NETZSCH

Proven Excellence.

Simultaneous Thermal Analysis
STA 319 *Jupiter*®

Method, Technique, Applications

Analyzing & Testing

Flexible, Sophisticated & Technically Outstanding

Simultaneous Thermal Analysis generally refers to the simultaneous application of Thermogravimetry (TGA) and Differential Scanning Calorimetry (DSC) to one and the same sample using a single instrument. The advantages are obvious. For a single sample, the TGA and DSC signals can be obtained under perfectly identical experimental conditions, including:

- Atmosphere
- Gas flow rate
- Vapor pressure on the sample
- Heating rate
- Thermal contact with the sample crucible
- Sensor radiation effect, etc.

Furthermore, sample throughput is improved as more information can be gathered from each test run.

DSC Possibilities

- Melting/crystallization behavior
- Solid-solid transition
- Glass transition
- Oxidative stability
- Specific heat capacity
- Degree of crystallinity
- Cross-linking reactions
- TM-DSC
- Kinetics simulations

TGA Possibilities

- Mass changes
- Decomposition
- Oxidation/reduction behavior
- Temperature stability
- Compositional analysis
- Corrosion studies
- Kinetics simulations

The STA 319 *Jupiter*®

Offering Access to Simultaneous Thermal Analysis

ADVANCED MICROBALANCE FOR ACCURATE TGA RESULTS

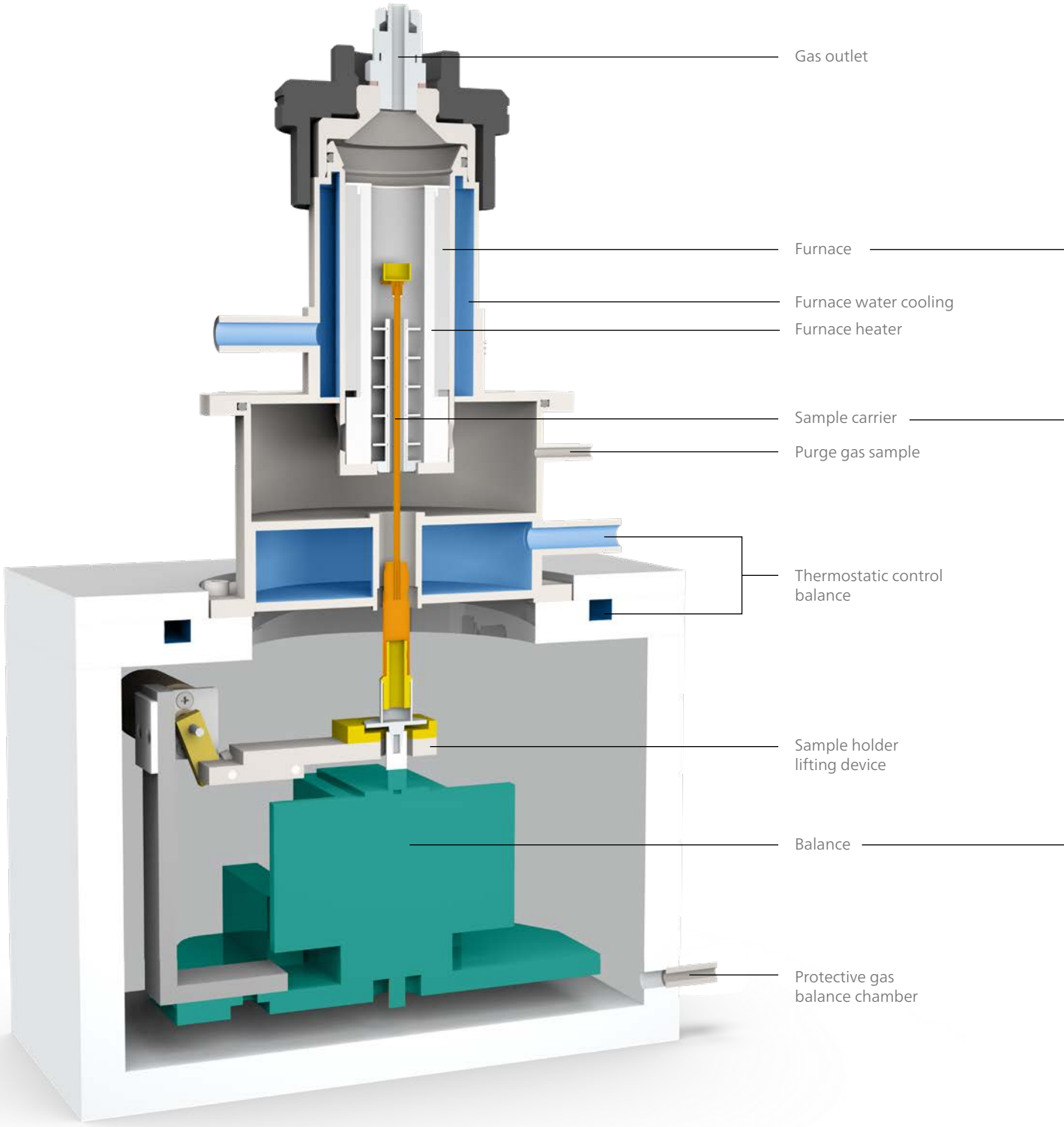
TOP-LOADING DESIGN FOR FREE AND SAFE ACCESS

LARGE AUTO SAMPLER AND COUPLING OPTIONS FOR HIGH EFFICIENCY AND ANALYTICAL DEPTH

HIGH-PERFORMANCE DSC SENSOR FOR RELIABLE AND PRECISE RESULTS

VACUUM-TIGHT DESIGN FOR DEFINED ATMOSPHERIC CONDITIONS

FAST THERMAL CONTROL VIA SOPHISTICATED FURNACE



Explore the STA 319 *Jupiter*®

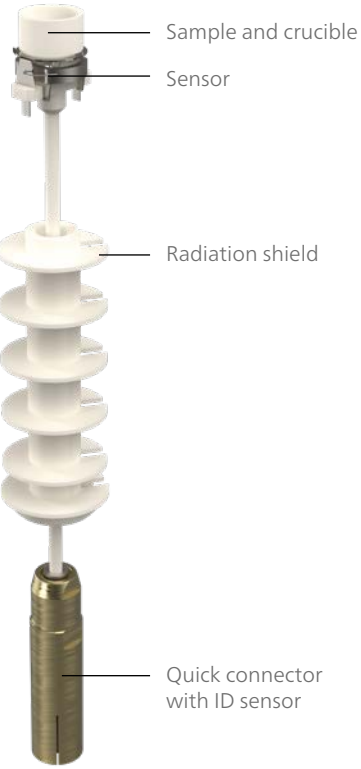
Shaping the Next Generation of Simultaneous Thermal Analysis

Robust and Fast-acting Furnace

The low-volume furnace enables rapid heating and ballistic cooling from 1100°C to room temperature, saving time and improving efficiency.

Innovative Design. Uncompromised Precision – the New DSC-TGA Sample Carrier

The STA 319 *Jupiter*® DSC-TGA sample carrier features a reference ring design that replaces the conventional reference crucible. This design simplifies handling, provides a stable thermal reference point, and improves measurement consistency, resulting in more reliable experimental outcomes.



Innovative Balance Design for Reliable Results

Achieve outstanding accuracy and reproducibility with a top-loading microbalance that delivers a 20-ng resolution as well as clean and stable baselines. During sample loading, the balance is automatically decoupled via the hoisting mechanism, reducing mechanical influence on the microbalance and preventing potential damage.

Accessories

Magnetic Shock Absorbers in the Device Base

The standard feet on the STA 319 *Jupiter*® series can be optionally replaced with a patented magnetic levitation system (Patent DE 10 2020 007 279 B4; US 11,747,176 B2) that effectively shields the instrument from external disturbances such as vibration. This feature provides reliable results that are unaffected by environmental impact.

Big Selection of Crucible Types

Various crucible types made of different materials and in different volumes are available to fit your application needs. Here, only a small selection of crucibles is shown. Sample-crucible compatibility must always be ensured to avoid reactions between the sample and the crucible.

Typical STA 319 *Jupiter*® Crucibles:

Material	Diameter/Height	Volume
Al_2O_3	6.8 mm/4 mm	85 µl
Pt/Rh	6.8 mm/2.7 mm 6.8 mm/6 mm	85 µl; 190 µl
Al (max. 600°C)*	5 mm/2.7 mm	30 µl; 50 µl

* *Concavus* crucible

Selection of crucibles to be used with the STA 319 *Jupiter*®

Sample Changer with 204 Sample Positions Featuring Removable Trays for Improved Handling

The STA 319 *Jupiter*® ASC is designed to house two interchangeable sample trays in microplate format, each holding 96 samples. This allows for clear assignment of the samples when they are prepared away from the instrument. An additional fixed strip is reserved for up to 12 calibration materials or empty crucibles of different dimensions and materials for calibration and correction purposes. Correction measurements with empty crucibles can, of course, also be defined on the trays.

This large number of positions ensures total flexibility and frees up time for other important day-to-day tasks.

Just-in-Time Automatic Piercing Device

This optional automatic piercing device is mounted on the gripper and opens sealed aluminum crucible lids right before the measurement. This allows defined gas release, prevents premature reactions, and guarantees consistent, reproducible results.

Evolved Gas Analysis (EGA) Extensions for the STA 319 *Jupiter*®

Coupling to FT-IR

The comprehensive coupling system incorporates a Bruker Optics INVENIO FT-IR spectrometer*, channeling the TGA purge gas through a short heated transfer line to a vacuum-tight gas cell.

Evolved gases with a changing dipole moment can be identified by their characteristic absorption spectra, and complex gas mixtures can be spectroscopically separated and identified.

* other systems on request

PERSEUS® STA 319 *Jupiter*®

The patented PERSEUS® STA 319 *Jupiter*® (patent: EP 2 674 749 B1 US 9,429,531 B2) is a tightly integrated design that combines a compact Bruker FT-IR spectrometer (Alpha II) with an STA. It features a directly heated, low-volume gas cell and a short transfer path, making it ideal for fast, compact evolved gas analysis with minimal dilution effects and high detection sensitivity.

Coupling to GC-MS

GC-MS is a high-resolution technique for the analysis of volatile and semi-volatile compounds. The gas mixtures are separated on the basis of differences in the component distribution between a stationary phase (e.g., inner coating of a capillary) and a mobile phase (purge gas; e.g., helium). A mass spectrometer serves as a detector for the gas species separated. (event controlled measurement mode GC-MS. Patent: EP 2 666 012 B1, US 9,689,818 B2)

COOPERATION SINCE 1993
NETZSCH BRUKER

Adapter and transfer line heatable to 400°C, depending on the coupling solution

Bruker INVENIO FT-IR spectrometer | External TGA-IR | STA 319 *Jupiter*® | Valve Box | GC-MS instrument

STA 319 *Jupiter*® coupled to the FT-IR Bruker INVENIO and GC-MS instrument

Coupling to MS

High-level material research and characterization can be achieved by coupling the STA 319 *Jupiter*® to our QMS 505 *Aëolos*® quadrupole mass spectrometer. Any gases evolved are introduced directly into the electron impact ion source of the MS via a capillary heated up to 350°C.

More Information

STA 319 *Jupiter*® coupled to QMS 505 *Aëolos*®

Vacuum-Tight by Design for Reproducible Measurement Conditions

Tests under vacuum for improved separation of decomposition steps

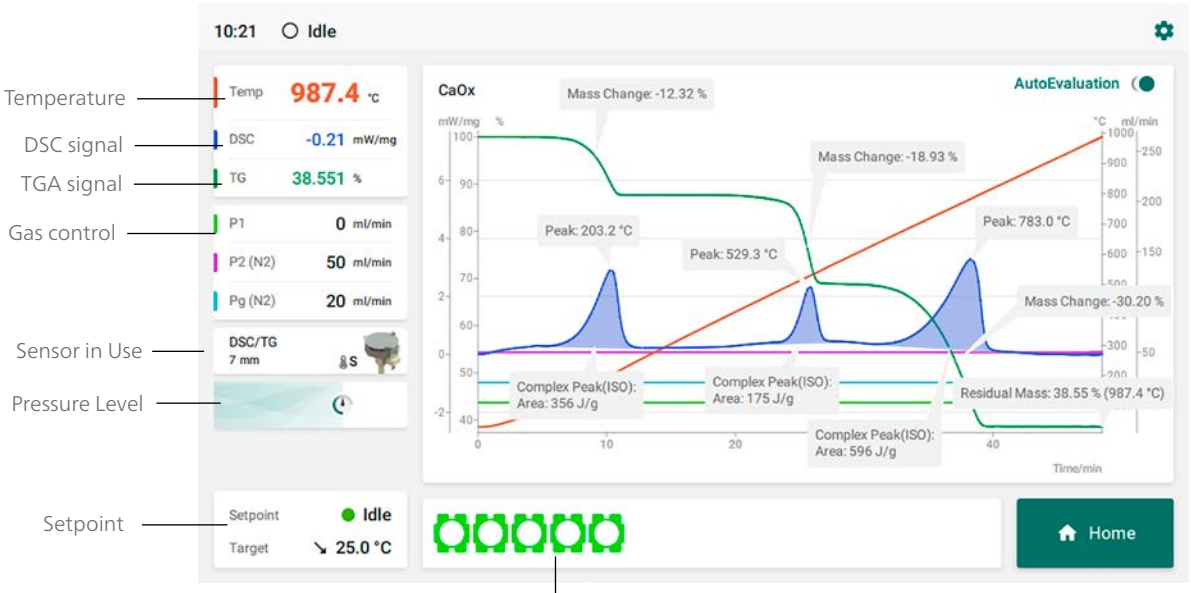
AutoVac – Reproducible Results

The *AutoVac** feature allows for software-controlled automatic evacuation and gas filling, thus providing uniform measurement conditions. When mixtures or blends are measured at reduced pressure, boiling point depression can be realized for volatiles (e.g., solvents, plasticizers). This improves separation of the components during decomposition. After release of the volatile, backfilling with an inert gas is possible, followed, for example, by an oxidizing atmosphere to continue the measurement until complete decomposition is achieved.

*optional

The STA 319 *Jupiter*®

Transfer Instrument Control and Information Directly to the Instrument

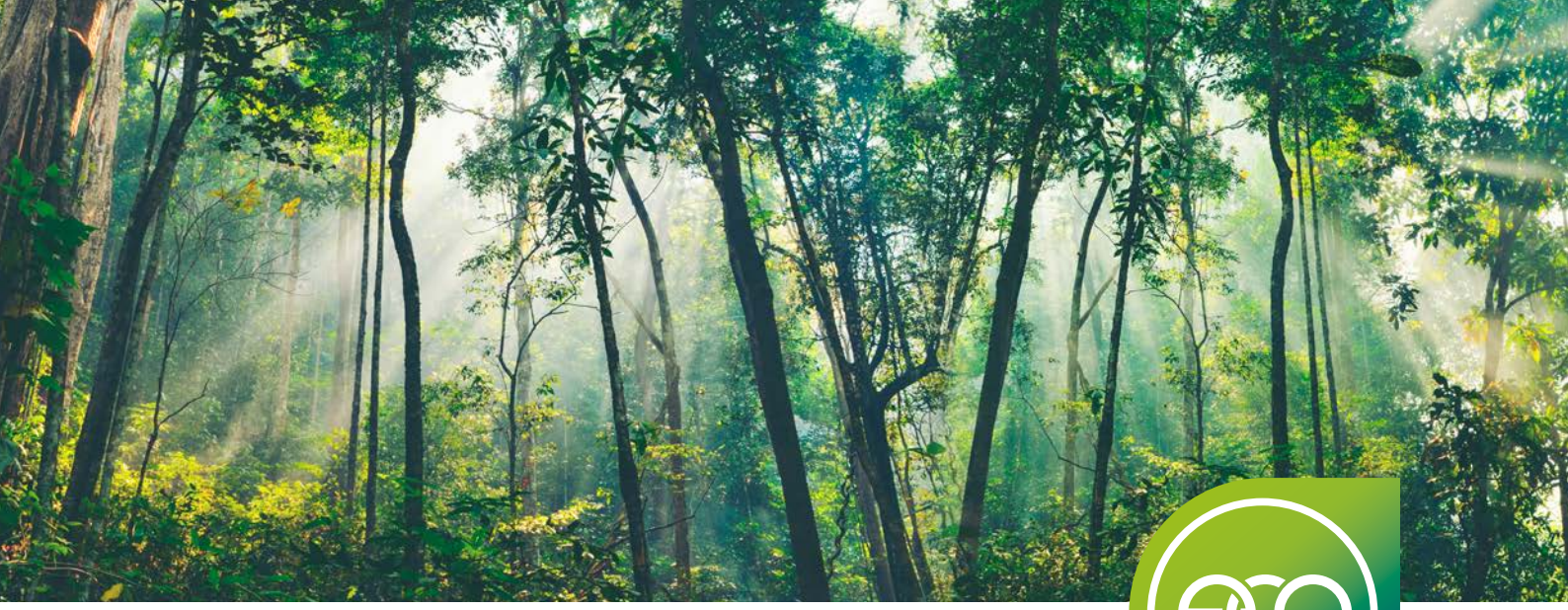


Supervising your measurement made easy, monitor measurement progress, control and configure setpoint and gas flow.

The integrated color display enables direct control and final measurement checks on the instrument, offering a simple, fast, and intuitive experience.

The color touch display offers the ability to:

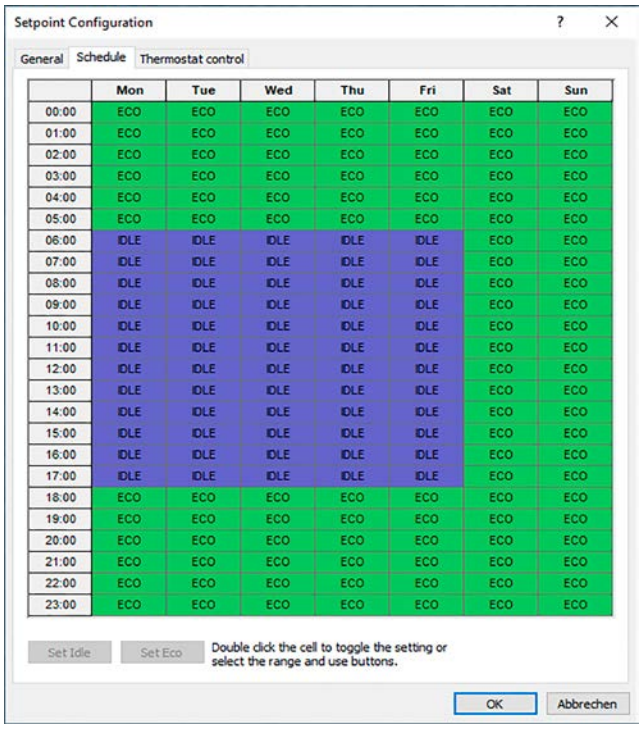
- Start measurements with a single touch
- Check recently finished measurements
- See the progress of your measurement and time remaining
- Check current temperature
- Check and change gas flow and gas types
- Tare balance signal directly on the display
- Start and check *AutoVac* cycles
- Monitor the pressure level of the balance vessel



FOCUS ON EFFICENCY AND A MORE SUSTAINABLE LABORATORY

Eco Mode – Uses Energy and Gases Only when Needed

Example of a Setpoint Eco/Idle Configuration



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04:00	ECO	ECO	ECO	ECO	ECO	ECO	ECO
05:00	ECO	ECO	ECO	ECO	ECO	ECO	ECO
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Instrument in Idle Mode
Instrument in Eco Mode

Sustainable laboratories are essential for advancing science in a responsible manner. They reduce energy use, waste, and environmental impact while enabling high-quality research that drives innovation and a cleaner future*.

On a typical lab day, STA instruments run for 10 to 12 hours, but are often shut down outside working hours, leading to long warm-up times and delayed results; or they are left running, leading to energy waste.

Our innovative Eco Mode changes the game. This intelligent, software-controlled feature automatically powers down the chiller when the instrument is not in use and seamlessly reactivates the gas flow and thermostat according to individual schedules – eliminating unnecessary restarts and ensuring your instrument is ready exactly when you need it.

Activating Eco Mode reduces power consumption by over 700 watts during inactive periods (as shown in the example on the left), saving up to 1,800 kilowatt-hours annually and cutting gas usage by 50%! This results in lower operating costs, significant energy savings, and a smaller carbon footprint – making your lab greener and more cost-effective than ever before.

*https://www.rsc.org/globalassets/22-new-perspectives/sustainability/sustainable-labs/sustainable-laboratories-report.pdf

STA 319 *Jupiter*® with *Proteus*®

OUR POWERFUL ANALYSIS SOFTWARE

BeFlat® – An Intelligent Way to Save Time

This software feature provides the appropriate TGA and DSC corrections for the selected measurement conditions without having to carry out a blank value determination in the form of a correction measurement.

Peak Separation

For experimental curves exhibiting overlapping effects (TGA, DSC, MS, FT-IR), our software enables the separation of these peaks. Different curve profiles can be applied to best describe the measured data, allowing experimental results to be presented as a sum of individual peaks and each peak to be analyzed separately.

Specific Heat Capacity c_p

From the DSC signal, the specific heat capacity, $c_p(T)$, can be calculated based on ratio and stepwise methods in accordance with ASTM E1269, DIN 51007 or DIN 11357-4 standards, but also directly and automatically from the DSC heat flow in accordance with DIN 51007. The $c_p(T)$ results can be shown together with uncertainty margin curves.

Kinetics Neo – Process Optimization by Prediction

Kinetics Neo uses temperature-dependent data to precisely model multi-step reactions, enabling accurate predictions and process optimization.

More Information

LabV® – AI Lab Assistant

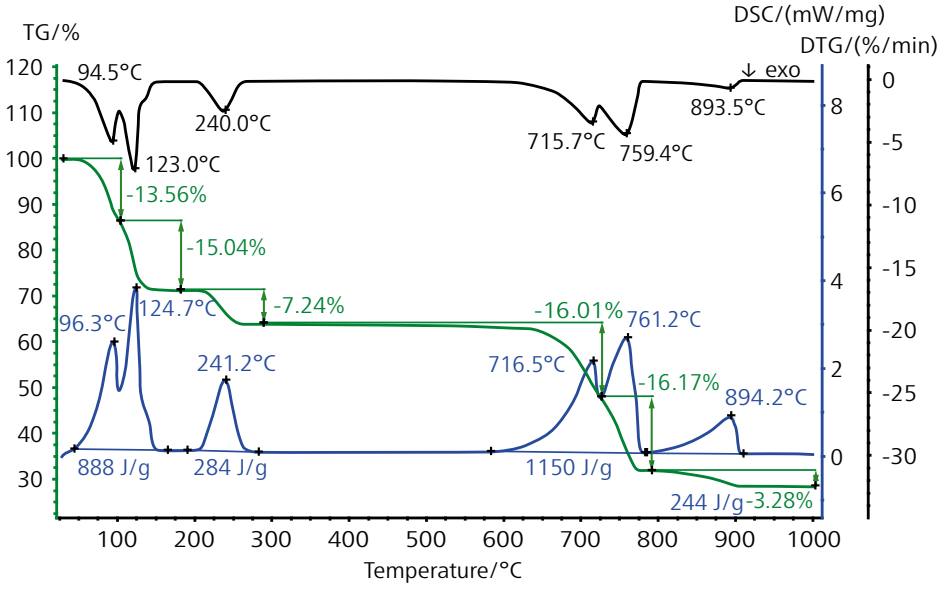
LabV®'s AI assistant simplifies data analysis. It uses natural language models to effortlessly reveal insights, trends, and correlations in sets of measurement data.

More Information

Software Features	
AutoEvaluation (TGA & DSC)	■
BeFlat®* (TGA & DSC)	■
OIT (Oxidation Induction Time/Temperature)	■
Eco Mode	■
Identify	□
Peak Separation	□
Specific Heat Capacity (c_p)	□
Temperature Modulation (TGA-DSC)	□
TauR	□
Report Generator	■
Proteus® Search Engine	□
Kinetics Neo	□
Termica Neo**	□
LabV®	□

■ included
□ optional
* included when MFC is selected
** requires Kinetics Neo

More features on request.



STA measurement on $CuSO_4 \cdot 5H_2O$ (13.72 mg) applying a heating rate of 10 K/min, N_2 atmosphere (70 ml/min) and PtRh crucibles with pierced lids; the DTG curve (black) was created by a mouse click and all evaluations were performed by *AutoEvaluation*

AutoEvaluation – Fast and Objective Results Right After a Measurement

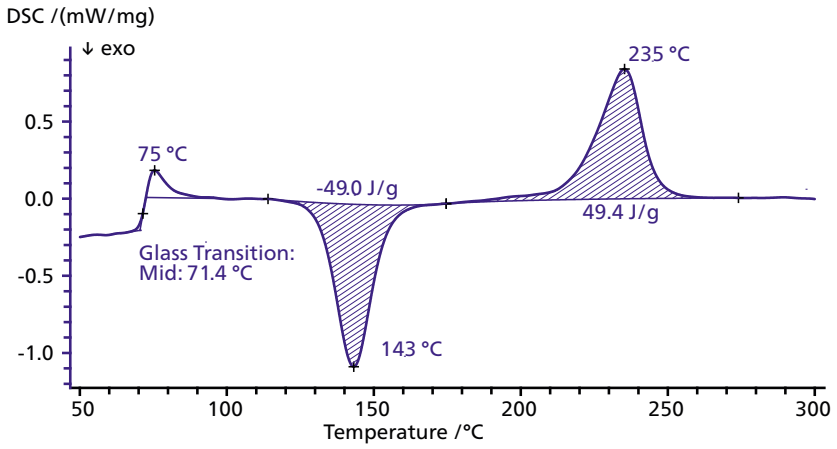
AutoEvaluation is the industry's first self-operating evaluation system for TGA and DSC analyses. It automatically evaluates significant mass changes, endo- and exothermic reactions, generates DTG curves, and identifies peak temperatures without user input. It provides real-time, post-measurement display of evaluated curves and allows customization of detection settings and displayed results. Offering time efficiency and objectivity, *AutoEvaluation* benefits both novice and expert users alike.

Identify – The Database for Material Identification and Quality Control

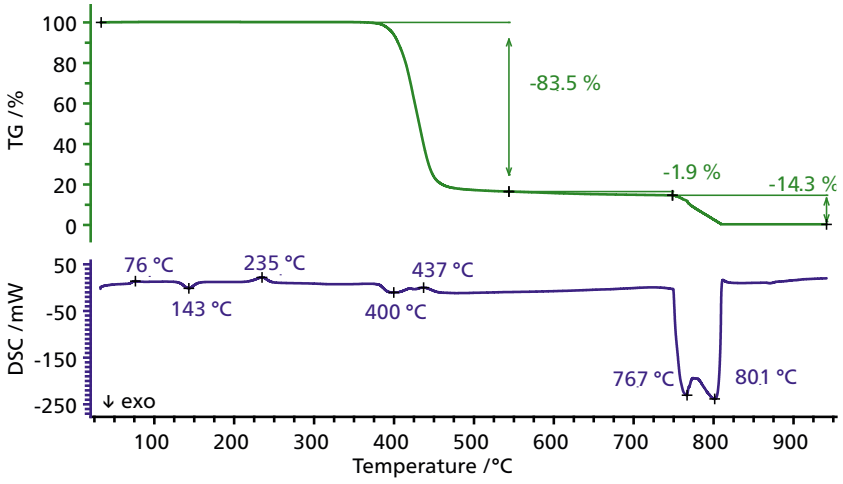
Identify is a unique software tool in the field of thermal analysis for the identification and classification of materials. The included NETZSCH libraries contain more than 1300 entries from the application areas of polymers, organics, pharmaceuticals, food, cosmetics, inorganics, ceramics, metals and alloys. Signal types currently supported include DSC, DSC c_p, TGA, TGA-c-*DTA*®, STA, DIL/TMA and DMA. Users can expand the database with libraries containing an unlimited amount of their own data. Ultimately, this growing collection of database entries and measurement conditions can also be extremely useful in preparing future experiments.

APPLICATIONS

Gain Comprehensive Insight into PET Quality



DSC curve of polyethylene terephthalate in a nitrogen atmosphere; sample mass: 13.91 mg; heating rate 20 K/min; platinum crucible with pierced lid



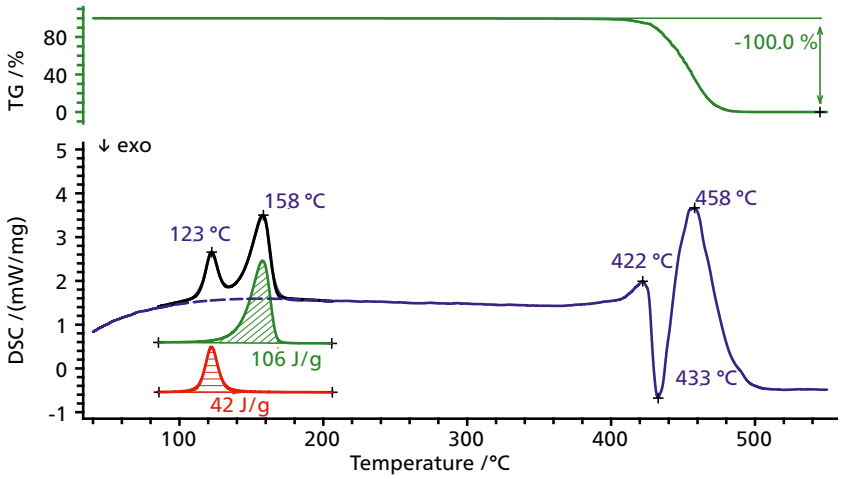
TGA-DSC measurement on polyethylene terephthalate; sample mass: 13.91 mg; heating rate 20 K/min; platinum crucible with pierced lid

Polyethylene terephthalate (PET) is a thermoplastic that is often used in beverage bottles, packaging materials, and textiles. TGA-DSC measurements provide information about a sample's thermal stability and structural properties. The position of the glass transition, which occurs at 71.4°C in this case, is important for determining the material's stiffness and possible operating temperatures. Conclusions can also be drawn about the sample's thermal history. During the first heating, cold crystallization occurred at 143°C, followed by melting at 235°C. The degree of crystallinity of the PET sample can be determined by comparing the peak areas with the literature value for the melting enthalpy.

The TGA curve, which was measured simultaneously, shows the pyrolytic decomposition of the sample above 380°C. An additional mass loss between 600°C and 750°C indicates the decomposition of carbonate-containing fillers. After switching to an oxygen-containing atmosphere, combustion of the pyrolysis soot is evident, accompanied by an exothermic effect.

Enhanced Analysis of a PE-PP Recycling Mixture by Precise *Peak Separation*

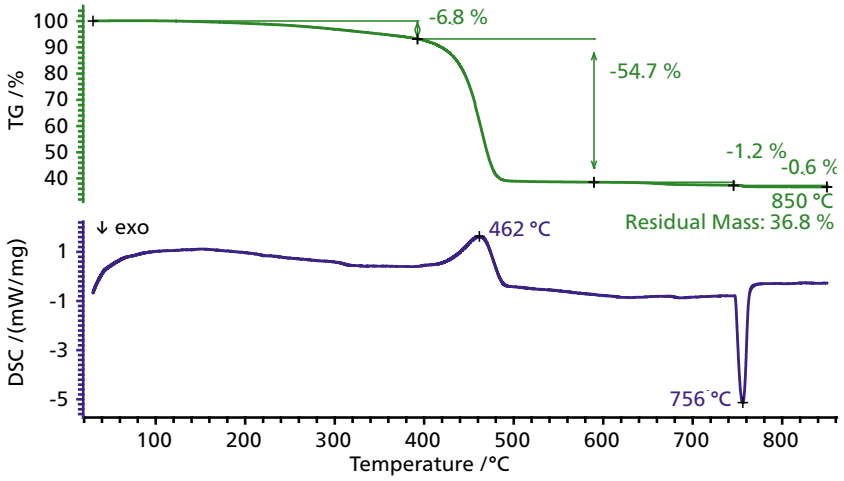
PE-PP mixtures are widely used in the recycling of plastic wase because they are an important starting material. As shown here, the complete pyrolytic decomposition of a sample occurs at a temperature bove 400°C. Additionally, the two melting effects of PE and PP occur as superimposed endothermic peaks at 123°C and 158°C, respectively. The the *Peak Separation* software function can be used to mathematically separate and individually evaluate these peaks.



TGA-DSC measurement on a recycling sample in a nitrogen atmosphere; sample weight: 9.28 mg; heating rate 20 K/min; platinum crucible with pierced lid

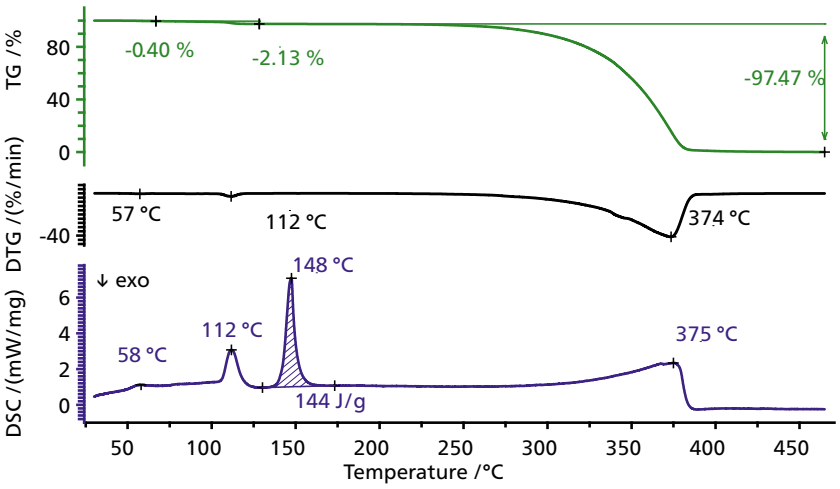
EPDM Composition and Thermal Stability

EPDM is a synthetic rubber that is often used as a sealing material. The TGA curve shows the release of volatile components at temperatures above 200°C. Pyrolysis occurred between 400°C and 500°C, accompanied by an endothermic effect. Between 600°C and 750°C, decomposition of carbonate-containing additives was observed, resulting in a mass loss of 1-2%. In an oxygen-containing atmosphere, 0.6% of the pyrolysis soot burned. The residual mass of 36.8% is due to the ash content of the sample.



TGA-DSC measurement on synthetic rubber; sample weight: 9.28 mg; heating rate 20 K/min; platinum crucible with pierced lid

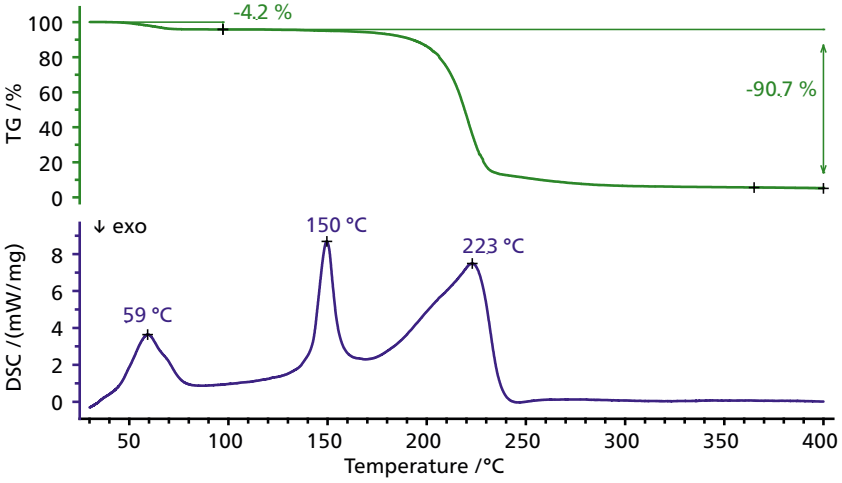
Purity and Stability of Crystalline Testosterone



Testosterone, a steroidal hormone belonging to the androgen group, can be synthesized in crystalline form. Analysis of a testosterone sample reveals a loss of mass at temperatures below 130°C, due to the release of moisture or solvent residues. Testosterone melts at around 150°C, as evidenced by a pronounced endothermic peak without significant loss of mass. The hormone begins to decompose at 200°C.

TGA-DSC measurement was performed on crystalline testosterone in a nitrogen atmosphere; sample mass: 10.10 mg; heating rate 20 K/min; platinum crucibles with pierced lid

Reveal Crystal Water Release, Melting, and Decomposition Behavior of Citric Acid Monohydrate

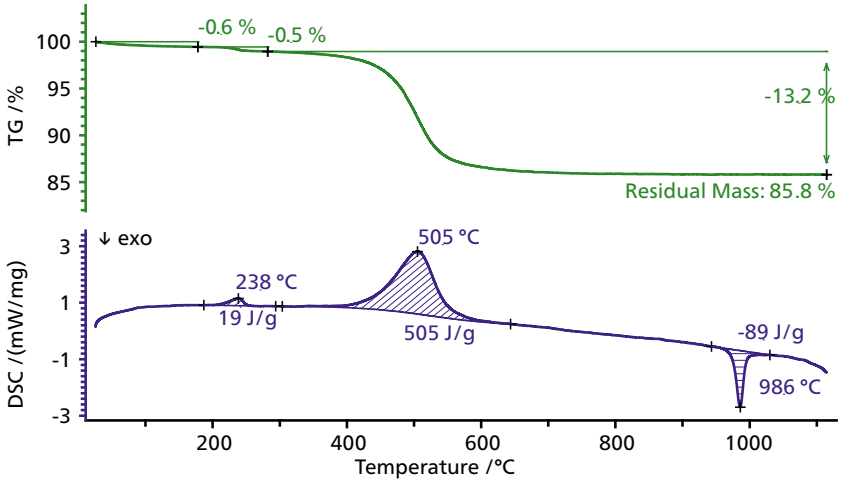


This measurement illustrates the thermal behavior of citric acid monohydrate, a substance used as a complexing agent in the food industry and as a cleaning agent in household products.

Below 100°C, crystal water is released, followed by the endothermic melting of anhydrous citric acid at approximately 150°C. Immediately afterwards, the pyrolytic decomposition of the sample under nitrogen begins.

TGA-DSC measurement on citric acid monohydrate in a nitrogen atmosphere; sample mass: 14.20 mg; heating rate 20 K/min; platinum crucible with pierced lid

Dehydroxylation and Mullite Phase Formation in Kaolin

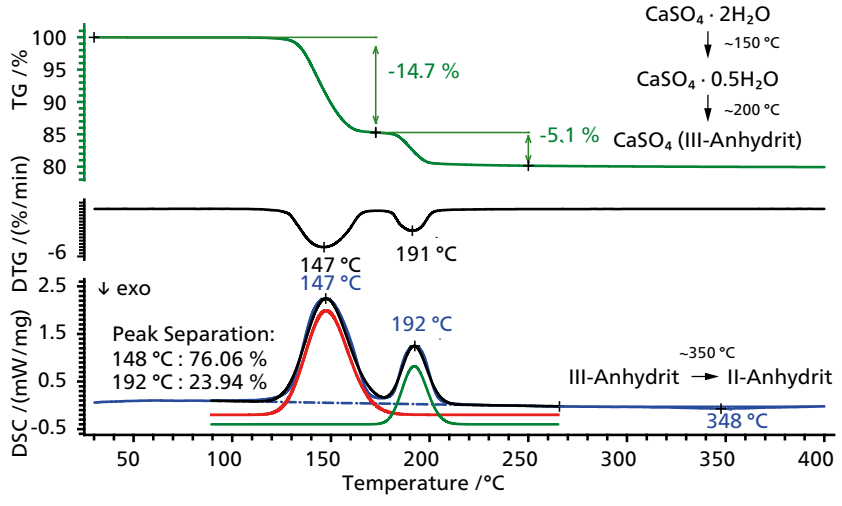


TGA-DSC measurement on kaolin (10.68 mg) in a nitrogen atmosphere; sample mass: 10.68 mg; heating rate 20 K/min; platinum crucible with pierced lid

Kaolin primarily consists of kaolinite ($Al_2Si_2O_5(OH)_4$), which undergoes dehydroxylation at temperatures ranging from 450 to 600°C. This process is reflected in the main loss stage of the thermogravimetric (TGA) curve, as well as the initial release of surface moisture or pore water.

Along with the endothermic effects of the mass-loss-stages around 1,000°C, the DSC curve shows the exothermic effect of mullite phase formation.

Accurately Determine Gypsum Hydration States



Gypsum sample measured in a nitrogen atmosphere; sample weight: 22.30 mg; heating rate 20 K/min; *Concavus* aluminum crucible with 50 µm lid piercing

Gypsum ($CaSO_4 \cdot 2H_2O$) is an important mineral in the construction industry, where it is used as a component of cement and mortar, among other applications. The TGA-DSC measurement shows the gradual dehydration of gypsum, with the conversion from dihydrate to hemihydrate to anhydrite. Special lids with 50-µm holes were used to clearly separate the two hydrate stages and accurately determine the hemihydrate content. After dehydration, a weak exothermic phase transition of the anhydrite can be observed above 300°C.

Unlimited Warranty

At NETZSCH, our commitment to quality extends well beyond the instruments themselves. We understand that your investment in advanced technology is a long-term one, and that's why we offer something truly unparalleled – our Unlimited Warranty.

What Does Unlimited Warranty Mean?

Unlike other warranties that may have hidden limitations, NETZSCH's Unlimited Warranty proves our dedication to your success. For as long as it is technically possible, we stand by our instruments and support you with:

- Attractive Contract Pricing
- Comprehensive Coverage
- Expert Service
- Predictable Costs
- Long-Term Reliability

https://netzs.ch/unlimited-warranty

E-Learning

Learn Today. Apply Tomorrow. Achieve Long-Term Success.

NETZSCH experts developed structured video courses to guide users from theory to measurement, helping students, researchers, and industry professionals improve efficiency, reduce errors, and perform analyses with confidence.

netzs.ch/E-learning

	STA 319 *Jupiter*®
Design	Top-loading
Instrument interface	Touch display
Temperature range	(10°C) RT to 1025°C/1100°C
Heating rate	0.001 K/min to 300 K/min
Cooling time[1]	▪ In nitrogen: ≈ 12 min from 1100°C to 100°C ▪ In helium: ≈ 5 min from 1100°C to 100°C, ≈10 min to 25°C
Max. sample weight/measuring range	2 g
Balance resolution	20 ng
TGA accuracy	0.0003%
DSC accuracy	± 5%
Temperature resolution	0.001 K
Temperature accuracy[2]	± 0.3 K (after calibration by DSC/c-*DTA*®, indium)
Temperature precision[3]	0.15 K
Temperature calibration	▪ DSC/c-*DTA*®, also for detection of endo- and exothermal effects ▪ TGA calibration ▪ Curie calibration
Vacuum-tightness	< 10^{-1} mbar
AutoVac	Automatic evacuation and refilling of purge gas; optionally available when MFC is selected
Gas control (optional)	▪ Gas switch ▪ integrated 3-fold MFC ▪ integrated 4-fold MFC
Evolved Gas Analysis	Optional
192+12-position ASC	Optional
Piercing device	Optional
Unlimited Warranty[4]	Optional

[1] 21°C chiller temperature, 200 ml/min He (purge + protective gas); the maximum temperature of the TGA system depends on the He gas flow: at 200 ml/min, T_{max} is 1020°C.
[2] Maximum deviation between measured and literature value
[3] Standard deviation based on 10 measurements
[4] In connection with maintenance contract

Technical Specifications

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.

NETZSCH-Gerätebau GmbH
Wittelsbacherstraße 42
95100 Selb, Germany
Tel.: +49 9287 881-0
Fax: +49 9287 881-505
at@netzsch.com
https://analyzing-testing.netzsch.com

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