components from FRTP laminates. The patented method of diaphragm forming was originally developed by ICI Ltd. and Superform Ltd. of Great Britain who utilised superplastic alloys that could deform several hundred percent within a certain temperature range. A typical diaphragm forming process for a FRTP laminate is illustrated in Figure 6. Despite the numerous variations that are sometimes found in the diaphragm forming process the same general principles remain common throughout.

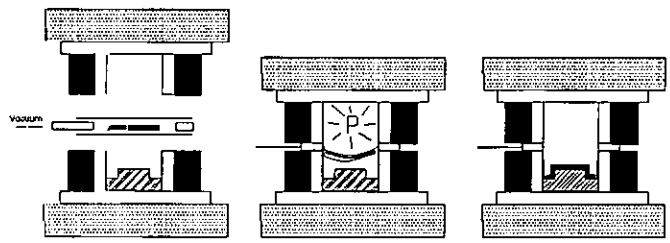


Figure 6. A typical diaphragm forming operation.

In the process a preformed laminate is cut into the shape of the desired blank before being carefully positioned between two compliant diaphragm sheets. The overhanging edges of both diaphragms are then clamped together in a ring frame arrangement while a vacuum pressure is applied between the diaphragms to limit the possibility of any wrinkling or void formation during the process. The blank is then heated to its forming temperature by either external or internal means. The former involves the transfer of the ring frame from an external heating device, such as an oven, to the press and forming apparatus. Alternatively, the heating source may be incorparated in the design of the forming setup. Both methods have their advantages and could be readily applied to an automated production line, however, it is typical for an external heating source to be used in most experimental setups.

Once the blank reaches the required temperature the actual forming process may commence. The first step involves the application of pressure on the ring frame which is usually facilitated by a conventional press. The establishment of a good seal around the frame is then followed by the application of hydrostatic pressure in the upper chamber resulting in the deformation of the stacked preform. The pressure is increased according to a predetermined process cycle forcing the preform stack to conform to the forming tool. After some time the setup is allowed to cool to an appropriate level at which time the pressure is released and the formed composite part may be removed.

As already mentioned, diaphragm forming methods can often adopt subtle changes from those found in the process illustrated above. One such important variation that has received a measureable amount of attention is the effect of adopting an inverted female tooling arrangement rather than a male mould. Although the final shape of the product may be identical in both cases, it is clearly obvious that the deformation paths are significantly different. The diaphragm materials used in this type of method may also vary depending on the FRTP composite being formed. As mentioned previously, the diaphragms may be superplastic alloys such as SURRAL 100™ aluminium

(British Alcan). Alternatively polymeric diaphragms may be utilised such as Upilex-R™ (UBE Industries and ICI Ltd.) and Kapton-HTM (DuPont). Regardless of material, the requirements of the diaphragm are the same, namely to survive the processing temperature of the FRTP composite and to achieve substantial deformation without failure. One interesting development that the Composites Research Group at the University of Auckland has been responsible for, has been in the recognition and development of silicon rubber material as suitable diaphragm material. The most significant advantage offered by this sort of material is its ability to be used many times, as opposed to traditional diaphragm materials.

A notable amount of success has been achieved in forming components made from a wide variety of FRTP materials. Some examples of these parts are illustrated in Figure 7. Like roll forming, the success or failure of the diaphragm process has been found to be significantly influenced by the laminate temperature. The same type of problems as those encountered in roll forming can often result from forming a component at too high or too low a temperature. Similarly, the forming pressure can have a great bearing on the final shape of the component. If pressures are less than adequate then the laminate may not realise the shape of the mould. On the other hand, excessive pressure may result in an undesireable amount of squeeze out which inturn leads to thickness variations through the part.

In recognition of the widening appeal of FRTP a worthwhile amount of research has been undertaken to identify applications which lie outside the traditional realms of the aerospace industry. One particular example has been a recent project that has looked at forming a composite orthotic leg splint. Such an application has been found to realise the benefits of reinforcing fibres as well as providing the means for custom moulding such a component to a particular patient's leg.

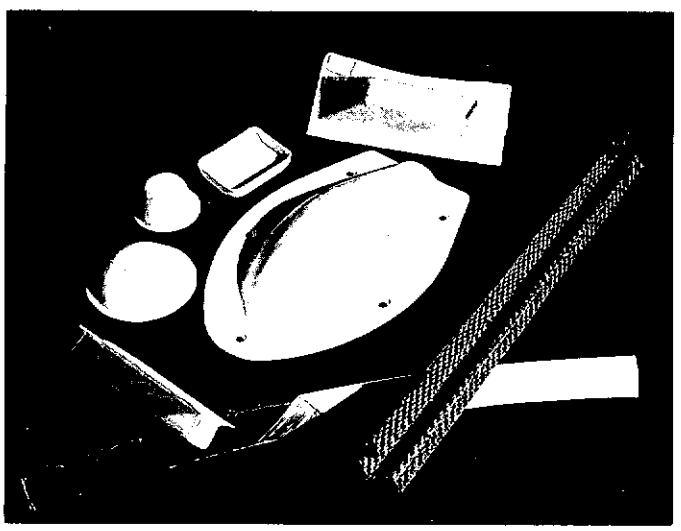


Figure 7. Numerous parts formed by the diaphragm process.

Development of the FR Composite Market

FR composites have been established as a material for over 50 years. Up until the mid 1970s they maintained a rapid growth rate, averaging 25% per year in the US. [source: The Society of the Plastics Industry, NY]. FR composite output in the US. is forecast to be 1,300,000 tonnes by 1995 (the EC is expected to exceed the US. output by 1995). The current medium term growth in FR composites is predicted to be 5% per annum, (Figure 10).

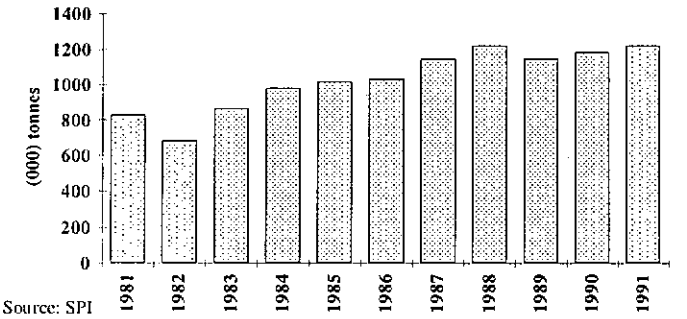


Figure 8. US composite industry output 1981-91, thermoset and thermoplastic based, plus reinforcements and fillers.

Comparative figures show the EC output in 1990 at 964,100 tonnes (1,216,000 tonnes in the US) with FRTP accounting for 17% or 162,000 tonnes of this (15% or 182,400 tonnes in the US). [source: UK Composite Processing Association.]

Initially FR composites were used in industries where the weight saving afforded by using FR composites gave large economic benefits, noticeably the aircraft and aerospace sector as well as land and marine transport sectors. Recently industries which take advantage of the other benefits of FR composites have experienced the largest growth, noticeably the corrosion resistance and electrical areas. The construction industry has also experienced relative growth within the FR composite market. It should be realised that these figures are a representation of FR composite use by sector and that FR composite consumption has increased from 67,500 tonnes in 1957 to 1,179,000 tonnes in 1990 in the US alone, (Figure 9).

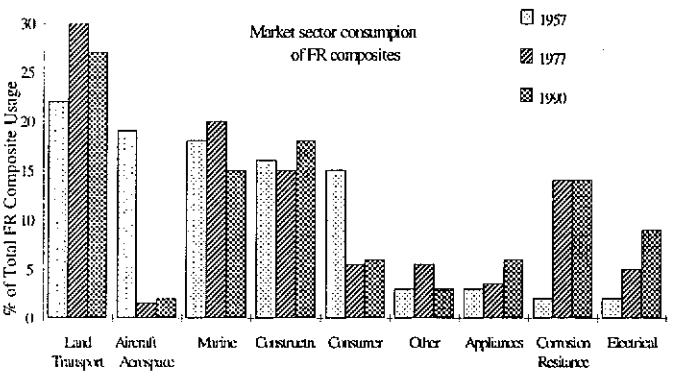


Figure 9. Market sector consumption as a percentage of total FR composite consumption. Source: SPI.

Presently the high labour intensive methods of fabrication, i.e. hand lay-up and spray deposition, dominate the market (Table 5). It is predicted that low labour techniques, such as filament winding, and pultrusion, will experience a growth in the share of total consumption of FR composite fabricated, this is expected to be approximately a medium term rate of 10% per annum. Greater use of FRTP are expected to account for this, the extra demand created by the new processes, such as roll forming of FRTP, has not been incorporated into this.

Table 5. Composite fabrication technique breakdown (10^3 tonnes) for 1990 EC market. Source: UK Composites Processing Association

Low Labour[a]	Medium Labour[b]	High Labour[c]	Thermoplastic	Total
231.2 24%	253.8 26%	317.4 33%	161.7 17%	964.1 100%

a. Low Labour - Filament winding, pultrusion, continuous laminating.
b. Medium Labour - Cold-press, hot-press, resin transfer moulding.
c. High Labour - Contact (hand) lamination, spray (projection) depostion.

Growth Forecast For FRTP Composites.

The growth forecast for FRTP composites is that they will account for approximately 25% of the FR composite market by the year 2000 [source: UK Composites Processing Association]. Predictions for the US market are somewhat higher at 30% of the FR composite by the year 2000 [source: SPI]. Figure 10 shows the combined consumption of FRTP composites for the US and EC markets. Consumption data based on fibre length is not available at present. These figures do not account for the increased consumption provided by use of new production methods.

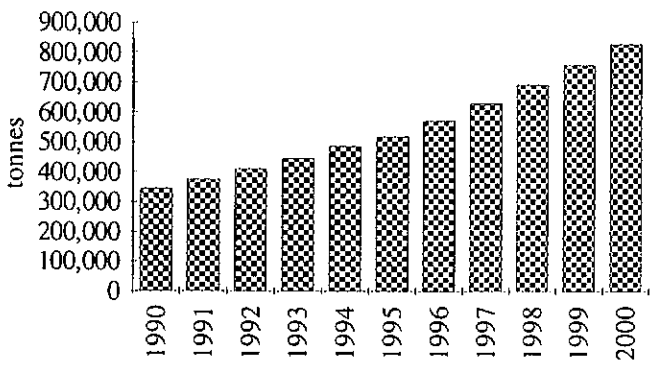


Figure 10. Projected growth of FRTP composite market for the US and EC markets not including any increased growth due to new manufacturing processes.

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Acknowlegement

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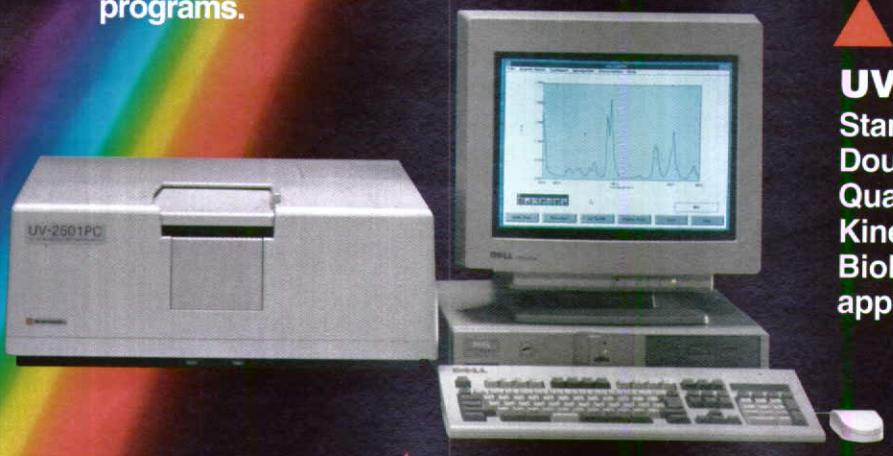

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ENVIRONMENTAL ISSUES

THE MINISTRY FOR THE ENVIRONMENT'S ORGANOCHLORINE PROGRAMME

The Ministry for the Environment has initiated a study to address issues associated with the presence of organochlorine substances in the New Zealand environment. This study will be carried out over a three year period.

Organochlorine substances which are the focus of this study include the following:

Polychlorinated dibenzodioxins (PCDDs)
These are produced as by-products in a number of industrial, manufacturing and combustion processes, and were also contaminants in a range of organochlorine chemicals including pentachlorophenol. They are now considered to be ubiquitous contaminants of the environment.

Pentachlorophenols (PCPs)
These were used extensively in the timber industry as an anti-sap stain up until 7 years ago.

DDT
An insecticide widely used in the past in horticulture and agriculture.

Dieldrin
Was used as an agricultural insecticide and along with **chlordane** was used in the timber industry.

Polychlorinated biphenyls (PCBs)
These were used in the electrical supply industry, principally in transformers and capacitors.

Many of these substances do not break down readily in the environment and are known to bioaccumulate through the food chain.

This programme will determine levels of these substances in the environment and assess the risk, if any, to people and ecosystems. A management strategy will be developed to deal with waste chemicals, contaminated soils and materials.

Five key programme objectives have been defined for the study. These are:

1. To determine the level of organochlorine contaminants in New Zealand ecosystems and to assess their significance in terms of environmental impacts; and where practicable, the levels of such contaminants within the local population and in food products, and to assess their significance in terms of human health.

2. To assess the current extent of holdings of organochlorine chemicals; and to identify potential sources and continuing emissions of key organochlorine substances including PCDDs.

3. To develop environmental standards for these contaminants in air, soil and water.

4. To evaluate selected technologies for the destruction of organochlorine wastes.

5. To identify further requirements to develop an integrated management strategy for organochlorines in New Zealand.

The Ministry for the Environment plans to carry out this programme in an open and consultative manner with the purpose of achieving consensus among interested parties. A small Consultative Group has been established to provide guidance for the programme. This group includes representatives of industry, regulatory bodies, central government and public interest groups. Representatives are expected to reflect the interest and view points of the group they represent and provide both input to the Organochlorines Programme and feed back to their respective group.

The New Zealand Institute of Chemistry participates in the Organochlorines Consultative Group through the professional bodies representative.

Upon completion of this programme a number of well-defined yet interdependent outcomes will be have been achieved. These can be summarised into the following three key areas:-

1. The status of organochlorine contamination in New Zealand.

2. National environmental standards and management strategies appropriate for these contaminants.

3. Appropriate and acceptable disposal technologies for these substances.

Members who wish to know more about this programme or who can provide information which may assist the consultative group should contact the NZIC professional bodies representative as follows:

Norman Thom
School of Environmental and Marine Sciences
The University of Auckland
Private Bag 92019
Auckland
Telephone: (09) 3737599 ext: 5659
Fax: (09) 3737420
Email: n.thom@auckland.ac.nz

UPCHURCH SCIENTIFIC APPOINTS GBC AS NZ DISTRIBUTOR

The company who first introduced the Fingertight HPLC fitting, Upchurch Scientific, have appointed GBC Scientific as their New Zealand distributor, with immediate effect.

Following the recent acquisition of Douglas Scientific by Shimadzu Oceania, this was a mutually agreed decision, with GBC Scientific taking over all Upchurch stocks held by Douglas. As well, GBC is committed to maintaining continuance of the excellent service given by the previous Upchurch distributor.

An Auckland stock of the most popular Upchurch fittings and tubing will be maintained, backed by a fast, efficient, delivery service, for non-stock items, out of the Washington State manufacturing plant, where Upchurch manufacture over 98% of their product line.

Copies of the new 1995 Upchurch 130-page fully illustrated catalogue are available by request.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Ph: (09) 3735765, Fax: (09) 3600683
Free phone/fax: 0800 428428
circle number 21 on the reader reply card

ZETA POTENTIAL ANALYSER

Particle & Surface Sciences Pty Limited are pleased to announce the release of the Galai Zeta Potential Accessory. The Zeta Potential Accessory can be fitted to either the CIS-100 Particle Size/Shape Analyser or DSA-10 Particle Shape Analyser. The system can measure the electrophoretic mobility and zeta potential of particles down to 0.5 μm in size. Analysis is automatic and takes less than 5 seconds.

By adding this accessory to the CIS-100 Particle Size Analyser the CIS-100 becomes the most comprehensive particle characterisation system available providing:

- Particle Size Measurement
- Shape Analysis
- Zeta Potential

By adding software packages, such as Fractal Dimension and Fibre Length a truly versatile system is available for the most complex of particle characterisation problems.

Contact: Particle & Surface Sciences Pty Ltd
P O Box 494 Gosford, NSW 2250, Australia
Ph: (+61-43) 237822, Fax: (+61-43) 237629
circle number 22 on the reader reply card

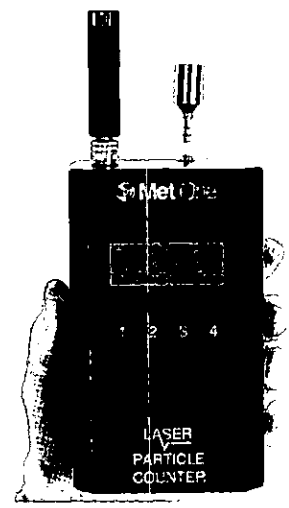
NEW AIRBORNE PARTICLE COUNTERS WEIGH LESS, COST LESS

Previously, airborne particle counters were heavy, cumbersome instruments with prices to match. So only a few organisations in New Zealand, mainly specialised test laboratories, possess particle counters.

There is an estimated 2000 laminar flow cabinets and safety cabinets in laboratories, hospitals and universities throughout the country and hundreds of cleanrooms, operating theatres and quarantine facilities, all of which are designed to produce clean air to protect a process and/or people. These critical systems have generally been tested for air quality annually by specialist test laboratories.

By introducing compact models at affordable prices, Met One, a US company specialising in particle counters has made this important technology available to a much broader customer base. Met One has appointed Total Air Care, a specialist cleanroom company to distribute their range of particle counters in New Zealand. Now users can monitor their own systems frequently to achieve tighter quality control. And it may be that general air-conditioning companies in New Zealand will extend their service by offering air quality testing of general air systems as in the US.

A full range of airborne and liquid-borne particle counters is available. The range starts with a simple hand-held airborne particle counter weighing only 650 g and priced at $3495.00. At the high end of the range there are facility monitoring systems applicable particularly to the pharmaceutical manufacturing industry.



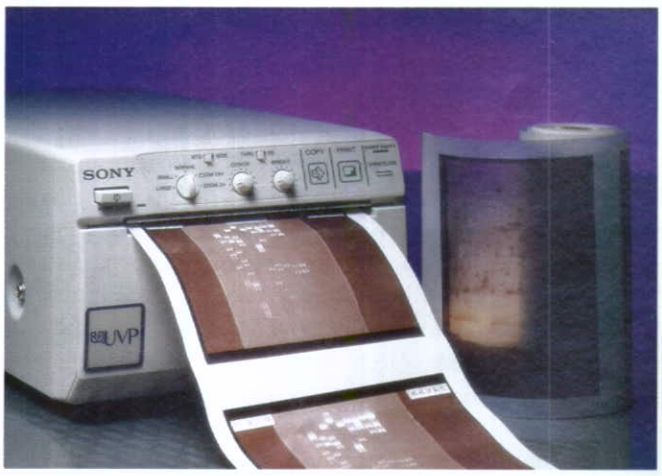
Contact: Total Air Care Ltd
P O Box 74227 Market Road, Auckland
Ph: (09) 6304358, Fax: (09) 6309601
circle number 23 on the reader reply card

NEW PRINTER IMPROVES IMAGE QUALITY

Ultra Violet Products, world leader in gel documentation and analysis, has introduced a new thermal printer for its advanced Gel Documentation Systems (GDS). The printer generates images in a few seconds and offers researchers a variety of image sizes together with improved resolution. A selection of different thermal papers is available including UVP's new translucent paper - this paper is ideal for producing 35 mm slides directly from the printer.

NEW PRODUCTS

The new UP890CE printer can magnify an image by either one and a half or twice its original size and prints sizes ranging from 36 mm x 24 mm (35 mm format) up to 10 cm x 8 cm. Compared with earlier GDS printers, image resolution has increased by over 14% and image contrast improved.



UVP's new UP890CE thermal printer provides users of gel documentation systems and image analysts with improved resolution and a selection of images sizes. The printer handles both conventional thermal papers and UVP's new translucent thermal paper — the latter is suitable as an image source for publication or as a negative to produce photographic prints.

The GDS incorporates a high resolution CCD camera, lens and filter, thermal printer, monitor and camera stand. The system combines the benefits of thermal imaging with modularity and high resolution. In addition to the ultra-violet imaging of DNA/RNA electrophoresis gels stained with ethidium bromide, the GDS can be used to view and document western blots, TLC plates, autoradiographs, and comassie blue- or silver-stained gels.

Options for UVP's Gel Documentation Systems include a gel band amplifier (GBA) to resolve faint images, an image enhancement package (Imagestore), and GelBase/GelBlot Pro analysis software.

Contact: Watson Victor Ltd
P O Box 1180 Wellington
Ph: (04) 3857699, Fax: (04) 3844651
Offices also in:

Auckland	Ph: (09) 5793039, Fax: (09) 5250951
Christchurch	Ph: (03) 3669282, Fax: (03) 3662537
Dunedin	Ph: (03) 4777291, Fax: (03) 4792372

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METTLER TOLEDO INTRODUCES THE NEW LC-PVolume VOLUMETRIC EVALUATION PRINTER

Realizing the need for a device to evaluate pipettes, Mettler Toledo introduces the LC-PVolume, a compact, easy-to-use printer designed for evaluating the performance of volumetric equipment by means of gravimetric analysis. This single balance system turns the repetitive, tedious procedure of evaluating pipettes into an easy-to-follow method. The system, based on NCCLS guidelines and ISO8655 standards, automatically performs the complex calcultions error free and prints them in a user-defined report.

Some of the features included in this system are storage of 60 programs, password protection, alphanumeric input and a verification report for ISO and GLP requirements.

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Dunedin	Ph: (03) 4777291, Fax: (03) 4792372

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DRY PARTICLE SIZE ANALYSIS OF COHESIVE POWDERS

The new API Aerosizer LD is the only particle size analyser specifically designed for the analysis of dry cohesive powders. Using the new Aerodispenser system materials such as micronised pharmaceuticals, and metal oxides including TiO_2 can be analysed without the hassle of dispersing solvents. Covering a total size range of 0.2 to 700 µm in 500 measured size channels provides the user with high resolution data in a couple of minutes.

The Aerosizer utilises the time-of-flight analysis principle which actually sizes and counts individual particles at a rate of up to 100,000 per second. By counting particles the true (and not calculated) population data and hence a more representative surface area distribution is obtained.

Special accessories to the base unit can be added, such as the Aerobreather and Aerosampler to directly measure the particle size distributions of Metered Dose Inhalers (MDI's) and Dry Powder Inhalers (DPI's).

Contact: Particle & Surface Sciences Pty Ltd
P O Box 494 Gosford, NSW 2250, Australia
Ph: (+61-43) 237822, Fax: (+61-43) 237629
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THE NEW GBC MC3000 MERCURY CONCENTRATOR AND NEW HG3000 HYDRIDE GENERATOR

GBC Scientific is pleased to announce the release of an exciting new accessory for the entire atomic absorption range. The *MC3000* Mercury Concentrator enhances the hydride performance by allowing the determination of mercury at parts per trillion (ppt) levels. The *MC3000* is easily and quickly coupled to the *HG3000* Hydride Generator. The *MC3000* will therefore satisfy new demanding legislative requirements introduced by governments worldwide, restricting the maximum permissible level of mercury in a wide variety of samples including drinking waters and effluents to the low parts per trillion (ppt) range.

Features of the *MC3000* include:

- Enhanced sensitivity provides excellent signal-to-noise performance for routine parts per billion mercury determinations
- Detection limit of 5 ppt using a 300 second collect
- Precision of better than 1% RSD between replicates
- Complete software control ensures accurate timing and control of all mercury collections and analyses
- Solid gold mercury ribbon (not gold plated substrate) ensures maximum surface area for efficient mercury concentration and long life
- Patented inductive heating allows higher temperatures ensuring accurate signal detection using peak height or area and no carry over between samples
- Rapid mercury vaporisation from the gold ribbon results in increased productivity
- Replicate analyses are easily performed
- *FS3000* Flame Autosampler is easily coupled to the *MS3000* for automated unattended operation
- Rapid changeover to normal hydride generation for analysis of other hydride forming elements
- Ease of cleaning and low maintenance. The gold ribbon cannot be directly handled, as it is sealed inside a glass envelope. The whole gold trap assembly is therefore immersed into concentrated nitric acid and boiled when cleaning is required.

The GBC HG3000 Hydride Generator has been enhanced, with the following new features:

- Allows either $NaBH_4$ or $SnCl_2$ to be used as reductant
- A new solenoid-driven 3-way switch is used to change between GAS OFF (turns inert gas flow off); SEPARATOR GAS ON (allows inert gas to flow to the gas liquid separator cap only. This is used when $NaBH_4$ is used as reductant); MIXER AND SEPARATOR GAS ON (allows inert gas to flow to mixer block and to the liquid separator cap. This is used when $SnCl_2$ is used as the reductant)
- Operates at 130 kPa inert gas - if pressure drops below 95 kPa, a pressure switch automatically turns the solenoid off, preventing severe contamination and resultant damage, requiring expensive repairs
- Mixer block design has changed to allow 4 inlets (Sample, Acid, Reductant and Inert gas) and an outlet to mixing coil-gas liquid separator
- To ensure the *HG3000* is corrosion resistant, the entire cabinet undergoes a powder coating process to give excellent chemical resistance over the entire internal and external surfaces, protecting against concentrated acids such as HCl, HNO_3 and Aqua Regia. All exterior screws are Teflon® coated.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Ph: (09) 3735765, Fax: (09) 3600683
Free phone/fax: 0800 428428
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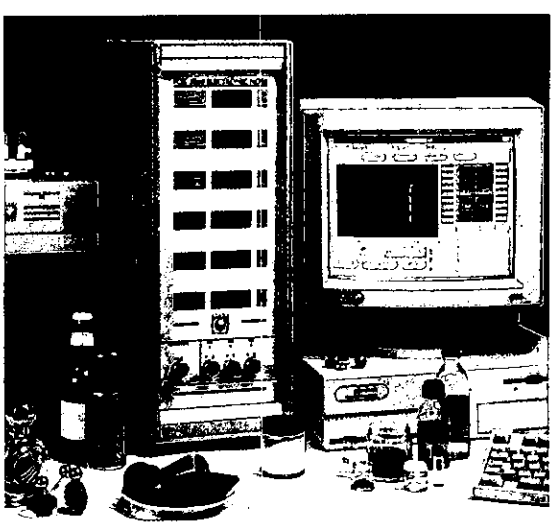
A NEW ANALYTICAL CONCEPT ODOURS AND VOLATILES IDENTIFICATION AND QUANTIFICATION IN A FEW SECONDS

GBC Scientific (NZ) has been appointed sole Australasian distributor for ALPHA M.O.S., of Toulouse, France, the manufacturers of the unique FOX 2000 Intelligent Nose ...

Like the human nose, the FOX 2000 instrument is sensitive to odorant molecules and volatile compounds, it uses a fingerprint technique and has the capability to learn by experience, recognise and memorise odours.



The FOX 2000 provides a direct method for quantification and identification in seconds or minutes, of raw materials or final

product volatiles, odours and vapours. It can be used as a quality control and a development tool to study different kind of products. The FOX 2000 mimics the human olfactory system with a detection principle based on gas sensors, as well as a specific software combining linear, multi-variate statistics and artificial neural network for pattern recognition.

The FOX 2000 is the only instrument that is upgradeable using arrays of 6, 12, or 18 exchangeable gas sensors:
Hybrid including different sensor technologies: Semiconducting oxide sensors (among a choice of 42) or Conducting Polymers (CP) that can be used simultaneously.
Modular, it can be connected to an automatic injection module or disconnected from the PC in order to perform field measurements.

The instrument is connected with a specially developed pattern recognition software with an architecture derived from the understanding of the mammalian system.

By using a variable flow rate depending on the vapour pressure of the odorant compounds (samples can be solid, liquid or gaseous), the apparatus detects changes in resistance of the sensors. Values of the sensors produce a fingerprint (a series of values which are characteristic of the sample olfactory quality). Therefore the FOX 2000, without being a separation technique can not only quantify the odours or volatile compounds, but also identify them.

The sensitivity for certain chemical compounds can be as low as the ppb level. The FOX 2000 can operate in polluted environments thanks to a specially designed measurement chamber. The instrument can be connected to a Purge and Trap Sampler, a GC autosampler or for example directly linked to a cooking oven. Several cleaning procedures of the sensors are available.

After the learning phase, during which the odour fingerprints are recorded and stored, artificial neural network is trained with data and the FOX 2000 has the capabilities to recognise, for instance, and artificial oil from a natural essential oil, one brand or type of coffee or beer from another, or the impact of a deodorant in a matter of seconds. The kinetics of emission of vapours (perfumed towels) can be studied for periods of time going from a few seconds to several minutes or days. Applications are numerous and include, food aromas and interaction with packaging, perfumes and cosmetics, polymers, synthetic chemistry, petrochemical and environmental industries.

Although not a replacement for trained sensory panels or GC analysis, the Alpha M.O.S. FOX 2000 Intelligent Electronic Nose can perform similar trained judgements to assist many organisations and industries with quality control or development projects.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Ph: (09) 3735765, Fax: (09) 3600683
Free phone/fax: 0800 428428
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ISCO SUPERALLOY SYRINGE PUMPS FOR PRECISION FLUID DELIVERY

If your tough pumping job requires:
- precision flow from 0.01 µL to 200 mL/min
- pulse-free pressure control from 0 to 10,000 psi, or
- handling viscosities from liquefied gases to tar, solve your problems with ISCO syringe pumps.

For precise, pauseless, stable delivery, these programmable syringe pumps will outperform any small displacement reciprocating piston pump. There are no check valves to cause flow noise, poor precision at microlitre/minute flow rates, or failure at high viscosities. You'll get dependable control of flow or pressure throughout a remarkable operating range. Nitronic 50 superalloy construction makes them suitable for brines and other corrosive liquids, Hastelloy construction is optional.

Programmable flow or pressure (constant or ramping) offers previously unavailable research opportunities. For unlimited volumes, two pump modules with automatic, overlapping refill provide non-stop pumping.

Contact: Shimadzu New Zealand
P O Box 45027, Auckland 8
Ph: (09) 8360673, Fax: (09) 8360668, Freephone: 0800 735725
circle number 29 on the reader reply card

ON LINE SFE-FTIR ANALYSIS FROM ISCO

Direct transfer of an analyte extracted by SFE to an FTIR spectrometer for quantitation, identification, and characterisation without the use of organic solvents, is now possible with ISCO's new SFX-IR Interface Kit.

The SFX-IR Interface Kits include:
- A heated, high-pressure infrared flow cell with connection cable,
- A SFX-IR temperature controller for the flow cell,
- Two (one for spare) heated transfer lines, three or six foot lengths,
- Two (one for spare) 1 mL/min coaxially heated capillary restrictors, and
- A restrictor temperature controller for heating one transfer line and one coaxially heated restrictor. An extractor side panel is included when required.

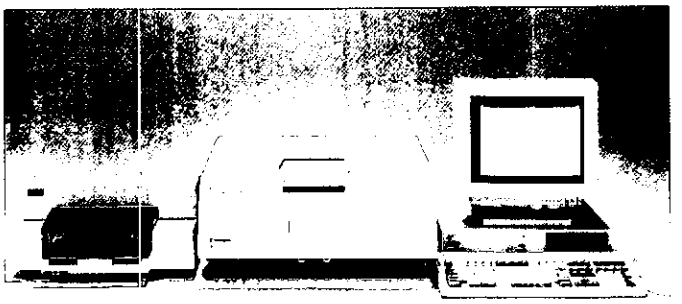
Contact: Shimadzu New Zealand
P O Box 45027, Auckland 8
Ph: (09) 8360673, Fax: (09) 8360668, Freephone: 0800 735725
circle number 30 on the reader reply card

NEW SHIMADZU UV-VISIBLE SPECTROPHOTOMETERS

Shimadzu has announced the release of two new models of UV-Visible spectrophotometer, UV-2401PC (single monochromator) and UV-2501PC (double monochromator).

The UV-2501PC uses double monochromator optics, originated by Shimadzu, utilising a double-blazed grating in one of the monochromators. This design provides extremely low stray light and a high signal-to-noise ratio comparable to conventional single monochromator instruments.

The economical UV-2401PC provides many of the features available in the UV-2501PC although with a single monochromator system. The UV-2401PC still provides exceptionally low stray light.



The standard wavelength range from 190 nm to 900 nm can be extended to 1100 nm with an optional photomultiplier. A small beam size (12 mm x 1 mm) makes analysis of minute samples possible which is especially useful for life science applications. These features coupled with the wide variety of accessories available make the UV-2401PC and UV-2501PC versatile, flexible choices in spectrophotometry.

The MS Windows-based software is easy to use. All operations are made rapidly and intuitively by clicking and dragging down menus using the mouse. Dynamic Data Exchange with other Windows-based packages allows results to be easily converted into formats compatible with commercially available data processing and spreadsheet software. This ensures high productivity in generating and editing reports.

Contact: Shimadzu New Zealand
P O Box 45027, Auckland 8
Ph: (09) 8360673, Fax: (09) 8360668, Freephone: 0800 735725
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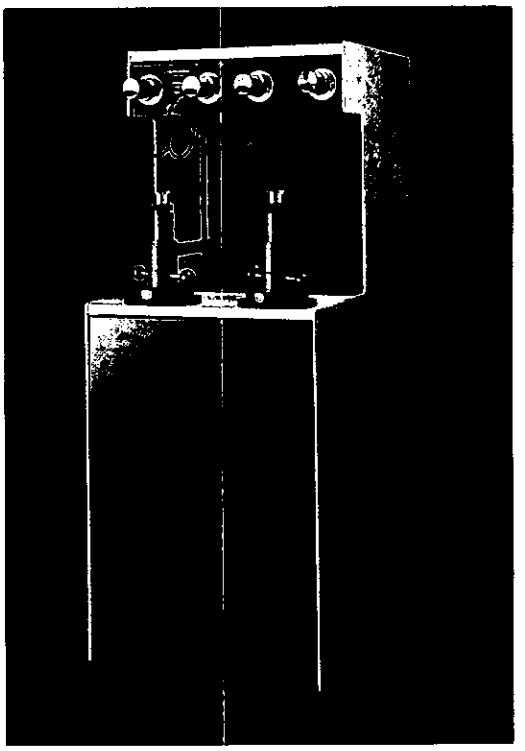
INTRODUCING THE NEW AUTOPORE III: MERCURY POROSIMETER

Micromeritics' commitment to developing state-of-the-art mercury porosimetry technology is far from slowing down. The new AutoPore III 9420 features a whole new pressure/intrusion system and A/D converter that permit extraordinary resolution of pore size and volume data: better than 0.1 µL. In other words, the AutoPore III offers the most accurate resolution you can get in a 0-60,000 psia porosimeter.

Pore size distributions ranging from 0.003 to 360 µm in diameter can be obtained with full-scale precision. Pore structures that extend from micropores to macroporous cracks and crevices can be measured with exceptional resolution.

Redesigned low-pressure ports now permit initial intrusion up to 50 psia, which gives you a broader analysis range of the low pressure ports and a faster analysis of the largest macropores. Easy-to-use, twist-on penetrometer closures have replaced the spring-loaded penetrometer caps. New cabinetry takes up half the floor space as before.



The AutoPore III also gives you the freedom to use the scanning mode or the detail-rich equilibration mode. The equilibration mode allows both time-based and intrusion-rate equilibration of pressure/volume measurements. The scanning mode approximates equilibration to achieve faster analysis time. Data are presented in tables, plots, and calculated summaries; the formats you can edit, rearrange, and customize.

Micromeritics have upgraded calibration of the pressure/intrusion system to achieve greater precision, and also upgraded the mercury containment system with easier-to-use reservoirs, traps, and trays.

Contact: Particle & Surface Sciences Pty Ltd
P O Box 494 Gosford, NSW 2250, Australia
Ph: (+61-43) 237822, Fax: (+61-43) 237629
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NEW AUTOMATED FLASH CHROMATOGRAPHY SYSTEM

Fast, automated separation of organic compounds. Milligram- to gram-scale purification

Flash chromatography is a rapid medium pressure chromatographic technique for preparative separation of synthesised organic compounds. For years now, ISCO's superior UA-6 Detector and Foxy 200XT Fraction Collector have been the choice of organic chemists for flash chromatography.

ISCO's automated Flash Chromatography System provides:-
- Unattended runs
- Reduced labour costs and
- Increased productivity

Flash chromatography systems are available with a choice of three flow ranges. Systems include the UA-6 detector with Type II optical unit and flow cell; Foxy 200XT fraction collector, pump with pulse dampener and pressure indicator, LabStacker organiser shelf; connecting tubing and fittings, and signal cables for connections between instruments.

Contact: Shimadzu New Zealand
P O Box 45027, Auckland 8
Ph: (09) 8360673, Fax: (09) 8360668, Freephone: 0800 735725
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PRO-TEAM LC: GRADIENT CHROMATOGRAPHY FOR PROTEIN PURIFICATION

ISCO's no-compromise low pressure LC system lets you select the best separation media and still get the best instrumentation. Use your favourite packing and run it on analytical-grade instruments from ISCO that cost no more but offer expanded performance.

Pro Team LC systems are ideal for protein purification using ion exchange or gel filtration columns. They're also suited for almost any other low pressure liquid chromatography such as drug purification by affinity chromatography.

The system is programmed on the Foxy Junior fraction collector keyboard: two buffer gradients of up to 40 segments, with a straight-line interpolation between program points, and easy to set. Multi-mode peak collection identifies peaks by their shape or level, then uses time windows to collect only selected ones. Using optional valves and a sub-controller, the same Foxy Junior program can also give you complete system automation from sample injection to column regeneration. Up to nine methods can be stored.

Pro Team LC systems are versatile, economical, bio-compatible, and cold-room proof. They're complete with all instruments, glass column, cables, and tubing - all you need are column packing and collection tubes. Take advantage now of this opportunity to get a new level of gradient elution, system flexibility and automation formerly expected only from HPLC.

Contact: Shimadzu New Zealand
P O Box 45027, Auckland 8
Ph: (09) 8360673, Fax: (09) 8360668, Freephone: 0800 735725
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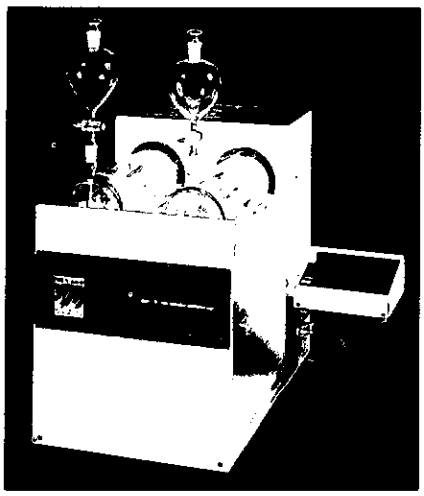
SUB-BOILING DISTILLATION UNIT FROM MILESTONE

Alphatech is pleased to introduce the Milestone subPUR and duoPUR ultrapure acid/water sub-boiling distillation units. These are two new sub-boiling distillation units which in combination with the QC.40 Quartz Digestion Vessels complete the Milestone line of clean chemistry apparatus. The subPUR system has one distillation unit while the duoPUR has two. With these units every laboratory can now become its own supplier of "fresh" acids and water of the highest purity at a great saving in cost (up to 90%) for highest purity reagents/ water.

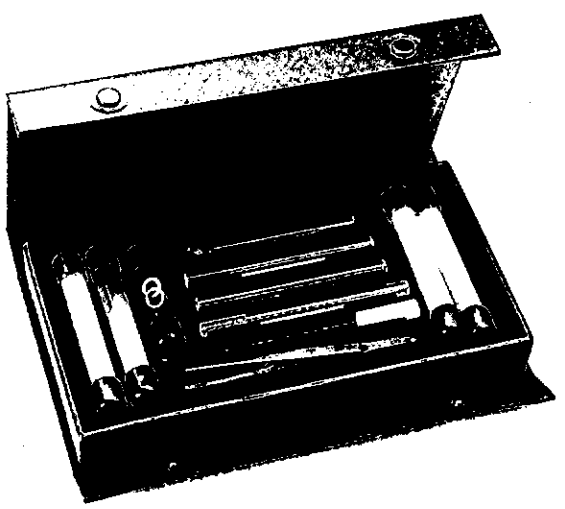


The subPUR and duoPUR are part of Milestone's wide range of innovative and high quality microwave products for the laboratory.

Contact: Trish Fenton, Alphatech Systems Ltd
P O Box 37583 Parnell, Auckland
Ph: (09) 3770392, Fax: (09) 3098514
circle number 35 on the reader reply card

SGE LINERS GUARANTEE PRECISE RESULTS

Utilizing their expertise in the manufacture of analytical glass syringes, SGE introduces a new range of Injection Port Liners which are produced to the same high level of precision and reliability.



A complete range of liners has been developed to aid the chromatographer. Deactivation of both the liner and quartz wool ensures enhanced reproducibility, and simple but effective designs reduce sample discrimination.

When producing this range SGE gave great consideration to the ever increasing use of rapid injection autosampler systems. As a result, this range of liners ensure complete vaporisation of the sample, giving greater reproducibility.

SGE Injection Port Liners are available to suit the following GC's; Hewlett Packard 5890, Varian 3400-3500, Carlo Erba-Fisons 6000-8000, Shimadzu, Finnigan 4100-5100 and the Perkin-Elmer 8400, 8500, 8600 and AutoSystem.

A wide variety of graphite and viton sealing rings to compliment the Injection Port Liner range are also available. For a copy of the SGE Guide to injection port liners:-

Contact: Alltech New Zealand Inc.
P O Box 100352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 652766
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ANALYTICAL BALANCES TO FIT CURTAILED BUDGETS

Time and again, the normal working day includes weighing tasks which require rapid, accurate and dependable weight determination to the nearest 0.1 mg, yet equipment budgets are being squeezed mercilessly as part of general cost-cutting measures. Mettler-Toledo AG has developed the AB series of analytical balances to cover such basic needs. The AB54 measures up to 51 g with a 0.1 mg display, the AB154 up to 101 g and the AB204 to 210 g.

Operator guidance is simple and logically structured so that even temporary staff can perform accurate measurements effortlessly. Thanks to the adjustable vibration adapter, this measurement performance is also possible in an unfavorable operating environment.

A test weight is supplied for periodic and rapid adjustment of the balance, e.g. to ensure compliance with in-house ISO standards. A rechargeable PowerPack is available for mobile operation and people who work in hazardous areas can utilise the PS-EX2 special power supply units. Density kits available as optional accessories, allow determination of the densities of solids and liquids. The optional LocalCAN universal interface ensures communication between balance and peripherals (printers, auxiliary displays, foot switches and via RS232C, all computers). A recent innovation is simple attachment of the popular SQC14/16 and SWC14/60 statistical quality control systems. All models conform to CE and an EC certified version is available if required. The balances are constructed to allow efficient cleaning without damage to the housing. The protective cover can be removed and changed if necessary.

Contact: Watson Victor Ltd
P O Box 1180 Wellington
Ph: (04) 3857699, Fax: (04) 3844651
Offices also in:

Auckland	Ph: (09) 5793039, Fax: (09) 5250951
Christchurch	Ph: (03) 3669282, Fax: (03) 3662537
Dunedin	Ph: (03) 4777291, Fax: (03) 4792372

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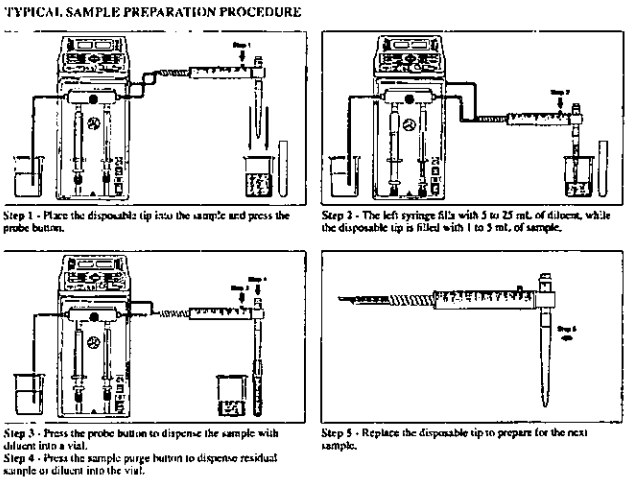
FAST, ACCURATE SAMPLE DILUTION WTIH HAMILTON 'S MICROLAB 503A

Hamilton's Microlab 503A (ML503) and the large sample (1 to 5 mL) hand probe make sample dilution fast and easy. Program the unit with the desired diluent volume and the desired sample volume, and you are ready to go.



Compared to glass pipettes or volumetric flasks, the Microlab 503A enables fast and accurate dilutions of high sample volumes. You can aspirate and dispense sample with low viscosity, such as water, or high viscosity, such as oil, using the same probe. You'll cut your sample preparation time in half, making cost justification possible even in laboratories diluting just a few samples.

Eliminate Carryover
The large-volume hand probe uses a disposable tip, which you can replace after each dilution.

Contact: Alltech New Zealand Inc.
P O Box 100352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 652766
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HT8-PCB COLUMN FROM SGE

"Congener specific selectivity, extremely low column bleed, excellent signal-to-noise ratio and reliable" is how many describe the performance of SGE's carborane modified HT8 capillary column when applied to PCB analysis.

Carborane-based phases have long been recognised for the unique selectivity exhibited towards complex isomer mixtures, particularly those containing aromatic ring systems. The combination of this and the extremely high thermal stability makes the HT8 column the ideal choice for all PCB analyses.

With a polarity similar to a 8% phenylpolysiloxane, the HT8 column allows the separation and quantitation by GC/MS of all seven key chlorinated biphenyls (CB28, 52, 101, 118, 138, 153 and 180) indicators used by many countries and international PCB monitoring bodies.

The extremely high thermal stability of this phase, up to 400°, ensures detection of sub-ppb levels by ECD and MS systems.

Retention data on all 209 CB congeners and Aroclor 1242, 1254 and 1260 mixtures obtained using the HT8 column is now available from Alltech.

Contact: Alltech New Zealand Inc.
P O Box 100352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 652766
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MAINTAIN SAMPLE INTEGRITY WITH HAMILTON'S NEW SAMPLELOCK SYRINGES

Hamilton Company's new SampleLock syringes allow you to collect, store, transport, and analyse liquid or gaseous samples without the danger of evaporative loss or environmental contamination.

Common applications for SampleLock syringes include environmental sample collection and storage, pre-pressurisation of gaseous samples for GC analyses, and sample spiking. A 5 mL version of the syringe is also available for purge and trap applications.

Purge & Trap Syringe

The SampleLock syringe combines the quality of the world-renowned Hamilton GASTIGHT® syringe with an easy-to-use twist valve. The syringe is available in sizes ranging from 50 µL to 100 mL. A positive rear stop on the SampleLock syringes (250 µL to 100 mL) prevents plunger blowout and loss of sample. Optional male and female luer and male luer lock adapters thread onto the SampleLock valve making the syringe compatible with a multitude of connectors and fittings.

Contact: Alltech New Zealand Inc.
P O Box 100352 NSMC, Auckland
Ph: (09) 4443230, Fax: (09) 4442399, Freephone: 0800 652766
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NEW BPX5 CAPILLARY COLUMN RANGE FROM SGE

SGE has released the second of the silphenylene modified polymers, the non-polar BPX5 (equivalent to 5% diphenyl polysiloxane). Addition of the silphenylene group into the backbone of a 5% diphenyl polysiloxane provided similar levels of thermal improvement as seen for the BPX70 stationary phase. Maximum operating temperatures of 360 °C - 370 °C are now commonplace for both thick (>1.0 µm) and thin (<0.5 µm) film BPX5 capillary columns.

Silphenylene modified polymers offer many advantages over conventional siloxane stationary phases. The most obvious being the tremendous increase in maximum operating temperature for a wide range of film thickness. Normally, to maintain these high operating temperatures, inertness of the column is often sacrificed. However, the new silphenylene modified polymers, in particular BPX5, have overcome this problem. They now allow the trace analysis of some of the most difficult environmental compounds while maintaining their high temperature capabilities.

Contact: Alltech New Zealand Inc.
P O Box 100352 NSMC, Auckland
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DIGITAL ACCURACY

Techne are proud to announce the newest addition to their family of Driblock® heaters. The Techne DB-2D takes up to two interchangeable insert blocks. Temperature is set using the knob and set button and is displayed on the LED panel, temperature is stable within less than ±0.2 °C, and together with the fast heat-up capability of the unit gives the user superb consistency and reliability.

Contact: John Morris Scientific Ltd
P O Box 6348 Wellesley Street, Auckland
Ph: (09) 3663999, Fax: (09) 3663060, Freephone: 0800-651700
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POSITIVE PROTECTION FOR YOUR COLUMNS & PUMPS

Aranda Scientific Instruments have introduced the COLUMN GUARD to offer complete protection for your valuable pump and columns.

COLUMN GUARD'S advanced microprocessor control monitors the presence of liquids in your LC system. If none is detected, it will switch off the power to the pump and close off the column outlet automatically.

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Run your system after hours and improve your productivity with complete confidence and in total safety!

Contact: Ancat Holdings Ltd
P O Box 12909 Penrose, Auckland
Ph: (09) 5790842, Fax: (09) 5790843
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BÜCHI VACUUM CONTROLLER B-720
Easy-to-use and Protects the Environment

Rotary evaporators and distillation systems used for low-stress and high-speed separation of solvents are no longer possible without a controlled vacuum source. Drawing on the latest technology, the vacuum controller from Buchi has now been

cost-effectively redesigned. You benefit from the highest Buchi quality at an attractive price.

The new B-720 is an environmentally sensitive manual vacuum controller:

- Up to 95% water savings
- Less solvent loss - cleaner vacuum pump effluent, cleaner air
- Less noise from vacuum sources.

The easy-to-use control panel ensures simple and reliable operation. The setpoint value is saved even when the controller is switched off or a power failure occurs. Operational reliability is assured by a highly resistant ceramic pressure sensor and the integrated power pack. Other features include:

- Large LED display
- Selector for mbar/Torr
- One function per key
- Short amortization period.

Contact: Watson Victor Ltd
P O Box 1180 Wellington
Ph: (04) 3857699, Fax: (04) 3844651
Offices also in:

Auckland	Ph: (09) 5793039, Fax: (09) 5250951
Christchurch	Ph: (03) 3669282, Fax: (03) 3662537
Dunedin	Ph: (03) 4777291, Fax: (03) 4792372

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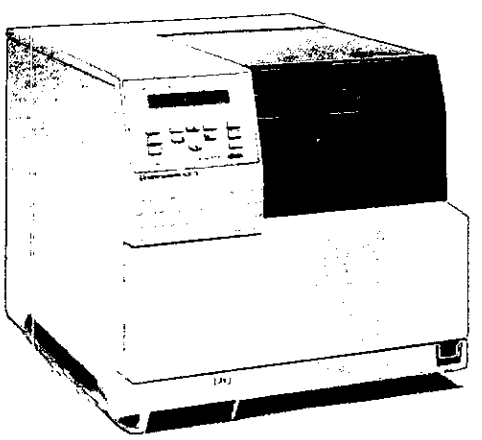
NEW SpectraSYSTEM AUTOSAMPLERS FROM THERMO SEPARATION PRODUCTS



The many standard features built into the new sample processing systems from Thermo Separation Products greatly expand autosampler options and let you maximise your HPLC system performance and efficiency. Features include:

- Patented PushLoop Injection to maximise precision for volumes under 200 µL, and requires only 15 µL of excess sample per injection.
- Needle height adjustments for extractions or different size vials.
- Maintenance and service logs
- Priority sampling and sample set queueing
- Integrated column oven and sample tray temperature control.
- Sample preparation option with patented vortex mixing and heater for automatic sample dilution.

The result is a sample preparation system with outstanding reproducibility, linearity and precision.

Contact: SciTech
P O Box 663, Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
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TAMSON CONSTANT TEMPERATURE BATHS

Ai Scientific Pty Ltd has recently been appointed the new exclusive distributor for Tamson constant temperature baths and circulators in Australia and New Zealand. Tamson products are manufactured in the Netherlands and have been available in Australia and New Zealand for over 40 years. The range includes viscometer and calibration baths, cooled circulators and an automated kinematic viscosity measuring system that complies with ASTM D445 and IP71. Ai Scientific will provide sales support and service for new customers and existing Tamson users.

Contact: Kevin Moloney, Ai Scientific Pty Ltd
39a Woodcote Drive, Auckland
Ph: (09) 4433940, Fax: (021) 788940
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PACIFICHEM '95 TECHNICAL PROGRAMME

The half day on which the session takes place is noted after each session: morning, noted by AM; afternoon, noted by PM. In addition, some poster sessions are scheduled for evening, noted by EVE.

Area 01 - Agrochemistry

New Product/Ingredient Development for Food Science (006). Mon (AM, PM, EVE), Tue (AM); *Royal Hawaiian.*
Free-Radical Scavengers in Food and Biological Systems (058). Mon (AM, PM, EVE); *Sheraton.*
Development of Recombinant and Wild-Type Viruses for Agricultural Pest Control (501). Thu (AM, PM, EVE), Fri (AM); *Royal Hawaiian.*
Biotechnology of Foods and Flavors (506). Thu (AM, PM), Fri (AM); *Royal Hawaiian.*
Pretreatment and Hydrolysis of Lignocellulosics (520). Tue (EVE), Wed (AM, PM); *Royal Hawaiian.*
Current Trends in Immunoassays in Residue Analysis (524). Sun (PM), Mon (AM, PM, EVE); *Royal Hawaiian.*
Phytochemical Pest Control Agents (526). Tue (AM, PM), Wed (AM, PM); *Royal Hawaiian.*
Chemical Modification of Lignocellulosic Materials (538). Wed (EVE), Thu (AM, PM, EVE), Fri (AM); *Royal Hawaiian.*
Process-Induced Chemical Changes in Foods (568). Tue (AM, PM, EVE), Wed (AM, PM); *Royal Hawaiian.*
Structural Changes in Lignocellulosics during Pulp Production (576). Mon (EVE), Tue (AM, PM, EVE), Thu (EVE); *Royal Hawaiian.*
Macromolecular Interactions (620). Thu (AM, PM, EVE); *Sheraton.*
Chemical Implications of Energy Uses for Agricultural and Forestry Resources (631). Mon (AM, PM); *Royal Hawaiian.*

Area 02 - Analytical Chemistry

Kinetic and Mechanistic Aspects in Analytical Chemistry (040). Wed (EVE), Thu (AM, PM), Fri (AM); *Sheraton.*
Chemical Sensors (042). Tue (PM, EVE), Wed (AM, PM, EVE); *Sheraton.*
Future Directions in Electroanalytical Chemistry (048). Mon (AM, PM, EVE), Wed (EVE); *Sheraton.*
Recent Advances in Separation Science for Biotechnology (050). Wed (AM, PM); *Sheraton.*
Future Generations of Analytical Reagents (051). Tue (EVE), Wed (AM, PM, EVE); *Sheraton.*
Trace and Ultratrace Analysis of Metals and Metal Complexes by HPLC and HPCE (052). Wed (AM, PM, EVE); *Sheraton.*
Synchrotron Radiation in Analytical Chemistry (055.) Mon (AM, PM, EVE), Wed (EVE); *Sheraton.*
Lasers in Analytical Chemistry (544). Wed (EVE), Thu (AM, PM); *Sheraton.*
Analytical and Biochemical Aspects of Seafood Safety and Nutrition (561). Tue (AM, PM, EVE); *Sheraton.*
Solid Phases in Analytical Chemistry (572). Tue (PM), Wed (AM, EVE); *Sheraton.*
Atomic Spectroscopy: Picogram and Beyond (599). Wed (AM); *Sheraton.*
Role of the Interface in Liquid-Liquid Separations (602). Wed (EVE), Thu (PM), Fri (AM); *Sheraton.*
Ordered Media (Micelles, Cyclodextrins, etc.) and Analytical Chemistry: A Successful Marriage (622). Tue (PM, EVE), Wed (PM, EVE), Thu (EVE), *Sheraton.*
Chemical Analysis with Micromachining and Miniaturized Systems (623). Tue (AM, EVE), Wed (PM); *Sheraton.*

Area 03 - BioScience and Technology

Antibody Engineering (025). Thu (PM, EVE); *Hilton.*
Advanced NMR Techniques and Biomolecular Structure (059). Wed (EVE), Thu (AM, PM, EVE), Fri (AM); *Hilton.*
Invertebrate Haemoglobins (510). Thu (AM, PM EVE), Fri (AM); *Hilton.*
Altered Proteins: New Applications in Chemistry, Biochemistry, and Medicine (534). Thu (AM, PM), Fri (AM); *Hilton.*
Natural Product Metabolism by Plant Cell Cultures (537). Thu (AM, PM), Fri (AM); *Hilton.*
Advances in Bioprocess Engineering (555). Mon (AM, PM), Tue (AM, PM, EVE), Wed (EVE); *Hilton.*
Biosynthesis of Natural Products and Isoprenoids (559). Mon (AM, PM), Tue (AM, PM, EVE); *Hilton.*
Regulation and Metabolic Engineering of Secondary Metabolite Biosynthesis (574). Wed (AM, PM); *Hilton.*
Enzyme Mechanisms (587). Tue (EVE), Wed (AM, PM); *Hilton.*
Macromolecular Structure and Function (589). Tue (EVE), Thu (AM, PM); *Hilton.*
Proteins in Extreme Environments (590). Tue (AM, PM); *Hilton.*
Racemases and Epimerases (590). Tue (AM, PM); *Hilton.*
Modern RNA Technologies in Chemistry and Biology (593). Mon (AM, PM); *Hilton.*
Molecular Diversity Approaches in Biology and Chemistry (596). Tue (AM, PM); *Hilton.*

Area 04 - Chemical Economics and Business

The Changing Chemical Scene in the Pacific Basin (562). Tue (AM, PM), Wed (AM, PM); *Sheraton.*
Technology Development and Transfer in Biotechnology Within the Asia-Pacific Region (636). Wed (AM, PM); *Ilikai.*

Area 05 - Chemical Education

How To Reform Introductory Chemistry (640). Mon (AM, PM); *Sheraton.*
Accommodating Students with Physical Disabilities in Chemistry Laboratory Courses (643). Mon (EVE); *Sheraton.*
Innovations in Teaching Chemistry (641). Tue (AM, PM, EVE), Wed (AM, EVE); *Sheraton.*
Computers for Molecular Graphics, Interactive Learning, and Communication in Chemical Education (642). Wed (PM, EVE); *Sheraton.*

Area 06 - Environmental Science and Technology

Safety and Environmental Effects of Organometallics (002). Mon (EVE), Tue (AM, PM); *Sheraton.*
Catalysis as Applied to Environmental Issues (010). Thu (AM, PM, EVE), Fri (AM); *Sheraton.*
CO_2 Fixation and Efficient Utilization of Energy (032). Wed (AM, PM), Thu (AM, PM, EVE); *Sheraton.*
Biogenic Hydrocarbons in the Atmosphere (509). Thu (AM, PM), Fri (AM); *Sheraton.*
Technology and Environmental Chemistry of Organometallics (518). Mon (EVE), Wed (AM, PM); *Sheraton.*
Environmental Applications of Ionizing Radiation Water, Wastewater, Industrial Waste (525). Wed (AM, PM, EVE), Thu (AM, PM, EVE), Fri (AM); *Sheraton.*
Environmental Biomonitoring and Specimen Banking (531). Wed (EVE), Thu (AM, PM, EVE), Fri (AM); *Sheraton.*
Analytical Reference Materials for Environmental Science and Technology (532). Mon (AM, PM), Tue (AM); *Sheraton.*
Protecting Drinking Water Quality and Its Sources: Monitoring, Treatment, and Assessment (533). Tue (AM, PM); *Sheraton.*
Phaseout of CFCs: The End of One Era, the Beginning of Another (535). Wed (AM, PM), Thu (AM); *Hilton.*
Remediation of Chemically Contaminated Water and Soils (578). Tue (AM, PM), Thu (EVE); *Sheraton.*
New and Emerging Environmental/Analytical Methods for Environmental Monitoring (583). Mon (AM, PM, EVE), Tue (AM); *Sheraton.*
Formation and Control of Combustion-Generated Pollution (594). Thu (AM, PM, EVE), Fri (AM); *Sheraton.*
Volcano-Atmosphere Interactions (603). Mon (AM, PM, EVE); *Sheraton.*
Quality Assurance and Quality Control: A Dynamic Partnership of Global Dimensions (633). Mon (AM, PM, EVE), Tue (AM); *Sheraton.*
Environmental Chemistry 1995: Problems and Prospects (637). Mon (AM, PM, EVE), Tue (EVE); Sheraton.

Area 07 - Inorganic Chemistry

Recent Developments in Structure, Bonding, and Applications of Inorganic Fluorine Compounds (004). Tue (AM, PM, EVE); *Hilton.*
Sulfur-Coordinated Transition Metal Complexes: Biological and Industrial Significance (009). Mon (AM, PM), Tue (AM, EVE); *Hilton.*
Advanced Material Design and Characterisation in Microporous Space (011). Mon (AM, PM), Tue (AM, PM, EVE); *Hilton.*
Polyoxometalate Chemistry: Synthesis, Structure, and Reactivity (015). Mon (AM, PM, EVE); *Hilton.*

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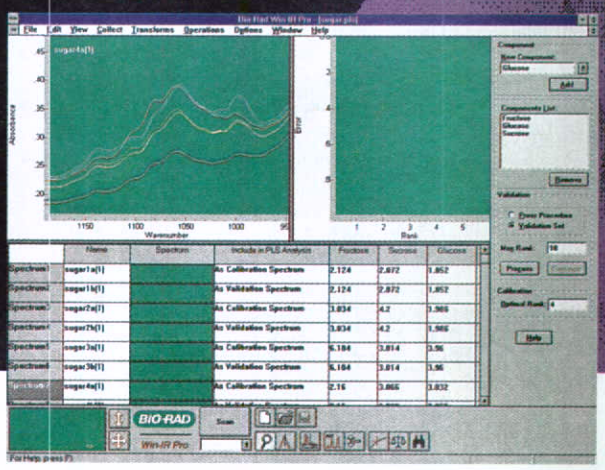

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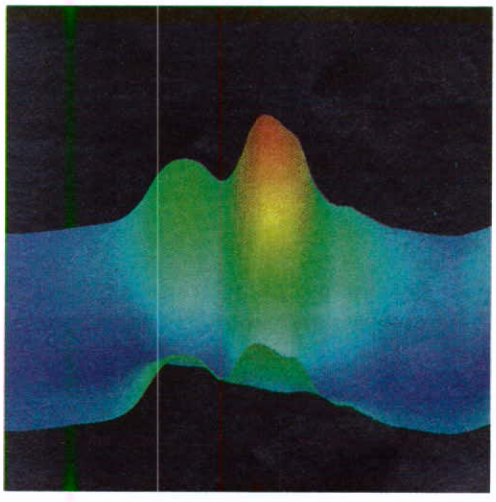

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Activation and Utilization of Small Molecules (016). Tue (AM, PM, EVE), Wed (AM); *Hilton.*
Metal Ions in Biology and Medicine: Natural and Synthetic Approaches (019). Mon (PM, EVE), Tue (AM, PM, EVE), Wed (PM, EVE); *Hilton.*
Recent Developments in Solution Coordination Chemistry (033). Wed (AM, PM, EVE); *Hilton.*
Electron-Transfer Reactions in Bioinorganic Molecules (054). Tue (EVE), Wed (AM, PM, EVE); *Hilton.*
Metal Complexes of Carbon: The Coordination Chemistry of C_x Ligands (505). Wed (EVE), Thu (AM, PM), Fri (AM); *Hilton.*
Research with Radioactive Nuclear Beams (507). Tue (EVE). Wed (PM, EVE), Thu (AM); *Hilton.*
Advances in the Chemistry and Properties of Novel Low-Dimensional and Conducting or Superconducting Solids (508). Wed (AM, PM, EVE), Thu (AM); *Hilton.*
New Techniques in the Chemical Analysis of Coal (512). Tue (AM, PM); *Hilton.*
Inorganic Photochemistry: Applications in Bioinorganic Chemistry, Energy Conversion, and Catalysis (514). Tue (AM, PM, EVE), Wed (AM); *Hilton.*
Chemical Effects of Ultrasound (546). Wed (AM, PM), Thu (AM, PM); *Hilton.*
Solid Superacids (548). Mon (AM, PM, EVE); *Hilton.*
Applications and Advances in Main-Group Element Chemistry (550). Wed (AM, PM, EVE), Thu (AM, PM); *Hilton.*
Role of Spectroscopic Methods in Modern Inorganic Chemistry (558). Wed (AM, EVE), Thu (AM, PM, EVE), Fri (AM); *Hilton.*
New Developments and Directions in the Organometallic Chemistry of the Late Transition Metals (563). Wed (PM), Thu (AM, PM), Fri (AM); *Hilton.*
Separation and Purification by Crystallization (584). Thu (AM, PM, EVE), Fri (AM); *Hilton.*
Geochemistry of Non-marine Source Rocks and Petroleum (608). Mon (AM, PM, EVE), Tue (EVE); *Hilton.*
Chemistry of Early Transition Metal-Group XV and XVI Compounds (614). Tue (PM), Wed (AM, PM); *Hilton.*
Chemical and Nuclear Properties of Actinides (616). Tue (AM, PM, EVE); *Hilton.*
Environmental Radiochemistry (617). Tue (EVE) Wed (AM, PM); *Hilton.*
Nuclear Medicine (618). Tue (EVE), Thu (AM, PM); *Hilton.*
Nuclear Science in 2020 (619). Mon (AM, PM); *Hilton.*
Transition Metal Carbides and Nitrides: Preparation, Properties, and Catalytic Reactivity (621). Mon (EVE), Tue (AM, PM), Wed (AM, PM); *Hilton.*
Environmental Geochemistry of Oxic-Anoxic Interfaces (632). Tue (AM); *Hilton.*
Chemical Terminology Involved in Materials Science: A Multidisciplinary Opportunity (635). Fri (AM); *Hilton.*

Area 08 - Macromolecular Chemistry

Design of Polymers with Controlled Architecture (005). Tue (PM, EVE), Wed (AM, PM); *Sheraton.*
Silicon-Based Polymers (007). Wed (AM), Thu (AM, M), Fri (AM); *Sheraton.*
Multi-Electron-Transfer Processes for Molecular Conversions (014). Thu (AM, PM); *Sheraton.*
Biomedical Functions and Biotechnology of Natural and Artificial Polymers (024). Wed (AM), Thu (AM, PM), Fri (AM); *Sheraton.*
Supramolecular Order in Polymer Colloids and Surfaces (044). Wed (AM), Thu (AM, PM), Fri (AM); *Sheraton.*
Polymers for Microelectronics and Photonics (045). Tue (AM, PM, EVE), Wed (AM, PM); *Sheraton.*
Environmental Polymer Biodegradation (502). Mon (AM, PM), Tue (AM, PM), Wed (AM); *Sheraton.*
High Performance Polymers (517) Mon (AM, PM), Tue (AM, EVE); *Sheraton.*
Kinetics and Modelling of Polymerizations (522). Mon (AM, PM, EVE); *Sheraton.*
Polymer Alloys and Blends (528). Mon (AM, PM), Tue (AM, PM, EVE); *Sheraton.*
Solid-State NMR: Polymer Spectroscopy and Materials Imaging (557). Mon (EVE), Tue (AM, PM, EVE), Wed (AM, PM); *Sheraton.*
Polymer Photophysics and Photochemistry (564). Thu (AM, PM, EVE), Fri (AM); *Sheraton.*
Radiation Chemistry of Polymers (569). Mon (AM, PM, EVE), Tue (EVE); *Sheraton.*
Reactive Melt Processing (581). Tue (EVE), Wed (AM, PM), Thu (AM); *Sheraton.*
Flow-Induced Structure Formation in Polymer Systems (607). Mon (AM, PM), Tue (AM, PM); *Sheraton.*
Polymers and the Environment: Synthesis, Processing, and Product Development (644). Tue (EVE); *Sheraton.*

Area 09 - Organic Chemistry

Reactive and Unusual Molecules (001). Thu (AM, PM, EVE), Fri (AM); *Hilton.*
Biocatalysis in Organic Synthesis (008). Mon (AM, PM, EVE), Tue (AM); *Hilton.*
Organomolecular Transformation by Electrochemical Activation (026). Wed (EVE), Thu (PM, EVE), Fri (AM); *Hilton.*
Mechanisms for Aliphatic Substitution Reactions (039). Wed (EVE), Thu (PM), Fri (AM); *Hilton.*
Fullerenes (043). Mon (AM, PM), Tue (AM, PM), Wed (EVE); *Hilton.*
Recent Advances in Organic Photochemistry (503). Mon (AM, PM, EVE), Tue (AM, PM, EVE), Wed (AM, EVE); *Hilton.*
Organometallics in Organic Transformations, Synthesis, and Asymmetric Catalysis (511). Mon (AM, PM, EVE), Tue (AM, PM), Wed (AM, PM, EVE), Thu (AM, PM), Fri (AM); *Hilton.*
Phthalocyanines (523). Mon (AM, PM, EVE); *Hilton.*
Molecular Recognition and Supramolecular Assemblies (539). Mon (AM, PM, EVE), Tue (AM, PM), Wed (AM, PM); *Hilton.*
Marine and Unusual Microbial Natural Products (540). Mon (AM, PM), Tue (AM, PM); *Hilton.*
New Organic Compounds: Novel Structures, Novel Properties (543). Mon (PM), Tue (AM, PM), Wed (AM, PM), Thu (EVE); *Hilton.*
Microwaves and Chemical Synthesis (545). Tue (AM, PM); *Hilton.*
Phase-Transfer Catalysis (547). Tue (PM), Wed (AM, PM), Thu (AM); *Hilton.*
Ketene Chemistry (552). Wed (AM, PM), Thu (AM, PM); *Hilton.*
Fluorine in Biological Chemistry (553). Tue (PM, EVE), Wed (AM, PM); *Hilton.*
Organic Radical Chemistry, Honoring Athel Beckwith (556). Wed (AM, PM), Thu (AM, PM, EVE); *Hilton.*
Artificial Intelligence in Organic/Medicinal Chemistry (566). Mon (AM, PM); *Hilton.*
Arachidonic Acid Metabolism in Health and Disease (573). Thu (AM, PM), Fri (AM); *Hilton.*
Anti-infective Agents (577). Mon (AM, PM), Tue (AM, PM); *Hilton.*
Molecular-Based Magnetic Materials (598). Wed (AM, PM, EVE), Thu (AM, PM); *Hilton.*
Natural Products Chemistry and Synthesis (639). Tue (PM), Wed (AM, PM), Thu (AM, PM); *Hilton.*

Area 10 - Physical Chemistry

Solvation Dynamics: From Ions to Proteins (003). Wed (PM), Thu (AM, PM), Fri (AM); *Ilikai.*
Molecular Interaction in Solution From the Macroscopic and Thermodynamic Viewpoints (013). Mon (AM, PM), Tue (AM), Wed (PM); *Ilikai.*
Recent Progress in Photoelectrochemistry and Its Application to Energy, Information, and Environmental Technologies (021). Mon (AM, PM), Tue (EVE); *Ilikai.*
Recent Developments in Vibrational Spectroscopy (022). Mon (AM, PM), Tue (AM), Wed (PM); *Ilikai.*
High-Resolution Solid-State NMR: Progress and Applications (027). Mon (AM, PM), Tue (AM); *Ilikai.*
Chemical Applications of Synchrotron Radiation (028). Tue (AM, PM), Wed (AM); *Ilikai.*
High-Temperature and Pressure Solution Chemistry (030). Tue (AM, PM, EVE); *Ilikai.*
Frontiers of Mathematical Chemistry (031). Thu (AM, PM), Fri (AM); *Ilikai.*
Design, Characterization and Performance of Advanced Catalytic Materials (034). Mon (AM, PM, EVE); *Ilikai.*
Low-Dimensional Molecular Systems on Solid Surfaces (035). Tue (AM, PM, EVE); *Ilikai.*
Supramolecular Assembly at Surfaces and in Solutions (036). Tue (EVE), Wed (AM, PM); *Ilikai.*
Biosurfactants and Biosurfaces (037). Wed (EVE), Thu (AM, PM); *Ilikai.*
Dispersed Systems and Effect of Added Polymer (038). Mon (AM, PM); *Ilikai.*
Advances in Cluster Science (041). Thu (AM, PM, EVE), Fri (AM); *Ilikai.*
Computer Aided Prediction Techniques in Chemistry (046). Tue (PM); *Ilikai.*
Small Particles in Organized Media (504). Wed (AM, PM, EVE); *Ilikai.*
Structure Dynamics, and Control of Excited States (516). Tue (PM, EVE), Wed (AM, PM, EVE), Thu (AM, EVE); *Ilikai.*
Electron Spectroscopy and STM/AFM Analysis of the Solid-Liquid Electrochemical Interface (521). Wed (AM, PM, EVE), Thu (AM, PM, EVE); *Ilikai.*
Computational Quantum Chemistry: Viable Partner to Experiment in Chemical Research (529). Tue (AM, PM), Wed (AM, PM), Thu (AM, PM), Fri (AM); *Ilikai.*
Excited-State Molecular Association: Exciplexes, Excimers, and Beyond (530). Thu (AM, PM, EVE), Fri (AM); *Ilikai.*
Advances in Quantum Monte Carlo (606). Mon (AM, PM); *Iliaki.*

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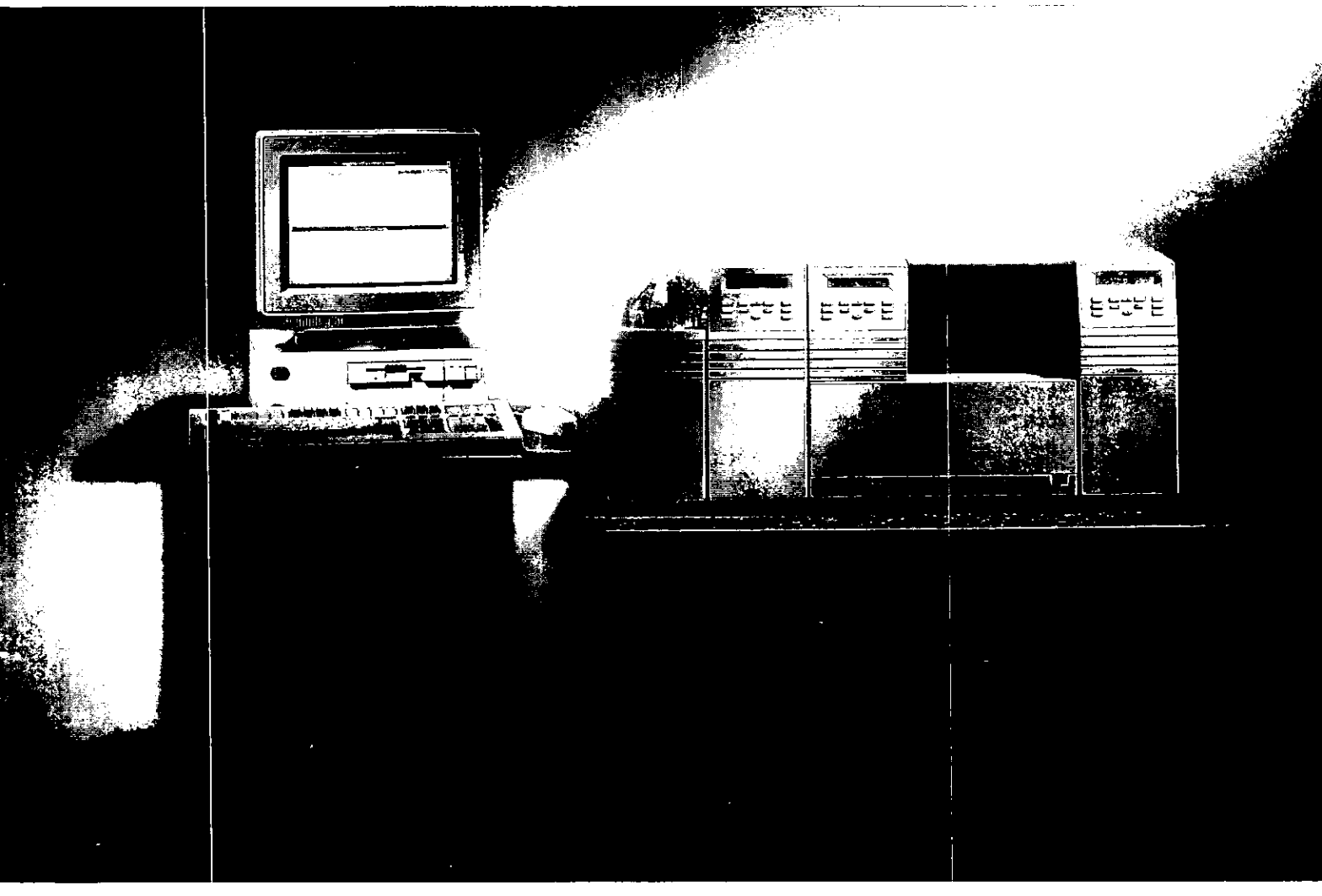

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INDUSTRY APPLICATIONS

USE OF DDSC TO DETERMINE THE GLASS TRANSITION TEMPERATURE OF POLYCARBONATE IN A BLEND WITH AMORPHOUS POLYETHYLENE TEREPHTHALATE

Introduction

Dynamic Differential Scanning Calorimetry (DDSC) is a new thermal analysis technique offered by Perkin-Elmer as an accessory for users of the Power Compensated DSC. One of its most practical uses is the determination of the glass transition temperature (T_g) when this event is obscured in an ordinary DSC analysis by some other process. In the case of a blend of polyethylene terephthalate (PET) and polycarbonate (PC), the problem is that the crystallization of the amorphous PET occurs in the same temperature range as the T_g of the PC.

Purpose

To determine the T_g of PET and PC in a PET/PC blend.

Experimental

DDSC: The DDSC accessory consists of an enhanced control/analysis board for the DSC and software which runs in the Perkin-Elmer system. With this accessory installed it is possible to run either standard DSC methods or DDSC methods. DDSC methods consist of a simple two-step repeated program. For this application, the sample is first equilibrated isothermally, then scanned at a constant heating rate for an equal amount of time. (An alternative repeat program is composed of a heating step followed by a cooling step.) The result is a dynamic thermal effect similar to the iso-scan-iso of a conventional specific heat analysis but with a shorter equilibration time. This program is repeated at a uniform increment for the desired number of iterations. The DDSC calculation performed on the collected heat flow data results in the time-dependent specific heat and the phase lag due to the relaxation within the sample material.

DDSC Method		
Sample	PET/PC Blend	Cut from test bar
	Analyser	Perkin-Elmer
DSC7		
	Encapsulation	Crimped Standard Aluminium
	Sample Weight	12.291 mg
Environmental	Purge	Nitrogen: 20 cc/min
	Cooling Device	Intracooler II
Parameters	Method	DDSC
	Repeat Program Type	Isothermal-Scan
	Equilibration Time	20 seconds
	Temperature Increment	4 °C
	Heating Rate	12 °C/min
	Starting Temperature	30 °C
	Repetitions	65

The Sample: The sample material consists of a blend of polycarbonate and PET, with a possible impact modifier. This material is used as an impact resistant engineering plastic for mechanical housings. The properties of the end product could be expected to depend on the blend ratio and on the amorphous and crystalline content of the blend.

A piece of the PET/PC test bar was cut to fit the bottom of a standard aluminium pan. It was placed into a weighed pan, covered with a lid and crimped using a standard crimper press. The sample weight and other parameters used for measurement can be seen in the table above. A baseline was run with a similar empty pan, using the same method parameters. The sample was run as received, that is, without imposing a specific thermal history.

Results

Figure 1 shows the raw DDSC heat flow data collected. The heat flow data shows the primary transitions of PET: the glass transition is observed at about 80 °C, the cold crystallization at about 165 °C and the melt at about 225 °C. There is no indication of the T_g of PC, which is expected to occur in the same range as the cold crystallization.

Figure 1: DDSC of PET/PC Blend
Heat Flow Data as Collected

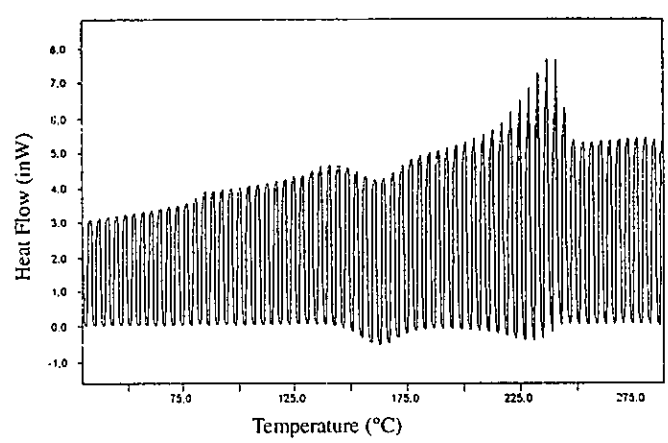

Figure 2 shows three of the curves generated from this data. The Total C_p curve is obtained using a conventional C_p methodology. That is, the isothermal data before and after the DDSC run are aligned, and the smoothed heat flow data is used to generate the specific heat. This C_p data is identical to that which would be obtained by a conventional, non-DDSC, specific heat analysis. As can be seen, the features are similar to that of PET, again with no evidence of the polycarbonate glass transition.

Figure 2: DDSC of PET/PC Blend
Storage C_p, Loss C_p, and Total C_p

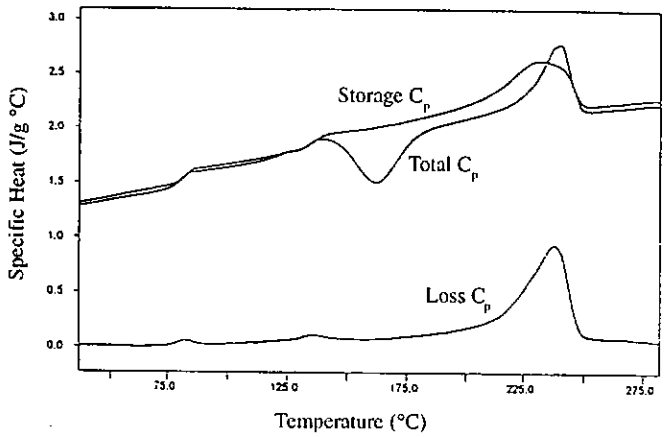

Figure 2 also shows a second curve, the Storage C_p. This is one of the dynamic curves produced by the DDSC calculation. It represents the in-phase specific heat capacity calculated over the time span of the equilibration time of the DDSC repeat program. Since the glass transitions are associated with an increase in C_p, they can be easily observed. They can also be observed as peaks on the loss C_p curve. The enthalpy effects associated with PET crystallization which overlap the polycarbonate T_g, are not observed on the storage and loss C_p curves.

Figure 3: DDSC of PET/PC Blend
T_g analysis

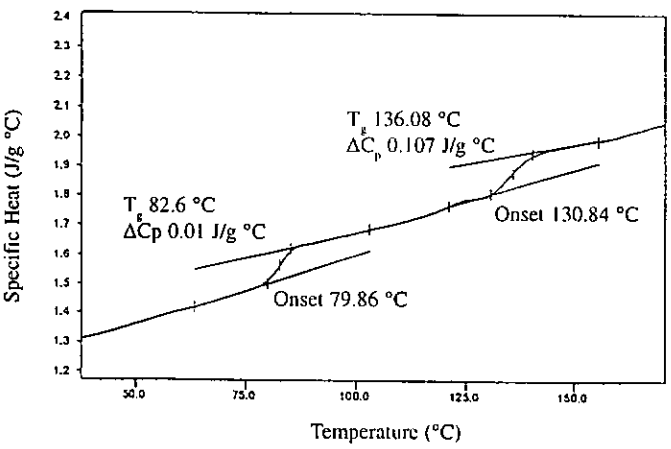

Figure 3 shows this same dynamic curve on an expanded scale with the glass transition calculations performed. Notice that the T_g of PET at 82.6 °C and the T_g of polycarbonate at 136 °C can be obtained easily from this curve. Both of these values are shifted several degrees toward one another when compared to the values obtained on standard PET and polycarbonate. This phenomenon is to be expected if the two amorphous phases are partially miscible. That is, the amorphous region of PET includes some polycarbonate which shifts the T_g toward the T_g of polycarbonate, and vice versa. The amount of shifting is roughly proportional to the fraction of each component in that phase. And the amount of polymer in each amorphous phase can be estimated in some cases from the change in specific heat in each T_g region.

One of the limitations of accuracy in glass transition temperature and ΔC_p measurements is uncertainty in the placement of the T_g constructs because of enthalpy effects which occur in the T_g region. But these enthalpy effects appear only on the total C_p curve and not on the storage C_p. Thus, T_g analysis on the storage C_p curve should help promote improved T_g quantification.

Conclusion

DDSC allows the determination of the glass transition even when it is overlapped and obscured by a crystallizing component as observed by standard DSC. In this case the polycarbonate is just one component of the blend, yet its T_g can be easily and accurately measured using the storage C_p data. The ability to measure glass transition temperatures accurately without the interference of enthalpy effects holds particular utility for blend analysis, since small shifts in the glass transition temperature can be indicative of mutual dissolution of the two polymer phases. Because of the simplicity of interpretation of T_g on the storage C_p curve, DDSC may help make T_g analysis more accurate and reliable.

For more information on this application or the instrumentation used:
Contact Perkin-Elmer New Zealand
P O Box 38833 Wellington
Ph: (04) 5890451, Fax: (04) 5870380
circle number 51 on the reader reply card

NEW ICP AND ICP-MS APPLICATION NOTES FROM THERMO JARRELL ASH CORPORATION

Thermo Jarrell Ash have released the following new applications notes for ICP and ICP-MS:

1. Determination of trace elements in high purity gold by IRIS ICAP with solid sampling accessory. Reprint No. Q59
2. Detection limits for trace elements in high purity gold using a DC Arc Spectrograph with solid state CID detection. Reprint No. Q60
3. Drift test on an IRIS-AP inductively coupled plasma atomic emission spectrometer. Reprint No. Q61
4. Analysis of samples in three separate 1% acid matrices using an IRIS-AP. Reprint No. Q62
5. The analysis of precious metals for trace impurities with an AtomComp 2000 CID detector DC-Arc. Reprint No. Q63
6. The determination of elemental nitrogen in gasoline aditive by ICP-AES with an iris. Reprint No. Q64
7. The multi-element calibration of copper-based alloys using an IRIS-AP. Reprint No. Q65
8. The continuous-focus ion optics of the TJA ICAP-MS instrument. Reprint No. R23
9. The analysis of 4 light masses in 1000 ppm U solution by plasma optical emission mass spectrometry. Reprint No. R24
10. The analysis of beverage waters by plasma optical emission mass spectrometry. Reprint No. R25
11. ThermoSPEC/WIN v1.20 release notes. Reprint No. R26
12. Virus protection. Reprint No. R27
13. Data storage options with ThermoSPEC/WIN software. Reprint No. R28.

For copies of any of these application bulletins:
Contact: Andrew Pearce, Sci Tech
P O Box 663 Dunedin
Ph: (03) 4777860, Fax: (03) 4777870
circle number 52 on the reader reply card

VERIFICATION OF POLYMER FORMULATIONS USING ATTENUATED TOTAL REFLECTANCE FTIR SPECTROSCOPY

The verification of polymer product formulations is a more difficult task than identity matches. Formulation analysis is still achievable using the Perkin-Elmer Paragon 1000 FTIR Spectrometer and the sensitive COMPARE function.

Verification of Ethylene Vinyl Acetate Copolymers Using COMPARE.

In this example the Paragon 1000 FTIR Spectrometer was used with a horizontal attenuated reflectance accessory (HATR) to record a series of four standard spectra of ethylene vinyl acetate having differing monomer ratios. These spectra were compiled with an additional 16 polymer standard spectra to form a COMPARE librrary. A spectrum of a copolymer sample with 25% vinyl acetate monomer was matched against the library using COMPARE (Figure 1).

As tabulated below (Table 2), the 25% vinyl acetate standard spectrum is the highest match. In contrast to identity matching, the correlations for other monomer ratio formulations are close to that of the target formulation. In formulation discriminant anlayses, statistical testing must be used to ensure the validity of the discrimination.

Table 2: polyunk2: 25% EVA for verification

correlation	factor	name	comment
0.999571	1.1284	std2	poly(ethylene 25% vinyl acetate)
0.992918	1.0072	std3	poly(ethylene 28% vinyl acetate)
0.986579	0.7805	std4	poly(ethylene 33% vinyl acetate)
0.973442	2.6056	std1	poly(ethylene 12% vinyl acetate)
0.661786	0.7610	std10	low density polyethylene
0.589833	1.5228	std11	high density polyethylene
0.463742	0.2401	std7	poly(37-39% acrylonitrile butadiene)
0.438299	0.2530	std9	poly(45% styrene butadiene)
0.422274	3.2145	std18	polyvinyl chloride
0.419834	0.2370	std5	poly(19-22% acrylonitrile butadiene)

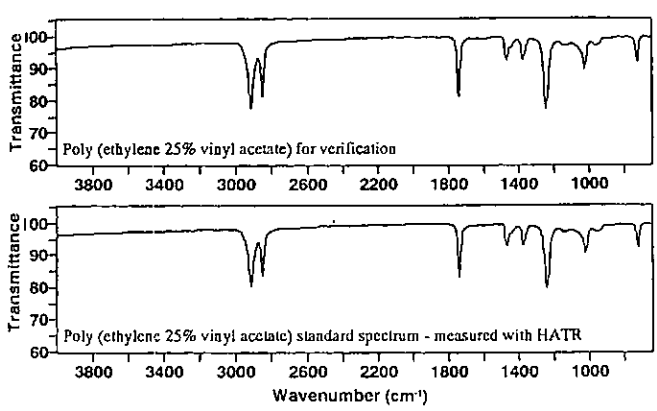

Figure 1: Ethylene vinyl acetate verification. At the top is the spectrum for verification, from a sample of poly(ethylene vinyl acetate) having a 25% vinyl acetate monomer ratio. At the bottom is the spectrum corresponding to the top correlation in the COMPARE match, also a spectrum of a sample of poly(ethylene vinyl acetate) having a 25% vinyl acetate monomer ratio.

Verification of Polystyrene Using COMPARE.

The IR spectrum of polystyrene foam was recorded using a HATR with the Paragon 1000 FTIR Spectrometer. The spectrum for product verification was matched by COMPARE against 20 polymer standard spectra also recorded using the HATR. An extremely high correlation for the polystyrene standard spectrum resulted (Figure 3) which was well distanced from the correlations for other standards (Table 4). The COMPARE function combined with simplified HATR sampling provides the tools for fast, turn key polymer product verification.

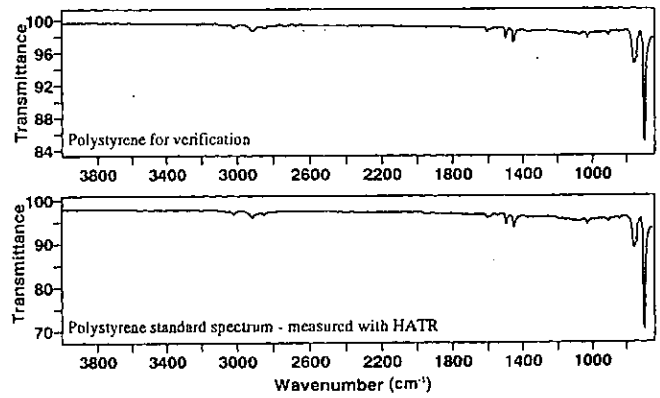

Figure 3: Polystyrene product verification. Shown above are the polystyrene spectrum for verification (top) and the top match standard spectrum (bottom) extracted from the COMPARE library of 20 standards.

Table 4: polyunk1: polystyrene foam for verification

correlation	factor	name	comment
0.999333	0.9895	std15	polystyrene
0.567276	0.0325	std9	poly(45% styrene/butadiene)
0.211241	0.0120	std7	poly(37-39% acrylonitrile butadiene)
0.210781	0.0390	std6	poly(30-32% acrylonitrile butadiene)
0.206136	0.0321	std8	poly(43-45% acrylonitrile butadiene)
0.199980	0.0121	std5	poly(19-22% acrylonitrile butadiene)
0.157044	-0.0442	std11	high density polyethylene
0.142830	-0.0668	std14	poly(ethylene terephthalate)
0.135843	0.1180	std18	polyvinyl chloride
0.129839	0.0200	std12	polypropylene

Contact Perkin-Elmer New Zealand
P O Box 38833 Wellington
Ph: (04) 5890451, Fax: (04) 5870380
circle number 53 on the reader reply card

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DR JOHN ROGERS • 1919 - 1995

It is with great regret that we record the death of Dr John Rogers on 9 November 1995. A tribute to his life and work will appear in the next issue of *Chemistry in New Zealand.*

ADVANCES IN MEASUREMENT OF SURFACE AREA BY GAS ADSORPTION

By R W Camp & H D Stanley

Micromeritics Inc., One Micromeritics Drive, Norcross, Georgia, GA 30093-1877, USA

Measurement of the surface area of solid materials is classically performed following a method developed by Brunauer, Emmett and Teller[1] and referred to simply as the BET method. The method first involves the removal of preadsorbed gases and vapours from the surface of the solid. Then the solid is typically cooled to the boiling point of a chosen adsorbate gas. The surface is then incrementally exposed to higher partial pressures of the adsorbate gas until the entire surface is covered by these molecules. When the surface is covered by exactly one molecular layer of the adsorbate gas, the layer is called a monolayer. The extent of the surface of the solid can be calculated by multiplying the number of molecules of adsorbate gas required to form the monolayer times the area covered by each adsorbate gas molecule. It sounds simple enough until the experiment is actually attempted.

In a typical experiment, a large number of errors and approximations come into play. A partial list of these would include deviations of the adsorbing gas from so-called "ideal gas" behaviour, thermal gradients in the coolant bath used during gas adsorption, and "free space" errors. Free space is defined as the space in the sample tube that is cooled to the cooling bath temperature but is not occupied by the sample itself. These and many other sources of error have plagued experimenters and instrument designers for decades.

Since the introduction of the BET theory in 1938, numerous manufacturers of minerals, pigments, catalysts, and chemicals have come to rely on surface area measurements to control their products and processes. Up until the present, such measurements were somewhat tedious and slow. Automating the measurement devices with digital computers was one answer. Abbreviating the technique by taking only one data point was another.[2] There was a continuing search for a better, faster, more accurate way to obtain the results.

During design work on an entirely different instrument, one of the authors developed a concept that would eliminate the above-mentioned experimental problems while increasing the speed and accuracy of the results. Called Gemini (patent pending) (Micromeritics, Norcross, Georgia) because of its mode of operation, this technique provides a dramatic improvement upon the already accepted methods of obtaining surface area results such as the static-volumetric and the dynamic or flowing-gas techniques.

The analyser consists of two tubes of matched internal volume. One of these tubes contains the sample while the other is empty. These two tubes are joined by servo valves as seen in Figure 1.

Instrument Operation.

In operation, a previously prepared sample is placed in the right-hand tube. The left-hand (balance) tube remains empty. A vacuum is pulled on the manifold system to expel residual gas and vapours before opening the tubes to the system. When a sufficient vacuum is obtained (usually a matter of a few minutes or less), the valves to the tubes are opened, and the system is brought into volumetric balance with an adjusting piston incorporated into the manifold. From this point on, any differences observed between the sample tube and the balance tube are due strictly to the presence and influence of the sample itself.

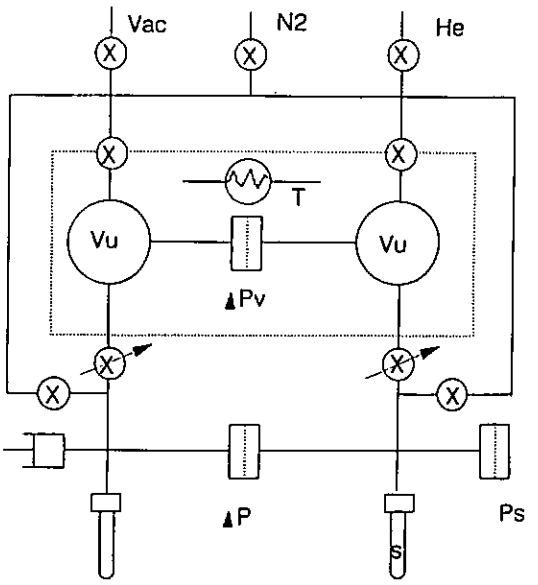

Figure 1: Diagram of the analyser showing the connection of the two matched tubes by the servo valve mechanism.

The sample and balance tubes are immersed in the coolant bath by raising the platform that holds the coolant bath. When the thermal equilibrium is achieved, the adsorbate gas is admitted into the manifold at the first relative pressure point desired. This gas had equal access to both the sample tube and the balance tube. Because there is no sample in the balance tube, no adsorption of the gas takes place. In the sample tube, however, the sample begins to adsorb the gas in direct proportion to its surface area.

As the sample adsorbs gas, the gas pressure in the sample tube drops. This unbalances the manifold and servo valve circuit. The servo valve circuit then causes more gas to be brought into the manifold in an attempt to bring the gas pressure back into a fully balanced condition. The amount and rate of new gas introduced into the manifold is in exact proportion to the amount of gas that has been adsorbed onto the surface of the sample. This action continues until the highest relative pressure requested has been reached. In every case, the instrument responds exactly to, and only to, the amount and rate at which gas is adsorbed by the sample. The system is responsive only to the sample.

Balancing Out Errors

Any deviation of the adsorbing gas from the ideal gas behaviour in the sample tube is exactly duplicated in the balance tube. By

subtracting the nonideal-gas behaviour in the sample tube from that observed in the balance tube, this error is completely cancelled out. The same is true for any thermal gradients in the coolant bath. Any gradients observed in the sample tube are exactly duplicated in the balance tube and therefore cancelled. Virtually all of the deviations from ideal conditions in the sample tube are exactly duplicated in the balance tube and are subtracted from the experimental results. The authors have constructed, therefore, a system in which true equilibrium between the gas phase and the solid (sample) phase is always maintained. At the same time, the speed of analysis is limited only by the rate at which the sample can adsorb the gas. In fact, this approach may best be described as a sorption method using adaptive rate technology (SMART). The Gemini gas sorption method adapts the rate at which gas is supplied to the system to the rate at which the sample can adsorb it.

Results

The increased analysis speed that results from this technique is rather impressive. A typical 5-point BET surface area analysis often requires only a few minutes rather than almost an hour as with conventional devices. As an example, a material with a total surface of 100 m^2 (BET surface area of 185 m^2/g), as measured by a 5-point, static-volumetric apparatus, required approximately one hour to complete. The same material analysed by the balanced adsorption device produced the same result in only 10 min. That represents an increase in speed of roughly seven times compared to static-volumetric methods. When compared to conventional flowing-gas methods, the speed advantage of the gas sorption method is more than 10 times greater. When using conventional flowing-gas surface area analysers for multipoint surface area analysis, a great deal of nonproductive time is used in between taking the data points. This time is required to change the gas composition to match the desired relative pressure points. This is usually done using either premixed gases or by manipulating a gas-flow regulator. In either case, the operator must wait for the new gas composition to flow completely through the analyser manifold. This can take 90 min or more for five data points.

The accuracy of the result obtained by use of this gas sorption technique is not at all diminished by its high speed of analysis. Table 1 shows typical results obtained by a static-volumetric instrument, a conventional flowing-gas instrument, and the balanced adsorption apparatus. The results clearly show that the balanced adsorption apparatus provides comparable, if not superior, results at a much lower investment in analysis time.

Table 1 Comparison of results between a static-volumetric, flowing gas and balanced adsorption apparatus

Analysis method	5-point BET (m^2/g)	Analysis time (min)
Balanced adsorption apparatus	193.8	10
Static-volumetric	194.2	68
Flowing gas	193.1	185

Discussion

As can be seen from Table 1, the balanced adsorption apparatus produces comparable results in a fraction of the time required for more conventional surface area analysers. This is because the construction of the analyser allows it to respond to the unique characteristics of the sample. The SMART technique supplies adsorbate gas to the sample at exactly the rate that the sample can adsorb it. The analyser is thus totally responsive to the sample. It does not ignore, but cancels out, all extraneous effects that slow down and distort the results obtained from other analysers.

References

1. Ebrunauer, S., Emmett, P. H., and Teller, E., "The adsorption of gases in multimolecular layers," *J. Am. Chem. Soc.* **60**, 309 (1938).

2. Nelson, P. M. and Eggertsen, F. T., "Adsorption measurements by a continuous flow method," *Anal. Chem.* **30**, 1387 (1958).

* * * * *

SEMINAR

PROBLEMS ASSOCIATED WITH NATURAL PRODUCTS PROCESSING

Natural Products Processing and Biotechnology at the University of Auckland

New Zealand is, with good reason, best known for its 'natural' image and the majority of its export earnings are from 'natural' products. It was with this in mind that on 19 April 1995, the *Natural Products Processing Group* was launched within the University of Auckland.

The aim of the group is:
To develop value added products and processes utilising natural resources by applying relevant multidisiplinary expertise within the University of Auckland.

The first action of the group was to initiate a one day seminar on "Problems Associated with Natural Products Processing". The aims of this meeting are:

- To communicate the latest advances in both the theory and practice of Natural Products Processing
- To use the University environment to promote cross-disciplinary and industry-institution interactions through lectures and free-flowing panel discussions
- To highlight the activities of the Natural Products Processing group and the facilities at the University of Auckland for both research and training in this area

Technical managers of New Zealand natural product manufacturers, senior researchers and managers active in natural products processing from the Dairy Board, MIRINZ, FRI, Hort Research and IRL, as well as consultants to industry have been specifically selected to give a comprehensive range of papers in the areas of :

- Dairy technologies
- Collaborative research
- Novel processing technologies
- Waste minimisation
- High margin products

During the day opportunities will also be available to visit the new fermentation facility and associated instrument/control room for the teaching of our new *BTech* programme in *Biotechnology* as well as our *BE* in *Chemical and Materials Engineering*. This facility has been designed to match the best standards of containment existing in the New Zealand biotechnology industry and forms part of a $2 million investment by the University of Auckland in the biotechnology programme.

Facilities available within the facility are to include:

- Fully instrumented and remotely controlled fermentations up to 30 litres
- Pilot scale
  - Reverse osmosis, nanofiltration, ultrafiltration and microfiltration unit
  - Heat transfer surface fouling and cleaning unit
  - Chromatography systems
- Ancillary facilities such as UHQ water, autoclaving, reticulated RO water, incubators, centrifuges, ethernet cabling to remotely situated data logging and controlling computers
- Instruments in the instrument/control room include:
  - GC-MS with olfactory monitoring response port
  - HPLC
  - UV-VIS scanning spectrophotometer
  - Thermal gravimetric analyser

All instruments will be connected to fast processing computers for data logging, analysis and control. Networking connections will allow remote access to this data from outside the University.

The Natural Products Processing Group is also currently organising a course in Membrane Separations with two of the world's top experts for October/November 1996 to follow up the successful course given by Sourirajan in 1993. Both this course and the seminar will be run in conjunction with the "Centre of Continuing Education" at the University of Auckland.

Further details of the activities of the Natural Products Processing Group at the University of Auckland can be obtained by contacting Dr Paul Pickering, Co-ordinator, Natural Products Processing Group, Department of Chemical and Materials Engineering, University of Auckland, Private Bag 92019 Auckland, New Zealand.
Tel +64-9-3737599 ext 5128, Fax +64-9-3737463
Email p.pickering@auckland.ac.nz

Persons wishing to register for the seminar on ***Problems Associated Natural Products Processing*** *or requiring more information should contact Barry Williams at the Centre for Continuing Education, University of Auckland, Auckland, New Zealand.*
Tel +64-9-3737599 ext 8903, Fax +64-9-3737419
Email b.williams@auckland.ac.nz

PROBLEMS ASSOCIATED WITH NATURAL PRODUCTS PROCESSING
FRIDAY, 23 FEBRUARY 1996

Time	Session	Title	Speaker
8.50 am - 9.00 am	Introduction	Welcome to the University of Auckland	Roy Sharp, University of Auckland
9.00 am - 9.30 am	Plenary lecture	Achievements in adding value in dairy products over the past 10 years	David Johns, Dairy Board
9.30 am - 10.00 am	1st Lecture	Membrane separations - minimising waste, maximising profits	Conrad Heron, Kiwi Dairies
10.00 am - 10.30 am	2nd Lecture	High and low temperature processing in the dairy industry	Dong Chen, University of Auckland
10.30 am - 11.00 am	Panel Discussion	Future challenges to the dairy industry	David Johns, David Munro, Robert Spurway, Steve Morrison
11.00 am - 11.30 am	Coffee Break		
11.30 am - 12.00 pm	4th Lecture	High margin products from New Zealand in the 21st century	John Cunningham, Calan Group
12.00 pm - 12.30 pm	5th Lecture	Improving quality in veterinary vaccine manufacture	Mike O'Hara, Mallinckrodt Veterinary
12.30 pm - 1.00 pm	6th Lecture & tour of research and training facilities	Research activites in natural products processing at the University of Auckland	Paul Pickering, University of Auckland
1.00 pm - 2.00 pm	Lunch at Old Government House		
2.00 pm - 2.30 pm	Plenary Lecture	Biochemical engineering challenges for the New Zealand biotechnology industry	Max Kennedy, Industrial Research
2.30 pm - 3.00 pm	1st Lecture	Minimal processing of foods with special reference to fruit & vegetables	Conrad Perera, HortResearch
3.00 pm - 3.30 pm	2nd Lecture	Recovery of valuable bioproducts from abattoir waste streams	Conan Fee, MIRINZ
3.30 pm - 4.00 pm	Tea		
4.00 pm - 4.30 pm	3rd Lecture	Waste minimisation as a pre-cursor to success in natural products processing	Basil Waklin, Kingston Morrison Consultants
4.30 pm - 5.00 pm	4th Lecture	Challenges for closed cycle processing in the New Zealand pulp and paper industry	Bob Allison, Forest Research Institute
5.00 pm - 5.30 pm	Panel Discussion	The impact of the Resource Management Act on the natural products processing industry	Basil Waklin, Mike O'Hara, Max Kennedy, Paul McFarlane
5.30 pm - 6.00 pm	Concluding Lecture	The problems and rewards of co-operative research	Geoff Page, Industrial Research

CONFERENCES & SEMINARS

12-16 December 1995
4th Pacific Polymer Conference
Venue: Kauai, Hawaii, USA
Contact: Professor Ray Otterbrite
Department of Polymer Chemistry
Virginia Commonwealth University
Richmond, Virginia 23204, USA
Fax +1-804-3678588

17-22 December 1995
Pacifichem '95 International Chemical Congress
Venue: Honolulu, Hawaii, USA
Contact: Professor B Halton
Chemistry Department
Victoria University
P O Box 600, Wellington
Ph (04) 4721000
Fax (04) 4955241

PACIFICHEM '95 UPDATE

The final schedule for the scientific sessions of Pacifichem '95 has now been completed. See pages 26-28 in this issue.

28-30 January 1996
International Macrocyclic Meeting
Venue: Victoria University, Wellington, New Zealand
Contact: Dr Sally Brooker
Chemistry Department
University of Otago
P O Box 56, Dunedin, New Zealand
Email: chemsab@otago.ac.nz

4-7 February 1996
5th International Congress on Trace Elements in Medicine and Biology - Therapeutic Uses of Trace Elements
Venue: Méribel, France
Contact: Mme Arlette Alcaras
Laboratoire de Biochimie C
CHRUG B P 217
F-38043 Grenoble Cedex 9, France

4-7 February 1996
21st Australian Polymer Symposium Preceded by Workshop on Polymer Reaction Engineering (3-4 February)
Venue: Wollongong, NSW, Australia
Contact: Dr Malcolm Binns
Mirotone Pty Ltd
21 Marigold Street, Revesby
New South Wales 2212, Australia
Ph +61-2-7724555
Fax +61-2-7713601

31 March - 4 April 1996
7th International Symposium on Supercritical Fluid Chromatography and Extraction
Venue: Westin Hotel, Indianapolis, Indiana, USA
Contact: Janet Cunningham
Barr Enterprises
P O Box 279
Walkersville
MD 21793, USA
Ph +1-301-8983772
Fax +1-301-8985596

15-17 April 1996
Starch: Structure and Function
Venue: Cambridge, England, UK
Contact: Mrs MA Staff
Cavendish Laboratory
Madingley Road
Cambridge CB3 0HE, England, UK

21-23 April 1996
2nd International Conference on Clinical Chemiluminescence
Venue: Berlin, Germany
Contact: Dr Gudrun Lewin
Research Institute for Antioxidant Therapy Co
Chausseestr 119-120
10 115 Berlin, Germany

THE ASSOCIATION FOR WOMEN IN THE SCIENCES

SCIENCE-WOMEN AND OUR FUTURE 1996 CONFERENCE

29-31 May 1996, Wellington, New Zealand

FIRST NOTICE AND CALL FOR PAPERS

After the success of our Suffrage Year conference, W2(SC), we're planning to do it again. This time we're calling for speakers to bring us visions, actions and mechanisms to take us into the future.

Topics include:

- What woman are doing with their science
- The nature and structure of the scientific workplace
- Social responsibility, community participation and accessibility
- What is science - what will it be tomorrow
- Ethics in science

Send us your outline for 20 minute papers and 90 minute participatory workshops by 20 February 1996.

Come to debate and influence the future of science, to hear local and international speakers. Between sessions there will be plenty of time socialise, network and have FUN!!

For more information, or if you are not on our mailing list and would like to be, contact: Helen Hancox, 86 Daniell St, Newtown, Wellington 6002, New Zealand.
Ph: +64-4-3892578, Fax: +64-4-3892589,
Email: hancox@actrix.gen.nz

CONFERENCES & SEMINARS

19-22 May 1996

1996 International Symposium, Exhibit and Workshops on Preparative Chromatography, Ion Exchange, and Adsorption/Desorption Processess and Related Techniques

Veune: Georgetown University Conference Centre
Washington DC, USA

Contact: Janet Cunningham
Barr Enterprises
P O Box 279
Walkersville
MD 21793, USA
Ph +1-301-8983772
Fax +1-301-8985596

4-5 June 1996

4th New Zealand Symposium of Chemical and Biosensors

Venue: William Sutton Room
The Arts Centre of Christchurch
Christchurch, New Zealand

Contact: Wendy Collier
AgResearch Grasslands
Private Bag 11008
Palmerston North, New Zealand
Tel: +64-6-3568019
Fax: +64-6-3518032/8042
Email: collierw@agresearch.cri.nz

16-21 June 1996

HPLC'96: 20th International Symposium on High Performance Liquid Phase Separations and Related Techniques

Venue: Marriott, San Francisco, California

Contact: Janet Cunningham
Barr Enterprises
P O Box 279
Walkersville
MD 21793, USA
Ph +1-301-8983772
Fax +1-301-8985596

14-18 June 1996

1st Science Centre World Congress

Venue: Heureka, Vantaa, Finland

Contact: Ms Helena von Troil
Secretary General, Keureka
The Finnish Science Centre
P O Box 166, FIN-01301 Vantaa, Finland

7-12 July 1996

Organometallic Chemistry XVII

Venue: Brisbane, Australia

Contact: Eva Comino
Secretariat, International Conference on Organometallic Chemistry
Faculty of Science and Technology
Griffith University
Brisbane, QLD 4111, Australia
Ph +61-7-8757564
Fax +61-7-8755369

9-11 July 1996

Chromatography '96 Separation Sciences Conference and Exhibition

Venue: Rose Hill Gardens, Sydney, Australia

Contact: Secretariat
Fax +61-2-7937139

14-19 July 1996

RACI/SETAC/ASE International Conference on Environmental Chemistry and Toxicology

Venue: Sydney, NSW, Australia

Contact: Dr Graeme Batley
CSIRO Centre for Advanced Analytical Chemistry
PMB 7, Menai
NSW 2234, Australia
Ph +61-2-7106830
Fax +61-2-7106837

14-19 July 1996

14th International Conference on Chemical Education (14ICCE)

Venue: Brisbane, Queensland, Australia

Contact: Sally Brown
Conference Secretariat
14th ICCE
Continuing Professional Education
The University of Queensland
Brisbane, QLD 4072, Australia
Ph +61-7-3656360
Fax +61-7-3657099
Email:chemed96@ceu.uq.oz.au

29 July - 2 August 1996

Recent Advances in Polymer Synthesis

Venue: University of York, England, UK

Contact: Professor P Hodge
Department of Chemistry
University of Manchester
Oxford Rd, Manchester
M13 9PL, England, UK
Fax +44-1612754598
Email: philip.hodge@man.ac.uk

4-9 August 1996

IUPAC MACRO '96

Venue: Seoul, Korea

Contact: Dr Kwang Ung Kim
Secretariat IUPAC MACRO SEOUL '96
Division of Polymers, KIOST
P O Box 131, Cheongryang
Seoul 130-650, Korea
Fax +1582-2-9576105
Email: iupac@kistmail.kist.re.kr

1-4 September 1996

Environmental Biotechnology, An International Conference

Venue: Massey University
Palmerston North, New Zealand

Contact: Conference Secretary
Environmental Biotechnology Conference

Process & Environmental Technology Dept
Massey University
Palmerston North, New Zealand
Ph +64-6-3505351
Fax +64-6-3505654
Email: g.f.withers@massey.ac.nz

8-11 October 1996
AUSPLAS '96 (Australian Plastics Conference)
Venue: Melbourne Exhibition Centre
Melbourne, Australia
Contact: John Kelly
Exhibition Management Pty Ltd
Melbourne, Australia
Ph +61-3-96464044
Fax +61-3-96461828

9-11 October 1996
Anticancer Targets and Strategies for the 21st Century
Venue: Castres, France
Contact: Marian Cabailh
Conference Secretariat, CRPF
17 Avenue Jean Moulin
81106 Castres Cedex, France
Ph +33-63-714368
Fax +33-63-714299

22-25 October 1996
19th International Federation of Societies of Cosmetic Chemists Congress
Venue: Darling Harbour, Sydney, Australia
Contact: Secretariat
P O Box 249 Kingsgrove
New South Wales 2208, Australia
Fax +61-2-5543228
or Peter Strasser
Ph +61-3-93875371

25-29 November 1996
13th International Corrosion Congress
Venue: Carlton Radisson Hotel, Melbourne
Contact: Conference Secretariat
P O Box 5142, Clayton
Victoria 3168, Australia
Ph +61-3-95440066
Fax +61-3-95435905

10-14 December 1996
Fifth Eurasia Conference on Chemical Sciences
Venue: Zhongshan (Sun Yatsen) University
Guangzhou (Canton), China
Contact: Professor Liang-Nian Ji
General Secretary, EuAsC_2S-1996
Biotechnology Research Centre
Zhongshan (Sun Yatsen) University
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Private Bag 92019, Auckland, New Zealand
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CALL FOR ABSTRACTS

Contributed papers are expected in the form of either oral or poster presentations which will carry equivalent scientific status in the program and be published equally. Scientists wishing to present a paper are invited to return an abstract of no more than one page by May 1, 1996. The authors should indicate their preference as to the presentation mode (oral or poster). The abstract should be camera ready and typewritten 1½ spaced in white 21 x 29.7 cm (A4) paper with good quality black ribbon. A margin of 3 cm should be left above, below and on either side of the text. The name of speaker is to be underlined. The IAB/IOC will select a number of oral presentations from submitted abstracts at the closing date.

SECOND CIRCULAR

The second circular will be destributed around January 15, 1996, in which detailed information and registration forms will be included.

LANGUAGE

The official language of the conference will be English.

December 1996
NZIC Conference 1996
Venue: University of Otago, Dunedin, New Zealand
Contact: Dr R M Carr
Chemistry Department
University of Otago
P O Box 56
Dunedin, New Zealand
Ph +64-3-4797932
Fax +64-3-4797906
Email:chemmail@otago.ac.nz

3-7 February 1997
22nd Australasian Polymer Symposium
Venue: Auckland, New Zealand
Contact: Mr N R Edmonds
Faculty of Science and Engineering
Auckland Institute of Technology
Private Bag GPO, Auckland, New Zealand
Ph +64-9-3079999 ext: 8181
Fax +64-9-3079973

13-17 July 1998
MACRO '98 - 37th IUPAC International Symposium on Macromolecules
Venue: Gold Coast, Queensland, Australia
Contact: Department of Chemistry
University of Queensland
Queensland 4072, Australia
Ph +61-7-3653511
Fax +61-7-3653628

* * * * *

INTERNATIONAL NEWS

ICI AUSTRALIA INVESTS IN TECHNOLOGY FOR THE FUTURE BY ACQUIRING A MAJORITY POSITION IN GBC

ICI Australia has announced that it has now acquired a majority position in GBC Scientific Equipment. ICI made its initial investment in GBC in 1985. GBC designs and manufactures high quality scientific instruments which it exports to over 70 countries. Its current products include atomic absorption, UV-Visible and inductively coupled plasma spectrometers plus a complete range of HPLC equipment. Founder and Managing Director, Ron Grey, has stated that GBC will continue as before, with its policies of worldwide customer focus and high quality design and manufacture. ICI Australia financial controller, John Beecroft said, "ICI Australia's heritage is in technology and GBC offers exciting opportunities to take us into the 21st century. GBC has cutting edge technology, strong worldwide distribution and a reputation for performance and quality. Demand for GBC's products, particularly for environmental analysis in the water, food and pharmaceuticals industries, has grown significantly as community and regulatory expectations continue to increase," said Mr Beecroft. "With ICI as majority shareholder we expect GBC will continue its rapid growth and become an international leader in analytical instrumentation".

PERKIN-ELMER'S ENVIRONMENTAL ACHIEVEMENTS AND RESULTS

Perkin-Elmer has been awarded the 1995 Corporate Environment Excellence Award sponsored by the National Association for Environmental Management. Among the achievements and results recognised by the National Association for Environmental Management are:-

- Rain forest reclamation - Perkin-Elmer has reclaimed and replanted thousands of acres of depleted Belize rain forests by donating an acre of land for each analytical instrument sold from 1992-1995.
- Package return - This employee initiated program has generated overall domestic return rates of packaging in excess of 27%. This translates to a diversion of more than 62 tons of cardboard and foam fill from the waste stream. The program has improved the environment and saved over $95,000.
- Plain paper fax and double-sided copiers - The replacement of 76 thermal paper fax machines with plain paper fax machines, and the use of 48 double-sided copying machines has resulted in white office paper savings in excess of 30,000 lbs annually.
- Water conservation - Since 1990, Perkin-Elmer has been able to reduce fresh water usage by 70%.
- VOC reductions - Perkin-Elmer has almost completely phased out the use of solvent-based paints, changing to more environmentally-friendly water-based products. This resulted in reductions of VOC emissions in excess of 50%.
- Energy reductions - An aggressive energy conservation and management program has resulted in energy usage being down by 18%.
- Hazardous waste reductions - Perkin-Elmer has successfully achieved a reduction of hazardous wastes generated in Connecticut manufacturing operations by 45% .
- Recycling - This award-winning program has achieved an overall recycling rate in excess of 64%. The company is also purchasing over 33% of their white paper as recycled stock.

LETTERS TO THE EDITOR

150 Dyers Pass Road
Christchurch 2

6 October 1995

The Editor
Chemistry in New Zealand

Dear Editor

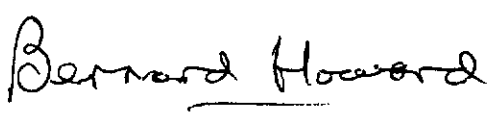
The September issue of Chemistry in New Zealand arrived this morning, and I have just read the interesting article "A Remarkable Ex-Patriot", about Professor Bill Fyfe, F.R.S., D.Sc (Hon., Otago).

Though the text of Dr Carr's article was full of praise for this eminent chemist, the shipshod misuse of English in the headline offers him a grave, and no doubt unintended insult, please note:

Ex-patriot: one who was once patriotic, that is so no longer, i.e. a traitor.

Expatriate: one born or brought up in a country, that is now living and working elsewhere.

Yours sincerely



B H Howard, FNZIC
Emeritus Professor, Lincoln University
(Expatriate Englishman)

Thank you to Professor Howard for pointing out this error which slipped past the author, myself and the Editorial Board - Ed.

Department of Chemistry
University of Canterbury
Private Bag 4800
Christchurch

19 October 1995

The Editor
Chemistry in New Zealand

Dear Editor

Re: Election of President

The history of the New Zealand Institute of Chemistry over the years reflects in large measure the quality of the President and Council. There have been periods when the Institute has thrived. The success of the Institute can reflect the quality of decisions made some years previously.

Without prejudice to present incumbents, I think it is time we instituted a procedure which maximised the chance of having the most talented person at any time as President.

This could be done by moving away from rotating the Presidency through the branches to a system where we have nominations for the Vice President and President with the membership voting. A brief statement on each candidate could be circulated with the Journal, along with the voting papers.

I urge discussion of this matter through the Journal.

Yours sincerely

James M Coxon
Professor of Chemistry

FROM THE PRESIDENT ...
WHAT'S IN IT FOR ME?
- A CHALLENGE AND A COINCIDENCE

As the incoming President I should first of all like to record my appreciation of the efforts of my predecessor Professor Bill Denny. That may sound like the banal pleasantries normally exchanged at change of incumbent. I assure you that they are not. Professor Denny in his term of office has made a significant contribution to the wellbeing and future of our Institute. He has produced a strategic plan, by consultation with the membership, whereby the membership can have its say in the future direction of the Institute. It is now my responsibility to continue Professor Denny's initiatives. I hope I am worthy of the task.

To use the hackneyed euphemism, often used by consultants, "let us take a step back". The responses received by Professor Denny included the question,

"What's in it for me?".

What did membership of the Institute offer a potential applicant or for that matter an existing member? It struck me that this is where I came in.

I came to New Zealand with my wife Linda and sons Shon and Michael in late May of 1984 to take up the position of Station Chemist at Huntly Power Station in the Waikato. Why Huntly? Why New Zealand? That is a tale for another time and another place. Suffice to say that I knew no-one in New Zealand other than my immediate manager at Huntly.

I soon realised that to succeed in my new position I had to get to know the scientific fraternity, my peers, and quickly. I had to network. I had been associated with the Royal Society of Chemistry since 1961 in some grade or other. It was only natural that I join the NZIC. I will not forget my 'professional interview' in a hurry. Three august members of the Institute from Waikato University.

To speed up the immersion process I attended the first available Annual Conference, Christchurch, '85 as I recall. The content of the papers bore little relevance to power station chemistry. The social intercourse and the opportunity to meet others, more than made up for it.

The next year the conference was in Dunedin. I asked my manager for permission for one of my staff to attend. It was refused. Refused on the grounds that the conference papers contained nothing of consequence to power stations and that I was the only one who needed to become known in the scientific fraternity.

My manager laid down two challenges. I could attend conference again if I gave a paper or if I 'changed' the Institute. The first challenge was easy. I gave a paper at the Auckland Conference of '87 entitled, 'The Chemist in a Thermal Power Station'. The second challenge, somewhat more prophetic.

Three years as Branch Chairman (Waikato), some seven years as Branch Council Delegate, four years as Vice-President of the Institute coupled with the Herculean efforts of Professor Denny see me potentially in a position to change the Institute. That challenge laid down by my manager in 1986 - was it prophetic? It certainly is a *coincidence!*

I accept that second challenge. Through consultation Professor Denny has laid out the path. By the time this article is published the strategic plan laid before the Council in August 1995 will have been seen by the membership. An audit of the functions of the Secretariat will have been completed and presented to the November 1995 Standing Committee meeting. We should be well on track to place before the February 1996 Council meeting the facts and options to give to the members to shape the future of the NZIC. Whether it be stand-alone, part of the Royal Society or whatever.

Digressing again. What has the institute to offer me? I have already outlined how it afforded an ideal vehicle for networking. Eleven years later it still has that potential. It also gave me the opportunity to attend branch meetings and hear presentations on aspects of chemistry that I would otherwise never have heard being employed in a very special branch of applied chemistry as I am. Membership of a branch gave the opportunity for comradeship. I will be forever grateful to the Institute for introducing me to some fine people. For introducing me to Don Llywellyn who has been mentor and valued friend these last 10 years.

Membership of the Institute should not be seen as one way only. It's too easy to say *"What's in it for me?"* The member might ask himself or herself, "What can I put back into Chemistry, for the benefit of others?". I think we have a responsibility to do that.

To summarise; *What's in it for me?* Membership of the NZIC; has given me a vehicle to network in, the opportunity to attend branch meetings, comradeship and an opportunity to contribute. Finally it has given me a challenge, to continue the work of Professor Denny and reshape the Institute.

Nath Pritchard
President, NZIC

NZIC NEWS

WAIKATO BRANCH NEWS

The Waikato Branch recently ran an Analytical Chemistry Competition for senior school students, involving the analysis of a sample of $BaCO_3$ for both barium and carbonate content by gravimetric and volumetric procedures. First were Joseph Seebeck, James Royson and James Curtis of Cambridge High School, second were Selena Austin and Nicola Stringer from Fairfield College, Hamilton, and third were Shane Cox and Francis Wu from Tauranga Boys College. Prizes for the competition were generously provided by R. J. Hill Laboratories, Hamilton. The Waikato Branch also gave prizes for the best exhibits on a chemical theme at the Waikato Science Fair, held at the beginning of August. The senior prize was awarded to Tania Lee of Hamilton Girls High School for her exhibit on "Soil pH", and the junior prize was awarded to Nikki Crosby, Jessica Cameron and Jacqui McKellar of Waikato Diocesan School, for their exhibit on "Water on Hair". Congratulations to all prizewinners.

As part of the year's activities, the Waikato Branch ran a trip to the Hamilton Pollution Control Centre in September. The final visit for the year was to the Forest Research Institute in Rotorua, on Wednesday 11 October.

Dr Chris Miles (AgResearch) and DPhil student Lucy Meagher recently attended the Molecular Design Down Under Conference in Cairns. DPhil student and AgResearcher Sarah Munday-Finch is currently studying the biological effects of tremorgenic mycotoxins at Imperial College, London. Sarah also had the distinction of representing New Zealand earlier this year at table tennis in Singapore, and then at the World Championships in China. Dr Bill Henderson has been awarded a travel grant from the Corday-Morgan Memorial Fund of the Royal Society of Chemistry, and will spend the summer giving research seminars at Universities in the UK, Singapore and Australia, in addition to carrying out collaborative research at the University of New South Wales. Professor Ken Mackay has recently returned from a trip to the UK, while the Chemistry department has undergone another expansion with the arrival of Dr Michael Mucalo. A new 400 MHz NMR spectrometer has recently been ordered by the Department.

The Food and Biological Chemistry laboratory at HortResearch, Ruakura has gained full Telarc accreditation for its commercial services in pesticide residues, environmental contaminants and mycotoxins, as well as a general approval for instrumental analyses (GC, HPLC, GC-MS). Science Manager Dr Patrick Holland says that the laboratory has achieved a high standard of QA/QC both through the Telarc accreditation and auditing process and through its participation in international inter-laboratory performance assessments in food and environmental analysis. Colin Malcolm has been appointed Laboratory Manager and Don McNaughton QA Manager.

Bill Henderson

MANAWATU BRANCH NEWS

Over forty people gathered on 4 October 1995 to hear RSC visiting lecturer Ted Baker talk on "Protein Folding, Metal Binding and Function: Research at the Chemistry-Biology Interface". Ted did his PhD at Auckland and post-doctoral work with Dorothy Hodgkin at Oxford. He returned to Massey University in 1971 and was made a fellow of the NZIC in 1984 and a fellow of the Royal Society. A stalwart member of the Manawatu Branch, Ted said he was delighted that the Royal Society, with assistance from NZIC and RACI, gave him the opportunity to speak to chemists throughout New Zealand and Australia.

In a field now called "structural biology", Ted said that Massey's Chemistry and Biochemistry Department was uniquely placed to encourage joint research between chemists and biologists. He described the group effort that, starting with actinidin and then to azurin and lactoferrin, was successul in discovering the confirmation of the bound and unbound proteins. Everybody enjoyed the lecture and many stayed for discussions over coffee.

Well, the end of the year is nearly upon us and people are leaving or returning to start new positions in the new year.

Derek Knighton has left the Dairy Research Institute to work at Tatua Cooperative Dairy Company.

Raewyn Town, lecturer in Analytical Chemistry has left Massey University for Queen's University, Belfast.

Professor Pat Sullivan has been appointed Head of Biochemistry at Massey University.

David Officer is leaving the Chemistry and Biochemistry Department for a sabbatical at Wollongong.

J A Schwartz, University of Orange Free State at Bloemfontein is coming to Massey University on a six month sabbatical.

Benny Theng, Landcare Research New Zealand, was overseas from 6 to 29 September 1995 visiting Germany and Thailand. Benny was granted a short-term (15 days) "overseas specialist" award by the Alexander von Humboldt Foundation in Germany to assist with living expenses on his visit. While in Germany Benny inspected a pyrolysis-GC-mass spectrometry facility, which is a relatively new technique able to be used in the characterisation of soil organic matter. He gave a seminar on research activities at Landcare, and on soil organic matter. On his return journey, Benny gave an invited seminar on "Soils with Variable Charge" at the Department of Land Development at Bangkhen (Bangkok).

Kevin Tate, Landcare Research New Zealand, was also overseas from 5 September to 5 October 1995, visiting IACR (Integrated Approach to Crop Research) - Rothamsted in the UK as part of the British Council Higher Education Link Scheme. While there, Kevin took the opportuinty to make methane oxidation measurements on selected New Zealand soils, and gave an invited seminar on New Zealand's net reduction policy for reducing atmospheric carbon dioxide levels. Kevin also attended, and presented a paper at, an international conference "Driven by Nature: (plant) litter quality and decomposition", held at Wye College, University of London; in addition, he was an invited participant at the Global Change and Terrestrial Ecosystems (GCTE) workshop on the below-ground effects of elevated carbon dioxide, held at Oxford University.

Our next meeting is on 20 November. Professor Antony Deeming of the Department of Chemistry, University College, London will talk on "Metal Clusters with Aromatic and Heteroaromatic Ligands".

The Manawatu Branch AGM will be held on 6 December 1995 at Wharearata. Following the AGM and dinner, the time has come, the Chairman says, to speak of many things - Of cows and genes and 'active' foods and aromatic rings. See you there for a fun meeting.

Grant Boston, Branch Secretary

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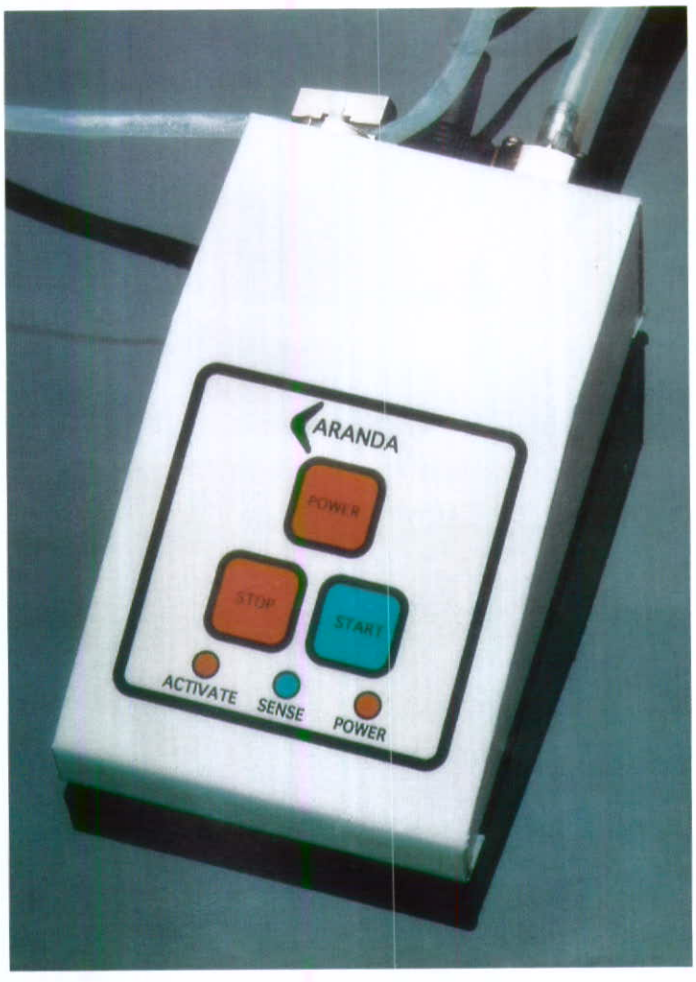

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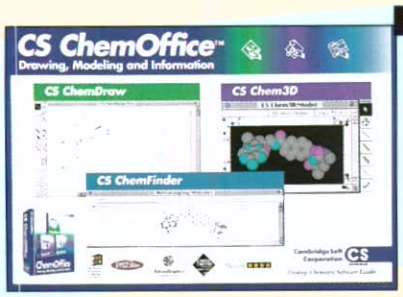

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