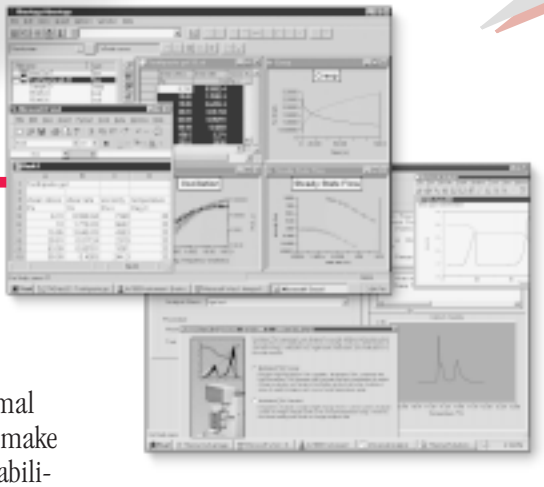
TA Instruments
THE TA HOTLINE

NEW! AR 500 RHEOMETER

TA Instruments proudly announces the introduction of the AR 500 Rheometer. This new instrument has been designed to meet the growing demand for a rheometer that can provide high performance, ease-of-use, and an economical price. The AR 500 is capable of performing both controlled stress and controlled rate measurements. It is applicable to a wide range of materials including liquids, pastes, gels, and soft solids such as foods, pharmaceuticals, polymers, inks, and consumer products.

The AR 500 offers a broad torque range, multiple measurement modes, precise and rapid control of temperature (5 available temperature control systems), direct quantification of normal force, inertia correction, automatic gap set, and a wide variety of sample geometries. Teamed with new, easy-to-use Rheology Advantage software, the AR 500 enables even inexperienced rheologists to characterize their samples successfully.

See page 4 for news about torsional analysis of solids for the AR1000 & 500 Rheometer!



INTRODUCING Advantage Software

New Advantage software for thermal analysis and rheology is designed to make it easier than ever to expand the capabilities of your lab by integrating both of these powerful materials characterization techniques.

Advantage software provides unmatched capabilities and ease-of-use with extensive on-line & context sensitive help, versatile real-time plot, save session, automated analysis, automated time-temperature superposition, the latest theoretical models and an easy-to-learn intuitive layout that is customizable to match individual needs and preferences.

Take advantage of wizards, templates, autoqueuing, and Navigator scripts to automate all aspects of sample testing from experiment design and sample identification to data analysis and hardcopy generation. This software's powerful new features will revolutionize the way you work in your lab.

1999 VOLUME 1

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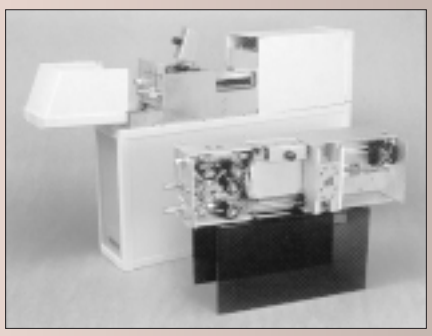
TA Instruments
Thermal Analysis & Rheology
A Subsidiary of Waters Corporation

Evolved Gas Collector (EGC)

At this year's PittCon conference TA Instruments introduced our new Evolved Gas Collector (EGC) system, which permits the collection of volatiles and decomposition products from thermogravimetric analysis (TGA) and Micro-TA experiments.

Later the collected gases can be thermally desorbed onto a Gas Chromatography – Mass Spectrometer (GC-MS) system for separation and identification. The GC-MS system can be located in another lab, building or country. The stainless steel collection tubes are specifically designed and optimized for the collection of gases from TGA and Micro-TA experiments.



For TGA users, the system is complementary to the direct connection of an Mass Spectrometer (MS) or FTIR to the TGA furnace. For Micro-TA users, the system adds another dimension to materials characterization. Collection tubes are available for use with the TGA 2050 and TGA 2950, fitted with the Evolved Gas Analysis (EGA) furnace, and for the Micro-TA 2990.

For additional information, contact your TA Instruments representative or ask for brochure TA-255.

TA Instruments Wins Its Decision in MDSC® Patent Infringement Action Against the Perkin-Elmer Corporation

We continue to receive a lot of questions about the status of the legal and patent actions taken by TA Instruments, Inc. to defend it's patented temperature-modulated DSC (MDSC®) technology. Although the legal processes could continue for a year or two, the current status is quite clear:

1. On December 7, 1998, the US District Court for the District of Delaware ruled that, as a matter of law, the Perkin-Elmer Corporation was liable for infringing seven claims asserted at trial by TA Instruments, Inc. with respect to its US patent numbers 5,224,775; 5,346,306 and 5,439,291.

2. On March 5, 1999, the US District Court for the District of Delaware issued an Order enjoining the Perkin-Elmer Corporation from making, using, offering for sale, selling or distributing its Dynamic Differential Scanning Calorimetry (DDSC) accessory or any calorimeters that incorporate a DDSC accessory.

3. Outside the United States, patents relating to TA Instruments, Inc. modulated-temperature technology have been issued in Canada and Europe and are pending in Japan.

TA Instruments intends to continue its strategy of market leadership in the development of new products and innovative technologies. Consistent with that goal is our resolve to protect those investments by vigorous defense of patented and proprietary technology.

Micro-Thermal Analysis Award

Since its introduction at the 1998 PittCon, this new technique has figured prominently in assorted articles and received several awards. At introduction, the µTA 2990 received the PittCon Gold award for best new product in 1998.

In the fall of 1998 the µTA 2990 won the R&D100 award for technical achievement. The R&D 100 Awards recognize the 100 most technologically significant new products annually. Selected products demonstrate improvements which are attributed to significant breakthroughs in technology. This means the products should exhibit multiple levels of improvement over existing technology.

Most recently the µTA 2990 received a Millennium Award from the British Government. Dr. Trevor Lever accepted the award during the Confederation of British Industry Conference (CBI) in Birmingham, England in November.

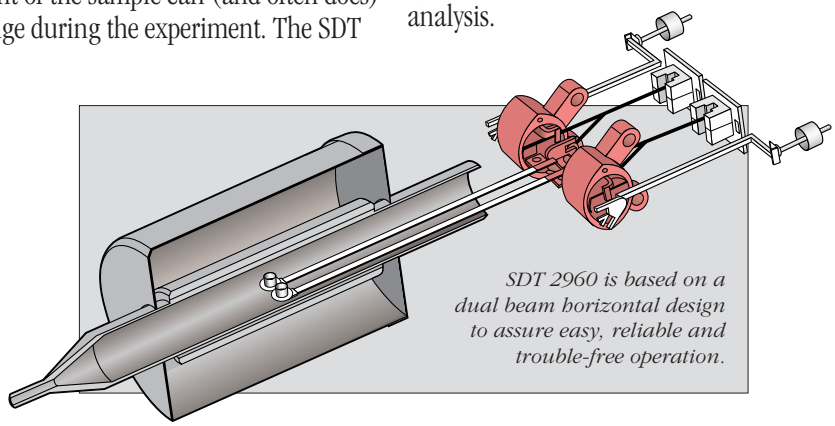
Gray Slough and John Furry of the Micro-Thermal Analysis development team

TA Instruments is committed to development of versatile solutions to solve tough materials characterization problems.

New SDT 2960 Simultaneous DSC-TGA

The TA Instruments SDT 2960 combines two thermal analysis measurements in a single instrument, thus providing easier interpretation of results and improved productivity at an attractive price. The STD 2960's exceptional TGA & DSC sensitivity and stable baseline, over a wide temperature range result in unmatched performance.

A unique feature of the TA Instruments SDT 2960 is the ability to calculate normalized DSC data based on the "actual" weight of the sample. Most instruments simply use the initial sample weight for this calculation. This practice can yield misleading results since the weight of the sample can (and often does) change during the experiment. The SDT 2960 provides the user with the ability to specify how the DSC signals are to be normalized, providing more accurate, meaningful, and repeatable results.



SDT 2960 is based on a dual beam horizontal design to assure easy, reliable and trouble-free operation.

Further improvements over competitive instruments include mechanical and electronic automation features that will appeal to novices as well as experienced thermal analysts. Convenient and easy sample handling minimizes the possibility of damaging the balance mechanism or thermocouples. The furnace assembly operates via a motor-driven screw for precise alignment and automatic opening and closing. The balance is based on a proven horizontal design, which assures excellent sample/atmosphere interaction while minimizing chimney and sample weight effects. In addition, low volume inside the balance and sample areas permits rapid atmosphere changeover. Furthermore, the overall atmospheric flow dynamics make the SDT 2960 ideal for coupling to a mass spectrometer or FTIR for evolved gas analysis.

TA Instruments proprietary electronics and furnace design assure precise temperature control for stable baselines and optimum DSC performance. Proprietary software corrects for beam growth effects at elevated temperatures, even under changing weight conditions. Five-point temperature calibration capability optimizes the accuracy of temperature measurements.

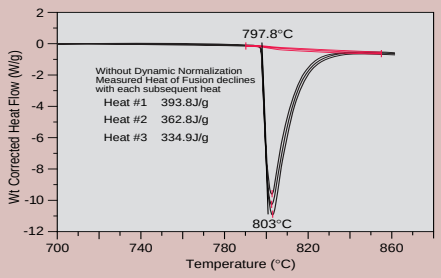
The SDT 2960 is one of TA Instruments' many thermal analysis and rheology techniques that complement each other. These modules, along with TA Instruments controllers and software, constitute the most complete, versatile, and cost effective systems available for characterizing materials.

Improved results with Dynamic Normalization

DSC data is routinely "normalized" by dividing the heat flow signal by the sample weight. This normalization provides the ability to quantify heats of fusion, reaction, etc. in units of energy per unit mass so that samples of different sizes can be easily compared. The sample weight used in this calculation is typically the initial weight of the sample. However, many samples exhibit weight loss prior to the transition of interest, so use of the initial weight could induce substantial error.

Figure 1

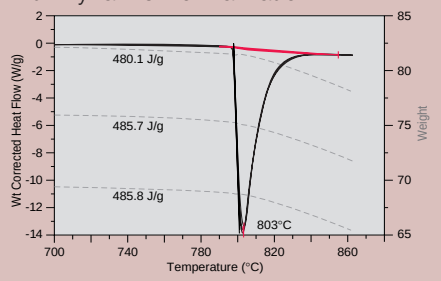
Sodium Chloride
Simultaneous DSC-TGA without Dynamic Normalization



Using its unique Dynamic Normalization™ algorithm, the SDT enables the user to specify how the DSC signals are to be normalized. Figure 1 shows DSC data from 3 sequential heats of Sodium Chloride using standard normalization. It would seem that the magnitude of the melting endotherm decreases with each heat. However, the TGA data shown in figure 2 shows that there is a weight loss associated with the volatilization of NaCl that occurs upon melting. The result is that in each sequential heat, there is less sample weight.

Figure 2

Sodium Chloride
Simultaneous DSC-TGA
with Dynamic Normalization



The DSC data shown in figure 2 illustrates the benefit of Dynamic Normalization. Here the sample weight for transition normalization was taken as the weight at the beginning of each transition, and indeed all three heats show reproducible heats of fusion.

DMA 2980

Submersible Clamps

Don't turn your Lab Upside Down to run Samples in Solution!

TA Instruments new Submersion Clamps for the DMA 2980 provide the ability to test viscoelastic properties of materials in solution. The clamps are available as optional accessories for the DMA 2980 Dynamic Mechanical Analyzer and can be added to existing instruments.

Many materials including bio-engineered polymers, automotive polymers, and foods are used "in solution." Testing these materials in conditions that simulate the real world provides more meaningful results that better correlate with end use performance. The clamps are easily and conveniently mounted to the instrument, providing in-solution testing without cumbersome instrument manipulations.

Large Volume DSC pans

DSC evaluation of foods and biological materials usually requires larger samples because those materials are dilute solutions and the transitions of interest are not highly energetic. Hence, new large volume stainless steel pans were developed to meet this need.

These consist of a pan, a lid, and an o-ring seal. The pans are sealed using a die set which fits the standard DSC sample press. The pan specifications include: internal volume 100mL; temperature range -100 to 250°C; internal pressure <25 atm.

Pans are available as an accessory kit, PN 900825.901, which includes the die set, pans, lids, o-rings and other necessary items.

Torsional analysis of Solids

TA Instruments recently introduced the capability to analyze solids in torsion. The new Environmental Test Chamber (ETC) is designed for use with AR 1000 and AR 500 rheometers to accommodate standard sample sizes and test methods including ASTM D4065. The ETC provides the ability to analyze solid samples in torsion with excellent temperature control over a wide temperature range (-150 to 400°C). Additionally, parallel plate and cone & plate geometries can be used to characterize liquids, gels, pastes, and soft solids over the same temperature range. This allows the rheologist to measure samples as diverse as steel and water, and the polymer chemist to characterize his materials over their complete viscoelastic spectrum.

Principle of Operation

The ETC is a clam shell design which combines resistive elements for radiant heating, and small jets of liquid nitrogen for cooling and subambient temperature operation. The advanced chamber design provides rapid cooling while minimizing nitrogen usage and frosting around the measuring system shaft, even during long experiments at low temperatures.

Solids in Torsion

Traditionally, controlled strain rheometers have been used for measuring solids in torsion. However, controlled strain instruments suffer from transducer compliance with high stiffness measurements (e.g., thermoplastics below Tg in a temperature ramp or at high frequencies), which results in the actual strain being less than requested. Also, because of the limited torque range of the transducer, controlled strain rheometers often must increase the applied strain with low stiffness measurements (e.g., as the material softens in a temperature ramp, or at low frequencies) to stay within the operating range of the instrument. In effect, there is only a very limited range where the strain is actually constant.

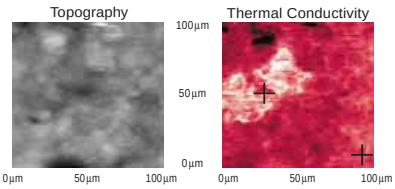
The AR1000, with its superior torque range (10^{-4} to 10^{2} mNm) and high strain resolution, together with the ETC and Torsion Clamps, does not suffer from these limitations and allows both controlled stress and controlled strain operation for optimum sample measurement. To prevent sample buckling, and to ensure accurate results, torsion measurements on solids must be made with the sample in tension. The torsion clamps for the AR1000 accommodate both rectangular and cylindrical samples in a wide range of thicknesses (diameters), without the need for mounting shims. The clamps are self-aligning with the lower clamp assembly held stationary, while the upper clamp is attached to the free-floating, air-bearing drive shaft. Once mounted, the operator can set an initial tensioning force, as well as a tension adjustment range and maximum allowable length change, to automatically accommodate material stiffness variations with temperature.

Available as an upgrade to existing AR1000 users

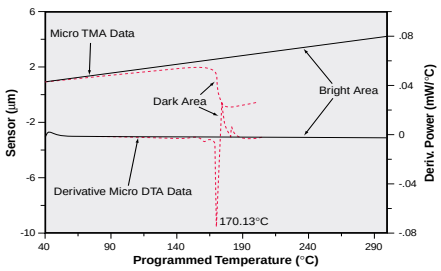
The Environmental chamber can be added to existing AR1000/500 rheometers with normal force capability, running under new Rheology Advantage Software. Contact your local TA Instruments representative for additional information on this exciting new capability.

Pharmaceutical Applications of µTA 2990

Micro thermal analysis (µTA) uses a thermal probe within an atomic force microscope (AFM) to collect images related to sample topography and thermal conductivity. Points can then be selected for examination by local thermal analysis (LTA). The probe is positioned at the selected points and the temperature is ramped at very high ramp rates (5-25°C/s). Signals analogous to TMA and DTA are collected simultaneously. A modulated temperature signal can be superimposed upon the base ramp to increase sensitivity.



A pharmaceutical tablet is easily mounted in the µTA 2990 straight from the package with no special preparation. This tablet contains two chemical compounds: paracetamol and a neutral excipient. The above images were obtained simultaneously and display the topography and relative thermal conductivity of a 100µm^2 area. While the topography does not indicate the presence of multiple components, the thermal image does show



contrast due to an area of relatively high thermal conductivity on the left hand side.

With the tip positioned on the region of high thermal conductivity, no transition is observed up to 300°C. Data collected with the probe positioned in the surrounding dark region, however, clearly shows a transition in both the DTA (melting event) and TMA (a softening event) signals at ~173°C. Values for paracetamol by standard DSC list a melting temperature of ~170°C, thus identifying the dark region in the thermal image as paracetamol and the bright area as the excipient.

New Applications Literature

NOW Available for download from the TA Instruments Website www.tainst.com

Summarized below are titles for recent additions to our applications literature list. Contact your local TA Instruments Representative to obtain a free copy of these items or purchase the entire library on CD-Rom (version 2.5 is now available).

Thermal Analysis

Micro-Thermal Analysis: a new form of analytical microscopy *[Ref. No. TA-247]*
Recent developments in the application of thermal analysis to polyolefins *[Ref. No. TA-248]*
Using Micro-Thermal Analysis to characterize the nanoworld *[Ref. No. TA-249]*
Determining volatile organic carbon by DSC *[Ref. No. TA-250]*
Obtaining kinetic parameters by modulated TGA *[Ref. No. TA-251]*
Recent progress in Micro-Thermal Analysis *[Ref. No. TA-252]*
Overlapping coal decomposition reaction *[Ref. No. TA-253]*
Characterization of PET by DSC and MDSC® *[Ref. No. TS-35]*
Characterization of polymer film by TMA penetration *[Ref. No. TS-36]*
Determination of curie point temperature by TGA *[Ref. No. TS-37]*
Characterization of polyurethane by MDSC *[Ref. No. TS-38]*
Characterization of polyurethane by TGA and Hi-Res TGA *[Ref. No. TS-39]*
Characterization of polyvinyl chloride (PVC) by DMA *[Ref. No. TS-40]*
Characterization of polyvinyl chloride (PVC) by MDSC *[Ref. No. TS-41]*
Subambient characterization of soft foam materials by DMA *[Ref. No. TS-42]*
Characterization of the glass transition temperature of lactose by MDSC *[Ref. No. TS-43]*
Characterization of semi-crystalline pharmaceutical compounds by MDSC *[Ref. No. TS-44]*
Characterization of the effect of water as a plasticizer on lactose by MDSC *[Ref. No. TS-45]*
Characterization of printed circuit board materials by DMA *[Ref. No. TS-46]*
Characterization of packaging films performance by DMA creep compliance *[Ref. No. TS-47]*
Characterization of packaging films performance by DMA storage modulus *[Ref. No. TS-48]*
Characterization of packaging films performance by DMA creep recovery *[Ref. No. TS-49]*
Characterization of a styrene pigment with MDSC® *[Ref. No. TS-50]*
Thermal imaging with Micro-Thermal Analysis *[Ref. No. TS-51]*
Local Thermal Analysis of Polymer film using µTA *[Ref. No. TS-52]*
Analysis of polymer melt using Micro-Thermal Analysis *[Ref. No. TS-53]*
The degree of cure of thermosetting resins using DSC *[Ref. No. TS-54]*
Using online signal display for optimizing conditions with DMA *[Ref. No. TS-55]*
Crystallinity variation of a polymer coated metal foil detected by µTA *[Ref. No. TS-56]*
Pharmaceutical application of Micro-Thermal Analysis *[Ref. No. TS-57]*
Polymer blend study by Micro-Thermal Analysis *[Ref. No. TS-58]*
Detection of high energy particles by Micro-Thermal Analysis *[Ref. No. TS-59]*
Characterization protein denaturation by DSC using high volume sample pans *[Ref. No. TS-60]*
Determination of linear viscoelastic region of a polymer using strain sweep on the DMA 2980 *[Ref. No. TS-61]*
Effect of frequency on the modulus and glass transition temperature of PET *[Ref. No. TS-62]*
Determining the optimum sample size for testing film in the DMA 2980 *[Ref. No. TS-63]*
Measurement of the glass transition using DMA *[Ref. No. TS-64]*
Characterization of EPDM rubber by DSC and DMA *[Ref. No. TS-65]*
Characterization of epoxy reinforced glass by DSC and DMA *[Ref. No. TS-66]*
Characterization of an acrylic/melamine copolymer blend by DSC and DMA *[Ref. No. TS-67]*
Determination of Crystallinity of a common automotive thermoplastic *[Ref. No. TS-68]*
Characterization of a polyester resin/catalyst system by TGA, DSC and DMA *[Ref. No. TS-69]*
PTFE/PEEK carbon fiber blend analysis by DSC *[Ref. No. TS-70]*
Characterization of a PTFE/PEEK carbon fiber blend by TGA and Hi-Res™ TGA *[Ref. No. TS-71]*
Characterization of a polyurethane hot melt adhesives by DSC and DMA *[Ref. No. TS-72]*

Rheology

Controlled stress rheometry as a tool to measure grease structure and yield at various temperature *[Ref. No. RH-066]*
Yield stress studies on greases *[Ref. No. RH-067]*
Environmental Test Chamber (ETC) product bulletin *[Ref. No. RH-068]*
Concentric cylinders product bulletin *[Ref. No. RH-069]*
Extended Temperature Module product bulletin *[Ref. No. RH-070]*
AR 500 product bulletin *[Ref. No. RH-071]*

A Triple-Detector TREF Instrument for Polyolefin Research

This article is an abbreviated version of a paper by Wallace W. Yau and David Gillespie of the Chevron Chemical Company, LLC. For additional information, or a copy of the complete article, contact the author at: WWYA@chevron.com

Figure 1
Automated TREF Instrument
with Triple IR-LS-Viscosity Detectors (3D-TREF)

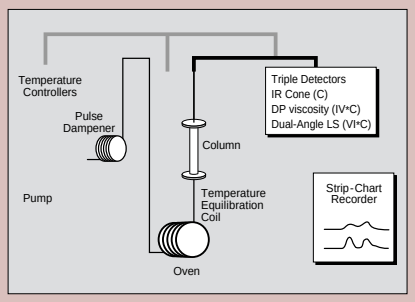
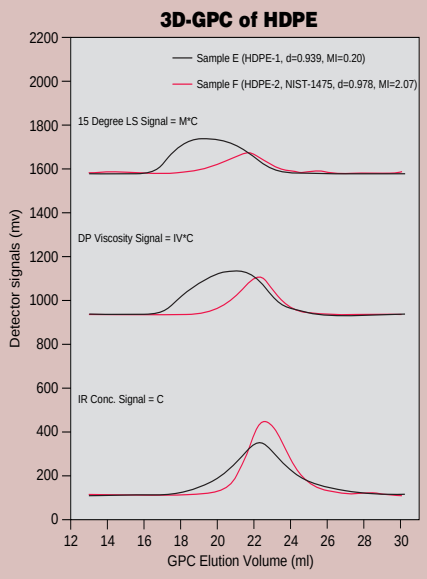
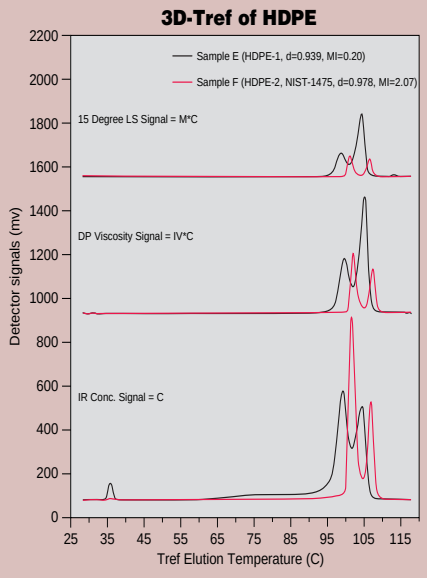


Figure 2
Triple-Detector GPC and
3D-Tref of Two HDPE Resins





Molecular weight and chain branching are the two most important molecular parameters of interest in the polyolefin research. Though all polyolefins are derived from simple carbon-carbon bonds, the end products cover a wide spectra of end-use properties ranging from coatings, lubricants, rubbers, films, bottles, cables, fibers, pipes, and so on. This wide functional diversity is made possible by controlling polymer molecular weight and branching.

High density polyethylene (HDPE) resins consist of linear polymer molecules with little or no branching. Low density polyethylene (LDPE) resins consist of polymer molecules containing long chain branching (LCB). Polymer LCB is an important factor for melt flow properties and product fabrication processing conditions. Polymer short chain branching (SCB) in linear low density polyethylene (LLDPE) is achieved through incorporation of α-olefin comonomer into the polyethylene backbone. SCB affects resin density and the sample's DSC curves. Differences in polymer SCB distribution have strong effects on polymer crystallinity, morphology, optics and tensile properties. Polymers made from metallocene catalyst (m-LLD) have narrower SCB distributions than those made from the Ziegler Natta process (ZN-LLD). Often, the terms SCB distribution, and copolymer (or chemical) composition distribution (CCD) are used interchangeably.

Being all carbons and hydrogens in makeup, polyolefins are a difficult polymer for chemical analysis. This makes GPC, gel permeation or size exclusion chromatography SEC[1], an important analytical technique for polyolefins. GPC separates polymers by size and, therefore, provides an indirect measure of the polymer molecular weight distribution (MWD). Since LCB adds to molecular weight more than to molecular size, adding a light scattering (LS) and a viscosity detector to GPC in the form of 3D-GPC or TriSEC[2] becomes a valuable tool to detect polymer LCB and the true MW of LDPE resins.

It should be noted however, GPC is not a sensitive tool to detect SCB. At the low comonomer levels commonly used in commercial LLDPE products, there are not enough molecular weight or size changes to make significant changes in GPC elution curves. A more sensitive technique for the detection of SCB, based on polymer solution crystallization process, has been made possible in the form of the Tref technique,[3] i.e., temperature rising elution fractionation. Tref relies on the crystallization and re-dissolution process to separate polymers having different degrees of branching. With the MW-sensitive detectors installed in a 3D-Tref instrument, one can determine both LCB and SCB distribution in one experiment.

The Automated 3D-TREF Instrument

Our triple-detector Tref instrument has been assembled using parts retrofitted into a Waters' 150C GPC system (see Figure 1). The Tref oven heater is externally controlled to provide the programmed cooling (from 145°C to 25°C) and heating (from 25°C to 145°C) cycles during a Tref experiment. In a Tref experiment, a sample solution is injected and held inside the Tref column during the cooling cycle to allow polymer molecules to crystallize and form a coating on the surface of the Tref packing particles. This is followed by the heating and elution cycle, during which the polymer molecules are re-melted and re-dissolved into the solvent flow stream. The solute molecules are detected by the IR-LS-Viscosity triple detectors as they emerge from the Tref column at different elution temperatures. Polymer molecules with higher SCB content elute from the column first at lower elution temperature.

Typical HDPE Results

TriSEC can more easily detect sample differences for broad MWD HDPE samples, as compared to the Tref technique (see Figure 3). However, the Tref analyses have proven useful in many cases where there is intentional copolymerization added for the

purpose of toughening HD film products. This is the case illustrated here for sample 1, which is a HDPE with a density value of 0.939, which is not a true homopolymer per se. The fact that the high melting "homopolymer fraction" takes the form of a split double peak is quite intriguing. Viewing the relative peak height of the LS and viscosity signals, one would have to conclude that the peak elution at the highest temperature has MW values at least a factor 2 or 3 higher than the peak occurring at the next highest elution temperature. One could speculate that these twin peaks might arise from the different catalyst sites with distinct MW preferences. If this is the case, it could give even more power to the 3D-Tref technique. It would mean that characteristics of individual sites in a heterogeneous system could be tracked and studied in detail as one varies reaction and catalyst conditions. However, a lot of work needs be done to make sure that this peak splitting is not an artifact caused by any yet unexplained events in the Tref process!

Typical LDPE Results

LDPE resins are perhaps the most interesting resins that can be seen in TriSEC and 3D-Tref curves (see Figure 3). Unlike the HD and LLD cases, the heights of the LS and the viscosity signals can actually follow an opposite trend under the LCB conditions. Higher degrees of LCB give larger LS peaks but relatively smaller viscosity peaks. This is true because, with LCB, there is more mass packed into a smaller volume. We note these detector behaviors for LDPE resins in both the TriSEC and the 3D-Tref curves. For these LD resins, the MW and polydispersity values from conventional broad HDPE calibration are very different from the "true" values determined from the LS results. From the 3D-Tref scan, there is one more observation that we can make. Note that the LD peaks in Tref are fairly narrow and they are highly downshifted in their Tref elution temperatures. These features are interesting evidence to the fact that these LDPE polymer molecules containing LCB actually have a high level of SCB incorporated within them. The SCB's are distributed fairly uniformly across the sample MWD.

Complementary Synergism with DSC

Figure 4 shows the Tref and DSC scans for a polymer blend sample made up with a 1:1 mixture of a LDPE resin and a HDPE standard (NIST 1484). One notices that the Tref elution temperature of the two peaks is similar to that seen in the DSC scan, except that the Tref temperatures are much lower. This downshift of the Tref elution temperature from DSC can be reasonably understood by examining the equation shown at the top of Figure 4. The additional requirement of the entropy of dissolution in the Tref case could be the major factor causing the temperature downshift of the Tref peaks.

It is interesting to compare the Tref and DSC peak height of the LD component with that of the HD component in Figure 4. We see that all these detector responses are showing us complementary information about this LDPE peak. The Tref-IR signal tells us the weight content of this component in the sample. The Tref-LS signal shows us that it is a very high molecular weight component, revealing the LCB nature of this component. The LCB character of this component is also reflected in the low heat of fusion feature of this peak seen in the DSC scan.

In many ways, the two techniques of Tref and DSC are somewhat related. But, in some ways, they can be used to our advantage to give us complementary information in understanding polymer structures. The 3D-Tref approach has the advantage of being able to give more quantitative assessment of the weight fraction distribution of polymer SCB and LCB. The advantage of DSC is its ability to study the sample thermal properties and the polymer memory effects of thermal and stress history in fabricated polymer products. Since DSC deals with the polymer solid and melt, it can be used to study polymer entanglement effects. Tref is a solution technique that characterizes the structural features of the individual isolated molecules.

References

1 Yau, W. W.; Kirkland, J. J.; and Bly, D. D., Modern Size Exclusion Liquid Chromatography; Wiley: New York, 1979.

2 Haney, M. A.; Gillespie, D; and Yau, W. W., Today's Chemist, 3 (11), 39 (1994).

3 Wild, L., Adv. Polym. Sci., 98, 1-47 (1990).

Figure 3

Triple-Detector GPC and 3D-Tref of Two LDPE Resins

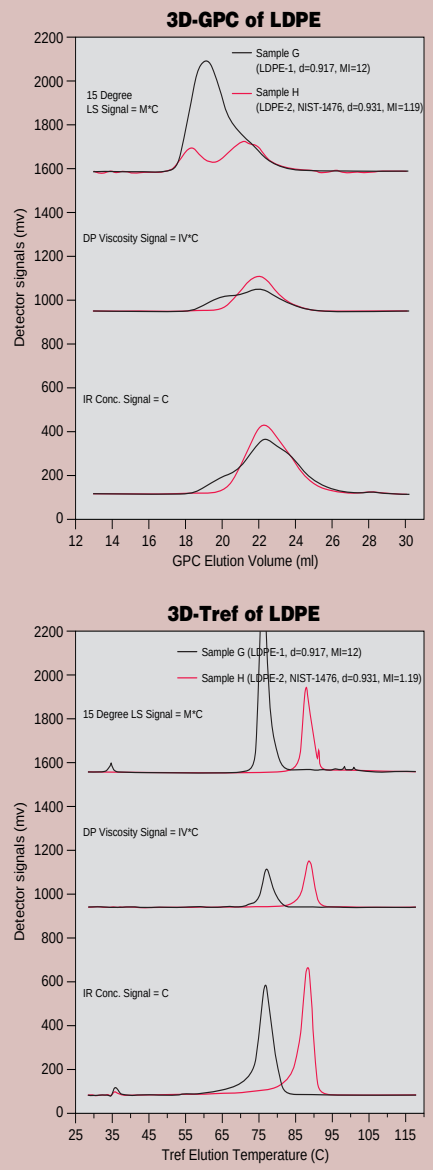
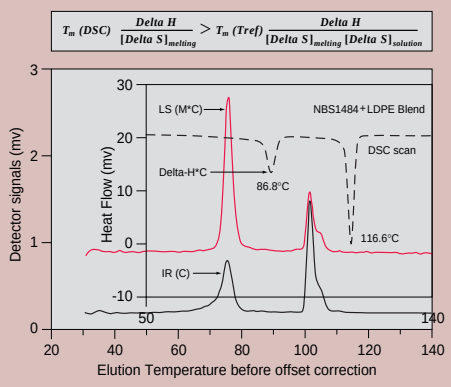


Figure 4

Synergism of TREF-LS and DSC
A Blend of LDPE-1 and HDPE (NIST 1484)



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Post NATAS Seminars

One of the things that differentiates TA Instruments from our competitors is the after-sale service and support we provide to our customers, and to the technical community in general.

Seminars and workshops are routinely held in cities around the world in a effort to make technology conveniently available to all. Recent examples include a series of two-day workshops, which were held in 16 cities around the US. One day was devoted to DSC and TGA training with introductions to Modulated DSC® and Micro-Thermal Analysis, with the 2nd day focusing on Rheology and DMA, with introductions to the new solids in torsion capability (for the AR 1000 & AR 500) and Compressional Rheology. The fourteenth annual rheology symposium was held at Lake Tahoe this spring. This 3-day course, designed for those who want to get beyond the basics, featured lectures by distinguished speakers from both industry and academia.

This September, for the third consecutive year, we will hold a two-day Post NATAS seminar following the NATAS conference. NATAS is the North American Thermal Analysis Society. The annual conference draws thermal analysts from around the world. The 1999 NATAS conference is scheduled for September 20-22 in Savannah, Georgia (visit www.natas.org for more information on NATAS).

By scheduling this seminar to follow the conference, we intend to make access as convenient as possible by allowing participants to simply extend their stay. Indeed, the seminars in 97 & 98 were well attended, and received positive reviews.

This year's seminar (Sept. 23 & 24) will focus on Modulated DSC®. Day one will feature invited speakers on the topic of new applications for MDSC. Day two will be designed to provide practical training for MDSC users, including theory, calibration, experiment design and set up, data interpretation, and applications.

Watch the TA Instruments web site, **www.tainst.com** for additional information and registration.
Use the enclosed postage paid reply card for early registration!

IQ/OQ Certification

Pharmaceutical customers, as part of the requirements for FDA or GLP certification, are interested in validation that their instruments are properly installed and operate correctly. IQ (installation qualification) and OQ (operational qualification) are targeted to meet that need. IQ/OQ consist primarily of detailed documentation of our installation/calibration processes which the service engineers provide at the time of original installation. This includes:

- Calibration using traceable reference materials
- Meets FDA, ISO and ASTM requirements
- Independent qualification increases productivity

IQ/OQ is an option available for installations of the DSC 2010, DSC 2910, and DSC 2920 (includes LNCA, RCS, or autosampler, if part of system); TGA 2050 and TGA 2950 (includes autosampler); and TMA 2940.

IQ/OQ is part of our ever-growing offering of customer support services. Contact your representative for additional details.

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