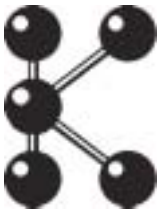


Thermal Analysis Thermophysical Properties

September 2004



NETZSCH at the K 2004

Approximately 250,000 visitors are expected to attend the K 2004, the 16th international trade fair for plastics and rubber which takes place from October 20th through 27th in Düsseldorf. It is one of the world's most important exhibitions for mechanical engineers, manufacturers of raw materials and processors of polymers.

NETZSCH-Gerätebau GmbH will again be among the 2900 exhibitors from more than 50 countries. We will be presenting our latest instru-

ment developments at our **Booth E 46 in Hall 10:**

- the innovative **F1 series**, featuring the differential scanning calorimeter **DSC 204 F1 Phoenix®** and the thermo microbalance **TG 209 F1 Iris®**, which can both be equipped with the same automatic sample changer (for 64 samples)
- simultaneous coupling with a fourier transform infrared spectrometer (Bruker Tensor 27) and the **QMS 403 C**
- the **Aëolos®** quadrupole mass spectrometer
- the **DEA Epsilon series** for measurement of the curing behavior of reactive resins, adhesives or paints - also in-situ!
- **LFA 447 Nanoflash™** for contact-free measurement of thermal diffusivity and conductivity of solids and polymer melts
- **DMA 242 C** for determination of mechanical properties such as storage modulus and loss factor

..... Your Partner in Thermal Analysis and Measurement of Thermophysical Properties

Plastics and elastomers are in greater demand than ever. They play an irreplaceable role in many industrial fields and daily life such as the automotive industry, aerospace, electrical engineering, medical technology, chemistry, sports and leisure. Knowledge of the thermal properties of the most varied polymer products is becoming

increasingly important in product development, quality assurance, process optimization and failure analysis.

In order to give you an overview of the application fields of modern measuring techniques in this area, we are hosting a **polymer seminar** (in German) **on Tuesday, October 26th, 2004,**

starting at 11 a.m. in room 8, CCD South of the Düsseldorf exhibition center. You are cordially invited! We will be pleased to provide registered participants with a free ticket.

The first part of the seminar will focus on Thermal Analysis for quality assurance and failure analysis of poly-

mers; part two (starting at 2:45 p.m.) deals with Thermophysical Properties and on-line cure monitoring.

Our experienced booth staff is ready to discuss and answer your detailed questions and support you in any way they can. We are looking forward to seeing you in Düsseldorf.

Gas Analysis in the F1 Series

By coupling the new TG 209 *F1 Iris*[®] or DSC 204 *F1 Phoenix*[®] to a mass spectrometer and/or FTIR, powerful systems for thermal and chemical analysis of various materials can be established.

The TG 209 *F1 Iris*[®] thermo microbalance is ideally suited for the investigation of thermal stability and quantitative component analysis. The versatile coupling to the QMS 403 C *Aëolos*[®] mass spectrometer or FTIR takes place via an easily mountable adapter system and transfer line. Gases evolving from the sample can so reach the detector system without any condensation.

The QMS 403 C *Aëolos*[®] - a compact and user-friendly quadrupole mass spectro-

meter with excellent performance - can, of course, be coupled to all other Netzsch instruments, such as STAs, or can even be operated as a stand-alone instrument.

The combination of DSC 204 *F1* and gas analysis, as yet unique, is especially appealing: the highly sensitive DSC becomes an analytical station which - while simultaneously investigating the smallest of energetic effects - can also answer questions concerning the stepwise decomposition or the chemical composition of a sample.

The automatic sample changers TG 209 *F1 ASC* and DSC 204 *F1 ASC*, coupled to gas analysis, offer another option: they enable measurements of entire sample series or reproducibility tests to be carried out easily at night or over the weekend. Every sample can, of course, have its own TG/DSC measuring and evaluation routine. For unstable samples, an automatic piercing device is optionally available.

The combination of the sophisticated hardware and software merges TG, DSC and gas analysis into a complete homogeneous system. Data is recorded synchronously; both TG and DSC as well as MS and FTIR files can be concurrently presented and evaluated in the *Proteus*[®] software.

Dr. Alexander Schindler



Colder than Ice ...

Good news for all users who want to do without liquid nitrogen as a cooling agent:

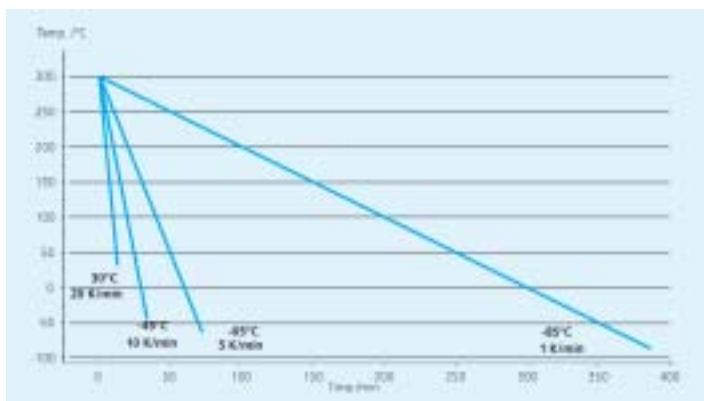
with the NETZSCH intracooler, based on the expansion principle of liquid cool-

ing agents, the DSC 204 *F1 Phoenix*[®] can reach temperatures down to -85°C. Even glass transitions of elastomers can be detected.

With an end temperature of 600°C, the mechanical cooling combination provides plenty of leeway even for the analysis of inorganic products.

Particularly for comparative polymer investigations, controlled cooling between the first and second heating is very important. As can be seen in the figure, a linear cooling rate at 10 K/min in the temperature range between 300°C and -45°C can be realized without any problems when employing the intracooler.

The intracooler consists of a closed cycle. During operation, no cooling agent is consumed; this enables an almost maintenance-free system. The operating costs are defined only by the electric power consumption and are therefore very low.



Cooling Performance of the DSC 204 *F1 Phoenix*[®] with intracooler

DMA - a Universal Method for the Characterization of Plastics

The Federal Institute for Materials Research and Testing, BAM, operates as a national institute with a principal focus on improving "Safety and Reliability in Chemical and Materials Technologies" and covers diverse application fields. It is responsible for certifications and accreditations in both the statutory area (e.g. legislation on dangerous substances and explosives) and the unregulated area. It administers the tasks of a national institute for metrology in chemistry and develops and supplies reference materials in this function. As part of its appraisal activities, BAM carries out investigations for the clarification of issues concerning damage claims.

Since 1991, Dr. Wolfgang Stark has worked for BAM as a scientific co-worker in the "Technical Elastomers and Reference Materials" laboratory in the "Durability of Polymeric Materials" division of the "Performance of Polymeric Materials" department.

In the beginning, his field of activity focused on reactive polymers, especially thermosetting molding materials. BAM had shared responsibility for quality assurance in the Europe-wide coalition for manufacturers and processors for thermosetting molding materials. A main focus of his research work was in the development of methods for quality assurance in production. This was during the time when research and development of on-line methods for record-

ing the reaction process in the production mold was in its infancy. The measurement of both dielectric and mechanical properties (ultrasonic) proved to be trend-setting. Sensors and measurement techniques were developed in close cooperation with the industry.

This development was accompanied by a variety of polymeric-physical methods. Besides DSC, DMA also always played an outstanding role. This was the reason behind the modernization of the instrumentation in 2003 during which a NETZSCH DMA 242 C, equipped with a variety of sample holders, was acquired. Dynamic mechanical analysis is used to characterize the degree of curing in reactive polymers by means of the glass transition temperature (figure 2 as an example).

As a complement to rheological measurements, the curing of casting resins is also characterized with the help of a self-developed method employing fabric strips (analogous to Torsional Braid TBA). Currently, the research field concentrates mainly on epoxy resins for cross-linking systems. In accordance with its principal focus, BAM deals with both the determination of the fatigue resistance and the detection of failure mechanisms in fiber-reinforced structures such as glider planes, windpower plants, etc. DMA is one of the basic methods for controlling the degree of curing of parts, for detecting reaction kinetics and for interpreting ultrasonic properties obtained



Figure 1. Dr. Wolfgang Stark in front of the NETZSCH DMA 242 C

during curing in the production mold.

Another field of activity is the characterization of elastomers and investigation of the vulcanization process. The laboratory manufactures reference materials which are distributed world-wide. It also participates in the accreditation of sealings for containers for the transportation of hazardous goods. With regard to the deter-

mination of the working temperatures of elastomer sealings, particularly in the low-temperature range, the DMA is of utmost significance.

Further information on the activities of BAM can be found at: <http://www.bam.de>.

Our thanks to Dr. Wolfgang Stark for providing us with this article.

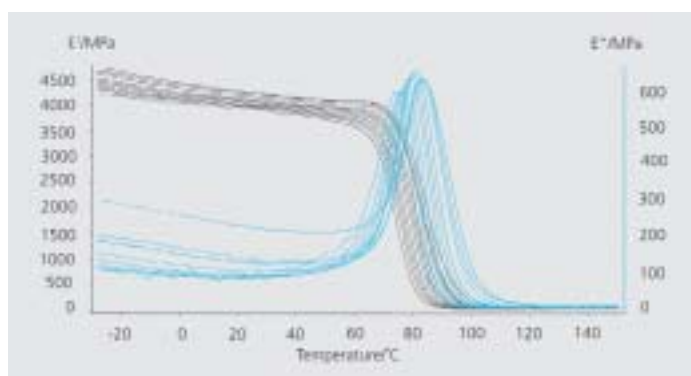


Figure 2. Frequency dependence (between 0.1 and 100 Hz) of the glass transition of cured epoxy compounds for ultrasonic sensor arrays (for the EU project of non-destructive testing of oil pipelines to 200°C and 1400 bar)

Strategic Alliance with BRUKER AXS in Japan



Representatives of NETZSCH-Gerätebau and BRUKER AXS on January 15th, 2004 in Selb

In January 2004, NETZSCH-Gerätebau GmbH signed a strategic alliance with BRUKER AXS Inc. Under the terms of the agreement, BRUKER AXS, based in Yokohama, Japan, will exclusively

market nearly the entire NETZSCH thermal analysis product line in the Japanese market.

Mr. Sadao Ueki, President of BRUKER AXS KK, comment-

ed: "The NETZSCH products have an excellent reputation for their quality and outstanding performance in Japan. Our co-workers are highly motivated ... also due to the fact that the NETZSCH TA specialists have joined and therefore strengthened the BRUKER AXS team."

This agreement follows an already existing, world-wide marketing cooperation between NETZSCH-Gerätebau and BRUKER Optics GmbH on TA-FTIR hyphenated instruments. BRUKER Optics GmbH in Ettlingen, Germany, is a privately-held affiliate of BRUKER AXS.

Dr. Wolf-Dieter Emmerich, Managing Director of NETZSCH-Gerätebau, stated: "This strategic cooperation agreement with BRUKER AXS KK will allow NETZSCH to further penetrate the Japanese materials characterization market. Our high-end products are complementary to the BRUKER AXS TA product line, and therefore we have an excellent opportunity for both companies to further drive market share in the attractive Japanese thermal analysis market. The professional BRUKER AXS sales and support organization with its excellent expertise and market penetration gives us high confidence that both companies will become leading TA instrument providers in Japan in the mid-term."

by the way

... did you know that on the occasion of the next GEFTA meeting, "30 Years GEFTA", from October 4th through 6th, 2004 in Braunschweig, the NETZSCH-GEFTA Prize will be given to deserving scientists for the 21st time?

This prize has been awarded, among others, to Prof. Dr. Hans Rudolf Oswald, University of Zürich, in 1980; to Dr. Robert Mackenzie, Macaulay Institute for Soil Research, in 1982; to Prof. Dr. Antonius Kettrupp, National Research Center for Environment and Health, Oberschleißheim, in 1984; and to Prof. Dr. K. Gallagher, Ohio State University in 1996.

Trade Fairs, Symposia 2004

We will be participating in the following exhibitions:

Physique	19 - 21 September, Paris, France
PhandTA 8	26 - 30 September, Monte Verita, Ascona, Switzerland
TECNARGILLA	01 - 05 October, Rimini, Italy
NATAS	03 - 06 October, Williamsburg, VA, USA
GEFTA Annual Meeting	04 - 06 October, Braunschweig, Germany
DKG Annual Meeting	11 - 13 October, Karlsruhe, Germany
Zwick Fachmesse	11 - 14 October, Ulm, Germany
K 2004	20 - 27 October, Düsseldorf, Germany
HET Instruments	01 - 05 November, Utrecht, Netherlands

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