INFRARED
THERMAL ANALYSIS
UV/VISIBLE

Material Characterization
Instrument Guide

PerkinElmer®
For the Better

INTRODUCTION AND OVERVIEW

Today's advanced and increasingly diverse Advanced Materials laboratories are facing new challenges on a daily basis - starting from raw materials right up to the finished product. PerkinElmer's comprehensive portfolio of analytical solutions is designed to give you the higher accuracy, sensitivity, and ease of use your laboratory demands for examining with confidence, the purity, composition, and performance of your polymers and compounds. What's more, a range of complementary services is available to keep your laboratory up and running, meeting the stringent requirements of a variety of environments and working practices.

Better insights for better products. Choose PerkinElmer.

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WHY LIMIT YOURSELF?

PerkinElmer's LAMBDA™ Series UV/Vis/NIR and UV/Vis spectrophotometers have consistently offered best-in-class accuracy, precision, and reproducibility to scientists for nearly 50 years. For sampling flexibility and superior data quality, our instruments have become the standard in thousands of laboratories, in multiple industries worldwide. Building on this tradition of excellence, the new high-performance, innovative LAMBDA Series range confirms our leadership in UV/Vis/NIR and UV/Vis spectroscopy.

LAMBDA 265/365/465

High Quality Result for the First Time.

LAMBDA 265/365/465 UV/Vis Spectrophotometers are easy to operate and deliver results you can trust with minimal operator training. With our complete range of LAMBDA systems it's easy to develop simple, robust methods and ensure they're followed without mistakes.

	LAMBDA 265	LAMBDA 465	LAMBDA 365
Range	190-1100 nm	190-1100 nm	190-1100 nm
Principle	Photo Diode Array	High Performance, Photo Diode Array	Double Beam
Bandwidth (nm)			0.5, 1, 2, 5, 20 nm variable
Source	Xenon Flash	Deuterium and Tungsten	Deuterium and Tungsten
Optical Resolution	2 nm	1 nm	
Applications	Scanning, Wavelength Program, Time Drive, Kinetics, Scanning Kinetics, Quant, Scanning Quant, Life Science, and Bio Assays		

Software Options

LAMBDA 265/365/465 ship with standard software packages designed specifically to get everyone in your laboratory running samples like an expert immediately. They are fully integrated with Wavelength Program, Scan, Quant, Kinetics, Scanning Kinetics, and Bio Applications (Protein / DNA / RNA analysis, DNA Melting). The software is designed with method windows which walk the analyst through all the steps in their analysis. All results and reports are automatically generated and stored in an encrypted database.

Features/Benefits

- Simplified software packages which walks the user through analysis
- Power on self check which scans electronics and lamp performance with easy Pass/Fail notification
- Methods window which layers all steps on one page

Advanced and Enhanced Security software options are also available for our LAMBDA 365/465.

Features/Benefits

- Multi-level user permissions including administrator, method developer, analyst and reviewer
- Password-protected access control includes password aging and expiry
- Method-lock facility ensuring methods cannot be overwritten. All revisions are saved in a single location
- Fully configurable e-signature points allowing you to remain paperless, without compromising security

LAMBDA 650/750/850/950/1050

The Cost-effective Choice for High Performance Measurements.

The LAMBDA 650/750 are designed specifically for chemistry and materials science applications. Providing affordable systems optimized for the analysis of tough liquids and solid samples.

The LAMBDA 850/950/1050 are designed for analysis of coatings, high performance glass, and components in both research and manufacturing. Meeting industry standards for ultra-high performance, flexibility, and convenience.

	LAMBDA 650	LAMBDA 750	LAMBDA 850	LAMBDA 950	LAMBDA 1050
Range	190-900 nm	190-3300 nm	175-900 nm	175-3300 nm	175-3300 nm
Principle	Double beam, double monochromator, ratio recording spectrophotometer PC-controlled.		Double beam, double monochromator, ratio recording UV/Vis spectrophotometer with microcomputer electronics, PC-controlled.	Double beam, double monochromator, ratio recording UV/Vis/NIR spectrophotometers with microcomputer electronics, PC-controlled.	
Optical System	All reflecting optical system (SiO_2 coated) with holographic grating monochromators. Littrow mounting, sample thickness compensated detector optics.		All reflecting optical system (SiO_2 coated) with holographic grating monochromator with 1440 lines/mm UV/Vis blazed at 240 nm, Littrow mounting, sample thickness compensated detector optics.	All reflecting optical system (SiO_2 coated) with holographic grating monochromator with 1440 lines/mm UV/Vis blazed at 240 nm and 360 lines/mm NIR blazed at 1100 nm, Littrow mounting, sample thickness compensated detector optics.	
Source	Deuterium Tungsten	Deuterium Tungsten	Deuterium Tungsten	Deuterium Tungsten	Deuterium Tungsten
UV/Vis Resolution	≤0.17 nm	≤0.17 nm	≤ 0.05 nm	≤ 0.05 nm	≤ 0.05 nm
NIR Resolution		≤0.20 nm		≤ 0.20 nm	≤ 0.20 nm
Stray Light	≤ 0.0001 %T	≤ 0.0001 %T	≤ 0.00007 %T	≤ 0.00007 %T	≤ 0.00007 %T
Photometric Range	6A	6A	8A	8A	8A

UV/Vis/NIR Accessories

The high performance LAMBDA series provides the most convenient and flexible approach to sampling than any other UV/Vis and UV/Vis/NIR system available.

100 mm Sphere Accessory

Integrating Sphere.

The integrating sphere is a research grade accessory offering the user a complete system for the measurement of diffuse reflectance, relative specular reflectance and diffuse transmittance of both solids and liquids and can be used as a general purpose sphere for routine scattered transmittance and reflectance. It can also be used as a detection sphere.

TAMS

Total Absolute Measurement System (TAMS).

The Total Absolute Measurement System (TAMS) for the LAMBDA 950 and LAMBDA 1050 provide the highest degree of flexibility and accuracy in measuring angular dependent specular, as well as diffuse transmission and reflectance capabilities, with upgradeable detector configuration.

URA

Universal Reflectance Accessory (URA).

The URA for the LAMBDA 1050, 950, 850 and 650 is a unique accessory to PerkinElmer which represents a breakthrough in multi-angle, high sensitivity absolute specular reflectance analysis. The URA dramatically improves on traditional methods of analysis by automatically and reproducibly changing the angle with no adjustments to sample or optics, reducing costs and producing faster results. Previously, multi-angle analysis often required three or four conventional accessories and many manual adjustments.

UV WinLab and UV WinLab Enhanced Security

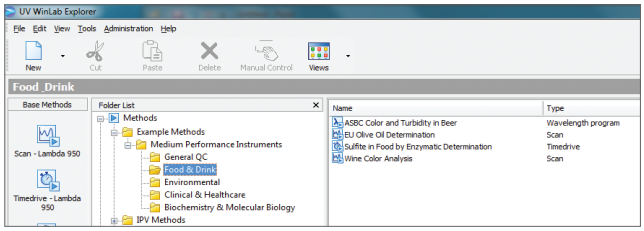


Figure 1. UV WinLab Method Explorer layout.

UV WinLab™ software is designed to provide a state-of-the-art user interface. UV WinLab Explorer is for the organization of data and methods, while UV WinLab Workspace mimicks the QA workflow, for the running of methods, with real-time spectral display, live instrument and accessory status bar. Quant applications optimizes calibration curves, calibration lifetime and calibration acceptance criteria. Results and reports are created automatically as defined by the method when an analyst runs or reprocesses data. The database query tool containing multiple search criteria to quickly and easily locate data.

Features/Benefits

- Instrument control for LAMBDA 650, 750, 850, 950, 1050, 800 and 900 high performance UV/Vis and UV/Vis/NIR instruments
- Instrument control for LAMBDA 365, 25, 35, 45, 20, 20Bio, 40, 40Bio and 40P medium performance UV/Vis instruments
- A method development environment that mimics the QA/QC workflow
- A fully user-definable sample table
- The ability to program data treatment for simplification of routine methods
- A configurable results table
- Conditional reporting based on results calculations, providing rapid and easy PASS/FAIL screening tests
- Simple, customized reporting using Communiqué; a "what you see is what you get" (WYSIWYG) reporting package developed by PerkinElmer
- Integrated relational database providing powerful trending tools; all important information, including methods, data, report templates and reports is stored securely in the database
- Enhanced Security available with multi-level permissions, password protection and e-signature points to comply with 21 CFR Part 11

UV WinLab at Work.

UVA and UVB Calculations

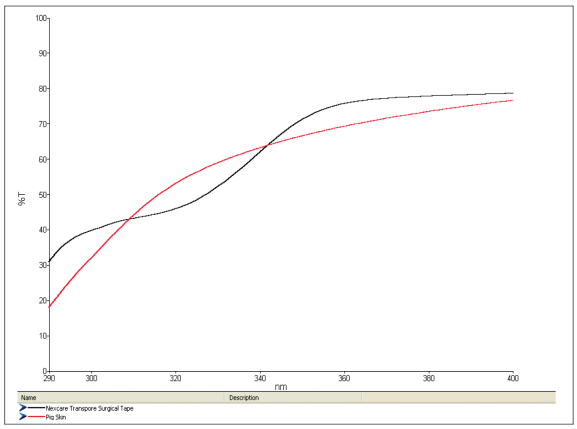


Figure 2. Scatter transmission spectral comparison of epidermis (porcine) with tape substrate (UVA + UVB).

Color Analysis

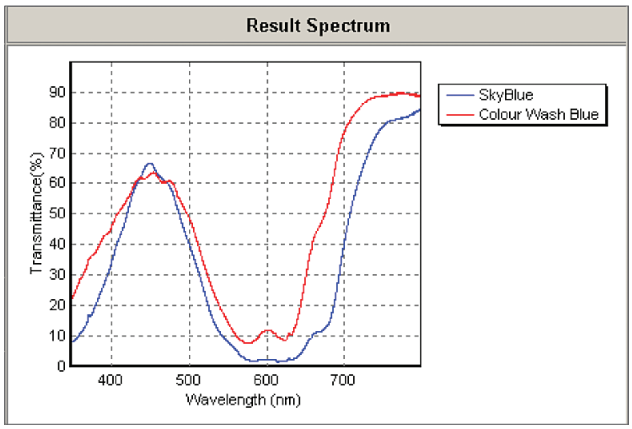


Figure 3. Transmittance spectrum of color filters.

Color Functions

- Illuminants A, C, D50/ D65/ D75
- 2 or 10 degree observer (CIE 1931 or 1964)
- Tristimulus (X,Y,Z)
- Chromaticity (Y,x,y)
- L*a*b*/ L*C*h*
- Whiteness/ Yellowness Index
- Thickness correction for transmittance
- Delta $ECIE_{1976}$ and Delta $ECIE_{1994}$

OUR LONG HISTORY OF WINNING IR TECHNOLOGY

PerkinElmer has been at the forefront of IR innovation for over 70 years.

Now, we've harnessed our experience and expertise to produce a platform that's equipped for any challenge – because every analysis application is different. Our latest innovations meet wide ranging IR needs across industries as diverse as pharmaceuticals, polymers, fuels, lubricants and nutraceuticals, as well as the environmental and academic spheres.

With PerkinElmer, you can enjoy fast, reliable results, every time.

FT-IR Frontier

IR Ready for any Challenge.

Powerful and adaptable, the Frontier™ meets all of your current analysis needs and can be expanded as your research goals evolve. And with automated range switching, mid-, near- or far-IR techniques are available at your fingertips. An exceptional signal-to-noise ratio and photometric performance assures optimal spectral performance to ensure best-in-class sensitivity. This configurable platform provides dependable, consistent and trouble-free operation through years of service.

Chemicals and Materials

- Develop new products with deeper insight
- Troubleshoot manufacturing problems
- Identify product contaminants
- Confirm quality of materials
- Study advanced material properties, with a wide range of sampling options
- Process and product improvement
- Demanding industrial and academic research

Research and Academia

- Configure complex experimental set-ups with custom sampling apparatus
- Quickly adapt the flexible platform for multiple research areas or research groups
- Perform far-IR characterization of synthesized materials, semiconductors and novel materials
- Characterize novel laser and detector devices using the configurable beam paths

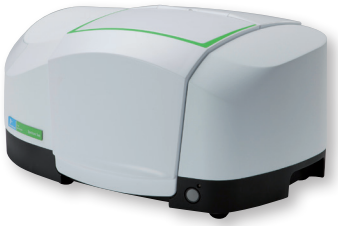
FT-IR Frontier Accessories

Frontier Sampling Systems.

Whatever your sample, there is a Frontier solution that can be customized to meet your specific needs. Offering more sampling options than any other FT-IR spectrometer, PerkinElmer Frontier's optical flexibility enables the addition of a vast array of specialized sampling accessories. Multiple applications can be addressed using a single instrument by simply switching the sampling accessory. Optimized smart, zero-alignment PerkinElmer accessories can be quickly interchanged to create the configuration of choice and maximize instrument uptime. In addition, an extensive range of third party accessories are available to meet additional requirements such as heatable sampling systems and gas cells.

- Solids autosampler
- Diffuse reflectance
- HATR
- TG-IR interface
- Diffuse NIR Reflectance - NIRA
- Universal ATR - UATR
- Remote liquids probe
- Remote solids probe

FT-IR Spectrum Two



IR Ready to Go.

Easy to use, powerful, compact and robust – Spectrum Two™ is the IR spectrometer of choice for everybody, everywhere, everyday. Spectrum Two systems are suited to a wide range of applications. With fully integrated, robust universal sampling for trouble-free measurements and portability options, Spectrum Two is ideal for use in both laboratory and remote testing environments.

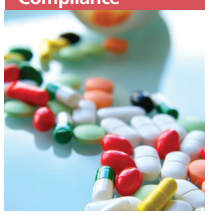
- **Dynascan™ Interferometer**
  Fixed mirror-pair interferometer design does not require dynamic alignment to compensate for errors
- **OpticsGuard™ Technology**
  A unique humidity shield design protects Spectrum Two from environmental effects
- **Atmospheric Vapor Compensation™ (AVC)**
  AVC features an advanced digital filtering algorithm designed to compensate for CO_2 and H_2O absorptions in real time
- **Absolute Virtual Instrument™ (AVI)**
  AVI standardization using gas phase spectra ensures your instruments are accurately calibrated

Resources and Application Packs.

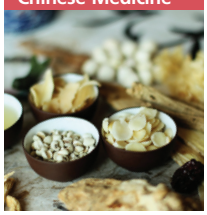
Education

Fuels

Pharma/ Pharmacopia Compliance



Nutraceuticals/ Traditional Chinese Medicine



In-Service Lubricants and OilExpress

Polymer QA/QC Application System

Oil in Water

Trans Fat Analyzer

Use It Everywhere You Need To.

Spectrum Two incorporates a number of features to enable your infrared analysis to move out of the laboratory. Multiple power options allow Spectrum Two to be used with or without external mains power. Once powered, a fast warm-up facilitates rapid measurement while optional wireless connectivity allows portable PC control. Compact and robust, Spectrum Two can easily be transferred from one location to another and the user-install capability allows instruments to be set-up by anyone, anywhere.

Spotlight Family

FT-IR/FT-NIR Microscopy

Microscopy That Overcomes Your Biggest Challenges And Your Smallest.

PerkinElmer's IR microscopy solutions play an important role in a wide variety of industries. Easy to use, yet exceptionally powerful and versatile, the Spotlight™ 150i/200i flexibility and sensitivity make it a perfect addition to any lab setting, in any discipline.

- Automatic ATR performs multiple sampling modes,including single point, line scans, and maps, in a single experiment – with minimum sample preparation compared with transmission analysis, while maintaining spectral integrity and quality
- Configurable validation routines speed instrument performance validation tests, so you're always ready for operation
- The capability of combining random markers and line scans across boundaries and 2D maps enables more complete, reproducible sample characterization – even in unattended mode
- When configured with the Frontier FT-IR platform, an automatic beamsplitter change can quickly reconfigure the system for multispectral range operation
- Macro Sampling
- Micro Sampling
- Optimized, zero-alignment accessories can be quickly interchanged to create the perfect configuration for your application

FT-IR/FT-NIR Imaging

A New Level of Imaging Performance and Flexibility.

With Spotlight 400 FT-IR and Spotlight 400N FT-NIR imaging systems, you experience unprecedented, uncompromising data quality and clear, complete, highly detailed results from all your samples. Spotlight FT-IR systems are purpose-built for a wide range of demanding imaging applications. So you're able to switch between sampling modes – standard transmission, reflection, ATR imaging, and more – with ease, and your images can be collected at high speeds with extraordinary signal-to-noise ratio.

It's been called the most productive laboratory FT-IR imaging system in the world. And how else would you describe a laboratory instrument that so dramatically improves the understanding of materials across an unprecedented range of industries? With IR imaging that's faster, more efficient, and more flexible than you'd even thought possible?

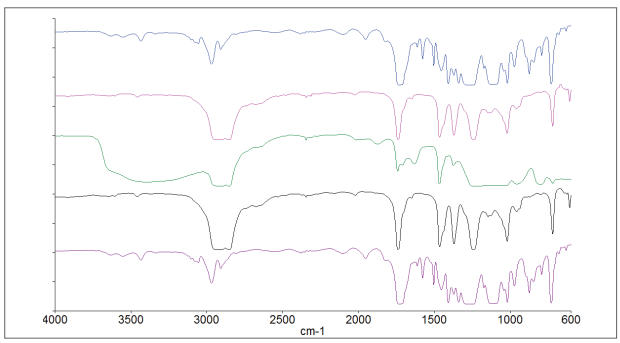


Figure 4. Spectra of layers in a multilayer laminate material.

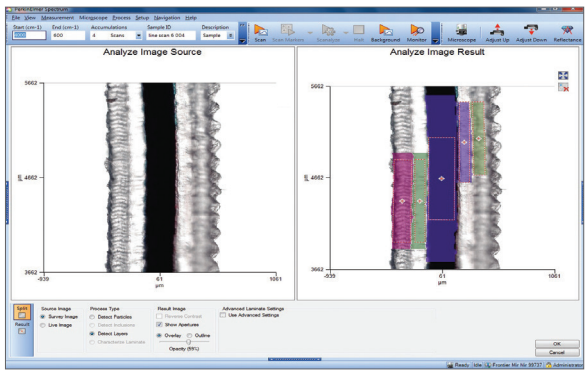


Figure 5. Automatic detection of layers in a laminate shows five layers.

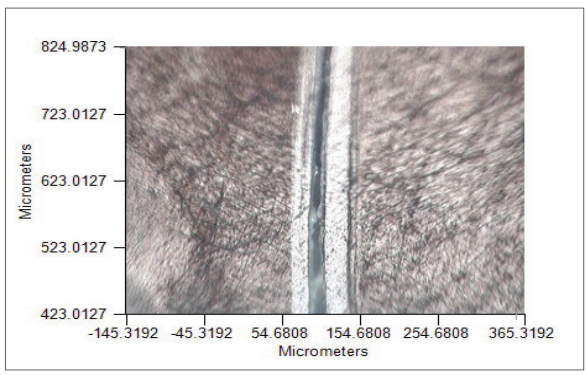


Figure 6. Visible image of a compostable food packaging laminate.

Spectrum 10 Software

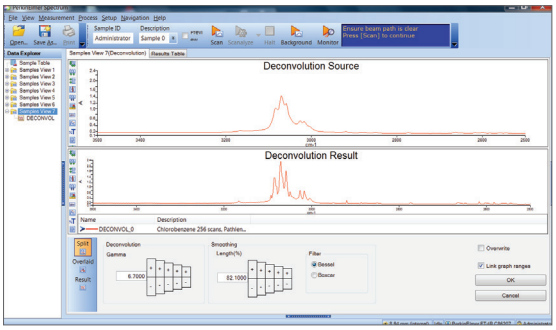


Figure 7. Comprehensive toolkit of data commands which allow you to adjust calculation parameters and see results instantly.

Spectrum 10™ includes a full suite of standard data processing commands designed specifically for spectroscopic processing. In addition, a unique Equations Editor enables you to quickly define non-standard process commands and make them single-click buttons on the toolbar or components in macro programs. No programming knowledge is required to use the smart equations or macro editors – customizing data commands is fast and intuitive.

Features and Benefits

- Configurable toolbar provides instant access to instrument controls making operating your instrument more efficient
- Customizable user specific workbenches enable you to have the commands you need at your fingertips
- Sample table enables you to pre-define samples and "Go", decreasing analysis times when running multiple samples
- "Send-to" other Microsoft applications enables you to get more from the data, faster and easier than before
- Innovative Workbench layered design ensures comprehensive processing power is available whilst not losing simplicity of operation
- No code required, macro builder capability enable customized applications to be developed quickly

Spectrum 10 at Work.

Interactive peak area/height/ratio calculations

With Spectrum 10 you can now calculate a peak height or area (or ratio between two peaks) for any number of spectra within a single process, greatly improving productivity for this common procedure. Simply select all of the spectra to process, then run the process from the Process menu or toolbar.

Quant predictions – any number of models, any number of spectra

Spectrum 10 can be configured for quantitative analysis using linear and chemometric models. The interface has been carefully optimized to maximize productivity and control over the results produced.

- Quant method Wizard for simple method building from Spectrum 10
- Review plots for easier evaluation of statistical data

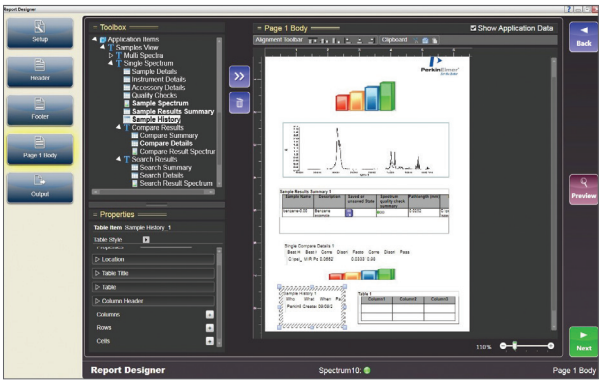


Figure 8. Interactive Report Designer lets you setup reports to see results the way you want.

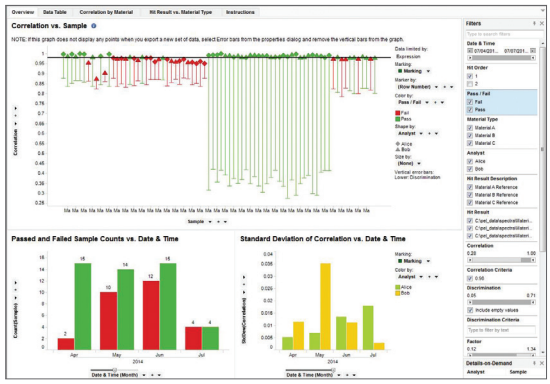


Figure 9. Fully customizable Compare results displays with TIBCO Spotfire® software.

THERMAL ANALYSIS SOLUTIONS AND BEYOND

At PerkinElmer, we're committed to the future of thermal analysis. Our line of high performance TGA, DSC and Thermodynamic analyzer solutions enables you to see more than you ever thought possible. Whether you're performing QA/QC applications, studying processes in polymers or pharmaceuticals, or developing the cures of tomorrow, our DSC platforms will open your eyes to a world of exciting new opportunities.

Truly comprehensive, our portfolio of applications, instruments and services, combined with our expertise in material characterization, can help you push the edge of science. That means greater access to insights and a team of experts, a far more effective work experience and the answers you need today and tomorrow. Look ahead, and you'll see new potential.

PerkinElmer is your one stop for Thermogravimetric Hyphenation, which is the coupling, or hyphenating of two or more instruments that can uncover results and insights not possible with individual techniques. The power of your analysis therefore becomes greater than the sum of its parts.

Our Thermogravimetric (TG) and Simultaneous Thermal Analysis (STA) instruments can be coupled to Fourier Transform Infrared (FT-IR), Mass Spectrometry (MS), or Gas Chromatography/Mass Spectrometry (GC/MS) providing you with greater analysis power and knowledge. Let PerkinElmer help you do and see more.

How can you improve accuracy, sensitivity, and performance? Let us show you.

DSC 4000

Reliable performance. Any way you look at it.

The DSC 4000™ is a compact workhorse that supports an extensive range of routine material characterization applications in academic, polymer, industrial, and pharmaceutical markets.

- Proven reliability and easy to use
- Flexibility - upgradeable to meet your future needs
- Greater throughput with optional 45-position autosampler

-100 °C — 450 °C

Excellence for every size lab

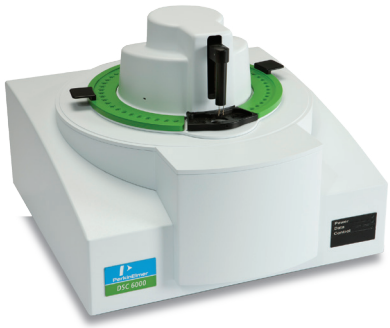
Proven Advantages

- Fast measurements
- Convenient easy-to-use gas control switch
- Easy to clean and maintain

Applications Focus

- Traditional materials characterization research
- Routine quality assurance and goods-in testing
- Oxidative Induction Testing (OIT)
- Multi-user, ad-hoc DSC analysis

DSC 6000



See what enhanced performance can do for you.

The DSC 6000™ gives you everything the DSC 4000 does and more. The advanced single furnace design with Modulated Temperature DSC (MT-DSC) enables new capabilities and easier data analysis.

- Modulated Temperature DSC technology
- Enhanced Software Package
- Flexible with optional photocalorimeter
- Greater throughput with optional 45-position autosampler
- UV-DSC studies with the optional UV photocalorimeter accessory

-180 °C — 450 °C

Expanded DSC Capabilities

Proven Advantages

- MT-DSC enables the separation of kinetic and thermal events
- Faster cooling rates for challenging applications with optional enhanced cooling
- Advanced photocalorimeter accessory allows for the study of photo-cured materials

Applications Focus

- Advanced materials research
- Analytical services
- Multipurpose analysis

DSC 8000

Deepen your insight with exclusive technology.

Responding to the need for greater sensitivity and accuracy, PerkinElmer brings you the DSC 8000™. It features our proprietary double-furnace technology, which directly measures the change in heat flow of the sample.

- Most accurate heat-flow measurements with power compensation design
- Flexibility - optional UV photocalorimeter and upgradeable to meet your future needs
- HyperDSC with heating rates from 0.01 °C to 300 °C/min
- Modulated Temperature DSC (MT-DSC)
- Greater throughput with optional 96-position autosampler

Pioneering DSC innovation.

Outstanding sensitivity and reproducibility

- All new double-furnace design delivers the most accurate heat-flow measurements
- Non-oxidating, chemically resistant platinum alloy furnaces
- Controlled heating and cooling for the most accurate results

-180 °C — 750 °C

Applications Include:

- Isothermal kinetics studies
- Demanding industrial and academic research
- Process and product improvement
- UV curing in polymers

DSC 8500

Hyper-enabled performance. Truly revealing.

PerkinElmer is proud to introduce the DSC 8500™, featuring second-generation HyperDSC® technology. Now you can gain unlimited insight into the structure, properties, and performance of your materials. And with hyper-enabled, double-furnace technology and better application capabilities, the DSC 8500 gives you higher accuracy and sensitivity.

- Double-furnace DSC
- HyperDSC Technology
- Optional UV photocalorimeter
- Enhanced software package
- Optional 96-position autosampler

Forward-thinking DSC innovation.

HyperDSC heating and cooling

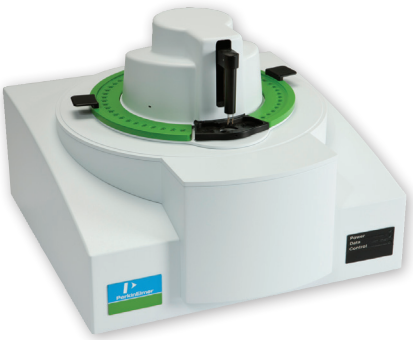
- Extremely fast controlled scanning rates to 750 °C/min
- In-situ ballistic cooling to 2100 °C/min, enabling experiments that mimic real-world processes
- Extremely fast readout rates (100 points/second) providing high data integrity

-180 °C — 750 °C

Applications Include:

- Polymorph characterization in pharmaceuticals
  - Measure samples without heating induced polymorph changes
- Process studies
  - Get a greater understanding of how the process affects the amorphous\crystalline content of the product
- Process simulation in polymers
  - Characterization of pharmaceutical materials

TGA 4000



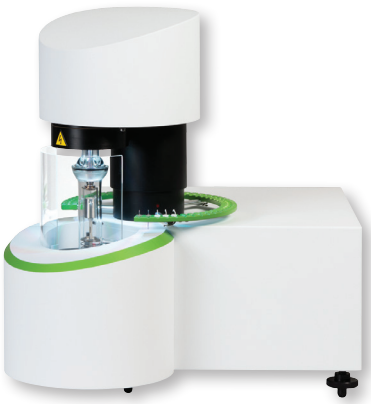
TGA 4000™ has a rugged compact design, created for a wide range of reactive gases for application flexibility you require today and tomorrow.

Key Features

- High performance balance and furnace for maximum accuracy and precision
- Top loading balance for easy sample loading and unloading
- Furnace and balance isolated from operators to minimize maintenance, ensuring uptime
- Fast cooling reduces cycle times improving productivity
- Integrated mass flow controller extends applications flexibility
- Optional 45-position autosampler allows unattended operation, improving productivity
- Pyris™ software suite is easy to use and feature rich for maximum application flexibility

15 °C — 1000 °C

TGA 8000



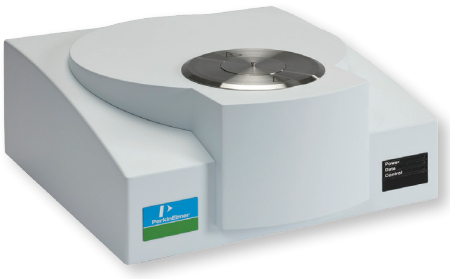
TGA 8000™ gives you complete control over your sample environment while delivering enhanced performance, maximum application flexibility, high throughput and reliability - even unattended. Plus our advanced hyphenation technology works beautifully with FT-IR, MS, GC/MS, and more for greater understanding of evolved gases.

Key Features

- High sensitivity ultra-microbalance
- Balance thermally isolated from furnace
- Fast cool-down increases throughput
- Most responsive temperature control gives accurate results
- Efficient gas switching gives reproducible results
- Ion stream eliminates static drift
- Autosampler runs 48 samples unattended
- AccuPik improves automated measurement of volatile samples
- Atmosphere control due to wide temperature range -20 °C to 1.200 °C
- High scan rates: 0.1 °C to 500 °C/min
- Mass-flow controlled gas environment
- iOS Application, iPhone® or iPad®, for local control and monitoring of auto load, furnace movement, and much more
- Colored illumination systems for unique identification of instrument run status
- Mixing of up to three gases with optional Gas Mixing Device
- Track sample position with patent pending positioning system in the autosampler
- Fully automated sample loading/ unloading
- Fast, simple, efficient coupling to FT-IR, GC/MS, MS when your work requires hyphenation

-20 °C — 1200 °C

STA 6000

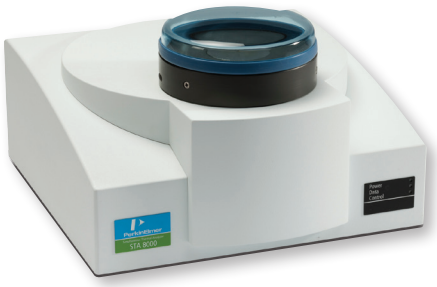


Simultaneous Thermal Analysis (STA).

STA 6000

The STA 6000™ gives you performance, reliability and productivity you can depend on. The STA 6000 uses advanced innovative sensor technology and measures both sample and reference material simultaneously to yield greater accuracy and higher quality simultaneous TG and DTA/DSC measurements. STA 6000 is designed for both routine and research applications.

STA 8000



STA 8000

The STA 8000™ gives you everything the STA 6000 does and more. The STA 8000 enables extended temperature analysis, up to 1600 °C, supports broader applications including fuel cell, ceramics, catalysis, and more. Designed for routine and research applications, the STA 8000 simultaneous thermal analyzer applies advanced innovative sensor technology and efficient design to yield high accuracy and precise results.

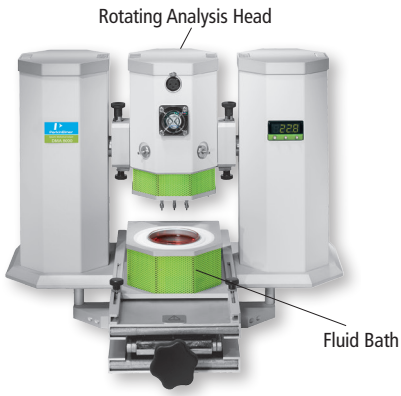
From TGA…

- Compositional analysis – quantitative content analysis
- Decomposition temperatures
- Engine oil volatility measurements (TGA Noack test)
- Filler content
- Flammability studies
- Lifetime predictions (via TGA kinetics software)
- Measurement of volatiles (e.g. water, oil)
- Oxidative stabilities
- Thermal stabilities
- Catalyst and coking studies
- Hyphenation to identify outgassing products

..to DTA/DSC

- Melting/crystallization behavior
- Glass transition temperatures
- Specific heat capacity
- Kinetic studies
- Transition and reaction enthalpies

DMA 8000



The DMA 8000™ is one of the most flexible, cost effective Dynamic Mechanical Analyzers (DMA) available. Its innovative design, high functionality, and flexible operation makes the DMA 8000 ideal for advanced research and routine quality testing in the polymers, composites, pharmaceutical, and food industries.

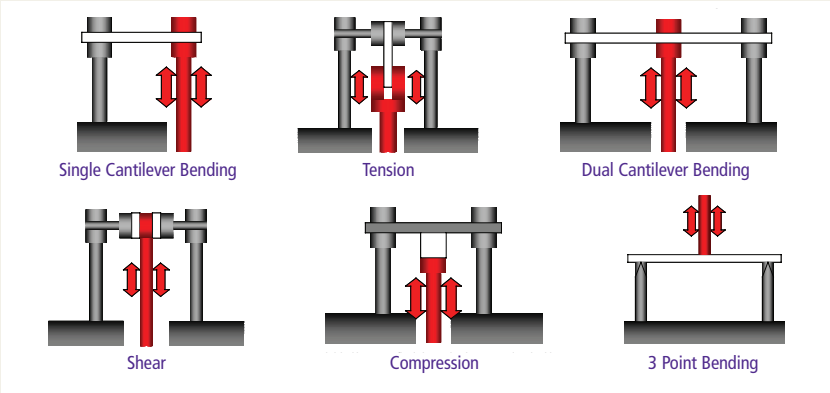
Quick Glance

- Unparalleled flexibility with rotating analysis head
- Enhanced performance due to a lightweight analytical train
- Dynamic and static force studies
- Superior cooling design
- Integrated Fluid Bath option
- Controlled humidity studies with a unique humidity generator
- Optional furnace window for viewing the sample
- Analysis of powders or other difficult to prepare samples

Geometry Options.

There are six common geometry modes that can be used for performing DMA experiments, covering the full range of sample testing needs. The geometry selected for an experiment is dictated by the nature and size of the sample being analyzed as well as its intended use. The fixtures can easily be adjusted to a variety of sample sizes.

Geometry	Typical Orientation
3 Point Bending	Vertical up
Cantilever	Vertical up
Compression	Vertical up/down
Shear	Horizontal
Tension	Tension



TMA 4000

The TMA 4000™ is a simple, easy-to-use, rugged thermal mechanical analyzer - perfect solution for determining coefficients of expansion – accurately and efficiently, time after time. Start with its rugged, all-metal furnace, designed to deliver thousands of hours of safe, failure-free operation at temperatures ranging from -80 °C to 800 °C. And its height-to-width aspect ratio enables accurate measurements of any size sample – from a few microns to a centimeter tall or more.

MODERN ULTRAMICROBALANCE FOR YOUR LABORATORY

The AD 6000™ Autobalance is a microprocessor-controlled ultra-microbalance capable of weighing samples in the range of 0 to 1000 mg to a resolution of 0.1 µg with a five-figure display resolution. The AD 6000 Autobalance offers a wide range of features, including high performance, fully automated operation, automatic calibration, and user convenience. With the AD 6000, you get the benefit of over 40 years of PerkinElmer experience in accurate weighing technology.

Thermal Sampling Accessories

Features and Benefits

- Dual photodetectors and LED to eliminate effects of temperature, vibrations, voltage changes, and component aging
- Remote weighing unit allows installation in special work areas such as dry boxes or fume hoods with convenient left- or right-and sample access
- RS-232C option allows connection to instruments for direct weight reading or to computers or other devices
- A range of accessories, extends the versatility of the AD 6000 Autobalance

Thermal Cooling Accessories

Cooling Option	Lowest Block Temperature
No Cooler	Ambient
Chiller	-20 °C
IntraCooler II	-80 °C
Portable Liquid Nitrogen Cooling	-100 °C
Cryofill Nitrogen Cooling	-180 °C
CLN2 Liquid Nitrogen Cooling	-180 °C

Chiller

The Chiller is a re-circulating fluid bath of coolant pumped through lines to a recirculation head bolted to the DSC. It can be set at various temperatures from -20 °C to above ambient for your specific application to provide for maximum stability. The cooling medium must be adjusted to achieve the desired temperature range.

Intracooler II: Low Maintenance Systems for Cooling

Intracoolers are fully sealed refrigeration units which, unlike chillers, have their cooling medium sealed inside the system. These units offer low maintenance cooling with low operating expenses. Since Intracoolers only require electrical power, they are excellent options for those without access to liquid nitrogen who need low temperature or fast cooling rates. The Intracooler II uses a dual stage heat exchanger and is a very popular cooling choice because its temperature range encompasses most DSC applications work.

Liquid Nitrogen Cooling Systems (LN2)

For the lowest possible operating temperatures as well as the fastest cooling rates possible, an LN2 system is required. LN2 systems require a source of liquid nitrogen and tend to have a larger footprint than other systems.

The Portable Cooling Device is a specially designed liquid nitrogen cooling system that enables customers to add the full power of LN2 cooling to a DSC 4000/6000 with removing the existing cooling system. The Cryofill LN2 system allows a DSC 6000 with autosampler to operate between -170 ˚C and 300 ˚C under He purge. Low temperature operation is simple and automated, allowing the analyst to do other tasks. The CLN2/DSC System enables the fastest cooling rates possible in the industry. This controlled refrigeration unit employs liquid nitrogen as the cooling medium. Extending to a sub-ambient range and enables the fastest cooling of all the cooling choices. Unlike previous LN2 systems where you were required to operate at -170 ˚C, the CLN2 allows you to choose a higher block temperature to conserve LN2.

Pyris Software

Pyris™ is the preferred choice in thermal analysis because it is intuitive, user-friendly, and provides a wide-range of standard features and capabilities for maximum flexibility. PerkinElmer's family of highly-sensitive thermal analysis instruments has been standardized on this powerful software platform. Add to this our superior customer service and support and you can be sure you are receiving a complete, robust system for accurate, reliable material characterization.

Whether you work in a research laboratory, an automated QA/QC lab, or on a stand-alone instrument, you can count on Pyris software to meet your thermal analysis needs.

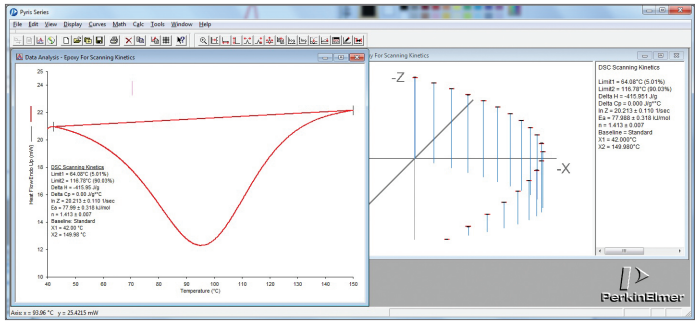


Figure 10. IDSC reaction peak using Kinetics software (left). 3D error plot to assess the quality of data fit (right).

Key Features

- Easy-to-use
- Minimizes risk of errors during calibration through Wizard approach
- Compares current measurement to reference curve during data collection
- Allows real-time calculation during sample run
- Provides fast method optimization during measurement
- A wide range of calculation features
- Allows rapid document generation through Report Manager
- Technically compliant to 21 CFR Part 11 regulations

Pyris Optional Software

- Pyris Specific Heat (Cp) Software
- Pyris MT DSC Software
- Pyris Purity Software
- Pyris Temperature Dependent Crystallinity Software
- Pyris Kinetics Software

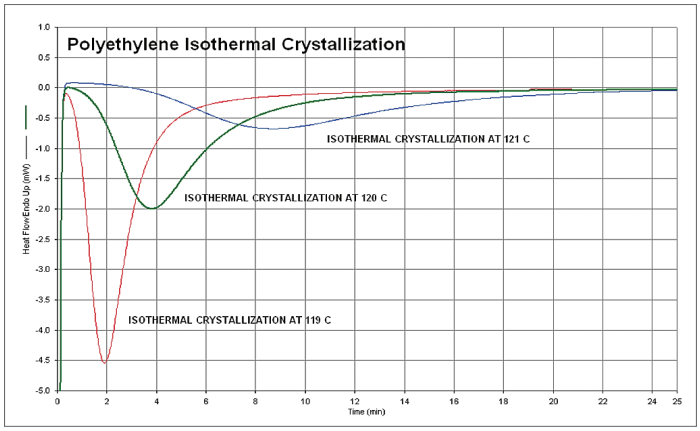


Figure 11. DSC Isothermal Kinetics.

HYPHENATED SOLUTIONS FOR YOUR ADVANCED APPLICATIONS

Hyphenation or hyphenated techniques couple two instruments together to gain insights previously unseen by either technique on its own.

Is hyphenation the solution you've been looking for?
Are you interested in how a material responds to a non-standard test environment like high UV levels or humidity changes? Try our TG-DMA or UV-DSC. Do you want to better understand how a material degrades or what gases evolve when that material burns? These techniques are often referred to as Evolved Gas Analysis and our TG instruments can be coupled to several FT-IR, MS, or GC/MS options to provide you with greater knowledge. These technologies will help you gain better insight and advance your laboratory.

The more you know, the more you can do.

When working with a hyphenated instrument, it is important not only to understand how each of the instruments work, but also how the connection affects them both. Unlike many instruments companies, PerkinElmer makes a range of products from thermal to gas chromatography and from infrared to ICP. Because of this experience, PerkinElmer is the only company capable of making, supporting, and servicing a combined system.

TG-IR

The data from the TGA run is transferred automatically to the Timebase software and compared to the Gram Schmidt plot. From this data, we can examine regions of interest as shown in the right image.

The combination of a Thermogravimetric Analyzer (TGA) with an Infrared Spectrometer (TG-IR) is the most common type of Evolved Gas Analysis (EGA) in use today. By heating a sample on the TGA, a sample will release volatile materials or generate combustion components as it burns. These gases are then transferred to the IR cell, where the components can be identified. Because of its ability to detect functional groups, IR analysis allows greater understanding of the processes seen in the TGA. The PerkinElmer TL 8000 transfer line is a state-of-the-art system for TG-IR. Unlike simpler systems that simply move the gas to the TGA, the TL 8000 is designed to make sure every component evolved in the TGA is transported to the IR.

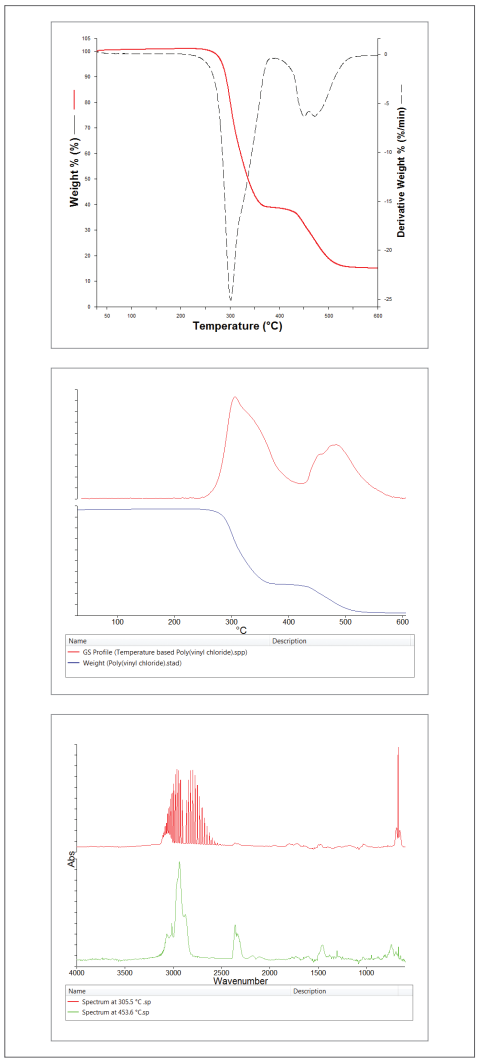


Figure 12. The Weightloss data (shown with the derivative) from the TGA run (top) can be displayed in the Timebase software and compared to the Gram-Schmidt plot of the IR data (middle). Spectra are shown (bottom) from the maxima of the two weightloss events.

TG-MS and TG-GC/MS

The combination of a Thermogravimetric Analyzer with a Mass Spectrometer is becoming increasingly popular due to its ability to detect very low levels of impurities.

Heating a sample on the TGA causes a sample to release volatile materials or generate combustion components as it burns. These gases are then transferred either to the MS or GC/MS for identification.

Because of its ability to detect very low levels of material in complex mixtures, the TG-MS or TG-GC/MS is a powerful tool for quality control, safety, and product development.

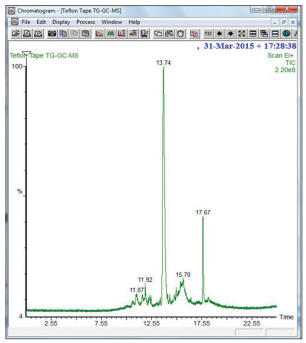


Figure 13. TGA-GC/MS of PTFE Tape, peaks of Perfluoroethylene and Perfuorooctanoic Acid.

TG-IR-GC/MS

Hyphenating TG-IR-GC/MS is a powerful approach for analysis of an unknown mixture to determine its primary components and identify additives or contaminants. This information may be needed, for example, to evaluate a competitor's product or to determine compliance with regulations. The PerkinElmer TL 9000 transfer line is used to allow TG-IR-GC/MS analysis on a sample by moving the off gases to the FT-IR and GC/MS after their evolution in the TGA. It acts as the interface between a TGA or STA, an FT-IR like the Frontier or Spectrum Two FT-IR, and a Mass Spectrometer or GC/MS, such as the Clarus SQ 8. The TL 9000 interface was used to perform a subsequent analysis to confirm the identity of the unknown substance in the aqueous sample. At the time of maximum concentration absorbance of the substance being analyzed, the gas in the IR gas cell was sent to a GC/MS.

UV-DSC/DMA

Photo-DSC Commonly Used

- Dental materials
- Electronic adhesives
- Orthopedic applications
- Coating for low VOC

Traditionally Studied by Photo-DSC

- Allows measure of energy of cure
- Study of cure kinetics
- Development of cure profiles

Traditionally Studied by Photo-DMA

- Measurement of modulus and viscosity as function of cure
- Ease determining of gelation and Virtification

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