Elastomer-Testing

GÖTTFERT

MDR *EL*

GÖTTFERT

ELASTOMER-TESTING

for determination of the processing behavior of reactive materials

We would like to present our systems that meet industrial standards by a robust construction, each with individual features, providing their measuring reliability especially in continuous operation. As usual they could be configured to specific needs.

QUALITY AND RELIABILITY
FOR YOUR REQUIREMENTS

In order to fulfill the continuous increasing requirements in regard to quality and consistency of rubber products, it is essential to make a comprehensive characterization of the raw compound while processing.

Elastomeric compounds are complex multiple mixture out of main components like polymers, fillers, plasticizes, additives and vulcanizing chemicals. The interactions of various materials cause a more or less high effect on the material properties and at the same time provide a wider range of characteristics.

The most important processing criteria for the final product are the **flow and the vulcanization behavior as well as the filling agent distribution.** While testing these characteristics there should be differenced among the production accompanying testing and the testing during developing phase, for example to simulate application dependent processes. The production accompanying testing serves primarily for quality control and requires a statistical analysis.

Our testing machinery is well suited for both testing applications.

In a growing manner the computerized process models apply for screw and molding definition. A full rheological characterization of the elastomeric compound already while developing state of the elastomeric product is therefore indispensable.

Under continuous supervision by a certified and approved quality management system, our equipment is developed and manufactured as per the latest technical standards.

Creativity and the long-lasting experience of our team keep our systems improving. **Latest up-to-date working** circumferences support constructive heads to implement technical expertise in market orientated products.

GÖTTFERT does not supply only tailor made machinery as per industrial needs, but also professional support and fast and transparent service along with fundamental data exchange under rheological aspects.

KNOWLEDGE

Scan QR code and learn more about the Elastomer-Testing

Applications
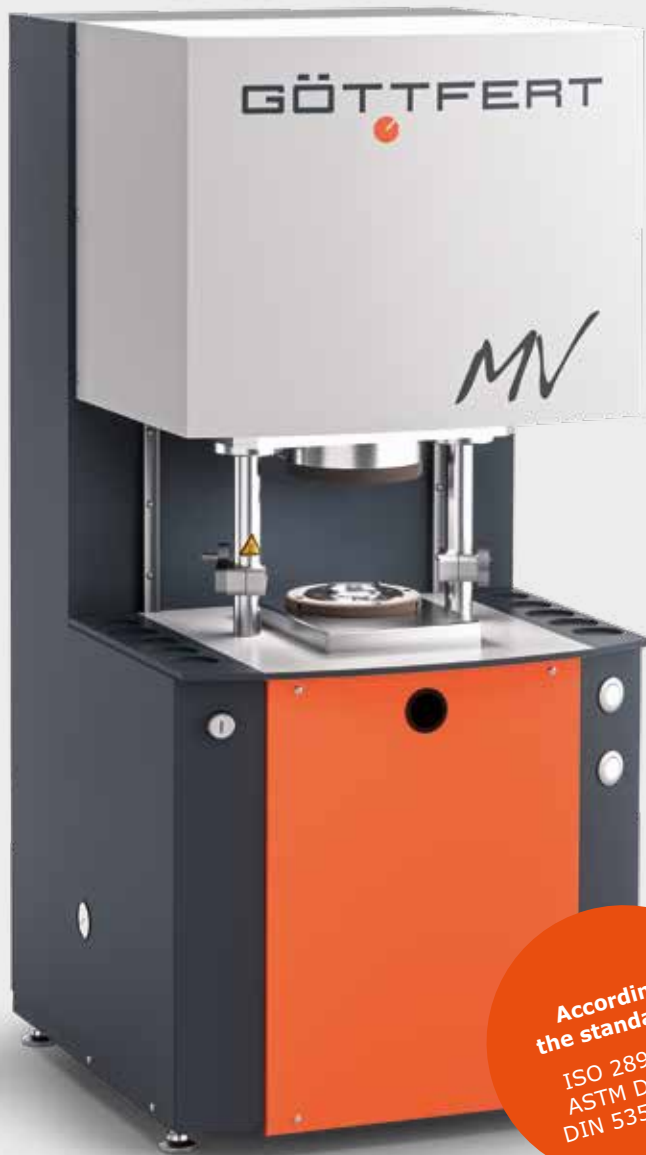goettfert.com/applications-elastomer-testing

Rheo-Info (Whitepaper)
goettfert.com/rheo-info-elastomer-testing

MOONEY-VISKOSIMETER

Rotational shearing disk viscosimeter
Standardized procedure for reliable test results

According the standards:
ISO 289 1-4
ASTM D1646
DIN 53523 1-4

HIGHLIGHTS

- Standard and dynamic viscosity testing
- Universal handling with one multifunction button (status display via color)
- High sensitive and precise torque transducer up to 200 ME
- Constant rotor speed of 2 min^{-1} (optional 0.1 to 5 min-1 or 0.1 to 50 min^{-1}, important for relaxation measurements)
- Speed acceleration in steps or linear
- Rotor stop in less than 20 ms for exact relaxation measurements
- Variable test die with profile standardized ground, top and wall surface
- Variable shear disk diameter (38.1 mm/30.48 mm)
- Pneumatic locking unit of the test chamber with max. 12.7 kN locking force
- Temperaturee control up to 200 °C, resolution +/- 0.1 °C
- High measuring accuracy by optimized tempering of the test chamber and rotor
- Long-life seals

MOONEY-VISKOSIMETER 91.22

A **rotational shearing disk viscometer** with closed chamber and rotor, which is used to determine the Mooney Viscosity, scorch characteristics and stress relaxation of rubber compounds, pure natural rubber or synthetic rubber.

The test sample consists of two round blanks (formed using a punch), one of it has a bore hole in the center for passing through the rotor. The punched test samples are formed homogeneous. The sample is being sheared in the closed test die under the constant speed turning rotor. With the constant values pressure, Temperaturee and rotation speed the resulting torque is being saved and evaluated.

MEASUREMENT PROCEDURES

- Mooney Viscosity (Plasticity)

- Mooney Scorch

- Mooney Relaxation

- Delta Mooney

- Dynamic testing by variable speed option

OPTIONS

- Free definable speed from 0.1 to 5 min^{-1}

- Free definable speed from 0.1 to 50 min^{-1}

- Rotor detection

- Chamber cooling/-tempering (Air- or Liquid tempering)

- Torque calibration device

- Volume punch

ELASTOGRAPH

Moving Die Rheometer (MDR)

According
the standards:
ISO 6502
ASTM D5289
DIN 53529

◈ HIGHLIGHTS

- Measurements with 50 min^{-1} (0.833 Hz)/100 min-1 (1,66 Hz) selectable

- Two frequencies by fix or variable strain rates

- Various test die design for different kind of materials (shore, liquid, bi-conical open, closed)

- Extremely fast Temperaturee control and a homogeneous Temperaturee distribution in the reaction die

- Torque recording

- Build-in Ethernet interface for data transfer to a PC

Open test die

Closed test die

ELASTOGRAPH

Deformation Amplitude:
Standard +/- 0.5° (optionally selectable one additional angle between +/- 0.1 up to +/- 1°)

A **rotor less rotational shear vulcameter** with different test die design, which is used for characterization and vulcanization of rubber compounds in the plasticized condition, during vulcanization phase and in the fully vulcanized sample.

MEASUREMENT PROCEDURES

• Vulcanization

• Isothermal & Non-isothermal measurement procedures

ELASTOGRAPH-S

Direct drive system with variable deformation amplitude:
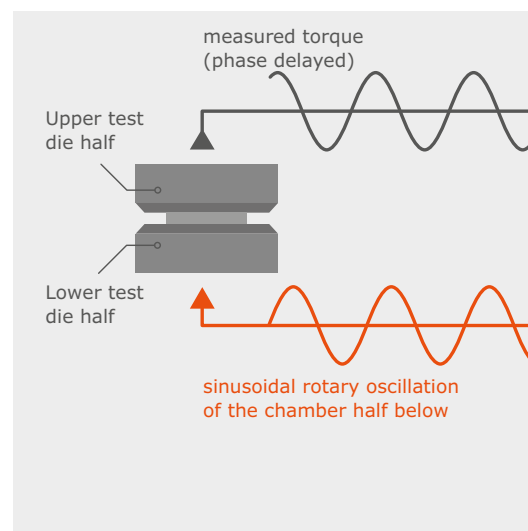From +/- 0.1° to +/- 10°

Strain rates: from 1.4 % - 55.8 %

OPTIONS

• Normal force measurement

• Air cooling

• Torque calibration device (torsion bar)

• Volume punch

• Autoloader (Automatic sample feeder)

The test sample consists of one round blanks (formed using a punch). The sample is being forced in the lower test die half by a sine rotation oscillation.

Torque and phase angle are determined as a function of the measuring time.

measured torque
(phase delayed)

Upper test
die half

Lower test
die half

sinusoidal rotary oscillation
of the chamber half below

VISCO-ELASTOGRAPH

Rubber Prozess Analyzer (RPA)

Acc. Standards:
ISO 6502
ASTM D5289
ASTM D6601
ASTM D6204
DIN 53529
ISO 13145
ASTM D7050
ASTM 6048
ASTM D7605

HIGHLIGHTS

- Standard and customized Test Champers

- Deformation or stress-controlled operation

- Temperaturee up to 230°C with high Temperaturee control and homogeneous Temperaturee distribution in the reaction chamber

- Deformation frequency 0,01 to 120Hz

- Amplitude ±0,001 to ±360°, angular resolution of the drive 0.001°

- Torque measuring range 25 Nm

- Normal force measuring range up to 10 kN for testing sponge and cellular rubber compounds and the effect of the blowing agents contained therein

- Cooling rate up to 1°C/s (optional)

MEASUREMENT PROCEDURES

- LAOS by using FFT
- Transient viskosity
- Isothermal / non-isothermal curve
- Frequency sweep
- Amplitudes sweep
- Temperaturee sweep
- Ramp function up to a gradient angle of 720°
- Relaxation test up to a deflection angle of 360°

OPTIONS

- Autoloader
- Volume punch
- Normal force measurement
- Torque calibration

RPA VISCO-ELASTOGRAPH

The Rubber Process Analyzer is used to **determine the viscoelastic material behavior in a plasticized state** during vulcanization and after vulcanization of the material sample. For this purpose, a torsional load is imposed on the sample by the rotational oscillation of the lower test die half. Torque and phase angle are recorded as a function of test time.

The RPA VISCO-ELASTOGRAPH was developed with the experience of 45 years in the field of rubber testing and has proven **high accuracy, reliability and repeatable measurement results.**

The vulcameter can be equipped with different test chamber designs depending on the standard and material used. Available are quasi, as well as hermetically sealed test chambers in biconical, shore and paste versions. With the optional autoloader, multiple tests can be performed fully automatically without user intervention.

Compared to the MDR, the RPA offers **much more freedom in test design.** Both the frequency and amplitude can be selected program-controlled in a very large adjustment range. In combination with the very fast Temperaturee control, not only frequency, amplitude and Temperaturee sweeps but also ramp or relaxation tests can be performed fully automatically.
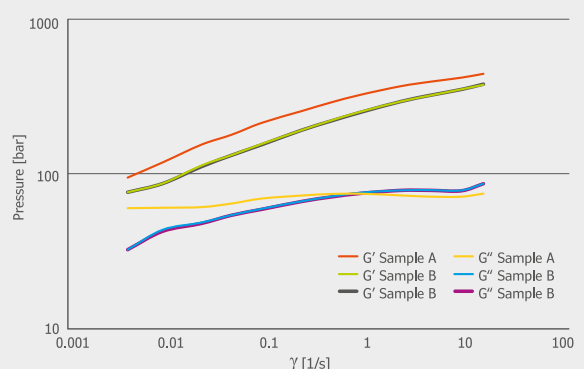
STORAGE AND LOSS MODE

The storage modulus (G`) measures the energy which is stored in the sample and which will be released after mechanical stress. The diagram shows the storage and the loss modulus of a NBR compound. This evaluation serves a comparison between the elastic and the viscous material behaviour.

RCR 75

„Horizontal" measuring stress controlled

According the standards:

ASTM D5099 (Rubber)
ISO 11443 (Visco)
GFT 014-02

HIGHLIGHTS

- Test under production and processing conditions

- Pressure- or speed controlled

- Test piston force of max. 20 kN or max. 75 kN

- Test piston diameter 20, 30 or 35 mm

- Short test intervals of less than 3 minutes

- High dynamic speed range: 1:800.000

- High dynamic piston acceleration: 0-15 mm/s in 0.35 s

- Position acquisition: high resolution encoder (0.00000064 mm)

- Dynamic test mode "constant speed" (3 steps)

- Both versions, including the known RHEOVULKAMETER functions of the previous generation work-speed and stress controlled.

RCR 75

Our RCR is an innovative Capillary Rheometer to determine the flow behavior of rubbers under special physical processing conditions.

The RCR operate in two test modes:
- „Extrusion mode" (flow behavior)
- „Injection mode" (with ramification- and/or spiral mold)
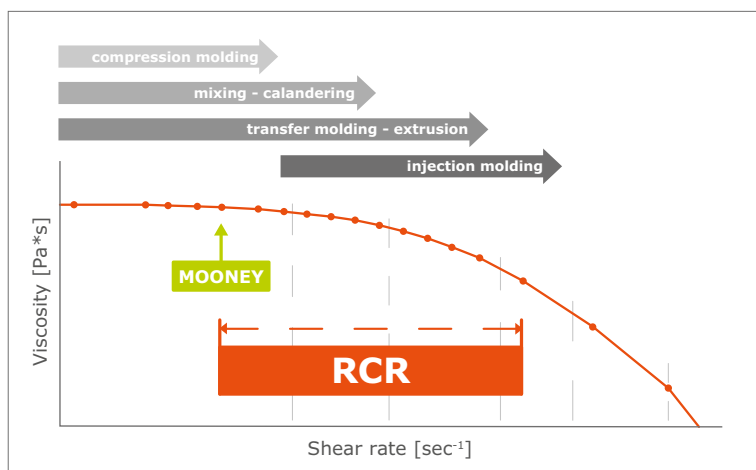

Extrusion

Injection

OPTIONS

- Different Molds (Injection mode)

- Test die with heat insulation (Injection mode)

- Divided capillaries (Extrusion mode)

- Die Swell Measurement

- Volume punch

Ramification Mold

Spiral Mold

RHEOGRAPH 120

High Pressure Capillary Rheometer

Acc. Standards:
ISO 11443
ASTM D 3835
DIN 54811
ASTM D 5930 (option)
ISO 17744 (option)
ASTM D 5099 (option)

◈ HIGHLIGHTS

- Single, twin or triple test barrel system with different test barrel geometries
- Constant high test force up to 120 kN
- Speed range from 0.00004 mm/s to 40 mm/s (= 1:1000000)
- Servo-drive, high dynamic test piston acceleration from 0 to 40 mm/s in 0.6 seconds!
- Position capture with high resolution encoder (step size 0.0000016 mm)
- Temperaturee range up to 400 °C (500 °C optional), display resolution 0.01 °C
- Automatic pressure transducer detection and identification „Plug&Test"
- Adaptive signal resolution of 0.005 % from the range of the pressure transducer
- Pressure transducer measurement range up to 2500 bar
- Timer function
- Special „Extrude mode"
- High safety shut down
- Multi monitoring of overload drive, force, pressure, heaters
- Automated Script file functionality

RHEOGRAPH 120

Not only suitable for high polymers but also for elastomers!

The complete multi-functional RHEOGRAPH family is also suitable to determine the flow and viscosity function on rubber compounds.

It can be used as a tool to **optimize the development on new blends.**

The system allows extensive and process near simulations for material characterization. Expressive evaluations, e.g. like Mooney correction (wall slip behavior) or flow instabilities (Shark Skin Effect) can be carried out easily.

OPTIONS

- Determination of flow instabilities (Shark Skin effect)

- Thermal conductivity

- PVT, isothermal or isobaric

- Die swell measurement, static and dynamic

- Counter pressure chamber

- Slit die

- Melt Temperaturee via thermocouple

- Corrosion resistant and wear resistant test barrel design

- Advanced tempering of the test chamber

- RHEOTENS and HAUL-OFF-System to determine the melt tensile

- CONTIFEED

SHARK SKIN MEASURING DATA
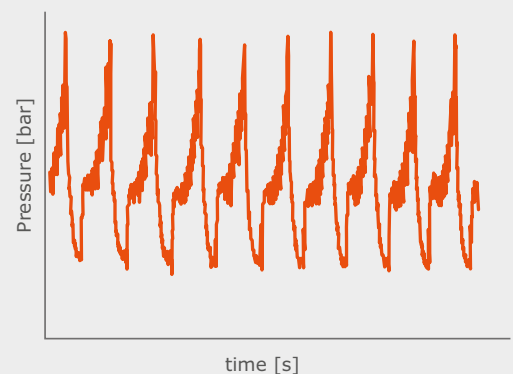
OPTIONS

VOLUME PUNCHES

The pre-condition for reproducible tests are test samples with a constant volume.

The following volume punches cuts out of an unvulcanized batch with **different thickness rates a test sample with a constant volume.** Precise components for accurate test results, two-hand operation for user safety.

The punching procedure is being released by a two-hand operation to ensure the safety of the operator. At first, the batch will be compressed - therefore excess material flows out or it is pressed out. Then the actual punching operation is performed. The volume of the sample can be adjusted exactly and the compression time is variable too.

Pneumatic Volume Punche

Our product range contains two different kinds of volume punches:
On one hand the hand-operated-volume punches and on the other hand the pneumatic volume punches.

Hand-Operated Volume Punches
• Hand-Operated Volume Punch 83.00 (MDR, RPA, RCR)
• Mooney Hand-Operated Volume Punch especially for Mooney-Viskosimeter)

Pneumatic Volume Punches
• Pneumatic Volume Punch 89.00 (for MDR, RPA, RCR)
• Pneumatic Volume Punch 89.17 / max. 18kN (for MDR, RPA, RCR)
• Mooney Pneumatic Volume Punch (especially for Mooney-Viskosimeter)

Pneumatic Volume Punche

Mooney Pneumatic Volume Punche

Hand-Operated Volume Punche

AUTOMATIC SAMPLE FEEDER

With the optional Autoloader system, 5 samples linear or up to 30 test samples with one magazine can be transported into the test die and measured automatically step by step between 2 Temperaturee resistant flat films.

The system identifies the filling level as well as the sample position in the magazine.

The tested sample is also being removed after the run. During the test free places can be charged with new ones for a continuous run.

The Software „RubberView" offers the possibility to predefine variable sequences.

Furthermore running test plans can be interrupted and then being continued again.

SOFTWARE „RUBBERVIEW"

Only a short view into the possibilities

RUBBERVIEW

RubberView is the database Software for ELASTOGRAPH, VISCO-ELASTOGRAPH, MOONEY-VISKOSIMETER and RCR (RHEOVULKAMETER).

The program is used for parameterization, for control of the measuring procedure as well as for evaluation under a simple to use and clearly represented desktop. Special applications are allowed to **implement very quickly.**

All data sets are being shown in table form and in diagrams, new measurements can be added, existing ones being modified and changed or deleted.

Quick help via safe TeamViewer connection possible!

HIGHLIGHTS

- Data handling in/out of local or network data bases with converting and compression function

- Automatic read in function of the test device information

- Free arrangement and display of the raw data and evaluation graphic

- Continuous monitoring of the current machine operating status

- Clear structured organization by single packets „test plan", „test parameter" and „test criteria"

- Subsequently recalculation and data updating when changing the test criteria, the measurement must not be repeated.

- Self-definable check boxes for time saving selection

- Self-explaining dialog windows and information fields, online help

- Open platform for user application fields, filter for measurements

- Selectable access rights for optimal

- Large portfolio with evaluating methods

- Definable limit curves, single limit values, times, tolerances, units

- Free design, size and placement of all display values

- Predefine menus for a faster parameterization, like e.g. automatic measurement name, user selection

- Data export to Microsoft EXCEL®

- „XML-interface for connection to LIMS systems"
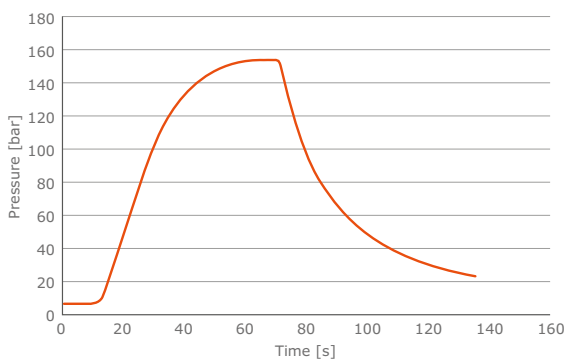
- Report creation

- XML-connection

MATERIAL CHARACTERIZATION
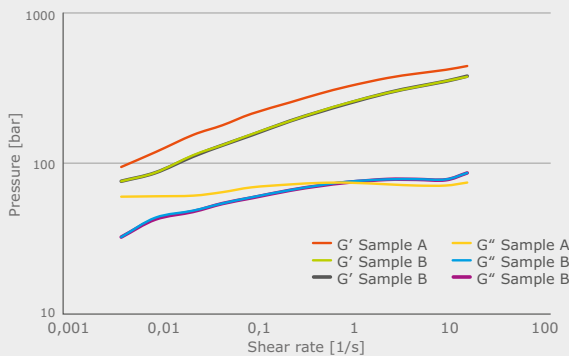
STORAGE AND LOSS MODE

The diagram shows the storage and the loss mode of 2 NBR compounds with different raw polymers. This evaluation serves a comparison between the elastic and the viscous material behavior

- VISCO-ELASTOGRAPH

Chart axes: Pressure [bar] (y-axis, 10 to 1000), Shear rate [1/s] (x-axis, 0,001 to 100)

Legend: G' Sample A, G' Sample B, G' Sample B, G'' Sample A, G'' Sample B, G'' Sample B

RELAXATION

The measurement of the relaxing time is being determined out of a disturbance test.
It characterize the viscoelastic material behavior and is important for process near properties.

- VISCO-ELASTOGRAPH
- MOONEY-VISKOSIMETER

Chart axes: Pressure [bar] (y-axis, 0 to 180), Time [s] (x-axis, 0 to 160)
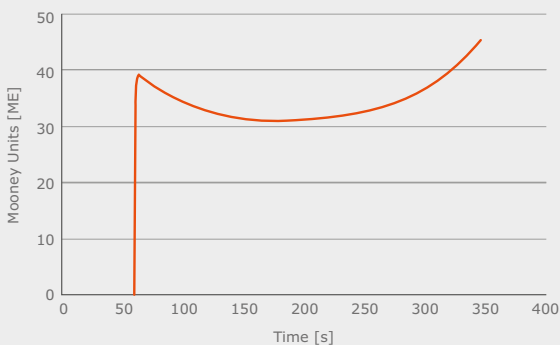
MOONEY-SCORCH

The Mooney-Scorch mode characterize the scorching (vulcanizing) behavior of a test sample at a higher Temperaturee. In this case the time is being detected where the viscosity increase by a given value.

- MOONEY-VISKOSIMETER

Chart axes: Mooney Units [ME] (y-axis, 0 to 50), Time [s] (x-axis, 0 to 400)
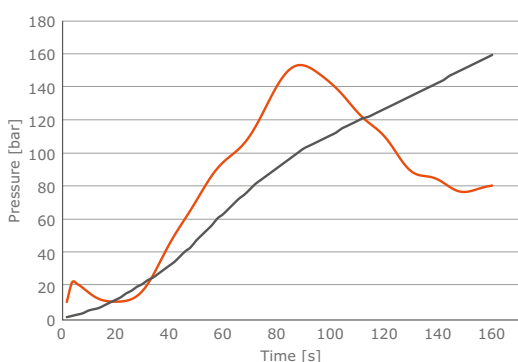
RCR

The extrusion through a die and the injection into a tool is a process near machining test for extrusion and injection molding.

- RUBBER CAPILLARY RHEOMETER

Chart axes: Pressure [bar] (y-axis, 0 to 180), Time [s] (x-axis, 0 to 160)
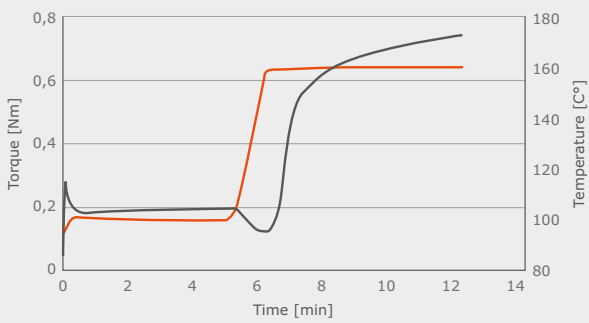
EVALUATION METHODS

Extractions of the capability
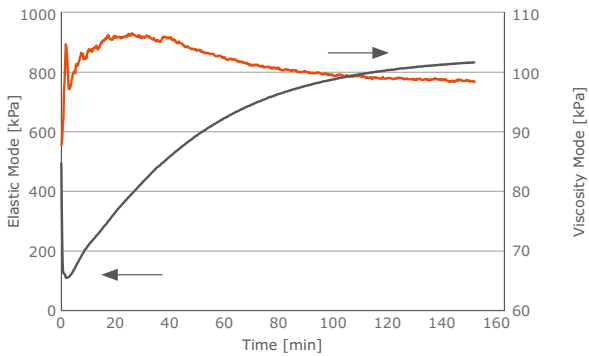
VARIABLE TIME

Comparable with the usual Vulkameter test here the module and the viscosity via the time are being captured at constant amplitude and frequency.
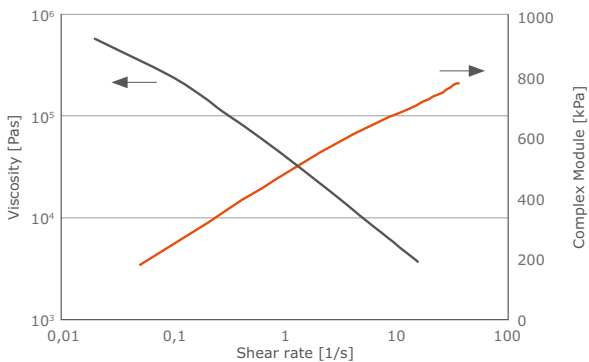
- ELASTOGRAPH
- VISCO-ELASTOGRAPH

TEMPERATURE SWEEP

Via an integrated temperature program definable temperature steps can be individually realized. The example here shows a non-isothermal vulcanization.
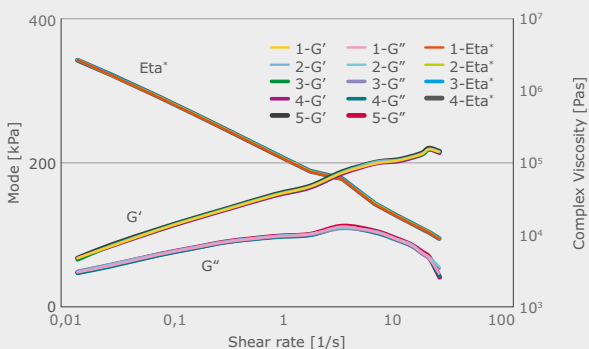
- ELASTOGRAPH
- VISCO-ELASTOGRAPH

FREQUENCY SWEEP

The swinging deformation of the lower chamber half can be controlled exactly between 0.1 to 50 Hz. Torque, module and viscosity are being measured at preselected amplitude. Classic test to determine the flow curve.
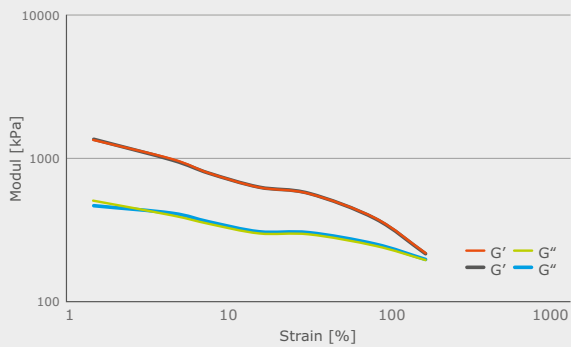
- VISCO-ELASTOGRAPH

MULTIPLE REPRODUCTION

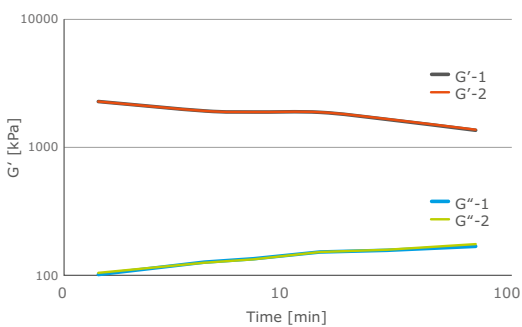Frequency sweep of a flour elastomer compound, 5 times reproduced.

- VISCO-ELASTOGRAPH

AMPLITUDE SWEEP NON VULCANIZED

With this measurement variable ramified polymers can be differentiated to various active filling additives (here at an example of a flour elastomer compound).
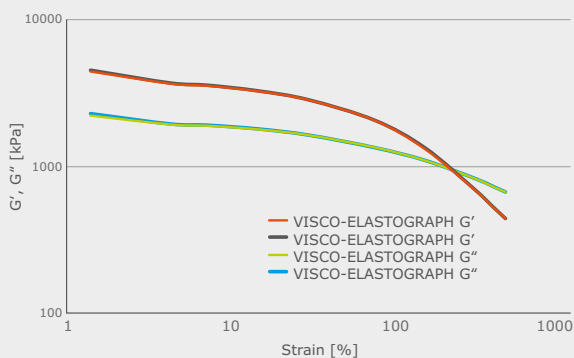
- VISCO-ELASTOGRAPH

AMPLITUDE SWEEP VULCANIZED

Is being used to judge the network which is raised during the vulcanization.
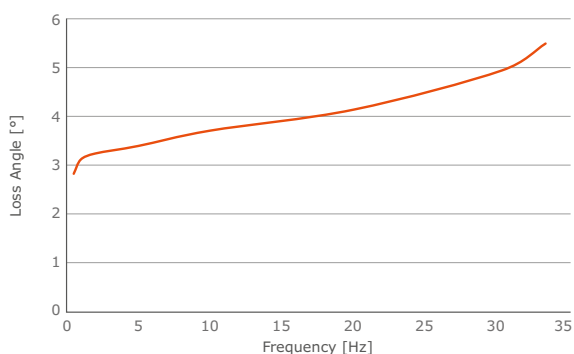
- VISCO-ELASTOGRAPH

PAYNE-EFFECT

An amplitude sweep at an non vulcanized compound shows the Payne effect. The crossing point of G' and G'' helps judging the filler medium network.
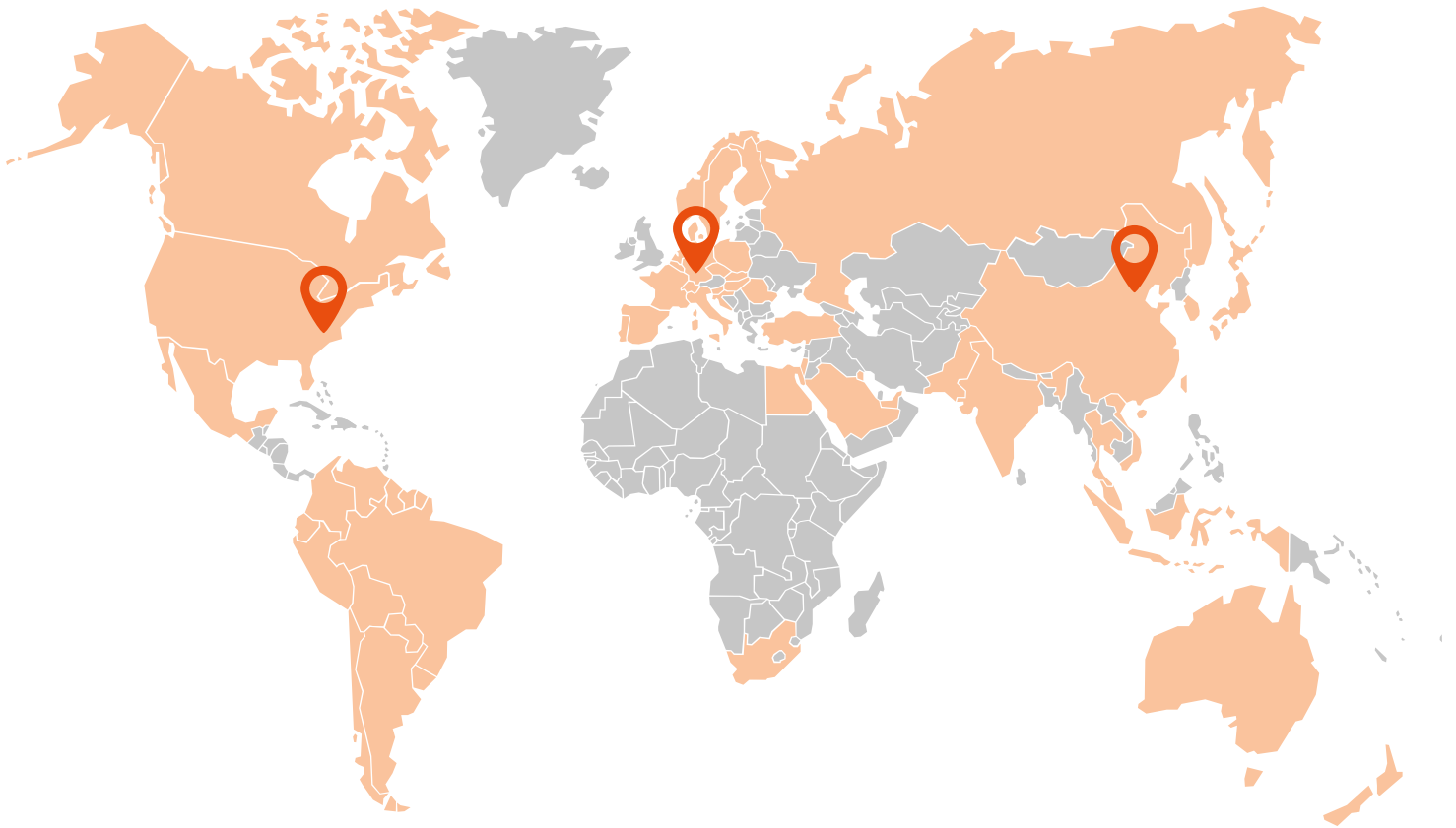
- VISCO-ELASTOGRAPH

FREQUENCY DEPENDENCE OF THE PHASE ANGLE

On the basis of the trend of the phase angle a conclusion about the damping behavior of the compound can be given (the test here at a completely vulcanized compound)

- VISCO-ELASTOGRAPH

THIS IS RHEOLOGY

GOETTFERT Inc.

Rock Hill, SC 29730
USA
📞 +1 803 324 3883
✉ info@goettfert.com

GÖTTFERT | Werkstoff-Prüfmaschinen GmbH

74722 Buchen
📞 +49 (0) 62 81 408-0
✉ info@goettfert.de

GOETTFERT (China) Ltd.

Beijing 100027
CHINA
📞 +86 10 848 320 51
✉ info@goettfert-china.com

www.goettfert.de