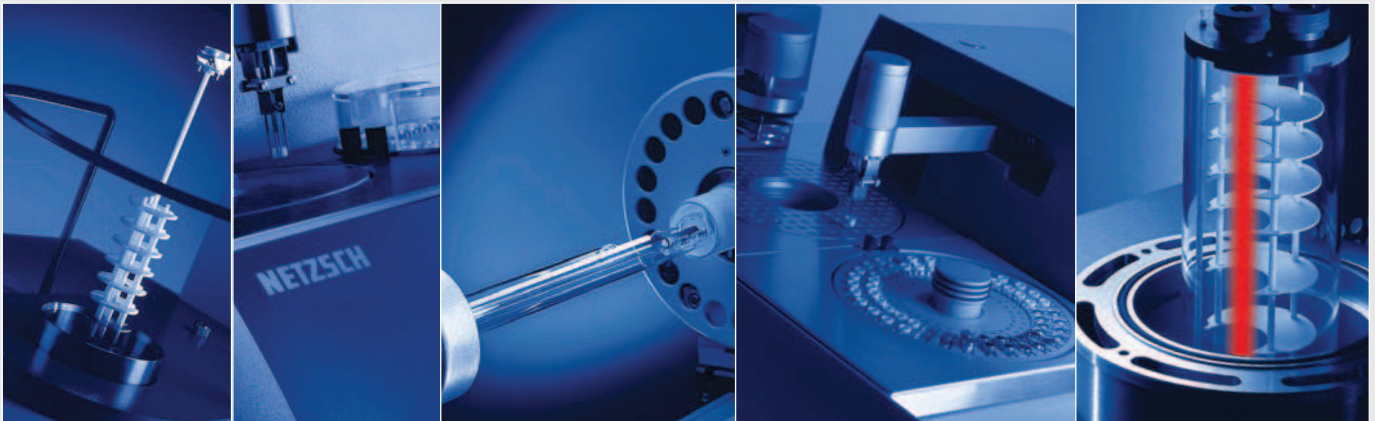


**NETZSCH**

## Thermal Analysis

Thermophysical Testing, Cure Monitoring



Leading Thermal Analysis .

# NETZSCH

## Analyzing and Testing

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

Thanks to our proficient R&D 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.

Besides the products themselves NETZSCH also provides localized software, operation manuals and application references. Seminars and users’ meetings are also organized by our specialists, and we offer a series of advanced training programs on demand.

Our branches, representative offices and application laboratories worldwide offer our customers excellent R&D and technical support, wherever on the globe they may be.

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

All materials change their physical properties and their chemical characteristics under the influence of temperature.

Thermal Analysis methods systematically analyze these changes by application of programmed temperature variations for heating and cooling, and by application of specified sample atmospheres and pressures. The properties most often studied are specific heat and enthalpy changes, weight loss or weight gain, Young's modulus, thermal expansion or shrinkage and gas evolution.

Knowledge of the thermophysical properties of solids and liquids has become very important for a sustainable energy industry and process economy. Thermal conductivity and thermal diffusivity measurements for insulating and for good conducting materials supply the data basis for engineering calculations and practical application of construction parts. The temperature-contingent information on material properties determined by Thermal Analysis methods allows conclusions to be drawn regarding the identification of materials as well as their purity and composition, polymorphism and structural changes,

thermal stability and temperature limits of application, aging behavior, thermo-mechanical behavior and viscoelastic properties, and processing conditions for shaping, casting, molding and extrusion. This comprehensiveness in material characterization encompasses all kinds of applications of Thermal Analysis for samples of organic, inorganic and biological origin. It is a very seldom occurrence that a sample cannot be tested successfully with any of the Thermal Analysis techniques.

NETZSCH Analyzing & Testing is focused on the development of versatile, reliable and sensitive instruments for material research, development, quality control and failure analysis. Our broad application know-how is transferred to our customers by means of demonstration or contract testing, application books for different materials or industrial branches, or directly and personally in seminars, workshops and users' meetings. In addition to laboratory techniques for Thermal Analysis and Thermophysical Properties, NETZSCH also offers online process control techniques for reacting resin systems based on the change of dielectric properties and ion mobility.

#### Thermal Analysis

- DSC/DTA
- TGA
- STA (TG - DSC, TG-DTA)
- DIL
- TMA/DMA
- DEA
- EGA (MS/FTIR Coupling)

#### Thermal Diffusivity and Conductivity

- LFA
- HFM/GHP
- TCT

#### Cure Monitoring

- DEA

#### Refractory Testing

- RUL/CIC
- HMOR
- TCT
- PCE

#### Advanced Software

- *Thermokinetics*
- Thermal Simulations
- DSC Correction
- Peak Separation
- Purity

# Dilatometry (DIL), High-Temperature DSC

## DIL 402 C

Pushrod dilatometry allows measurement of the dimensional changes of a sample as a function of temperature or time.

The DIL 402 C allows this over a broad temperature range in well-defined atmospheres with very high resolution and accuracy.



DIL 402 C

- Temperature range: -180 ... 2000°C
- Resolution: 0.125 nm/digit
- Atmosphere: vacuum, oxidizing, inert or reducing gas
- Vacuum:  $10^{-4}$  mbar
- Sample holder: graphite, alumina, fused silica
- Unique *c-DTA*<sup>®</sup> function

## DIL 402 CD

The dual- and differential-dilatometer, DIL 402 CD, offers a higher sample throughput, direct comparison of samples and online calibration of expansion measurements.

- Temperature range: -180 ... 1600°C
- Resolution: 0.125 nm/digit
- Atmosphere: vacuum, oxidizing, inert or reducing gas
- Vacuum:  $10^{-4}$  mbar
- Sample holder: alumina, fused silica
- Unique *c-DTA*<sup>®</sup> function

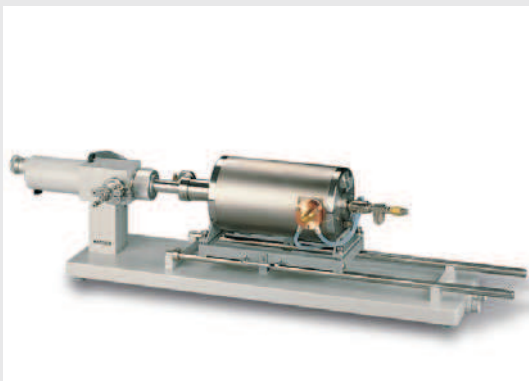


DIL 402 CD

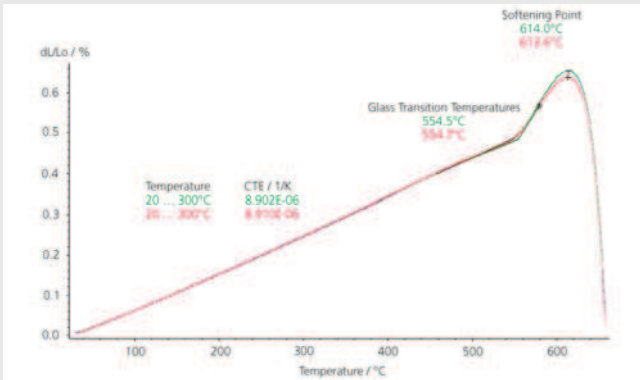
## DIL 402 E

The DIL 402 E series instruments are designed for the highest temperature applications. Measurements can be carried out up to a maximum temperature of 2800°C, with pyrometer for temperature measurement and control.

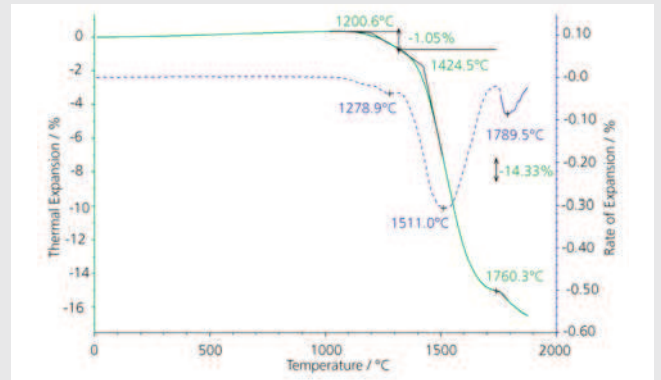
- Temperature range: RT ... 2800°C
- Resolution: 0.125 nm/digit
- Atmosphere: vacuum, inert or reducing gas
- Vacuum:  $10^{-4}$  mbar
- Sample holder: graphite, alumina
- Unique *c-DTA*<sup>®</sup> function (with thermocouple operation)



DIL 402 E



Coefficients of thermal expansion (CTE), glass transition temperatures and softening points are important parameters for the characterization of glass materials. Such properties can be easily measured using pushrod dilatometry.



Determination of the shrinkage during sintering of ceramic or powder-metal-lurgical products can be accurately measured with dilatometers. Presented here is the sintering range of the technical ceramic silicon nitride.

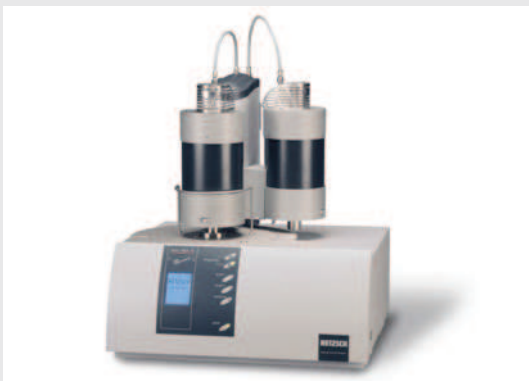


DIL 402 PC

#### DIL 402 PC

The DIL 402 PC is specially tailored for glass and ceramic applications. It is a cost-effective instrument for research, development and quality control.

- Temperature range: RT ... 1600°C
- Resolution: 8 nm/digit
- Atmosphere: oxidizing, inert (static, dynamic)
- Sample holder: alumina, fused silica
- Unique *c-DTA*® function



DSC 404 **F1** Pegasus®

#### DSC 404 **F1** Pegasus®

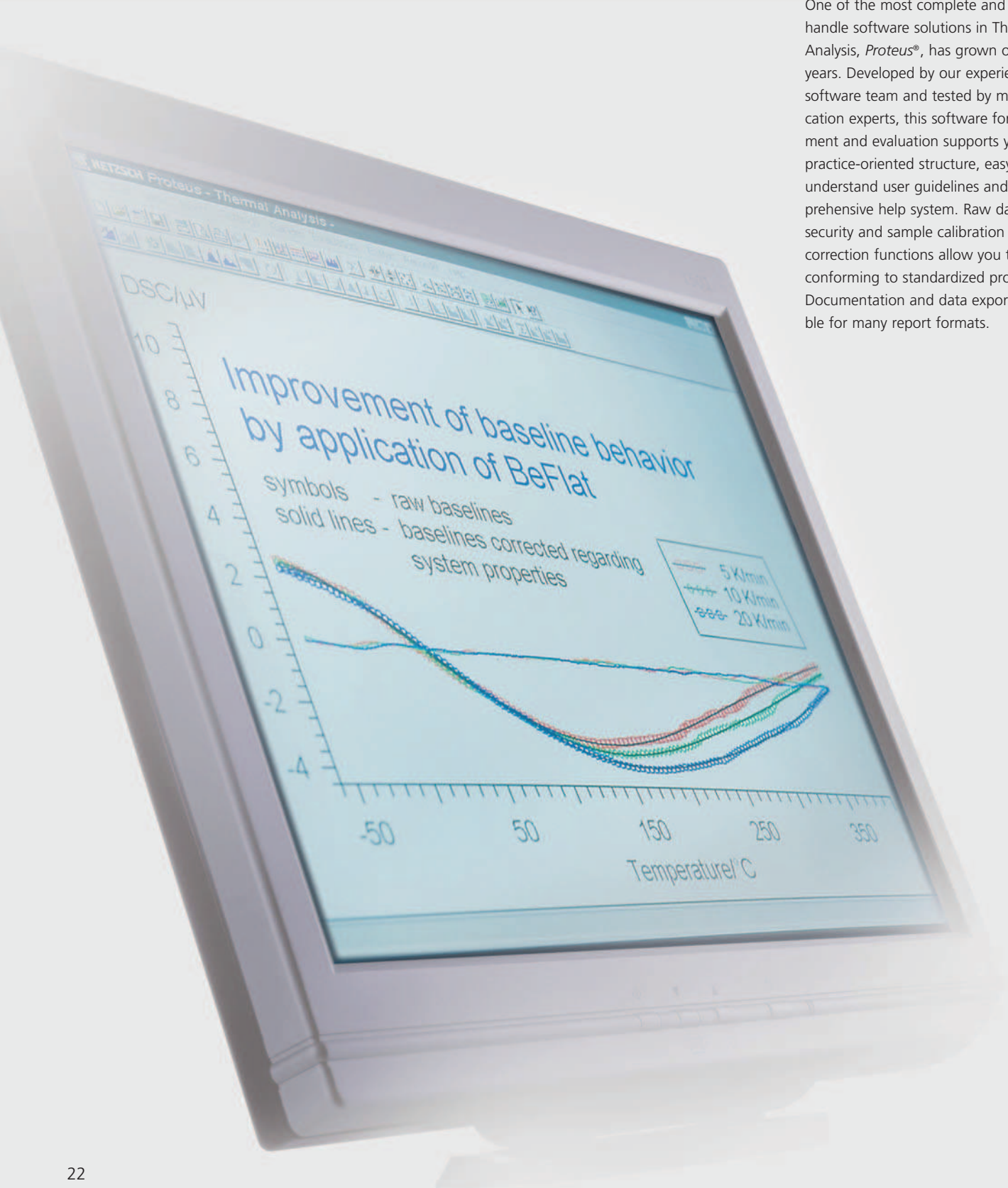
This unique high-temperature DSC system features easily interchangeable furnaces for different applications. Thanks to the design of the heating system and the automatic furnace lifting hoist, a stable baseline and high reproducibility can be achieved.

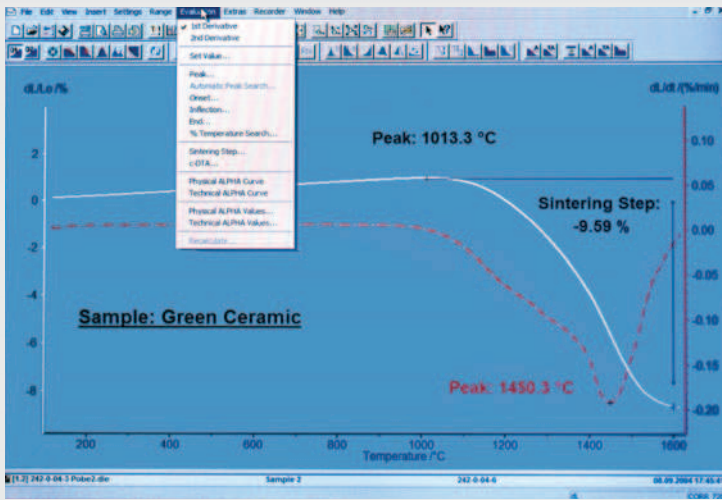
- Temperature range: -150 ... 2000°C
- $c_p$  measurement: -120 ... 1500°C
- Atmosphere: static and dynamic, inert, reducing, oxidizing
- Vacuum:  $10^{-4}$  mbar
- Sensor: DSC- $c_p$ , DSC, DTA
- High precision for  $c_p$  measurement

# Proteus® Software for Measurement and Evaluation

## Advanced Software for More Information

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. Raw data security and sample calibration and correction functions allow you to work conforming to standardized procedures. Documentation and data export are flexible for many report formats.

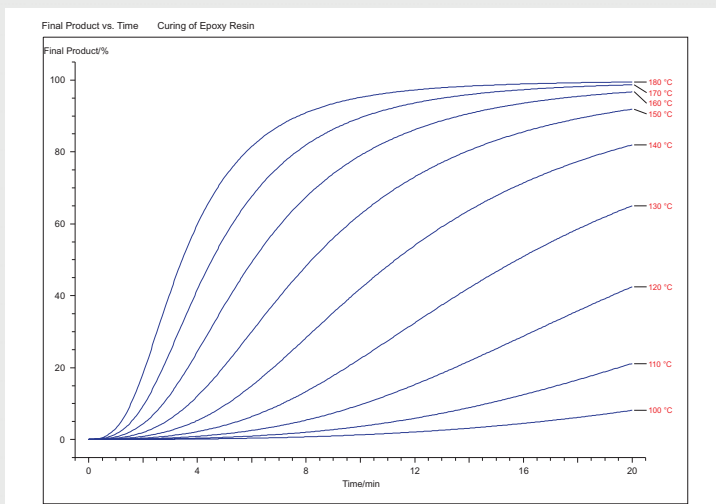




## Proteus® Software

Proteus® measurement and analysis system

- User-friendly
- Multi-tasking system
- Multi-mode, simultaneous control of up to 4 instruments
- Combined analysis of different methods
- Storage and restoration of analyses
- Macro recorder
- Auto baseline correction
- Export result to ASCII file
- Context-sensitive help system
- Fully compatible with other Windows® applications
- ISO 9001 certified by BVQI

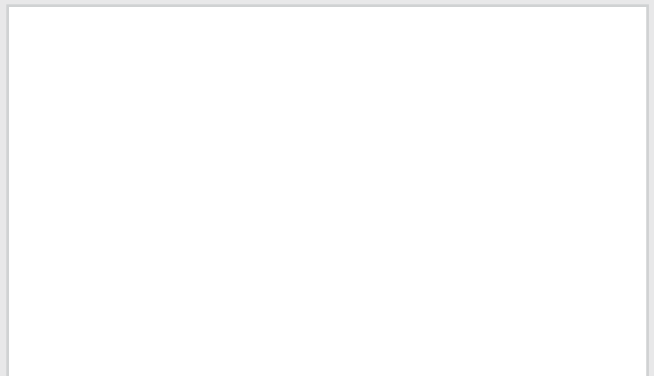


## Advanced Software

- *Thermokinetics* (multicurve, multistep analysis by nonlinear regression for process predictions)
- Thermal simulations for hazardous reactions in a Pilotplant-scale
- Peak separation
- Purity
- DSC/DTA correction (thermal resistance, time constant)
- TM-DSC, temperature modulated DSC 204 *F1 Phoenix®*
- Specific heat
- *c-DTA®* (calculated DTA for TG and DIL)
- Rate controlled mass change *SuperRes®* (TG)
- Rate controlled sintering (DIL)

# Leading Thermal Analysis .

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