NETZSCH

Proven Excellence.



Advanced Materials Testing

Thermal Analysis, Methods for Determination of Thermophysical Properties, Cure Monitoring, Rheology, Fire Testing, Accelerating Rate and Isothermal Calorimetry

Analyzing & Testing

Leading Thermal Analysis

Since 1962, NETZSCH-Gerätebau GmbH has consistently provided our customers with the latest thermal analysis techniques, the broadest range of highest quality products, the most complete technical support and the most comprehensive service.

Thanks to our experienced team, NETZSCH Analyzing & Testing consistently offers the "utmost": the most complete product line, the widest temperature range and the highest measurement pressure, to name a few. The series of patents and international R&D awards which we have received attest to our products' leadership in terms of technique and quality. Our branches, representative offices and application laboratories worldwide offer our customers excellent instruments and technical support, wherever on the globe they may happen to be.

At NETZSCH, we regard customer satisfaction as our first priority. We are looking forward to working with you.



Product Portfolio

Diversified Product Range for Eclectic Applications

At NETZSCH, you will find solutions for Thermal Analysis, thermo-physical properties testing, cure monitoring, dynamic-mechanical testing, rheology, multiple module and accelerating rate calorimetry as well as for fire testing.

Our instruments and methods allow for material characterization and the study of properties such as specific heat capacity, enthalpies, weight change, Young's modulus, dimensional changes, thermal conductivity, thermal diffusivity, viscosity and evolved gases including determinations with regard to purity and composition, poly-morphism, thermal stability and application temperature limits, aging and thermomechanical behavior, visco-elastic properties, processing conditions, and fire behavior.

NETZSCH Analyzing & Testing develops sensitive, versatile, and reliable instrumentation for research and development, quality control, process safety and failure analysis. We offer our customers broad applications knowhow through publications, demonstrations, contract testing, seminars and users' meetings.

Let NETZSCH open up a whole new perspective on the materials in your world.

Thermal Analysis
- DSC/DTA
- STA (TGA-DSC, TGA-DTA)
- TGA
- DEA
- DIL
- TMA
- Coupling to EGA (MS/FT-IR/GC-MS)

Dynamic-Mechanical Testing
- DMA
- High-Force DMA

Rheology
- Rotational Rheometer
- Capillary Rheometer

Thermal Conductivity and Thermal Diffusivity
- Guarded Hot Pipe
- Guarded Hot Plate (GHP)
- LFA
- HFM
- Guarded Heat Flow Meter (GHFM)
- Time Domain Thermoreflectance

Accelerating Rate Calorimetry/ Battery Testing
- ARC®
- MMC

Fire Testing Systems
- KBT 916, SBI 915, TBB 913, TNB 912, KBK 917, TRDA, UL 94, LOI 901, HBK 919, TCC 918, TDP T4

Refractory Testing
- RUL/CIC

Proteus® Measurement and Evaluation Software*
Offering features like:
- *AutoEvaluation*
- *Identify*
- Specific heat
- *PeakSeparation*
- Temperature Modulation
- *Kinetics Lite*

Additional Software*
- *Kinetics Neo*
- *Termica Neo*
- *Proteus® Now Quantify*

* Depending on instrument type

DIFFERENTIAL SCANNING CALORIMETRY

Differential Scanning Calorimetry (DSC) determines transition temperatures and enthalpy changes in solids and liquids under controlled temperature change. DSC is the most frequently used method in the field of Thermal Analysis. Rapid analyses, high significance for research and quality control tasks, and easy handling of the measuring instrument contribute to its versatility.

The Pathfinders

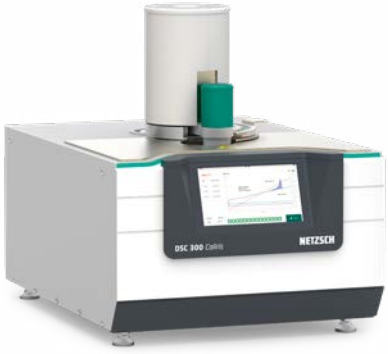
The premium systems DSC 300 *Caliris*® *Select* and *Supreme* and DSC 500 *Pegasus*® integrate a number of hardware and software features which are useful in the lower temperature range including application fields such as polymers, foods, pharmaceuticals, composite materials and the higher temperature range including application fields such inorganics, metals, alloys, and ceramics, etc. The economic entry-level DSC 300 *Caliris*® *Classic* combines a robust instrument with excellent performance. With its small footprint it is ideal for quality control and fits great into teaching environments.

DSC 300 *Caliris*® Series

Supreme	*Select*	*Classic*
Currently three modules available: ▪ H: widest temperature range (-180°C to 750°C) ▪ P: fastest heating-cooling rates (500K/Min) ▪ S: high metrological stability for routine measurements		S-cell
H-Module: -180°C to 750°C	H-Module: -180°C to 650°C / 750°C	
P and S-Module: -170°C to 600°C	P and S-Module : -170°C to 600°C	-170°C to 600°C
Interchangeable module	Exchangeable module	No module exchange
Gas-tight	Gas-tight	Gas-tight
Integrated 3-fold MFC, 4-fold MFC*	Integrated 3-fold MFC	Integrated 3-fold MFC
Automatic sample changer*: for up to 192 positions and 12 reference materials		Automatic sample changer for 20 samples*
Software		
AutoEvaluation and *Identify* for curve evaluation and interpretation	*AutoEvaluation* and *Identify* for curve evaluation and interpretation*	*AutoEvaluation* and *Identify* for curve evaluation and interpretation*
Proteus® Search Engine	*Proteus*® Search Engine*	*Proteus*® Search Engine*
Temperature-modulation	Temperature-modulation *	Temperature-modulation*



DSC 300 *Caliris*® *Select/Supreme*



DSC 300 *Caliris*® *Classic*

* Optional feature



DSC 300 *Caliris® Classic*

This is a robust, gas-tight instrument for routine measurements in your laboratory. It is a reliable entry-level heat flux DSC for use in quality assurance and failure analysis, as well as in an educational environment.

- Temperature range: -170°C to 600°C
- Thoroughly informed and in full control thanks to integrated touch display*
- Perfect for routine applications thanks to predefined and user defined methods
- Automatic sample changer*
- Speed up results wih *AutoEvaluation** and *Identify**

DSC 500 *Pegasus®*

- High-temperature DSC: -150°C to 2000°C (DTA above 1750°C, c_p determination up to 1500°C)
- Defined atmospheres or vacuum
- Quickly interchangeable sensors (DSC-c_p, DSC, DTA)
- Automatic sample changer* or double-furnace operation
- Temperature-modulation*

DSC 204 HP *Phoenix®*

The high-pressure DSC features one of the highest working pressures. It is well-suited for energy materials (e.g., hydrogen storage) and petrochemistry (e.g., oxidation of oils).

- Temperature range: -150°C to 600°C
- Pressure range: vacuum up to 15 MPa
- Inert, reducing, oxidizing atmospheres under static or dynamic conditions
- Precise flow control (precision 0.02 bar)*



DSC 500 *Pegasus®* with two furnaces



DSC 204 HP *Phoenix®*

SIMULTANEOUS THERMAL ANALYSIS THERMOGRAVIMETRY

Thermogravimetry (TG)/Thermogravimetric Analysis (TGA) investigates the thermal stability and decomposition, whereas Simultaneous Thermal Analysis (STA) combines thermogravimetric analysis and differential scanning calorimetry in one measurement under perfectly identical test conditions (same atmosphere, gas flow rate, etc).

STA 509 *Jupiter*® Series – Thermogravimetry When You Want it – TGA/DSC When You Need it

The STA 509 *Jupiter*® integrates thermogravimetry (TGA) and differential scanning calorimetry (DSC) in a single, flexible platform. Use it as a dedicated TGA to quantify mass changes, as a dedicated DSC to measure heat-flow events, or run both simultaneously to obtain complete cause-and-effect data under identical conditions. With an exceptionally broad temperature range, configurable atmospheres, and a comprehensive suite of accessories, the STA 509 *Jupiter*® adapts to plastics, rubbers, resins, fibers, coatings, oils, ceramics, glass, cements, refractories, metals, fuels, and pharmaceutical materials alike.

	Supreme	*Select*	*Classic*
Temperature range	-150°C to 2000°C	-150°C to 2400°C	RT to 1600°C
Furnaces	9, incl. water-vapor, high-speed	12, incl. water-vapor, high-speed	SiC furnace
Sample weight, weighing range	5 g	35 g	35 g
TGA resolution	0.025 µg	0.1 µg	0.1 µg
Vacuum	10^{-4} mbar	10^{-4} mbar	10^{-2} mbar
Sensors	TGA, TGA-DSC, TGA-DSC-c_p, TGA-DTA	TGA, TGA-DSC, TGA-DSC-c_p, TGA-DTA	TGA, TGA-DSC, TGA-DTA
Temperature-modulation	Yes	Yes	Yes
Automatic sample changer*	20 samples	20 samples	20 samples
DSC-*BeFlat*®	Yes	Yes	Yes
Tau-R® Mode	Yes	Yes*	Yes*
TGA-*BeFlat*®	Yes	Yes	Yes
Glove box version	Yes	Yes	–



STA 509 *Jupiter*®



STA 2500 *Regulus*

This TGA-DTA analyzer uses a differential balance system which cancels out buoyancy and convection influences over a broad temperature range. Time-consuming correction measurements are no longer required.

- Temperature range: RT to 1600°C
- Top-loading
- Sample load (incl. crucible): 1 g
- Weighing range: ± 250 mg
- TGA resolution: 0.03 µg
- Vacuum: 10^{-4} mbar
- Built-in mass flow controllers
- Low cost of ownership



STA 2500 *Regulus*

STA 319 *Jupiter®*

An advanced simultaneous TGA-DSC analyzer for routine analysis, quality assurance and process optimization.

- Temperature range: (10°C) RT to 1025°C/1100°C
- Top-loading
- Max. sample weight/measuring range: 2 g
- TGA resolution: 0.02 µg
- Vacuum-tightness: 10^{-1} mbar
- Robust and fast-acting furnace
- Built-in gas switch or mass flow controller*



STA 319 *Jupiter®*

* Optional feature

Supreme Determination of Mass Changes – the TG 309 *Libra*® Series

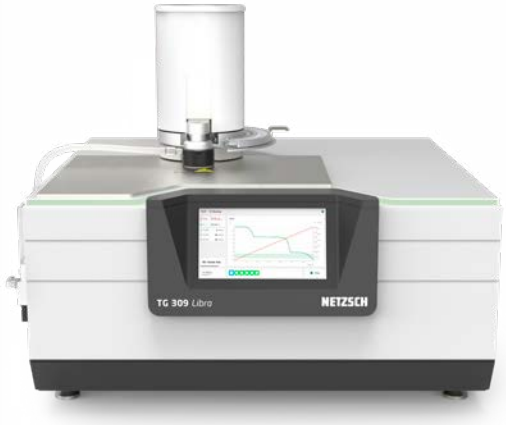
Thermogravimetry (TG)/Thermogravimetric Analysis (TGA) investigates thermal stability and decomposition by quantifying mass change. Simultaneous Thermal Analysis (STA) provides this capability as a standalone TGA and also combines thermogravimetric analysis and differential scanning calorimetry in one measurement under perfectly identical test conditions (same atmosphere, gas-flow rate, temperature program, etc.), enabling direct correlation of heat-flow events with mass loss or gain for clear, cause-and-effect interpretation.

	Supreme	*Select*	*Classic*
Temperature range	(10°C) RT to 1100°C	(10°C) RT to 1025°C/1100°C	(10°C) RT to 1025°C
Max. sample weight/ Max. weighing range	2 g/2 g	2 g/2 g	2 g/2 g
Balance resolution	10 ng	20 ng	50 ng
AutoVac	Optionally available when MFC was selected	Optionally available when MFC was selected	Optionally available when MFC was selected
Vacuum	$<<10^{-1}$ mbar	$<<10^{-1}$ mbar	1 mbar
Gas Flow	3-fold MFC, 4-fold MFC*	3-fold MFC, 4-fold MFC*	Gas switch block[1], 3-fold MFC*
Automatic Sample Changer	up to 204 samples*	up to 204 samples*	up to 20 samples*
Coupling options	FT-IR, QMS, GC-MS	FT-IR, QMS, GC-MS	-
Software			
AutoEvaluation	incl.	incl.	incl.
Identify	incl.	incl.	*
Peak Separation	incl.	*	*
Proteus® Search Engine*	incl.	*	*
Temperature modulation	incl.	*	*
Eco Mode	incl.	incl.	incl.

[1] Gas switch block (3 gases incl. protective) required if no MFC is selected



TG 309 *Libra*® *Select/Supeme*



TG 309 *Libra*® *Classic*

* Optional feature



DIELECTRIC ANALYSIS

Dielectric Analysis (DEA, or Dielectric Thermal Analysis (DETA), is a technique for monitoring changes in the viscosity and cure state by measuring variations in the dielectric properties—even during processing. The DEA 288 *Ionic* series is used for most thermosets, adhesives, paints, and coatings, including fast-curing thermosets such as SMC/BMC and UV curing.

DEA 288 *Ionic* Series – Clear-Cut Determination of the Curing Behavior

The DEA 288 *Ionic* covers a wide range of measurement frequencies in order to accurately determine the changes in dielectric properties during reaction. With their minimum data acquisition time of less than 5 ms, the instruments can handle fast curing systems such as UV curing.

Portable Version

With up to 7 channels, this DEA is the flexible version for your day-to-day work. It can be easily transported between different measurement locations.

- Frequency range: 1 mHz to 1 MHz, freely selectable values
- Temperature range: -140°C to 400°C (with furnace)
- True simultaneous operation of all channels
- Minimum data acquisition time: < 5 ms
- Wide spectrum of implantable and reusable sensors
- Accessories*: furnace, press, and UV lamp

Rack Version for Integration into an Industrial Process

The 19" Rack version is designed for an electrical cabinet. It supports 8 simultaneous measuring channels which can be extended up to 16 modules.



DEA 288 *Ionic*: Portable version (left) and Rack version (right)

DYNAMIC-MECHANICAL ANALYSIS

NETZSCH offers the widest range of Dynamic-Mechanical Analysis (DMA) instruments and testing machines for the investigation of the temperature-dependent visco-elastic properties by applying an oscillating force – up to the highest force range— to the sample. The product range includes flexometers, also for thermal fatique tests of rubber materials and instruments for the measurement of the dynamic shore hardness or the adhesive properties (autohesion), for instance for rubber compounds before vulcanization.

DMA 303 *Eplexor*® – The All-Rounder for Forces up to 50N

This all-rounder offers a high resolution of the deformation measuring system which enables precise measurements of visco-elastic properties on both very rigid and very soft samples. The system offers a variety of deformation types, digital signal filtering, kinetic evaluation and frequency extrapolation.

- Temperature range: -170°C to 800°C
- Frequency range: 0.001 Hz to 150 Hz
- Modulus range: 10^{-3} MPa to 10^{6} MPa
- Force range: up to 50 N (static and dynamic)
- Static deformation: 30 mm
- Dynamic deformation: ± 2500 µm
- Deformation modes: bending, tension, shearing, compression/penetration
- Accessories*: immersion bath, dielectric analyzer (DEA)



DMA 303 *Eplexor*®

The DMA 503 *Eplexor*® Series – High-Force DMA

The DMA *Eplexor*® high-force series offers different maximum forces and strains.

- Dynamic force range: ± 500 N, ± 150 N, ± 100 N
- Temperature range: -160°C to 1500°C
- Maximum Sample dimensions:
  - Tension: 80 mm x 10 mm x 10 mm (80 mm length)
  - Shear: ø 4 mm to 20 mm (standard: 10 mm)
  - 3-point bending: up to 70 mm free bending length (up to 120 mm sample length)



DMA 503 *Eplexor*®

* Optional feature



DMA 523 *Eplexor*® High-Force and the HBU 523 *Gabometer*® up to 4000 N

The DMA 523 series comes in two instrument variations, the DMA 523 *Eplexor*® and the HBU 523 *Gabometer*®. The HBU 523 *Gabometer*® can be used as Goodrich flexometer for heat build-up and fatigue tests.

- Temperature range:
  - DMA 523: -160°C to 500°C
  - HBU 523: -160°C to 300°C
- Two independent drives for static and dynamic load
- Force range: static 6000 N, dynamic up to 4000 N
- Changeable force transducers
- Frequency range: 0.0001 Hz to 100 Hz
- Deformation modes: bending, tension, shear, compression/penetration
- Accessories*: immersion bath, humidity chamber, automatic sample changer
- Special sample holders for liquids, fibers or tire cord testing
- HBU 523 *Gabometer*®:
  - Heat build-up
  - Blow-out test



DMA 523 *Eplexor*®
HBU 523 *Gabometer*®

RHEOLOGY

Rheology is the study of flow and deformation of materials under applied forces which is routinely measured using a rheometer. The measurement of rheological properties is applicable to many materials from fluids such as dilute solutions of polymers and surfactants through to concentrated protein formulations, to semi-solids such as pastes and creams, to molten or solid polymers as well as asphalt.

Rotational Rheometers

Kinexus Prime Series

The Kinexus Prime isn't just a rheometer – it is redefined the way it interacts with you. Kinexus Prime is the next generation rotational rheometer platform that's been developed from extensive market feedback, integrating innovative instrument design with a revolutionary software interface, to deliver a solution that will exceed your rheological expectations.
The Kinexus Prime series includes standard rheometers (Kinexus Prime lab+, Kinexus Prime pro+) and rheometers for advanced testing (Kinexus Prime ultra+).

- Temperature Range: -40°C to 450°C
- Torque Range: 0.5 nNm to 250 mNm, depending on instrument version
- Torque resolution: 0.05 nNm to 0.1 mNm, depending on instrument version
- Force Range: 0.001 N to 50 N



Kinexus Prime ultra+



Kinexus Prime DSR-III

Kinexus Prime DSR Series – Especially for Asphalt Binder and Bitumen Testing

The Kinexus Prime DSR Series is the next generation rotational rheometer platform for asphalt testing that's been developed from extensive market knowledge and feedback, integrating innovative instrument design with a revolutionary software interface, to deliver an intelligent solution that will exceed your rheological expectations.

- Temperature Range: -40°C to 450°C
- Torque Range: 1 nNm to 225 mNm
- Torque resolution: 0.1 nNm
- Force Range: 0.001 N to 50 N



Advanced Capillary Rheometers for Research, Product Development and Quality Control

Rosand RH7/RH10

The current RH7 and RH10 models retain the robust *H* frame design principle, which lies at the heart of the instruments' ability to operate under high loading conditions. A digital drive system gives the RH7 and RH10 unsurpassed performance in terms of speed control, accuracy, and dynamic operating range. This hardware is supported by the latest generation of Windows® based software, Flowmaster, with many new experimental possibilities.

- Temperature Range: Ambient to 400°C (500°C optional), 5°C to 300°C (cooling coil option)
- Force Range:
  - RH7: 50 kN
  - RH10: 100 kN
- Maximum Speed:
  - RH7: 600 mm/min
  - RH10: 1200 mm/min
- Bore diameter: 15 mm standard (9.5, 12, 19 and 24 mm bore options)



Rosand RH10



Rosand RH2000

Rosand RH2000

The Rosand RH2000 series of benchtop capillary rheometers are compact systems capable of most testing requirements encountered in capillary rheometry.

- Temperature Range: Ambient to 400°C (500°C optional), 5°C to 300°C (cooling coil option)
- Force Range: 12 kN standard (20 kN optional)
- Maximum Speed: 600 mm/min standard (1200 mm/min high speed option)
- Bore diameter: 15 mm standard (9.5, 12, 19 and 24 mm bore options)

THERMOMECHANICAL ANALYSIS DILATOMETRY

Many materials undergo changes to their thermomechanical properties when they are exposed to temperature changes, e.g., phase changes, sintering steps or softening which can occur in addition to thermal expansion. TMA analysis provides valuable insight into the composition, structure, or application possibilities for materials such as plastics, elastomers, paints, composites, adhesives, films, fibers, ceramics, glass, and metals. Dilatometry (DIL) is the method of choice to study length change phenomena of ceramics, construction materials, glasses, metals, etc.

More than just Thermal Expansion – TMA 512 *Hyperion*®

With its compact design and user-friendly operation, the TMA 512 series sets new standards for the analysis of a variety of materials. The sample holder (for expansion, penetration, bending or tension measurements) is freely accessible once the top-mounted furnace has been raised. This ensures easy sample selection for fast measurement start.

- Temperature range: -70°C to 1500/1600°C and -150°C to 1600°C via interchangeable furnaces
- Measurements down to -70°C using intacooler and down to -150°C using LN_2
- Measurement of length change and corresponding force
- Vacuum-tight thermostatic measuring system
- Easily interchangeable sample holders made of fused silica or alumina
- Max. sample length 30 mm
- High resolution: 0.125 nm/digit
- Force range: 1mN to 4 N (only for *Supreme*, 3N for *Select*)
- Modulated force* (*Select*)



TMA 512 *Hyperion*®

* Optional feature

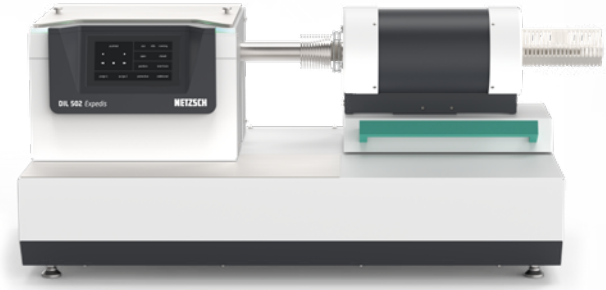


Dilatometry Redefined – DIL 502 *Expedis*® Series

The dilatometer DIL 502 *Expedis*® series offers state-of-the-art technology and is designed for a wide range of sophisticated applications. All instruments of the DIL *Expedis*® series feature the revolutionary *NanoEye* measuring cell – a unique dimension in measuring range and accuracy.

DIL 502 *Expedis*® *Classic*

The *Classic* version stands out by its all-in-one design and ease of use which make it very suitable for routine measurements in the fields of ceramics, building materials and glasses.



DIL 502 *Expedis*® *Classic*

DIL 502 *Expedis*® *Select/Supreme*

The comprehensive, fully-equipped *Supreme* model and the upgradable *Select* type are designed for research & development and sophisticated industrial applications.



DIL 502 *Expedis*® *Supreme*

	Classic	*Select*	*Supreme*
Temperature range	RT to 1600°C	-180°C to 2000°C, various furnaces	-180°C to 2800°C, various furnaces
Type	Single or double dilatometer	Single or double dilatometer	Single or double dilatometer
Measuring range	± 5000 µm	± 10000 µm	± 25000 µm
NanoEye	Yes	Yes	Yes
ΔL resolution	2 nm	1 nm	1 nm
Automatic sample length detection	Yes	Yes	Yes
Force range	0.01 N to 3 N	0.01 N to 3 N	0.01 N to 3 N
Force modulation	Optional	Optional	Yes
Sample length	0 to 52 mm	0 to 52 mm	0 to 52 mm
Vacuum-tightness	–	≈10^{-5} mbar	≈10^{-5} mbar

EVOLVED GAS ANALYSIS – COUPLED TO THERMAL ANALYSIS

Our Thermal Analysis equipment incorporates vertical gas flow systems in the furnaces. This yields perfect gas transport in the natural upward flow direction and requires only low purge gas flow rates, resulting in low dilution of the evolved sample gases. Sensitive and complete detection and analysis of evolved gas species result from our many years of experience in coupling gas analyzers. The temperature range of the coupling is according to the coupled thermal analysis instrument.

Thermal Analysis and Evolved Gas Analysis – A Smart Combination

All vacuum-tight thermobalances (TGA) and Simultaneous Thermal Analyzers (STA) are the ideal basis for coupling with one or two evolved gas analyzers (EGA) – even when equipped with the automatic sample changer (ASC). Simultaneously recorded data about weight changes, enthalpy changes and evolved gases provides an optimum platform for comprehensive material characterization.

The coupling to thermal analyzers (STA, TGA, DSC) can be realized with the following types of spectrometric gas analyzers: MS, FT-IR and GC-MS.

Possible Applications

- Analysis of decomposition steps
- Solid-gas reactions
- Evaporation, outgassing
- Detection of volatiles
- Analysis of additives
- Compositional analysis
- Analysis of aging processes
- Desorption behavior



Bruker INVENIO with external gas cell

STA 509 *Jupiter*®

The All-Encompassing Coupling to Gas Chromatograph-Mass Spectrometer (GC-MS) and Infrared Spectrometer (FT-IR)



Mass spectrometer

Gas chromatograph

STA 509 *Jupiter*®

* Optional feature

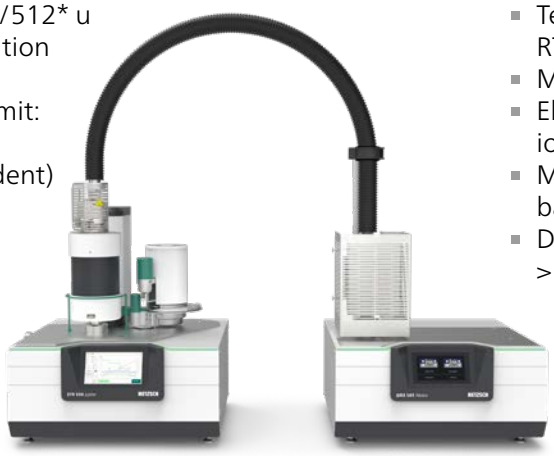


Mass Spectrometer Coupling via Capillary or *SKIMMER*

STA 509 *Jupiter*® – QMS 505 *Aëolos*

The STA systems offer fast atmosphere adjustment, especially with very pure and non-oxidizing sample atmospheres.

- Optimized gas transfer
- No dead volume or cold spots
- Low dilution – high sensitivity
- Up to 300 u/512* u
- 3D presentation of results
- Detection limit: > 100 ppb (gas dependent)



STA 509 *Jupiter*® coupled to QMS 505 *Aëolos*

STA 509 *Jupiter*® *Select* with *SKIMMER* Furnace

The *SKIMMER* coupling is the shortest possible solution for the transfer of gas from the sample to the QMS. All components of the system are heated to at least the sample temperature, thus preventing the possibility of any condensation. Even metal vapors are detected by this unrivalled coupling system.

- Temperature range: RT to 1450°C or RT to 1950°C
- Mass range: 1 u to 512 u
- Electron impact ionization
- MID, scan, scan/bar-graph
- Detection limit: > 100 ppb



STA 509 *Jupiter*® *Select* with *SKIMMER* furnace

PERSEUS – Integrated FT-IR Coupling

PERSEUS TG 309 *Libra*®/PERSEUS STA 509 *Jupiter*®

The PERSEUS coupling is an alliance between the TG 309 *Libra*® *Select/Supreme* or STA 509 *Jupiter*® *Classic/Select/Supreme* and a compact FT-IR spectrometer by BRUKER Optics. Its design is both unprecedented and unmatched, and sets a benchmark for coupling techniques.

- Affordable gas analysis
- No separate transfer line
- Built-in heated gas cell
- Optimized low-volume design
- Space-saving



PERSEUS TG 309 *Libra*®

GUARDED HOT PLATE

Absolute Measurement of the Thermal Conductivity by Means of Guarded Hot Plate

All NETZSCH and NETZSCH TAURUS Instruments GHP systems are based on various international standards including ISO 8302, ASTM C177, EN 1946-2, EN 12664, EN 12667, and EN 12939.

Guarded Hot Pipe for Pipe Insulations

The TRL 1000 offers the absolute method for determining the thermal conductivity of pipe insulations in accordance with DIN EN ISO 8497, DIN EN 1946-5, DIN 52613, ASTM C 534, and ASTM C 335.

- Measuring range:
  0.001 W/(m·K) up to 0.25 W/(m·K)
- Specimen diameter:
  - inner: 18 mm to 89 mm
  - outer: 30 mm to 220 mm
- Temperature range:
  - test chamber: -15°C to 140°C
  - hot pipe: 20°C to 200°C



TLR 1000

GHP 456 *Titan*®

For the absolute determination of the thermal conductivity, the GHP 456 *Titan*® is the ideal tool for researchers and scientists. It features outstanding reliability and accuracy.

- Temperature range[2]: from -160°C up to 600°C
- Accuracy: typically 2%
- Symmetric test configuration for one or two specimens
- Thermal conductivity range: 0 to 2 W/(m·K)
- Atmospheres: inert, oxidizing, vacuum
- Sample thickness: up to 100 mm
- Plate dimensions[2]: up to 500mm x 500mm
- 31 separately calibrated sheeted Pt-100 temperature sensors for optimum temperature measurement



GHP 456 *Titan*®

[1] Depending on material and thickness
[2] Depending on the instrument; when testing near the limits of these ranges, special precautions must be taken



GHP 721-500 mm and GHP 721-600 mm

Measuring devices of the GHP 721 series (GHP 500 mm/600 mm) are robust, user-friendly cabinet devices which are especially suited for testing thicker specimens.

- Measuring range[1]: 0.005 to 2.0 W/(m·K)
- Specimen size (L x W): 500 mm x 500 mm/600 mm x 600 mm
- Temperature range:
  - Cooling plate: -15°C to 60°C
  - Heating plate: -5°C to 70°C
- Specimen thickness:
  - 1x 15 mm to 200 mm (1-specimen)
  - 2x 15 mm to 100 mm (2-specimen)



GHP 721-500 mm

GHP 721S-900 mm

The GHP 721S-900 mm offers a tiltable test chamber especially for insulating glass, e.g., windows and skylights. It is able to measure the thermal conductivity as a function of temperature and mounting angle.

- Measuring range[1]: 0.005 to 2.0 W/(m·K)
- Specimen size (L x W): 900 mm x 900 mm
- Temperature range:
  - Cooling plate: -10°C to 60°C
  - Heating plate: 0°C to 70°C
- Specimen thickness:
  - 1-plate method: 1x 15 mm to 380 mm
  - 2-plate method: 2x 15 mm to 180 mm



GHP 721S-900 mm

THERMAL DIFFUSIVITY

The characterization of highly conductive materials at cryogenic and moderate temperatures or ceramics and refractories at elevated temperatures is of high interest. Many challenges can only be met with precise knowledge of the thermal diffusivity and conductivity. One accurate and robust solution for the direct determination of the thermal diffusivity is offered by the Laser/Light Flash Methods (LFA). The thermal conductivity is then calculated by using the LFA results. The software already includes various corrections, calculation models and mathematical operations for improved evaluation of the LFA data.

LFA 717 *HyperFlash*® Series – Optimized Field of View Between -100°C and 1250°C

The *HyperFlash*® series features an intelligent lens system, *ZoomOptics*, between the sample and the detector, an extremely fast data acquisition and a wide temperature range, which is handled by a single instrument setup, without changing either the detector or the furnace. These systems are capable of measuring thin films.

LFA 717 *HyperFlash*®

- Temperature range: -100°C to 500°C
- Various cooling devices*
- Thermal conductivity range: 0.1 W/(m·K) to 4000 W/(m·K)
- Light source: Xenon flash lamp
- Data acquisition: up to 2 MHz
- Min. measurement time (10 half times) down to 1 ms → for highly conducting and/or thin samples
- Max. measurement time up to 120 s → for low-conducting and/or thick samples
- Automatic sample changer for up to 16 samples (4 x Ø 25.4 mm, 6 x Ø 12.7, 16 x □ 10 mm)
- Special sample holders*: liquids, pastes and powder, fibers, etc.
- Most advanced calculation models and corrections

LFA 717 *HyperFlash*® *HT*

- Temperature range: RT to 1250°C
- Thermal conductivity range: 0.1 W/(m·K) to 4000 W/(m·K)
- Light source: Xenon flash lamp
- Data acquisition: up to 2 MHz
- Min. measurement time (10 half times) down to 1 ms → for highly conducting and/or thin samples
- Max. measurement time up to 120 s → for low-conducting and/or thick samples
- Vacuum: 10^{-5} mbar (with turbo pump)
- High-speed mini-tube furnace for up to 4 specimens (4 x Ø 12.7 mm, 4 x □ 10 mm)
- Small foot print
- Most advanced calculation models and corrections



LFA 717 *HyperFlash*®



LFA 717 *HyperFlash*® *HT*

* Optional feature



LFA 427

The LFA 427 is the most versatile instrument allowing tests on solids, powders, laminates, or even liquid metals and slags up to highest temperatures.

- Temperature range: -120°C to 2800°C
- Thermal conductivity range[1]:
  0.1 W/(m·K) to 2000 W/(m·K)
- Vacuum: 10^{-5} mbar
- Atmospheres: inert, oxidizing, reducing
- Sample dimensions[2]:
  □: 8 x 8 or 10 x 10 mm²,
  Ø: 6, 8, 10 or 12.7 mm, 20 mm; thickness: 0.1 to 6 mm
- Special sample holder for liquid metals, slags, pastes, powders, etc.
- Model wizard

[1] Lower values possible, depending on sample's properties
[2] Special dimensions on request



LFA 427

LFA 707 *StratoFlash® Classic*

The LFA 707 *StratoFlash® Classic* measures the thermal properties of materials like ceramics, metals, polymers, and composites over a wide temperature range. It comes with various sample holders and offers an automatic sample changer for up to 5 samples.

- Temperature range: RT to 1600°C
- Measuring range:
  - Thermal diffusivity: 0.01 mm²/s to 2000 mm²/s
  - Thermal conductivity: 0.1 W/(m·K) to 4000 W/(m·K)
- Measurement atmospheres: inert or vacuum (<2 x 10^{-5} mbar; turbo molecular pump)
- Sample dimensions[1]:
  Ø: 6 mm, 8 mm, 10 mm, 12.7 mm, 20 mm, 25.4 mm; 0.1 mm to 6 mm thickness
  □: 10 x 10 mm², 20 x 20 mm²; 0.1 mm to 6 mm thickness
- Special sample holders for molten polymers/low viscosity liquids, resins during curing, pastes, powders, fibers, laminates, in-plane and mechanical pressure

[1] Special dimensions on request



LFA 707 *StratoFlash® Classic*



THERMAL CONDUCTIVITY

Thermal conductivity is a significant thermophysical property and can be determined by means of heat flow meters or the Guarded Hot Plate.

Heat-Flow Meters – HFM 706 *Lambda* Series

The Heat Flow meter is suitable for insulation and building materials such as different fiber boards, loose fill, cellular plastics, powders, foams, evacuated panels, etc. The HFM series is based on standards ASTM C518, ISO 8301, JIS A1412, and EN 12667.

- Temperature range of plates: -30°C to 90°C
- Thermal conductivity range: 0.001 W/(m·K) to 2.0 W/(m·K)
- Thermal resistance range: 0.05 to 10.0 $(m^2 \cdot K)/W$
- Sample dimensions: from 203 mm x 203 mm up to 611 mm x 611 mm and thickness up to 200 mm
- Four-corner thickness determination
- Automatic measurement of mean sample thickness
- Variable contact pressure up to 1930 N for density variation of compressible materials



HFM 706 *Lambda Small, Medium* and *Large*

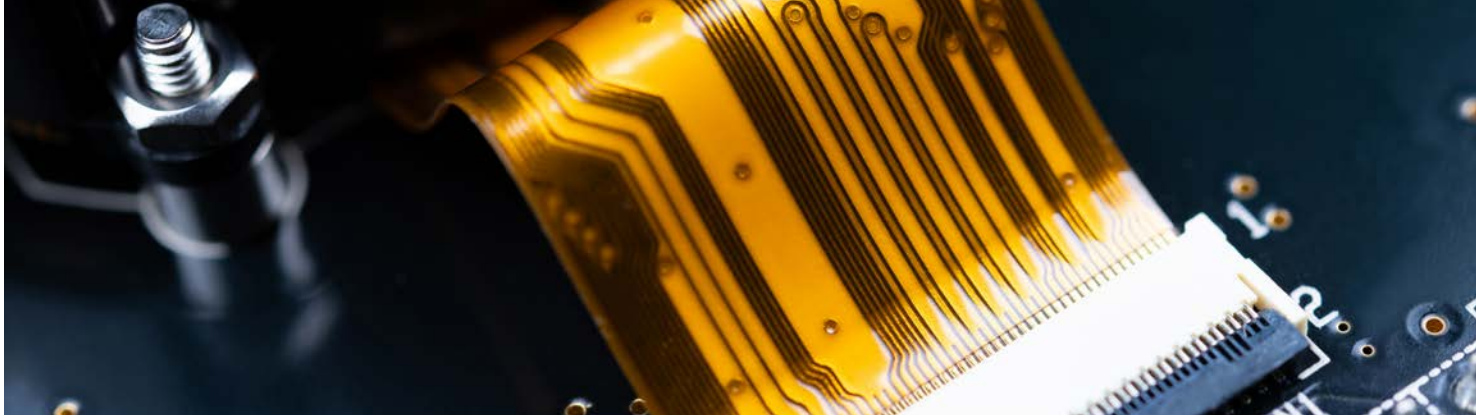
Guarded Heat Flow Meter – TCT 716 *Lambda*

The use of a guarded heat flow meter makes it possible to accurately measure thermal conductivity and thermal resistance. The system consists of a heat source and a temperature sensor, both enclosed in an insulating layer known as a "guard". At elevated temperatures, the use of a guarded furnace effectively reduces heat leakage to the sides and improves the accuracy of measurements. The TCT 716 *Lambda* is based on ASTM E1530.

- Mean temperature: -10°C to 300°C
- Thermal conductivity range: 0.1 to approx. 45 W/(m·K)
- Thermal resistance range: 0.001 to 0.030 $m^2 \cdot K/W$
- Sample dimensions: Round with ø 51 mm (2 inch; +0 in, -0.005 in); height up 30 mm (1¼ inch)
- Number of samples: Two test stacks for the measurement of one or simultaneaously two specimens



TCT 716 *Lambda*



TIME DOMAIN THERMOREFLECTANCE BY PULSED LIGHT HEATING – NanoTR/PicoTR

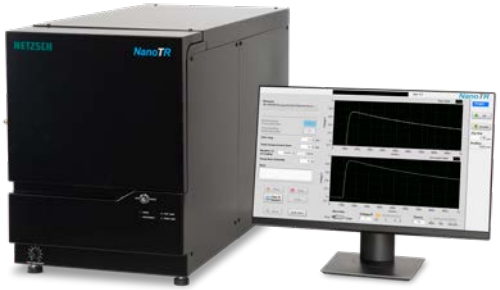
The Laser Flash Method for Thin Films

With the significant progress in the design of electronic devices and the associated need for an efficient thermal management, accurate thermal diffusivity/thermal conductivity measurements of thin films with thicknesses in the nm and µm range are more than ever crucial.
The thicknesses of nanometer-thin films are often less than the typical grain size. Consequently, their thermophysical properties differ significantly from the bulk material.
Both the nano-second thermoreflectance device *NanoTR* and pico-second thermoreflectance device *PicoTR* allow for absolute measurements of the thermal diffusivity of thin films. The determination of thermal diffusivity and interfacial thermal resistance can be achieved by Rear Heating/Front Detection (RF mode) and Front Heating/Front Detection (FF mode).

	NanoTR	*PicoTR*
Pump laser	Pulse width: 1 ns Wave length: 1550 nm Beam diameter: 100 µm	Pulse width: 0.5 ps Wave length: 1550 nm Beam diameter: 45 µm
Probe laser	Pulse width: continuous Wave length: 785 nm Beam diameter: 50 µm	Pulse width: 0.5 ps Wave length: 775 nm Beam diameter: 25 µm
Measurement properties	Thermal diffusivity and effusivity, interfacial resistance	
Sample film thickness (RF method)	Organics: 30 nm ... 2 µm Ceramics: 300 nm ... 5 µm Metals: 1 µm ... 20 µm	Organics: 10 nm ... 100 nm Ceramics: 10 nm ... 300 nm Metals: 100 nm ... 900 nm
Sample film thickness (FF method)	Thicker than 1 µm (min.)	Thicker than 100 nm (min.)
Substrate	Material: Opaque/Transparent Size: 10 ... 20 mm square Thickness: max. 1 mm	
Thermal diffusivity	Range: 0.01 ... 1000 mm^2/s Accuracy: ± 6.2% with 40 min measurement time, for CRM 5808A in RF Mode, 400 nm thickness Mo Repeatability: ± 5%	



PicoTR



NanoTR

ACCELERATING RATE CALORIMETRY BATTERY TESTING

Accelerating Rate Calorimeters help secure safe and cost-effective operations in industry. As highly versatile miniature chemical reactors, they measure thermal and pressure properties of exothermic chemical reactions. The resulting information helps engineers and scientists to identify potential hazards and address key elements of process safety design including emergency relief systems, process optimization, and thermal stability. For all NETZSCH Accelerating Rate Calorimeters with internal heaters, the patented *VariPhi*® option enables measurements at constant heating rates (exo/endo) and monitoring pressure data.

Multi-Module Calorimeter

MMC 315 *Nexus*®

Interchangeable calorimeter modules of the MMC 315 *Nexus*® allow adiabatic and scanning tests accompanied by pressure measurements. For coin cell studies two dedicated coin cell modules are available. Data generated from the MMC test is merged seamlessly with the data generated from the cycler/analyzer.

- ARC and Scanning module:
  - Tracking rate of 50 K/min
  - Temperature range: RT to 500°C
  - Max. pressure: 150 bar
  - Container volume:
    0.5 ml to 8.5 ml (ARC module)
    2.6 ml (Scanning module)
- Two Coin Cell modules for testing coin cells (e.g. CR2032):
  - High Temperature module:
    Temperature range: RT to 300°C
    Limit of detection: 0.1mW
    Container volume: to 1 ml
  - High Sensitivity module:
    Temperature range: RT to 200°C
    Limit of detection: 0.05 mW
    Container volume: to 1 ml



MMC 315 *Nexus*®

Accelerating Rate Calorimeters – Tracking Exothermic Reactions

ARC® 244/305

The models allow to safely measure the amount and rate of heat release associated with the processing or storage of chemicals. In addition, the 305 model offers options for the stirring, venting, *VariPhi* and injection of chemicals.

- Temperature range: RT to 500°C
- Max. pressure: 150 bar
- Max. tracking rate:
  - ARC 244 up to 20 K/min
  - ARC 305 up to 200 K/min
- Sample volume: 0.5 ml to 130 ml



ARC® 305



FIRE TESTING

For preventive fire protection, the appropriate choice of materials and components is essential in order to prevent fires completely or prevent them from spreading. Fire tests are according to German, European and international standards and used to classify the flammability and the burn rate of materials for the construction, textile, automobile and electrical industry. Material development and production should consider low flammability, prevention of rapid ignition and generation of the least possible amount of smoke.



SBI 915 – Single Burning Item

Preventive Fire Protection

The selection of materials is decisive for fire prevention and the spread of fire. Fire tests according to German, European and international standards for classifying the flammability and burn rate of materials for the construction, textile, automotive and electrical industries play a major role.

Building Materials

The fire resistance of components and the fire reaction of building materials with the resulting parameters of flammability, flame spread, flaming droplets, flammability, heat release, calorific value, smoke production and toxicity are particularly important for the construction industry.

Mobility

Tests in the field of mobility focus on the flammability and flame spread rate of materials are for the interior of vehicles (e.g., lining, trim, seats and floor coverings of aviation vehicles, railed and road vehicles, etc).

Electrical Industry/Cable

Reactions to fire – especially issues such as flame spread and flaming droplets for electronic and electrical parts, smoke density, insulation integrity and the formation of corrosive gases upon flame impact for electrical, control and data cables.

Textile Products

Upholstery fabrics, curtains and drapes, decorative materials, floor coverings and protective clothing are primarily tested and classified for flammability, reaction to fire, and dripping behavior.



UL 94 –
Fire Tester



TBB 913 – Floor
Radiant Panel



TCC 918 –
Cone Calorimeter



KBT 916 – Fire Testing
for Cables



TNB 912 –
Non-Combustibility Tester

Product	KBT 916	SBI 915	TBB 913	TNB 912	KBK 917	TCC 918	UL 94 Classic/ Supreme	LOI 901	HBK 919	TRD 908	TDP T4	TDP T3
Heat release	x	x				x						
Smoke development	x	x	x			x				x		
Flame spread	x	x	x								x	x
Flaming droplet	x	x					x				x	x
Non-combustibility				x								
Ignitability					x						x	x
Burning time/speed		x					x		x		x	x
Time to ignition						x						
Mass loss						x						
Heat of combustion						x						
Combustion gas						x						
Oxygen index								x				
O_2, CO_2, CO analyzer						x						
Euro classification/ Euro fire testing lab		x	x	x	x	x	x			Mostly integrated	x	x
Industry	Cables	Building	Building	Building	Building	Building, Auto-motive, Polymers	Electro-nics, Polymers	Polymers	Auto-motive	Single/ Stand-alone	Roofs	Roofs
Standards	EN 50399, IEC 60332-3	EN 13823	EN ISO 9239-1	DIN EN ISO 1182	DIN EN ISO 11925-2	ISO 5660-1, ASTM E 1354	UL94, DIN EN 60695-11, ISO 9773	ISO 4589-2, DIN 22117, ASTM D 2863	ISO 3795, DIN 75200, MVSS 302, GB 8410, IS 15061, CMVSS 302, U.T.A.C. 18-502, FAR 25.853	DIN 50055	DIN CEN/TS 1187, test procedure 4	DIN CEN/TS 1187, test procedure 3



TRDA – Smoke Density Tester with Light Measurement System



KBK 917 – Small Burner Box



LOI 901 – Oxygen Index Analyzer



HBK 919 – Horizontal Burner Box



TDP T4 – Fire Testing for Roofs



REFRACTORIES TESTING

All NETZSCH refractories testing instruments conform to the pertinent instrument and applications standards, e.g., ISO 1893, ISO 3187, ISO 5013, DIN EN 993-7/8/9/12/14/15, DIN 51048, DIN 51053.

Refractoriness Under Load (RUL) and Creep in Compression (CIC)

RUL/CIC 421

Refractoriness under load (RUL) is a measure of the resistance of a refractory product to deform when it is subjected to the combined effects of load, rising temperature, and time. Creep in compression (CIC) refers to the percent of shrinkage of a refractory test piece under a constant load and exposed to a constant high temperature over a long period of time. The RUL/CIC 421 allows for reliable RUL/CIC tests and precise dilatometer measurements on large and even inhomogeneous samples.

- Temperature range: RT to 1700°C
- Specimen size: Ø 50 mm, 50 mm height
- Load range: 1 N to 1000 N, in steps of 1 N and 100 N
- Test atmosphere: static air, inert gas purge*



RUL/CIC 421

* Optional feature



All over the world, the name NETZSCH stands for comprehensive support and expert, reliable service, both before and after sale. Our qualified personnel from the technical service and application departments are always available for consultation. In special training programs tailored for you and your employees, you will learn to tap the full potential of your instrument. Choose your preferred training method: Online, on-site or at our NETZSCH training center.

To maintain and protect your investment, you will be accompanied by our experienced service team over the entire life span of your instrument.

Expertise in SERVICE

TECHNICAL SERVICE

- Maintenance and Repair
- Software Updates
- Exchange Service
- IQ/OQ Documents
- Calibration Service
- Spare Part Assistance
- Moving Service

TRAINING

- Basic Seminars
- NETZSCH Online Academy
- Comprehensive Instrument and Method Training

LABORATORY

- Application Service and Contract Testing

STANDARD AND ADVANCED SOFTWARE

One of the most complete and easy-to-handle software solutions in Thermal Analysis, *Proteus*®, has grown over the years. Developed by our experienced software team and tested by many application experts, this software for measurement and evaluation supports you with a practice-oriented structure, easy-to-understand user guidelines and a comprehensive help system.

Proteus®* – Measurement and Evaluation at its Best

- *SmartMode* – features a clear structure, uniform navigation and user friendliness
- *Expert Mode* – offers full access to all functions provided by the *Proteus*® software
- *AutoEvaluation* – allows for the evaluation – autonomously or at the push of a button – of unknown curves
- *Identify* – is a unique tool for automatic identification and interpretation of curves with only a single click.
  The database contains a NETZSCH library for typical polymers and can also be extended by adding the user's own materials
- *BeFlat*® – Automatic baseline correction
- *Purity Determination*
- *Tau-R*® mode (thermal resistance, time constant)
- Specific heat capacity (c_p)
- c-*DTA*® (calculated DTA for TGA and DIL)
- Rate-controlled mass change, *SuperRes*® (TGA),
  Rate-controlled sintering (DIL)
- *Peak Separation*
- Temperature-modulated DSC/TGA-DSC (STA)
- *Kinetics Lite* – enables fast, reliable kinetic analysis of DSC and TGA measurements; directly out of the NETZSCH *Proteus*® software
- *Proteus*® *Protect* ensures data integrity and meets the requiremens of 21 CFR Part 11 or EU Annex 11

Proteus® Protect
21 CFR Part 11
compliant

* Optional feature, not available for all instruments



Additional Software* – Extensions for Comprehensive Evaluation

Kinetics Neo

The *Kinetics Neo* software module creates kinetic models of chemical processes based on a series of laboratory measurements using DSC, TGA, DEA, rheometry, and DIL under different temperature conditions. It analyzes overlapping or parallel steps as well as the influence of the glass transition. The software can be used to predict the behavior of chemical systems under user-defined conditions for process optimization. With *Kinetics Neo* analysis, the number of reaction steps and the following values for each step can be determined:

- Reaction type
- Activation energy
- Order of reaction
- Other kinetic parameters

Termica Neo

Termica Neo is a software for simulating the thermal behavior and thermal safety for chemical reactions and crystallization in solids or liquids in volumes ranging from centimeters to meters. The main applications are materials with high thermal potential, as well as reactions of curing, cross-linking, sintering and polymer crystallization reactions.

Proteus® Now Quantify – Using Predictive AI to Decode Recyclate Composition

Proteus® Now Quantify combines classical machine learning (e.g., decision trees) with deep learning (neural networks) to accurately interpret even challenging material mixtures – including those with overlapping melting peaks. Each result contains an uncertainty score, similar to a standard deviation, providing a confidence measure for each prediction and helps identify unknown or borderline cases.

The owner-managed NETZSCH Group is a leading global technology company specializing in mechanical, plant and instrument engineering.

Under the management of Erich NETZSCH B.V. & Co. Holding KG, the company consists of the three business units Analyzing & Testing, Grinding & Dispersing and Pumps & Systems, which are geared towards specific industries and products. A worldwide sales and service network has guaranteed customer proximity and competent service since 1873.

When it comes to Thermal Analysis, Calorimetry (adiabatic & reaction), the determination of Thermophysical Properties, Rheology and Fire Testing, NETZSCH has it covered. Our 60 years of applications experience, broad state-of-the-art product line and comprehensive service offerings ensure that our solutions will not only meet your every requirement but also exceed your every expectation.

Proven Excellence.

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