NETZSCH

DSC 200 *F3*
Maia®

Leading Thermal Analysis.

DSC 200 *F3 Maia*® - Principle of operation

Differential Scanning Calorimetry

Differential Scanning Calorimetry (DSC) is one of the most frequently used techniques in the field of thermal characterization of solids and liquids.

The DSC method can be used for the analysis of energetic effects such as:

- melting/crystallization behavior
- solid-solid transitions
- polymorphism
- degree of crystallinity
- glass transitions
- cross-linking reactions
- oxidative stability
- decomposition behavior
- purity determination
- specific heat

Applying this technique, a sample is placed inside a crucible which is then placed inside the measurement cell (furnace) of the DSC system along with a reference pan which is normally empty. By applying a controlled temperature program (isothermal, heating or cooling at constant rates), caloric changes can be characterized.

Rapid analyses, easy handling and high significance for research, development and quality control are only some of the advantages of this analytical technique. Many standards (ASTM, DIN, ISO, etc.) are available for specific material-, product- and characteristic-oriented applications, evaluations and interpretations.
The new DSC 200 *F3 Maia*® combines the advantages of modern technology, high sensitivity and a robust, easy-to-operate work horse. Tests can be carried out in the maximum temperature range between –150 and 600°C.

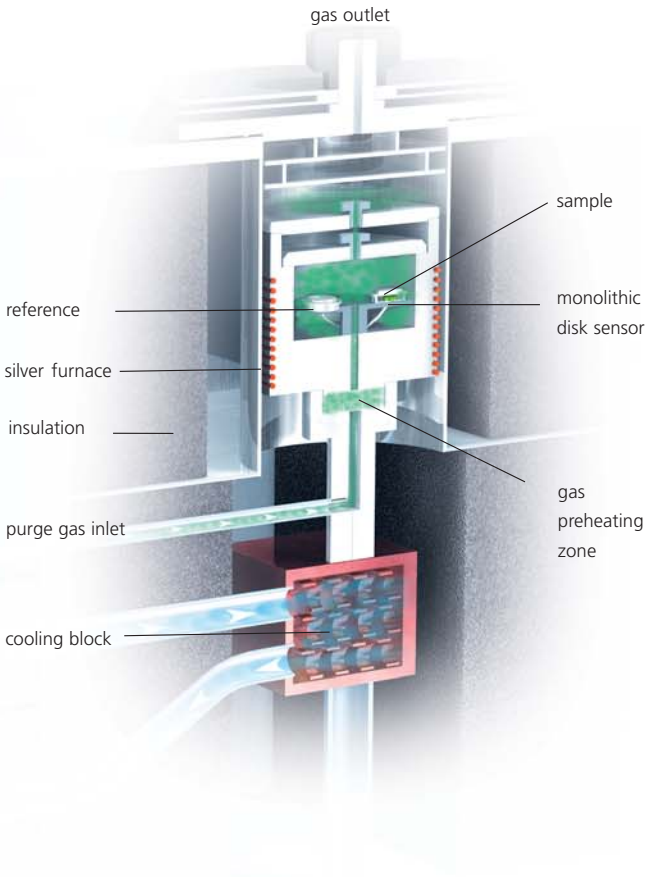
DSC 200 *F3 Maia*®

The key components of the DSC 200 *F3 Maia*® are the new DSC heat flux sensor and a new furnace.

The sensor of the DSC 200 *F3 Maia*® combines high stability, improved resolution and fast response time. Laser-guided welding processes for the sensor disks and thermocouple wires yield true sensitivity and robustness.

The heating wires of the newly developed furnace surround the entire sensor plate. They are arranged in such a way that no temperature gradients occur in or above the sensor disk. This arrangement is the basis for a highly homogeneous heat flow to the sample and reference pans from all sides and therefore also for a highly stable baseline and an excellent signal-to-noise ratio. Protective and purge gas inlets are, of course, standard features of the unit.

For improved cooling times and sub-ambient temperature tests, various cooling options such as forced air, intracooler or liquid nitrogen cooling systems are available. Of course, a versatile gas switching and flow control system are also available.



Technical Specifications (subject to change)

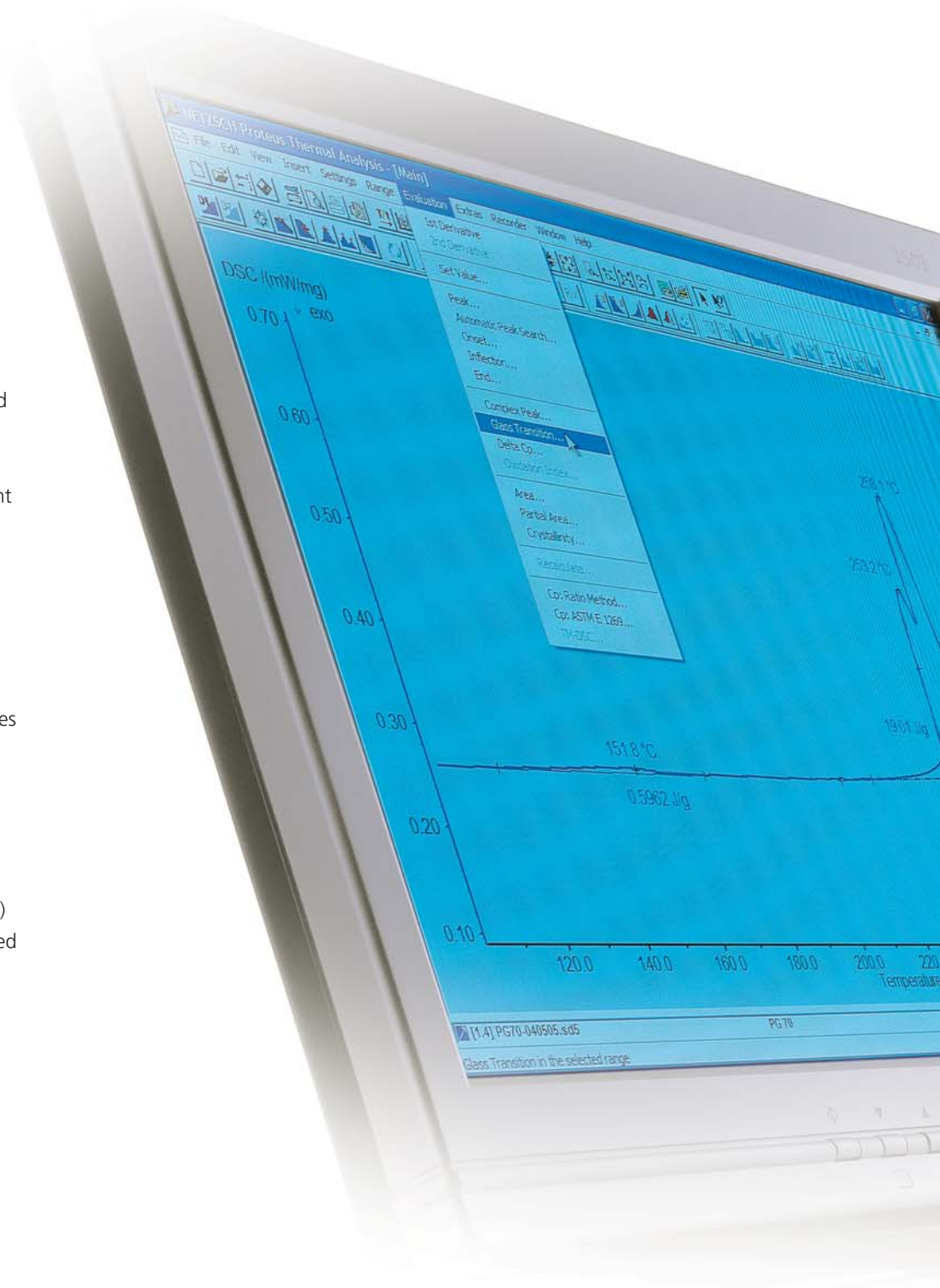
Temperature Range:	-150 ... 600°C
Heating rates:	0 …100 K/min
Cooling rates:	0 … 70 K/min (depending on temp.)
Sensor:	Heat flux system
Measurement range:	0 ... ±600 mW
Temperature accuracy:	0.1 K
Enthalpy accuracy:	< 1%
Cooling options:	Forced air
	LN_2
	Intracooler
Atmospheres:	oxid., inert (static, dynamic)

DSC 200 *F3 Maia*® - Proteus® Software

The DSC 200 *F3 Maia*® runs under a 32-bit MS® Windows® software package which includes everything you need to carry out a measurement and evaluate the resulting data. Through the combination of easy-to-understand menus and automated routines, a tool has been created that is extremely user-friendly and, at the same time, allows sophisticated analysis.

General Software Features:

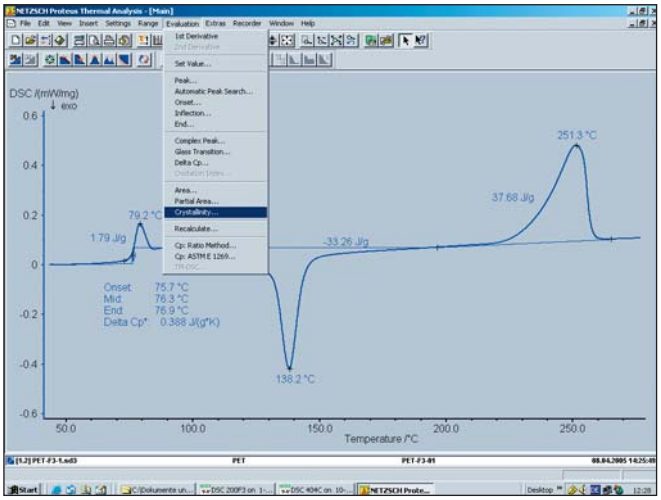
- Windows Software: fully compatible with other Microsoft®Windows® programs
- multi-tasking: simultaneous measurement and evaluation
- multi-moduling: operation of different instruments with one computer
- combined analysis: comparison and/or evaluation of DSC, TG and TMA and DMA measurements in one plot
- labeling: input and free placement of text elements
- calculation of 1st and 2nd derivative
- selectable scaling
- graphic and data export
- selectable colors and line types
- storage and restoration of analyses
- Macro recorder (option)
- context-sensitive help system
- temperature calibration
- compatible with advanced software packages (Peak Separation, Thermokinetics)
- Software produced by ISO-certified company

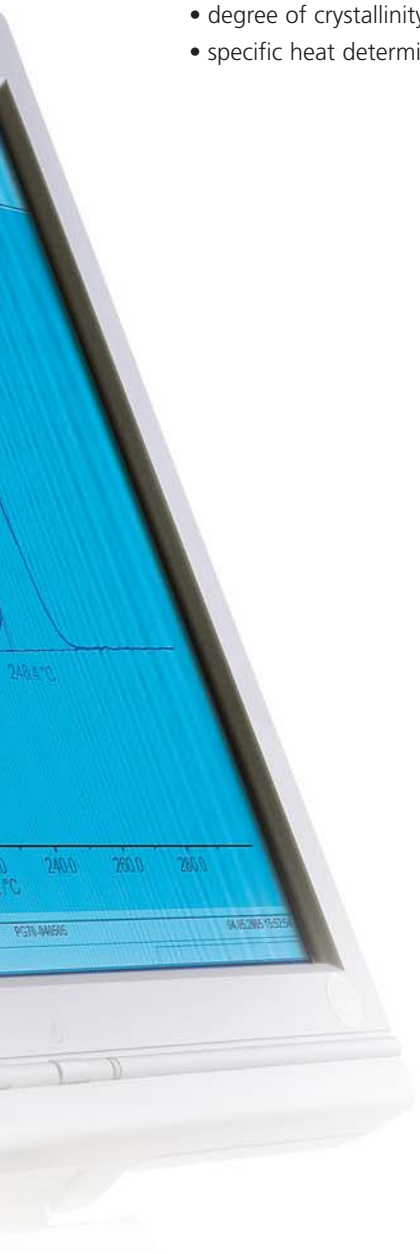


Certified ISO 9001 by

DSC Features:

- determination of onset, peak, inflection and end temperatures
- automatic peak search
- transformation enthalpies: analysis of peak areas (enthalpies) with selectable baseline and partial peak area analysis and consideration of mass changes
- comprehensive glass transition analysis
- automatic baseline correction
- degree of crystallinity
- specific heat determination (option)





Advanced Software (options)

- Peak Separation Software: allows accurate separation and evaluation of overlapping first order transitions
- NETZSCH *Thermokinetics*: allows advanced characterization of reactions and kinetic parameters on the basis of multiple-step kinetic analysis an upto 16 curves and provides predictions of the process
- DSC Correction: evaluation of exo- and endothermal effects under consideration of system time constants and thermal resistances

DSC 200 *F3 Maia*® – The Solution

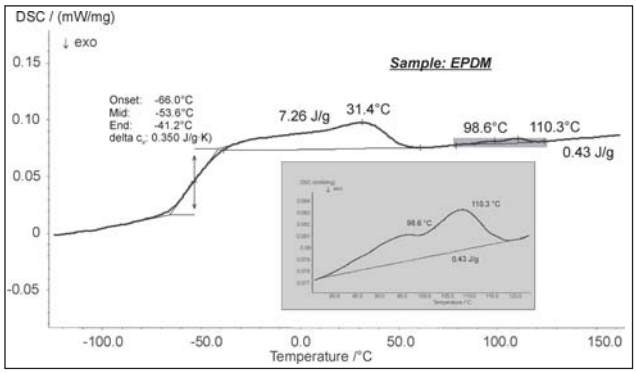
Application Fields

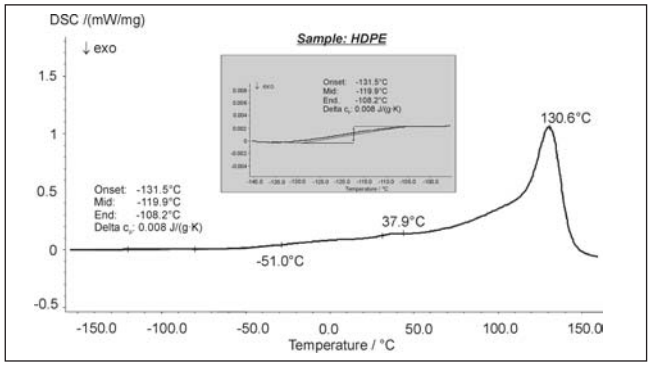
The DSC 200 *F3 Maia*® can be employed for the characterization of a great variety of materials and applications including polymers, pharmaceuticals, textiles, foods, cosmetics, and so on.

For researchers in fields such as automotive, clothing, drugs, and so on, the technique employed by this instrument is a fast and reliable research tool. Furthermore, due to the easy operation, fast analysis time and standardized evaluation procedures, the DSC 200 *F3 Maia*® is optimized for application in quality assurance and failure analysis laboratories.

Ethylene-Propylene-Diene-Rubber-Mixture (EPDM):

The thermal behavior of an EPDM rubber mixture was measured between –125 and 160°C at 10 K/min. The glass transition was detected at –52.5°C. The melting above the glass transition (peak temperature at 31.4°C) is typical for the behavior of a sequence-type EPDM. The further endothermal effects (at 98.6 and 110.3°C) are due to the evaporation of processing agents. The presentation in the separate window clearly shows the high sensitivity of the DSC 200 *F3 Maia*® even for small energetic effects (0.43 J/g).



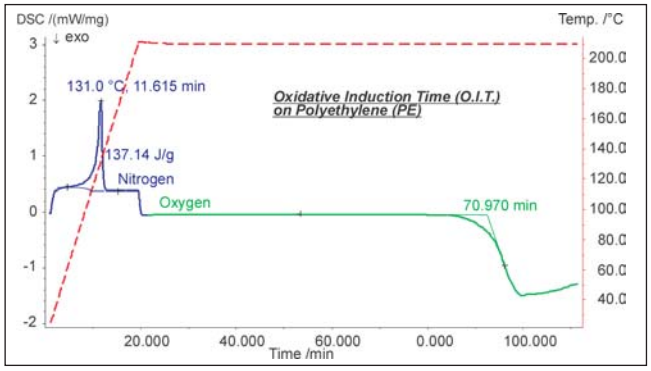


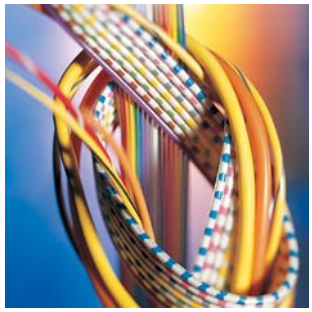
Polyethylene (PE)

PE materials such as high-density polyethylene (HDPE) are often used for the production of containers for packaging. Differential scanning calorimetry is often used to characterize the melting behavior of such materials, but the DSC 200 *F3 Maia*® can do even more. Due to its excellent low-temperature performance and outstanding sensitivity, the system also allows the detection of the glass transition (at –119.9°C). This extremely weak step in the DSC-curve is presented in the embedded picture in more detail.

Oxidative Induction Time (O.I.T.)

Analysis of the thermal stability of polymers is important for materials under thermal load such as polymer insulation for electronics. Determination of the oxidative induction time (O.I.T.) is a standardized technique which can be easily carried out using the DSC 200 *F3 Maia*®. Presented here is a measurement on PE heated to 210°C under inert (nitrogen) conditions. After a five-minute equilibration time, the atmosphere was switched to oxygen; the sample then began to degrade after 71 minutes under oxidizing conditions.

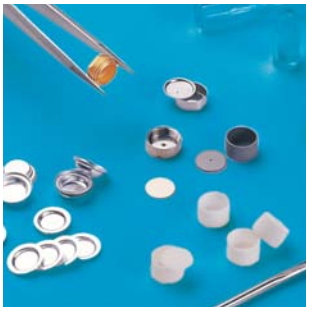




DSC 200 *F3 Maia*® – Accessories and Customer Support

DSC - Accessories

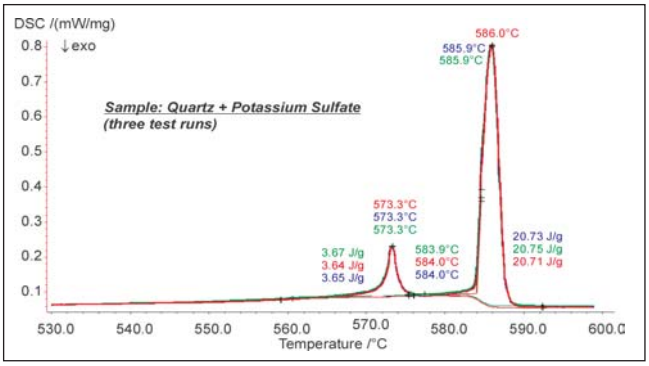
The DSC 200 *F3 Maia*® can be equipped with various accessories and extensions for optimum adjustment of the system to your requirements.
Various cooling systems (forced air via compressor or pressurized air) can be used to cool the furnace back to room temperature. Subambient temperatures (down to -40°C) can be achieved with the cost-effective intracooler. The liquid nitrogen cooling system allows tests at subambient temperatures down to –150°C. For accurate gas flow control, the DSC 200 *F3 Maia*® can be equipped with a gas flow control system for up to three different purge/protective gases. A wide range of crucibles (aluminum, silver, gold, copper, platinum, alumina, zirconia, graphite, stainless steel, etc.) is available for nearly all possible applications and materials.



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 the world over 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.

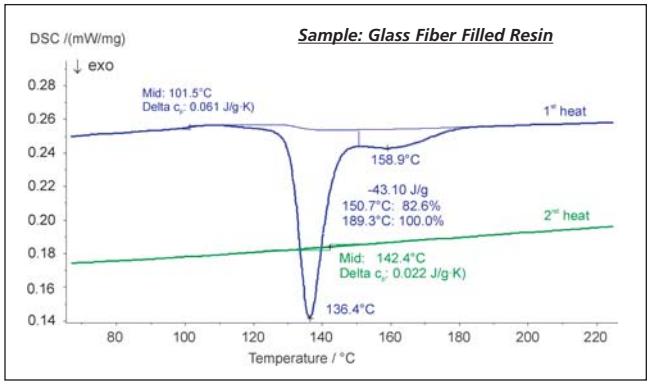


High-Temperature Applications

The DSC 200 *F3 Maia*® allows tests up to 600°C with excellent baseline stability and reproducibility.
Presented here are three runs on a mixture of crystalline SiO_2 (quartz) and potassium sulphate (K_2SO_4). The result clearly proves the out-standing temperature and enthalpy reproducibility of this cost-effective differential scanning calorimeter even at the limits of the temperature range.

Curing of a Thermosetting Resin:

Analysis and optimization of the curing process of thermosets can be easily carried out using differential scanning calorimetry. Presented here is a measurement on a glass fiber filled epoxy measured in the DSC 200 *F3 Maia*®. The two-step exothermal cross-linking reaction slightly above the glass transition (at 101.5°C) is clearly visible during the first heating of the sample. After a controlled cooling at 5 K/min, the sample was heated a second time. In comparison to the first heating the glass transition is shifted to 142.4°C in the second heating.



Maia®

advantage in polymers

The new DSC 200 *F3 Maia*® 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 key features of the DSC 200 *F3 Maia*® are:

- Smart-Running
- Top Quality
- Easy to Use
- Wide Range of Accessories
- Low Cost of Ownership

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

NETZSCH additionally offers a full range of high temperature thermal analysis instruments for temperatures between -260 and 2800°C, including dilatometers, thermobalances, 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.

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NETZSCH

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