

Thermogravimetric Analysis

NETZSCH



TG 209 F3

Tarsus

Leading Thermal Analysis.

TG 209 F3 Tarsus - Measuring Principle

Thermogravimetry

Thermogravimetry (TG) or Thermogravimetric Analysis (TGA) in accordance with ISO 11358, ISO/DIS 9924, DIN 51006, ASTM E 1131 or ASTM D 3850 is second only to Differential Scanning Calorimetry (DSC) as the most widely spread thermoanalytical measuring method. It measures mass change as a function of time or temperature, thereby subjecting the sample to a defined and controlled environment (heating rate, gas atmosphere, flow rate, crucible type, etc.).

A thermobalance is employed for measuring the quantitative composition of a polymer compound or a blend. Mass loss in inert gas atmospheres occurs as a result of processes such as the release of water or moisture (drying behavior), the emission of solvents and plasticizers, or the decomposition of polymers, temporally differentiated according to thermostability properties. After switching from an inert gas to an oxidizing atmosphere (such as air or oxygen), added carbon black, for example, combusts to carbon dioxide. Inorganic filler materials like

talcum or glass fiber remain as residue in the temperature range to 1000°C and so comprise the ash content.

TG has therefore proven itself particularly in areas such as incoming goods inspection, quality assurance, failure analysis, and process optimization. However, a gain in mass resulting from such processes as the adsorption of oxygen on a metal surface (oxidation) can also be quantitatively determined with thermogravimetry.

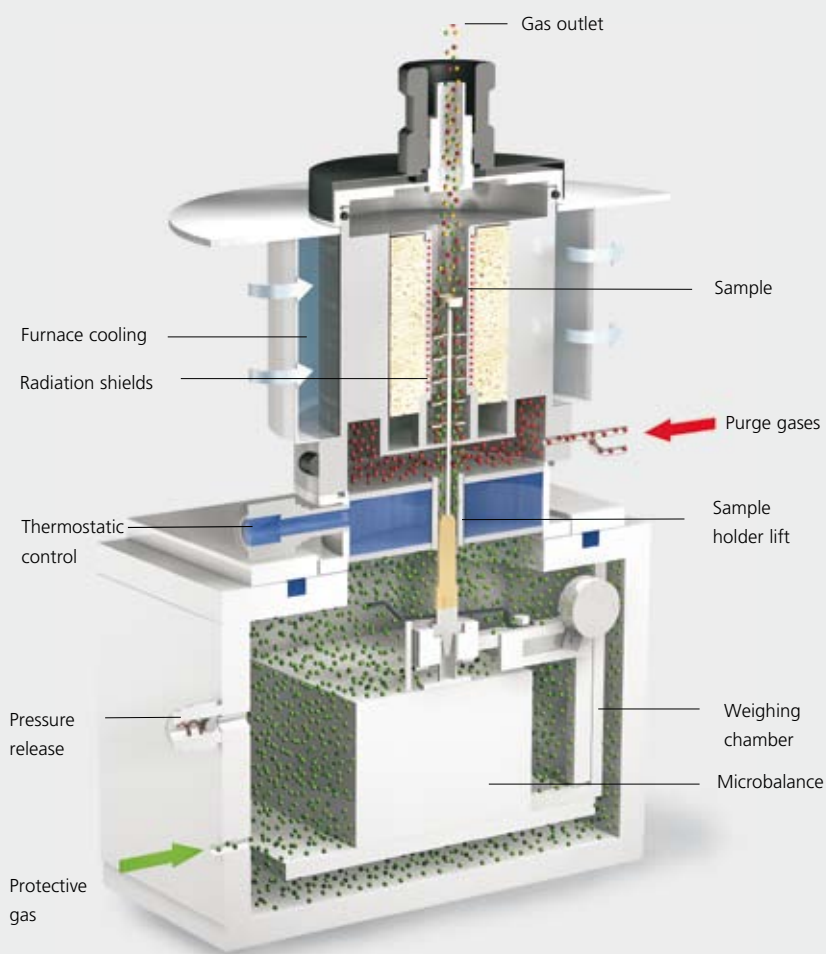


TG 209 F3 Tarsus

Together with the DSC 200 *F3 Maia*[®], the new thermo-micro-balance, TG 209 *F3 Tarsus*, represents a cost-effective overall concept, tailored not only to the quality assurance of plastics but also to routine applications in the fields of organic chemistry, pharmaceuticals, cosmetics and foods.

This new entry-level instrument for thermogravimetric measurements operates between room temperature and 1000°C with freely selectable heating rates from 0.001 K/min up to 50 K/min. The exact sample temperature is detected by a thermocouple in direct contact with the sample crucible. Through the reliable vertical construction, the thermobalance is easy and safe to use as a top-loader, with no hanging wires or exposed fragile parts.

The calculated DTA-signal *c-DTA*[®] (optional) is ideal for temperature calibration. It yields important information regarding endothermic processes (e.g. evaporation with mass loss or melting without mass loss) and exothermic reactions of sample measurements.

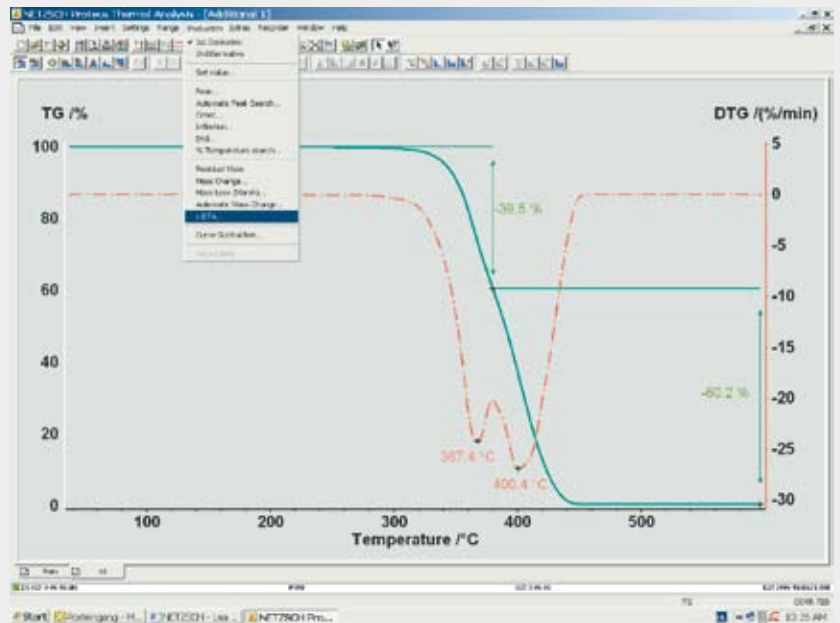


Technical Specifications (subject to change)

- Temperature range: RT to 1000°C
 - Heating and cooling rates: 0,001 K/min to 100 K/min
 - Cooling time: 20 min to 25 min (1000°C to 100°C)
 - Wide measuring range: 2000 mg
 - Resolution: 0.1 µg
 - Atmospheres: inert, oxidizing, static, dynamic
-
- Integrated magnetic valves for programmable gas switch
 - Tightly adjusted gas flow via built-in frits (two purge gases with 20 ml/min each, protective gas with 10 ml/min)
 - Gas-tight construction with evacuation capability
 - *c-DTA*[®] for the calculated DTA-signal, ideal for temperature calibration (optional)
 - Automatic sample changer (ASC) for up to 20 sample crucibles (optional)

TG Features

- Mass changes in % or mg
- Automatic evaluation of mass change steps
- Determination of mass/temperature pairs of variates
- Determination of the residual mass
- Extrapolated onset and endset
- Peak temperatures of the 1st and 2nd derivatives of the mass changing curve
- Automatic baseline- and buoyancy-correction
- *c-DTA*[®] for the calculated DTA signal with evaluation of characteristic temperatures and peak area (optional)



Advanced Software (options)

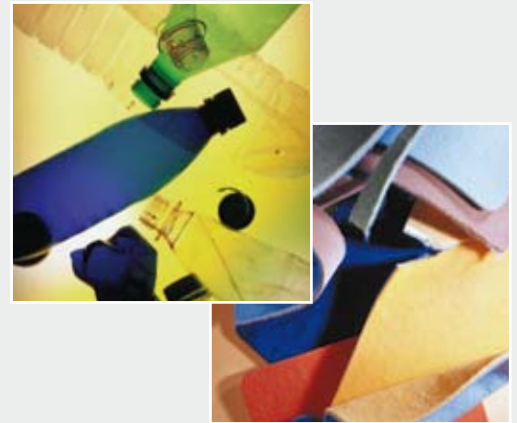
- **Peak Separation:**
for accurate separation and evaluation of overlapping peaks of the DTG curve
- **Thermokinetics:**
allows kinetic calculation of decomposition behavior and thermostability based on multiple-step kinetic analysis of up to 16 curves; also allows process prediction.

TG 209 *F3 Tarsus* – The Solution

Application Fields

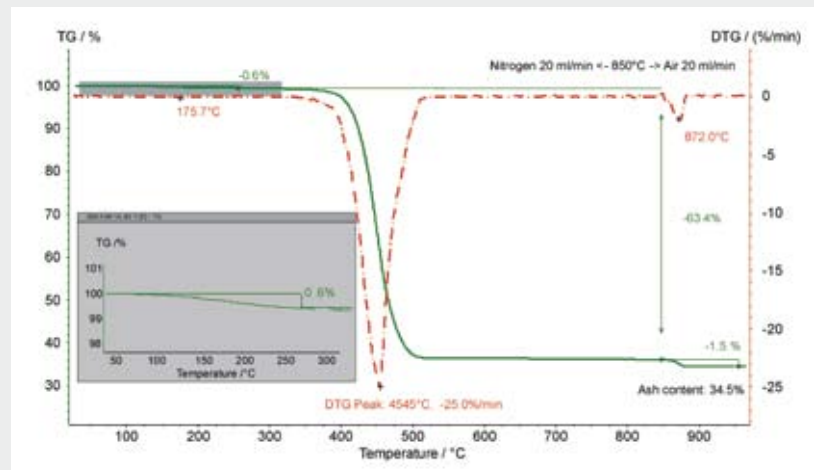
The TG 209 *F3 Tarsus* can be employed for the characterization of a great variety of materials and applications including polymers, pharmaceuticals, textiles, foods, cosmetics, and other organic and inorganic materials. For researchers in fields such as automotive, pharmaceuticals, textiles, and so on, the technique employed by

this instrument is a fast and reliable research tool. Its easy operation, fast analysis time and standardized evaluation procedures make the TG 209 *F3 Tarsus* optimal for application in quality assurance and failure analysis laboratories.



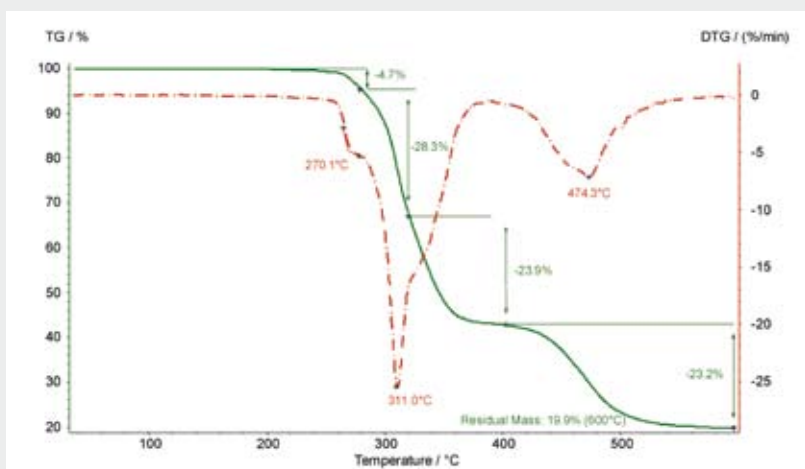
Components of glass fiber-reinforced polyamide

This PA66/GF sample was heated to 850°C in an inert gas atmosphere at 20 K/min. Already between 70°C and 250°C, a considerable mass loss of 0.6% is determined (picture-in-picture presentation). Decomposition (63.4%) starts at approx. 360°C with a maximum decomposition rate at 455°C (DTG peak). After switching to an oxidizing atmosphere at 850°C, the pyrolysis carbon is burnt (1.5%). The remaining residue corresponds to the glass fiber amount (34.5%).



Decomposition of a modified rigid PVC plate

The decomposition of a PVC sample yielded not only the two known TG steps in a nitrogen atmosphere – separation of chlorine at 311°C (DTG-Peak) and the subsequent cracking of the hydrocarbon backbone at 474°C (23.2%) – but the gray-dyed PVC sample already showed a further mass loss step at approx. 270°C (4.7%). The residue of 19.9% at 600°C is due to an inorganic filler.



TG 209 *F3 Tarsus* – Accessories and Customer Support

TG - Accessories

To protect the weighing system against the hot furnace and to minimize any system drift during long-term measurements, the standard TG 209 *F3 Tarsus* is equipped with a thermostat. To achieve a lower starting temperature, the connection of a cooling thermostat is highly recommended.

Linked to the optimal configuration using mass flow controllers (MFC), a membrane pump can also be connected, enabling evacuation of the thermo-microbalance. Thus, measurements in pure inert gas atmosphere (pyrolysis) are guaranteed.

There is a wide variety of different crucibles of aluminum oxide, platinum, aluminum, graphite and fused silica available in different sizes.

The automatic sample changer, ASC, handles your routine measurements in quality control. Day and night it works for you to free your time for other tasks, allowing you to make optimal use of the TG 209 *F3 Tarsus*, even over the weekend.

Of course, each sample can be assigned a different measurement and evaluation program. Easy-to-understand input fields lead you

through the programming of a series of measurements. Unplanned analyses can also be inserted into a pre-programmed series of measurements already in progress.



Automatic Sample Changer for 20 crucibles

Global Customer Support & Service Network

State-of-the-art technology combined with optimum customer support are the trademarks of NETZSCH. Our training department provides a complete range of programs tailored to the needs of our customers in research, education and industry. A wide range of

different seminars, users' meetings, or individual training programs are available to assist you in achieving optimum performance and benefit from your thermal analysis system.

NETZSCH is the fastest-growing company in the field of thermal

analysis and thermophysical properties testing in the world. This can be attributed not only to our superior technology and quality, but also to our unmatched pre- and after-sales service network.

NETZSCH-certified staff at 45 service centers around the world provide fast and reliable customer support including qualified installation and calibration services and maintenance contracts. Finally, our applications laboratories offer contract testing and support on even the most specific of questions.





advantage in polymers

The new TG 209 *F3 Tarsus* is the ideal tool for day-to-day work in your laboratory. The system is generally employed for:

- Product development
- Quality assurance
- Failure analysis

The TG 209 *F3 Tarsus* forms part of the NETZSCH polymer series of instruments. Together with the DSC 200 *F3 Maia*[®] (differential scanning calorimeter), the TMA 202 (thermomechanical analyzer), the DMA 242 (dynamic-mechanical analyzer), the DEA 230/231 series (dielectric analyzers) for cure monitoring and other DSC and TGA systems, a full-scale thermal analysis of your materials and parts can be carried out.

The key features of the TG 209 *F3 Tarsus* are:

- Top quality
- Easy to use
- Wide range of accessories
- Low cost of ownership

NETZSCH additionally provides a full range of high temperature thermal analysis instruments for temperatures between -260°C and 2800°C, including dilatometers, thermo-balances, DTA/DSC systems and STA (TG-DSC) systems.

For thermophysical properties tests (measurement of the thermal diffusivity/conductivity), NETZSCH offers a broad range of heat flow meters, flash devices and other TCT systems.

Leading Thermal Analysis. ■

NETZSCH

NETZSCH-Gerätebau GmbH

Wittelsbacherstraße 42 · 95100 Selb/Germany
Phone: +49 9287 881-0 · Fax: +49 9287 881-505
E-mail: at@netsch.com

www.netsch.com