onset

Thermal Analysis

September 2002

Happy Birthday NETZSCH-Gerätebau!

"40 years of NETZSCH-Gerätebau, 40 years of growth" is how the successful history of the company could be described. In 1962, the department "Testing Instruments" of the Gebrüder NETZSCH-Maschinenfabrik became NETZSCH-Gerätebau GmbH, which nowadays holds a leading position as a high-tech company in the field of Thermal Analysis.

This was extensively celebrated on July 9th, 2002. Almost 400 co-workers, customers and business partners met at the Rosenthal Theater in Selb to celebrate this anniversary. The highlight was a speech given by Prof. Dr. Dagmar Schipanski, the Minister of Science, Research and Art of Thuringia, Germany. She focused on the close connection between science and research which, in her view, NETZSCH-Gerätebau has been able to realize in an almost ideal way.

The picture opposite depicts Prof. Dr. Dagmar Schipanski in a conversation with Dr. Wolf-Dieter Emmerich, head of the "Analyzing and Testing" business unit and managing director of NGB, and Thomas Netzsch, chairman of the NETZSCH group.

Dr. Wolf-Dieter Emmerich, Prof. Dr. Dagmar Schipanski and Thomas Netzsch (from left to right)

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Nowadays, flash methods are a recognized technique in science for the determination of thermophysical properties. With this non-contact, non-destructive method, temperatures and thermal conductivities of a variety of materials can be quickly and accurately determined. The high costs of purchasing such an instrument have so far discouraged many scientists in research, development and quality assurance.

With the new LFA 447 Nanoflash™, NETZSCH is offering for the first time a measuring system which delivers the mentioned advantages at a very cost-effective price. The Nanoflash™ operates with specially adapted flash lamps and can be optionally equipped with a furnace up to 200°C. Apart from measuring materials with different sample sizes and geometries, it also allows for in-situ charaterization of layer systems. With this data, heat removal problems in electronic parts can, for example, be investigated and optimized.

Following the Curing Trail

After what amount of time or at what temperature does a curing reaction start? Is the thermosetting already entirely cured? Which adhesive shows the higher reactivity? Has the paint already been sufficiently dried? Such or similar questions are those which resin processors, adhesive developers and paint users would like to answer comprehensively.

Thermal Analysis offers the appropriate tool for this, as clearly depicted in the NETZSCH applications volumes "Focus on Thermal Analysis for Paints" and "Focus on Thermal Analysis for Polymers". The DSC method, however, can only be used, for example, for liquid paints in a restricted way since the exothermal curing reaction is overlapped by the endothermal evaporation peak of the solvent. Further, DSC cannot be employed for very fast curing processes (for example polyurethane systems) since mixing and weighing of the sample still takes a few minutes.

These problems can be avoided when using Dielectric Analysis (DEA). This measuring principle is based on the sample being in direct contact with a dielectric sensor. Both electrodes can be arranged either as a plate condensator or a fringed design. A sinusoidal voltage is applied (input signal) to one electrode. The second electrode acts as a receiver for the resulting current. During the curing of a reactive resin, the ionic mobility (ion conductivity) as well as the arrangement of the dipoles in the alternating current field are decreasing. The change in dielectric properties, i.e. permittivity and loss factor, is then evaluated by means of the measuring signal. Presentation of the so-called ion viscosity, the reciprocal value of the ion conductivity, has proven worthwhile in practice. Figure 1 shows the isothermal curing of an epoxy resin prepreg at 180°C. First, a decrease in the ion viscosity correlating with the mechanical viscosity can be determined. Unless the critical starting time for the curing reaction is reached (here after 17 min), the ion viscosity increases to a saturated value.

NETZSCH offers various DEA systems, not only restricted to the lab scale, but above all suited for in-situ curing in the press, in the oven, autoclave or mold.

The high-performance instrument DEA 230/2 has two external interfaces. It is the only DEA which can be equipped with the highly sensitive and highly accurate chip sensor. This is ideal for very weak or slow reactions. With the DEA 230/2, multi-frequency measurements can be carried out between 10^{-3} and 10^{5} Hz. The DEA 230/2 as well as the 1-channel DEA 230/1 and 10-channel DEA 230/10 can be operated with the Eumetric® Software under MS®-Windows™.

Each DEA 230 can be connected to the DMA 242 C so

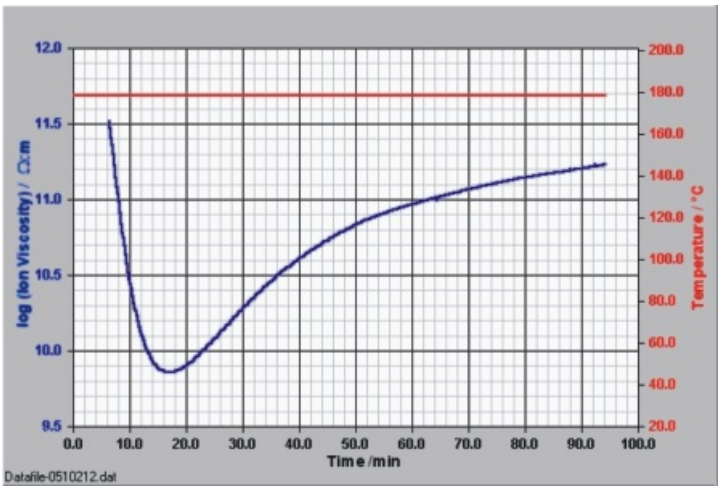

Figure 1. Course of the ion viscosity during the isothermal curing of an EP prepreg

that both the dielectric and viscoelastic properties of a resin during curing can be simultaneously determined in one experiment.

For very fast curing processes (<3 min), the 1-channel DEA 231/1 or the 4-channel DEA 231/4, all working at a freely selectable single frequency up to 10^{4} Hz, are recommended. Due to the considerably faster data acquisition rate in the milli-second range, they are, for example, also used for curing of polyester compounds (SMC and BMC), but also for UV curing. With the CPC (Critical Point Control) Software, four critical points are determined for the quantitative curing description in quality control and assurance. Practical values can also be used as a trigger signal to open a press in order to reduce the cycle time.

The DEA 230 and 231 systems can be equipped with implantable (disposable) IDEX (Interdigitated Electrode) and MS sensors (Micron Sensor, ideal for thin coatings), but also with reusable TMS™ (Tool Mount Sensor, figure 2), DFS (Dielectric Fluid State) and Monotrode Sensors for in-situ curing.

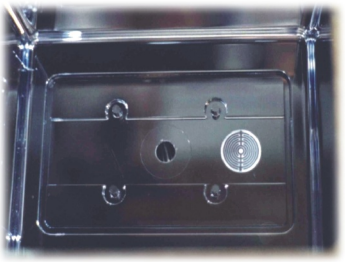

Figure 2. TMS™-Sensor, mounted in the mold

Please contact us for further information on our special instruments DEA 233 SMART*weave*™, DEA 234 CurePak™ and MPS 235 MiniPress for the curing of reactive polymers.

Stephan Knappe,
Sales & Applications Support

Please allow us to introduce our friend: Linn High Therm - Front Line Technology for Laboratories and Industrial Plants

View of Linn High Therm Premises in Eschenfelden and Bad Frankenhausen

Linn High Therm GmbH, founded by Horst Linn in 1969, began by specializing in electrically heated high-temperature, laboratory and research furnaces as well as inductive melting and casting units for sample preparation and for jewelry and dental casting.

By developing new microwave furnaces and by taking over a Thuringian furnace producer in 1990 - now Linn High Therm subsidiary 2, in Bad Frankenhausen - just after the reunification of Germany, they entered the field of industrial production plants.

With approximately 100 employees, sales offices in Eastern Europe, China and Southeast Asia, and representatives in more than 70 countries, we meet market challenges on a global scale. The export quota has now reached 60%. Besides broad standard product lines of laboratory and industrial furnaces, casting machines and micro-wave dryers, Linn boasts strengths in the construction of special plants tailored to customer specifications.

30 years' experience, the introduction of high-quality modern materials and the le close cooperation with clients from research and development ensure not only that Linn maintain its position in this rapidly developing field, but that they play a decisive role in the development of certain areas like microwave technology.

A main objective of all developments is to guarantee customers' satisfaction through modern, long-lived, economic plants which fulfill all safety and environmental regulations.

Besides chamber furnaces (up to 5 m^3) and continuous flow furnaces (up to 8 m in length) for the ceramic- and metal-processing industry for steel-hardening and ceramic-firing, industrial and laboratory kilns for the temperature range up to 1800°C are manufactured. The production line includes protective gas muffle furnaces up to 1150°C, high-temperature furnaces for vacuum and protective gas operation up to 2800°C and over-pressure furnaces up to 250 bar/2300°C, as well as cold-wall furnaces up to 2800°C for vacuum and protective gas operation.

Remelting and treatment systems for sample preparation of oxidized and metallic materials and induction centrifugal casting machines for precision casting, jewelry and dental use, medical technology and industry are also included in the product line. Furthermore, microwave continuous flow furnaces up to 150 KW and microwave chamber furnaces for industrial drying, equipment for microwave technology for plastic processing and research plants for the sintering of ceramics and hard metals are manufactured.

We would like to thank Linn High Therm for this contribution.

Knowledge Management

In July 2002, we founded a new department called "Sales & Applications Support (SAS)", active world-wide, in an effort to better serve you and to facilitate your communications with our technical department and our applications laboratory.

Erwin Kaisersberger and Stephan Knappe (see photos)

Erwin Kaisersberger Stephan Knappe

- both long-time employees of NETZSCH-Gerätebau GmbH with commensurate experience - comprise our new SAS team. In close cooperation with both your local NETZSCH representative and our in-house experts, they will tailor our expertise and technical know-how especially to your needs.

The ONSET team wishes them both success in their endeavors.

We would like to provide you with even more detailed and up-to-date news about NETZSCH-Gerätebau in the future.

Therefore, as of spring 2003, we plan to send you the ONSET in electronic form alone. Please register on our homepage, www.ngb.netzsch.com, under the category NEWS to make sure that you receive the next ONSET edition online.

If you have no internet access, please let us know.

Trade Fairs, Symposia

We will attend the following exhibitions:

NATAS USA	23. - 25.09.2002, Pittsburgh, PA
MATERIALICA 2002 Germany	30.-09. - 02.10.2002, Munich
INTERPLAS Great Britain	30.09. - 04.10.2001, Birmingham
TECNARGILLA 2002 Italy	01. - 05.10.2002, Rimini
Polyurethanes Expo 2002 USA	13. - 16.10.2002, Salt Lake City, UT
R+d in life sciene 2002 Switzerland	22. - 24.10.2002, Basel
Physique France	22. - 24.10.2002, Paris
HET Instrument 2002 Netherlands	04. - 08.11.2002, Utrecht
CBECIMAT - Congresso Brasiliero de Engenharia e Ciencia dos Materiais Brazil	09. - 13.11.2002, Natal

Contract Testing at NETZSCH-Gerätebau GmbH

Do you have a problem that could be solved by means of thermoanalytical or thermophysical measuring methods? Do you need exact thermal data (e.g. thermal conductivity) for the characterization of your material? If you do not want to invest in the corresponding instrument right now, we have the solution for you. Just feel free to contact us. We will be pleased to carry out these measurements for you or to forward your inquiry to competent laboratories all over the world. For more details, please contact our lab staff in Selb at lab400@ngb.netzsch.com.

by the way

Take the opportunity to perfectly couple and pulse calibrate during the 5th "Selb Coupling Days SKT 2003" in Bad Orb (May 25th through 28th, 2003) directly following ACHEMA. We look forward to seeing you there!

Do you have questions regarding the safety of your products with regard to toxic emissions during processing and identification of the gases released during the firing process? Or would you like to know what all happens during firing and so forth and so on? Then an interesting program is awaiting you! Experienced users will answer your questions during practical work and advanced training courses.

More details can be found at www.skt.2000.com, or contact Dr. Albrecht Rager at BRUKER OPTIK (phone +49 7243/504651) or Silke Popp, NETZSCH-Gerätebau GmbH (phone +49 9287/881-131).

InnoPlast Solutions Inc. is hosting a seminar entitled "Getting the Most out of Thermal-Rheological Techniques", from October 7 - 10, 2002, at the Hilton at the Zürich airport. NGB will participate with several lectures. For more details, call +1-973-539-0487, or send an e-mail to InnoPlast@aol.com.

New in the Laboratory

Dr. Ekkehard Füglein

Dr. Ekkehard Füglein was born in Neustadt in 1967. He studied chemistry at the University of Würzburg, where he received his Phd in the field of solid-state chemistry at the beginning of 1998. After finishing a research project at the University of Vienna, he joined Linseis in Selb the same year and began his intensive work in the field of Thermal Analysis. Since February 2002, he has been employed in the applications lab at NGB with a special focus on the DSC product range.

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NETZSCH - the exact solution