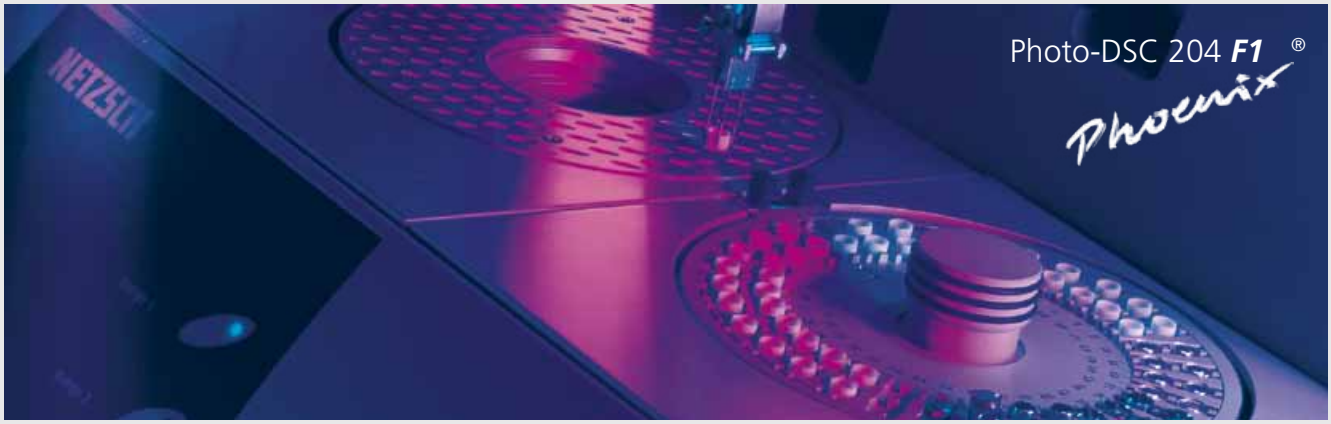
NETZSCH

Analyzing & Testing

Photocalorimetry – Photo-DSC

Method, Technique, Applications



Leading Thermal Analysis

Advantages of Photocalorimetry

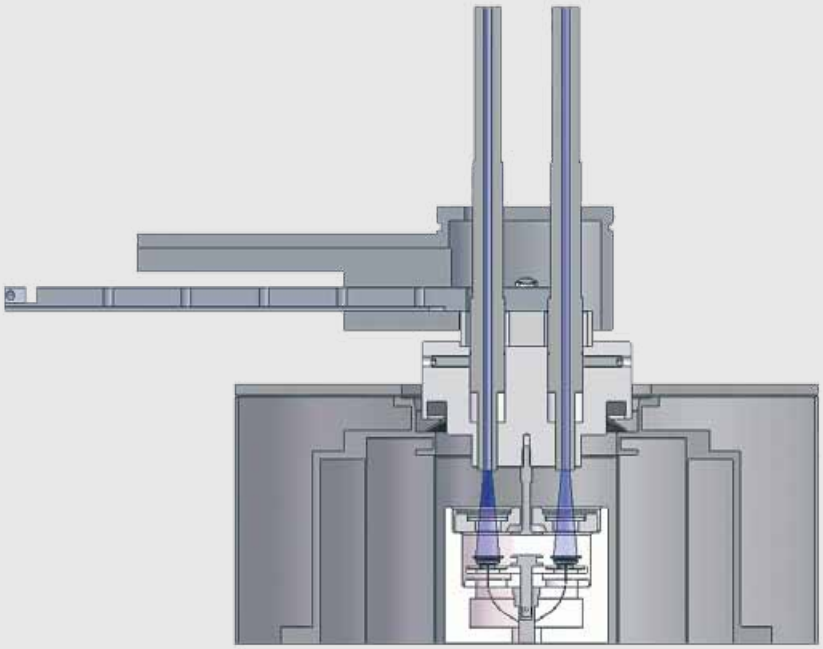
Besides thermally activated reactions, which can be studied by conventional Differential Scanning Calorimetry (DSC), many polyadditions and radical polymerizations can also be started by irradiation with sufficiently high energy.

The main advantages of light- (normally UV-) curing systems are their fast reaction – within a few seconds at low isothermal temperature – and their absence of solvents.

Often, a combination of thermal and light curing reactions is applied to dual cure adhesives or paints.

Your Benefits

- extending the DSC technique with light radiation capability
- analyzing photo-initiated reactions in a broad variety of materials
- measuring the light curing of polymer resins, paints, coatings and adhesives (degree of cross-linking)
- studying the influence of UV stabilizers in pharmaceuticals, cosmetics and foods (aging effects)
- selecting temperature, atmosphere, light intensity, wave length and exposure time
- determining the reactivity and curing time of dental composites



Cell design of the Photo-DSC 204 ***F1*** *Phoenix*®

DSC 204 ***F1*** *Phoenix*® with Hg-Lamp OmniCure® S 2000

Technical Specification		
Temperature range	-100°C to 200°C	
Crucibles	open Aluminum	
Recommended Hg-Lamp types	DELOLUX 04	OmniCure® S 2000
Max. Power	9.9 W/cm²	>10 W/cm²
Wavelength range	315 nm to 500 nm*	320 nm to 500 nm*
Irradiation time	0.1 s to 1000 s	0.2 s to 1000 s
Existing orifice diameter	8 mm, 4 mm, 2 mm	8 mm, 4 mm, 2 mm
Life Time (Lamp)	1500 h	2000 h

*variable and extendable with various filters

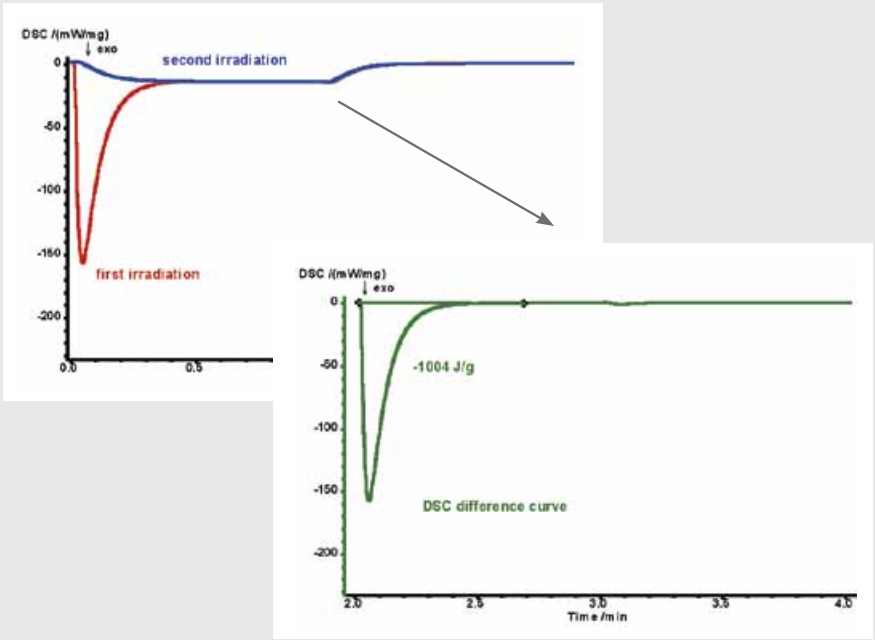
Highest Flexibility

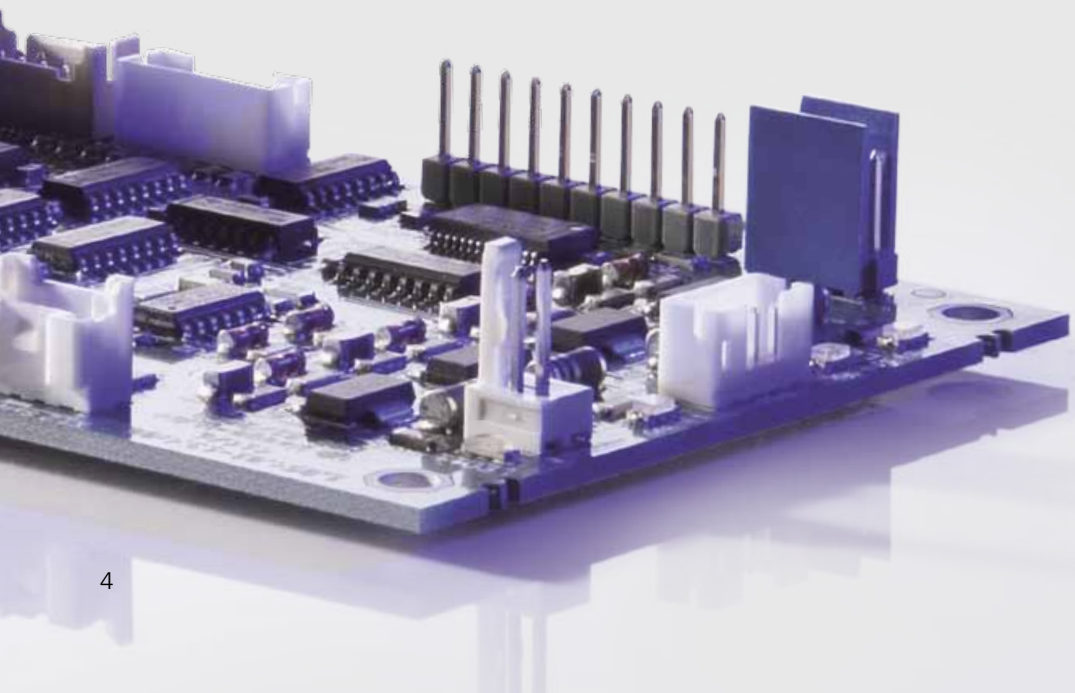
- gas-tight heat flux DSC cell
- purge gas control by mass flow controller (MFC)
- adaptability of various commercial lamps to the DSC
- adjustable light guides with defined distance to the DSC cell
- automatic cover lift for easy handling and reproducible test results
- measurements with Automatic Sample Changer (optional)

Photo-DSC 204 ***F1*** *Phoenix*® – Various Applications

Photo-DSC Measurement and Evaluation

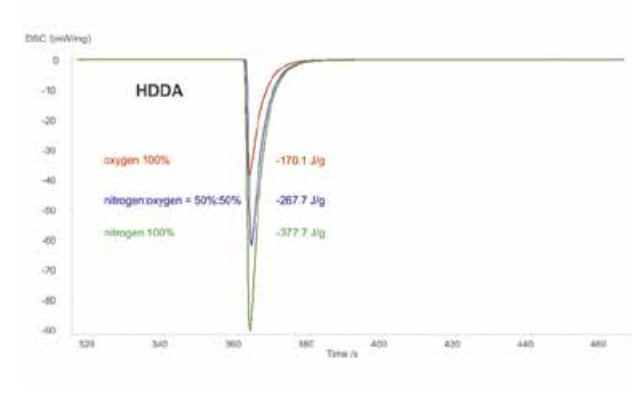
Sample and reference are irradiated with UV light at a constant temperature until the sample is cured. Afterwards, the already cured sample and the reference are irradiated for a second time for the same duration and at the same temperature. Finally, the difference between the first and the second irradiation is calculated to determine the pure heat of reaction (curve subtraction).





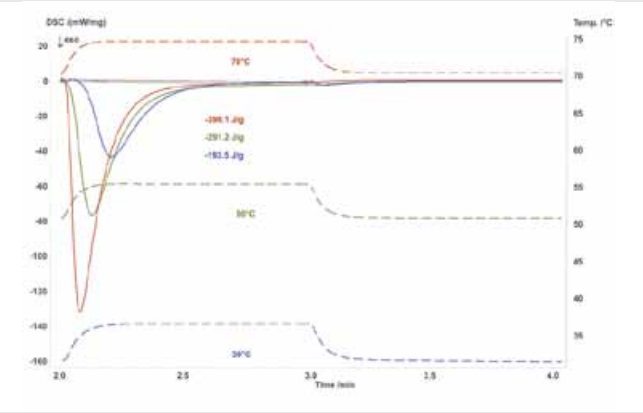
Paints

The irradiation for 1 s of a sample of hexandiol diacrylate (HDDA) was investigated using three different atmospheres. The heat of cross-linking is at its highest under an inert atmosphere of 100% nitrogen (green curve) with 378 J/g. A mixture of 50% nitrogen and 50% oxygen yields 268 J/g (blue curve), a pure oxygen atmosphere only 170 J/g (red curve). There is obviously a competitive reaction due to the influence of oxygen.



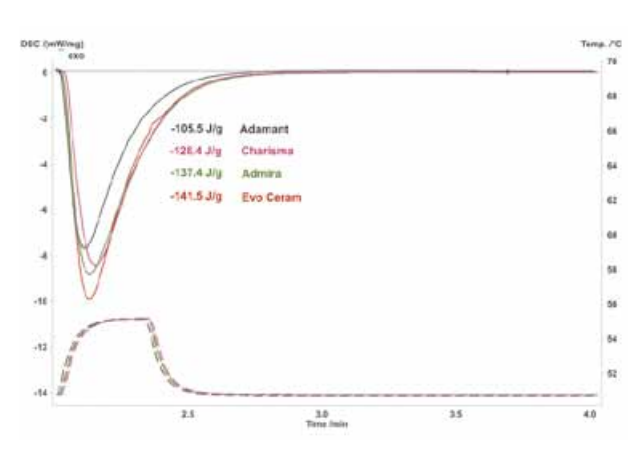
Adhesives

The fluorescent one-component modified epoxy resin is activated with visible light of 400 nm to 500 nm. A cationic curing mechanism allows the adhesive to cure after having assembled the different components.
A higher temperature accelerates this reaction. The adhesive is used for bonding metal, glass, or plastics and especially for stress-equalizing bonding or sealing products.

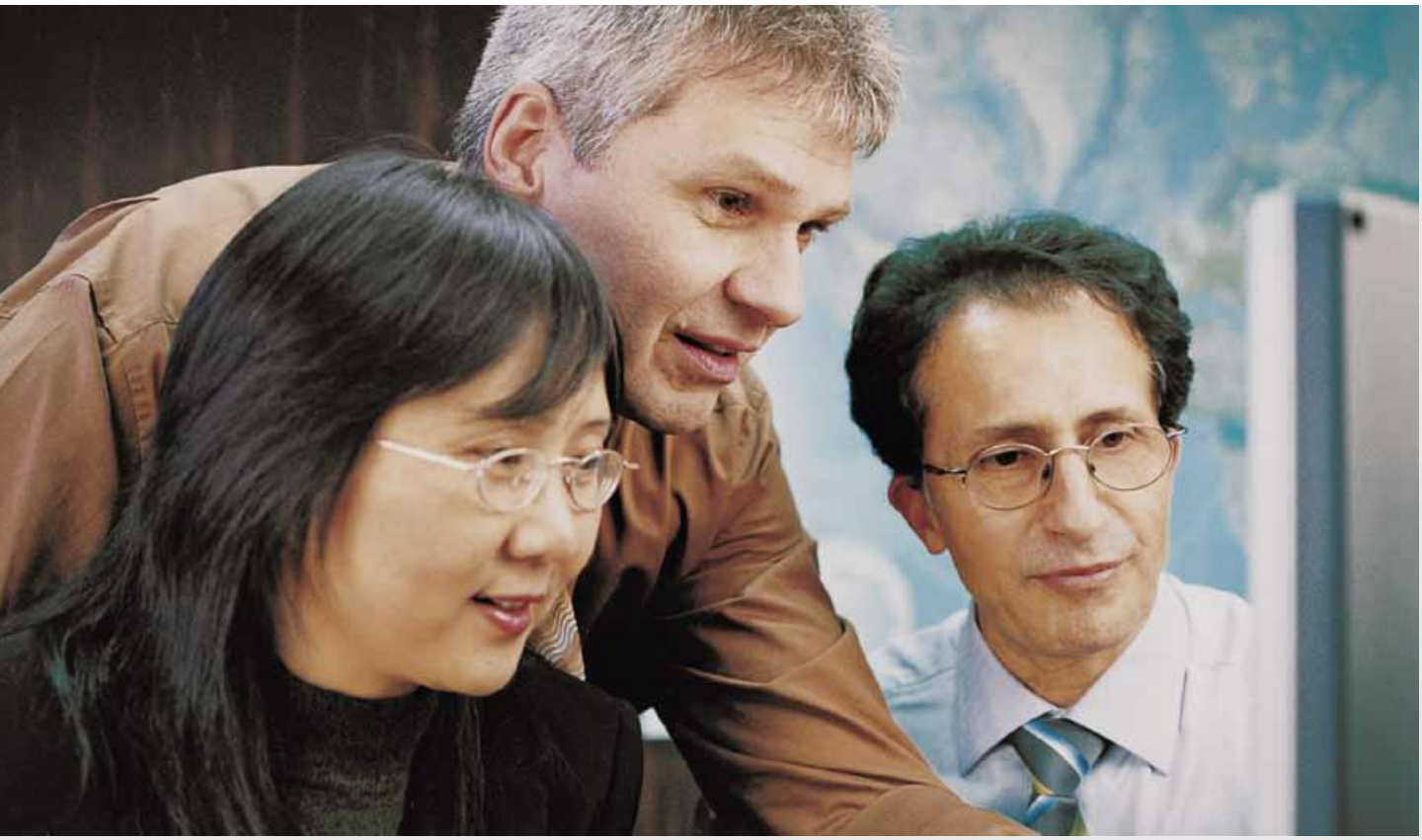


Dental Composites

In dental applications, light-curing dental composites are used as restoratives (fillings) or veneering materials. The materials are generally composed of methacrylate systems such as bis-glycol-dimethacrylate (bis-GMA) or urethane dimethacrylate (UDMA). Additional monomers are used as diluent or to guarantee the cross-linking abilities of the resin. Inorganic fillers up to 80 weight percent improve the mechanical properties and reduce shrinkage during cross-linking.



Expertise in Service



Our Expertise – Service

All over the world, the name NETZSCH stands for comprehensive support and expert, reliable service, 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.

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

Summary of Our Services

- Installation and commissioning
- Hotline service
- Preventive maintenance
- Calibration service
- IQ /OQ/PQ
- On-site repairs with emergency service for NETZSCH components
- Moving/exchange service
- Technical information service
- Spare parts assistance

NETZSCH

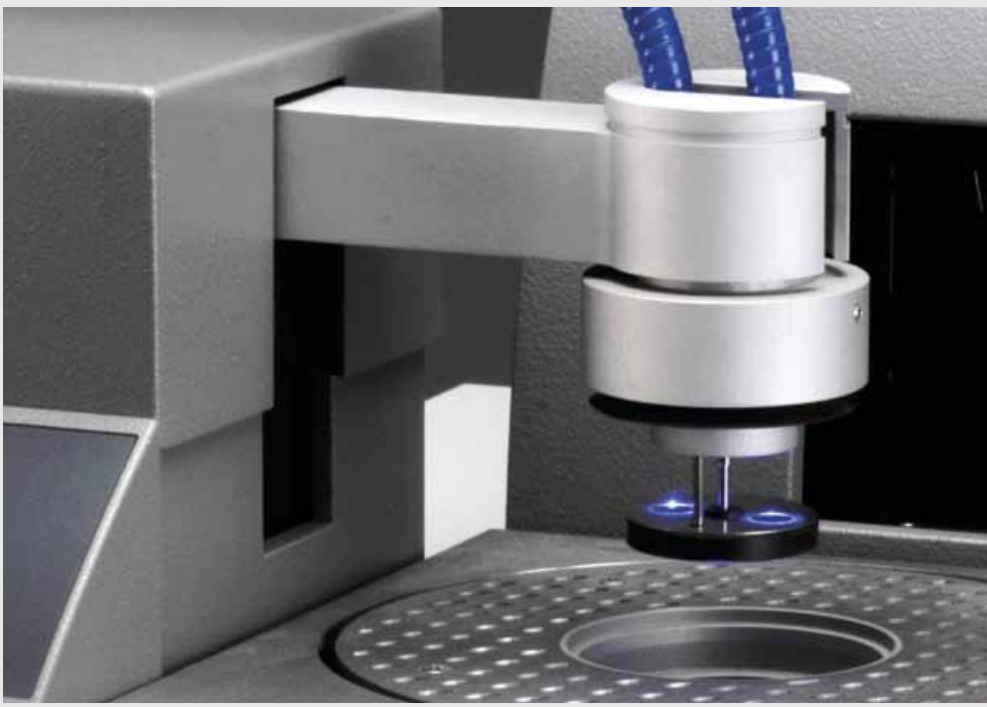
Our Expertise – Applications Laboratories

The NETZSCH Thermal Analysis Applications Laboratories are a proficient partner for nearly any thermal analysis issue. Our involvement in your projects begins with proper sample preparation and continues through meticulous examination and interpretation of the measurement results. Our diverse methods and over 30 different state-of-the-art measuring stations will provide ready-made solutions for all your thermal needs.

Within the realm of thermal analysis and the measurement of thermophysical properties, we offer you a comprehensive line of the most diverse analysis techniques for materials characterization (solids, powders and liquids).

Measurements can be carried out on samples of the most varied of geometries and configurations. You will receive high-precision measurement results and valuable interpretations from us in the shortest possible time. This will enable you to precisely characterize new materials and components before actual deployment, minimize risks of failure, and gain decisive advantages over your competitors.

For production problems, we can work with you to analyze concerns and develop solutions. The minimal investment in our testing and services will reward you with reduced down time and reject rates, helping you optimize your processes across the board.



NETZSCH

The NETZSCH Group is an owner-managed, internationally operating technology company headquartered in Germany.

The three Business Units – Analyzing & Testing, Grinding & Dispersing and Pumps & Systems – provide tailored solutions for highest-level needs. Over 2,200 employees at 125 sales and production centers in 23 countries across the globe guarantee that expert service is never far from our customers.

Leading Thermal Analysis

When it comes to Thermal Analysis, Adiabatic Reaction Calorimetry and the determination of Thermophysical Properties, NETZSCH has it covered. Our 50 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.

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NGB · Photo-DSC 204 ***F1*** *Phoenix*® · E · 1000 · 10/10 · MD · Technical specifications are subject to change.