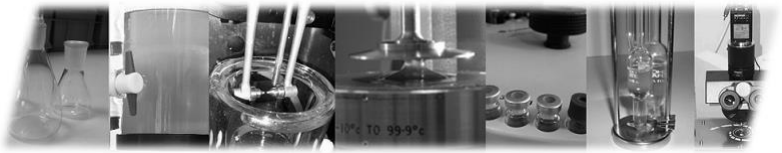
WEE-Solve GmbH



RHEOLOGY / VISCOMETRY

Viscometry

Capillary viscometry is considered as the most accurate method for the determination of the viscosity of Newtonian liquids. By this technique the time is measured a certain volume needs to flow through a capillary of defined dimensions. The meniscus is detected by means of light barriers, enabling the precise determination of the flow time.

In the field of polymer chemistry capillary viscometry is used to determine the viscosity number, the K-value and the intrinsic viscosity. By means of these data the molecular mass can be determined, which is one of the most important values to characterize polymers.

Measure:

- Intrinsic Viscosity (also known as Staudinger-Index)
- Viscosity number
- K-value (Fikentscher)
- Viscosity index
- Degree of particle swelling
- Relative change of viscosity, specific viscosity
- Inherent viscosity
- Relative viscosity, viscosity ration
- Kinematic viscosity
- Dynamic viscosity

Service provider for polymer fractionation / purification, rheological measurements, and contract research.
WEE can solve your problems!

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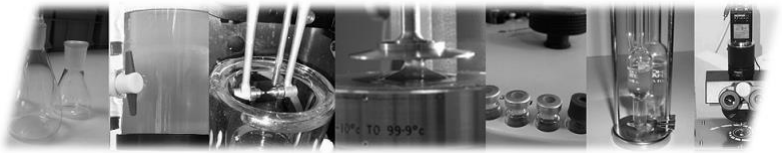

Methods:

DIN EN ISO 1157	Determination of the viscosity number and the viscosity ratio of cellulose acetate in dilute solutions.
DIN EN ISO 1628/1-6	Determination of the viscosity of polymers in dilute solution using capillary viscometers: Part 1: General principles Part 2: Poly(vinyl chloride) resins Part 3: Polyethylene and Polypropylene Part 4: Polycarbonate (PC) molding and extrusion materials Part 5: Thermoplastic polyester (TP) homopolymers and copolymers Part 6: Methyl methacrylate polymers
ISO 307	Plastics — Polyamides — Determination of viscosity number
SNV 195 598	Determination of the viscosity number of cellulose in EWN
ASTM D4603	Determining Inherent Viscosity of PET by Glass Capillary Viscometer
ASTM 5525	Measuring solution viscosity of Polymers with a Differential Viscometer

The measurements can be adjusted to the requirements of the customers, e.g. choice of the solvent or temperature. We possess a large databank of Kuhn-Mark-Houwink parameters, enabling in many cases the transformation of the intrinsic viscosity into molecular weights.

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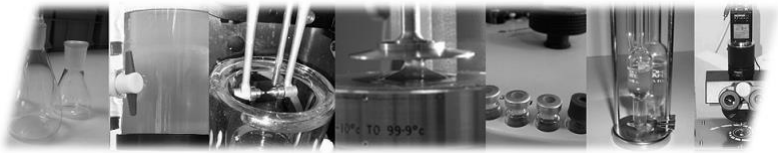
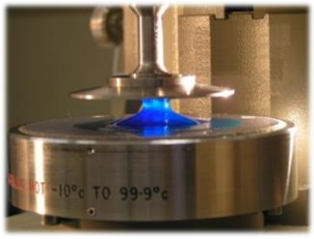


Rheology



Rheology describes the flow and deformation behavior of samples under mechanical stress. These properties are very important for the production of coating, food, polymer, cosmetics, pharma and others.

Beside rheological and viscometric standard measurements we also deal with complex rheological questions like the development of measuring procedures for the areas research and development or quality control. The following table shows some rheological terms together with the corresponding product properties.

Procedures / Applications:

Rotational experiments:

- Measurement at constant shear rate
- Flow / viscosity curve
- Thixotropy test
- Standard quality control
- Pumpability, brushability, yield point
- Levelling and sagging, thickening

Oscillatory experiments:

- Amplitude sweep
- Frequency sweep
- Time test
- Storage stability
- Polymer processing
- Geling, curing

Methods:

DIN EN ISO 3219	Viscosity measurements with cylinder- and cone/plate geometry
ISO 6721/10	Oscillatory tests with plate/plate geometry
ASTM D 4440	Polymer melts using oscillatory tests
ASTM D 4473	Curing of resins using oscillatory tests

A detailed overview of our services and measuring procedures can be found on our homepage: www.wee-solve.de.

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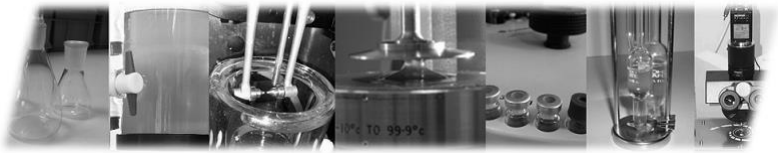

Pressure rheology

Pressure rotational rheometer

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The specifications of our pressure rheometer are the following:

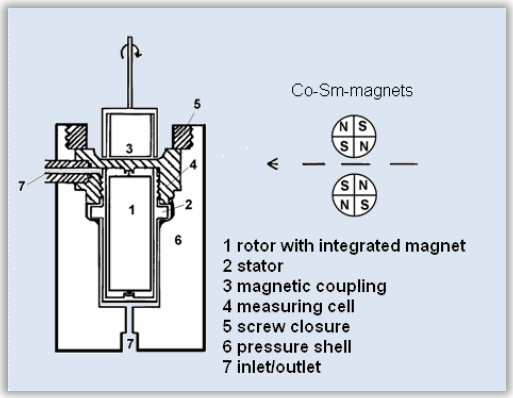
- Pressure range: standard to 150 bar
- Temperature range: RT … 300°C
- Rheometer: MCR 102 (Anton Paar Germany GmbH)
- Measuring systems: cylindric, blade, cone/plate, and plate/plate measuring system
- Filling volume: measuring cell up to 20 mL

Pressure rheometer for extremely high pressures

We possess special rheometers and viscometers for measurements under pressure up to max. 2000 bar. The **rotational rheometer** enables the analysis of liquids with viscosities between ca. 10 mPas and 100 Pas. The **rolling ball** viscometer is suitable for low viscous samples with Newtonian flow behavior. Typical samples are solutions in solvents above the boiling point or in supercritical gases.

Rotational rheometer with cylinder geometry

- Pressure cell made from Inconel
- Magnetic coupling
- Pressure range: up to 1.000 bar
- Temperature range: -40 to 300°C
- Middle to high viscous samples



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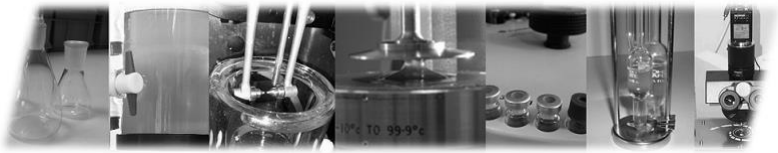
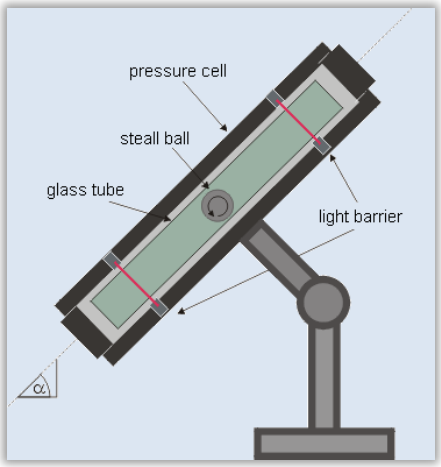
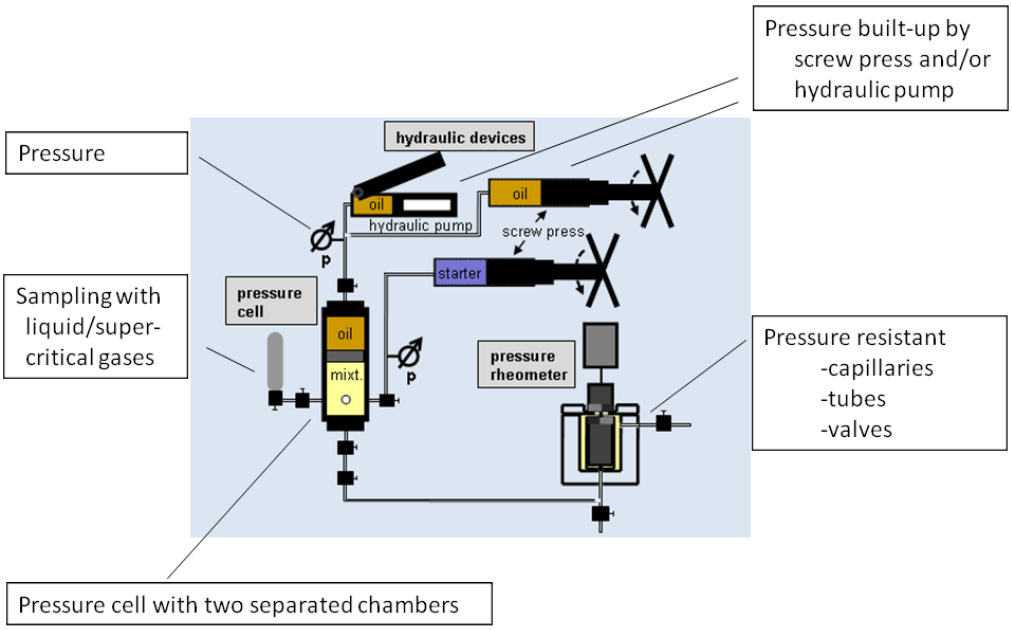


Rolling ball viscometer:

- Pressure resistant steel cell
- Glass tube with low roughness
- Precision ball (steel or glass)
- Pressure: up to 2.000 bar
- Temperature: 0 to 130°C
- Low viscous samples



Our equipment includes complex accessories for the handling of samples under pressure like shown in the following picture for the analysis of a reacting mixture.



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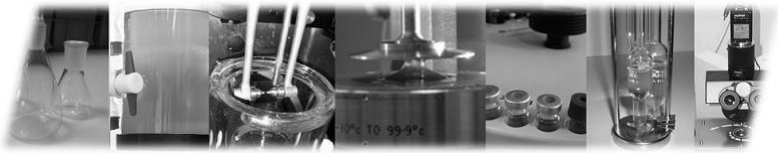
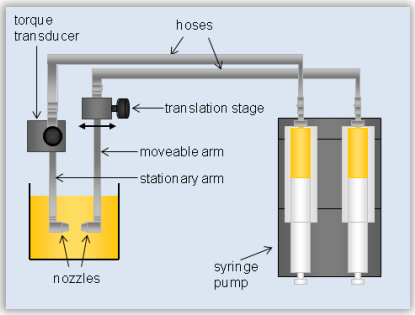


Extensional rheology

Liquids under extensional flow

The **extensional viscosity** is an important parameter for many applications, e.g. in sprays (coating and cosmetic), inks or jet fuels (obfuscation) and in food industry. This property is relevant if **extensional flow** prevails.



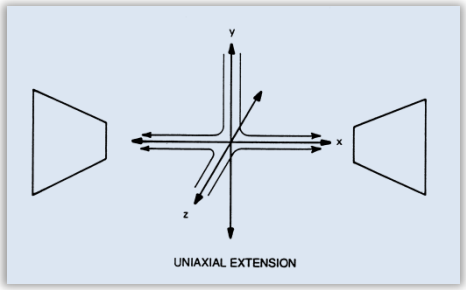
Always when the diameter of a flow channel changes the flow can't be described by shear flow only: Extensional flow takes (at least partially) place. In this case extensional viscosity plays an important role for the flow behavior. The extensional viscosity differs from the shear viscosity; for samples with simple flow behavior this difference can be calculated. For complex samples like polymer containing mixtures the extensional viscosity has to be measured.

A typical example for an extensional flow is the streaming (entering or leaving) of a liquid through a nozzle. The measuring principle of our extensional viscometer is based on the determination of flows and forces in such a nozzle-flow.

Extensional flow rheometer: Rheometrics RFX Fluid Analyzer

- Extensional viscosity of liquid samples
- Measuring principle: opposed nozzles
- Uniaxial extensional flow
- Variation of the extensional rate by changing the nozzle diameter or flow rate.

The extensional flow rheometer **Rheometrics RFX** is suitable for the determination of extensional viscosities of liquids with shear viscosities ranging from 50 mPas to ca. 10 Pas. Depending on the viscosity of the sample extensional rates up to 10.000 1/s can be achieved.



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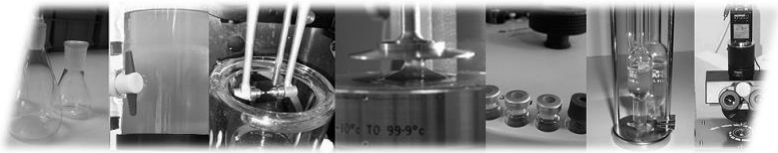
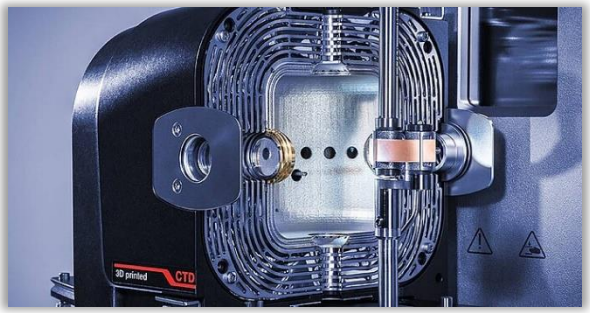


Extensional rheological measurements of foils and films:

Extensional rheological measurements of oils, films, and fibers can be realized by means of the **Universal Extensional Fixture (UXF)** combined with an air beared rheometer. The measurements deliver information about the temperature stability, the shrinking, recovery, and brittleness of the material.



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The Universal Extensional Fixture (UXF) is a combined measuring system of a rotating and a stationary cylinder. With the help of a convection oven deformation and shear stress-controlled DMA experiments can be realized in a huge temperature range.

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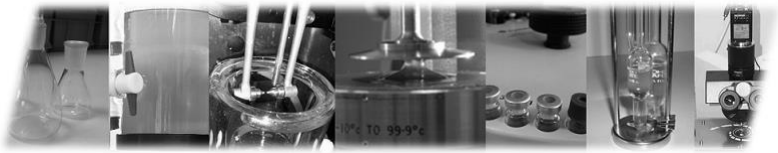

TRAINING

The WEE-Solve GmbH offers you flexible customer orientated trainings for following topics:

- **(Capillary) Viscometry**
- **Rheology**

The courses can be hold as an inhouse-training in your facilities with your staff but also in our labs.

For each accomplished training the participants will get a certificate of participation.

The contents will be customized according to your instructions.

Please contact us!

WEE-Solve GmbH

Zertifikat

Hiermit bestätigen wir die Teilnahme von

Herrn Max Mustermann

an unserem Seminar „**Kapillarviskosimetrie**“
am 24.12.2017 in Mainz.

Dieses halbtätige Seminar hatte folgende Schwerpunkte zum Inhalt:

- Grundlagen der Viskosimetrie
- Kapillarviskosimetrie
- Staudinger-Index
- Experimentelles Vorgehen
- Praktisches Arbeiten an einem Kapillarviskosimeter

WEE-Solve GmbH

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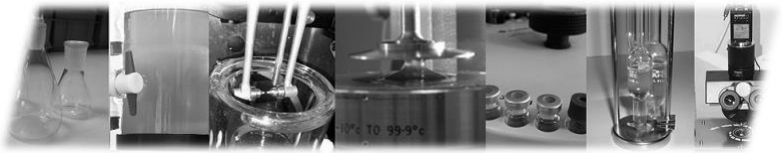

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