

Rheometer RHEOTEST[®] RN 4.1

For Quality Control and R&D

Applications

- paints and coatings
- polymers and lubricants
- pharmaceuticals and cosmetic
- food and luxury food
- building material
- bitumen and bituminous products



Novelties

1. There are 2 basic versions of the Rheometer RHEOTEST[®] RN 4.1 on offer:
 - **PC-controlled** rheometer series RHEOTEST[®] RN 4.1 with complete software for realization and evaluation of rheological tests in CR-, CS- and Oscillation mode. First time a rheometer system with ball bearings carries out also oscillation tests in a very well price-performance-relation.
 - **Viscometer with separate operating unit.** It enables to carry out tests with controlled shear rate and with controlled shear stress as well as in extreme temperature conditions. At the same time we fulfil first of all requirements of laboratories of oil-producing branch in former CIS countries where it is necessary easy-to-maintain, very reliable and with reasonable price the subsequent model RHEOTEST[®] RV2.1 for measurement of dynamic viscosity of petroleum products in temperature range of -60 to $+200^{\circ}\text{C}$.
2. There are news also in the field of measurement systems. Measurement systems and methods of measurement have been developed as a result of oriented to practical needs cooperation with research institutions. They are very much right for reproducible assessment of rheological properties of substances' systems that contains solid particles, such, e.g., as plasters, adhesive mixtures for ceramic tile, cement binding materials and liquid concrete and are repaid when using in laboratories of building materials.

Features

Rheometer is a highly sophisticated item of instrument engineering both in development, manufacturing and marketing and also for the consumers and users.

At present *development of rheometers* is justified only in individual cases by needs of existing oriented to the practical purposes branch rheological sciences.

It is required *for the quality production*:

- mature technology of manufacture
- well-trained and experienced production personnel
- high-performance equipment for mounting, adjustment, calibration and final check-up
- good and trustworthy cooperation with the corresponding partners.

Serious marketing activities should be oriented in a proper way and require exclusively close cooperation between the marketing service of the manufacturer, possible go-between and future consumer.

It is necessary purpose-oriented training of the service personnel concerning operational regulations of the instrument for its *efficient operation*, as well as corresponding to the requirements After Sales Service that is carried out by the manufacturer or seller.

Only some manufacturers and suppliers meet these specific requirements.

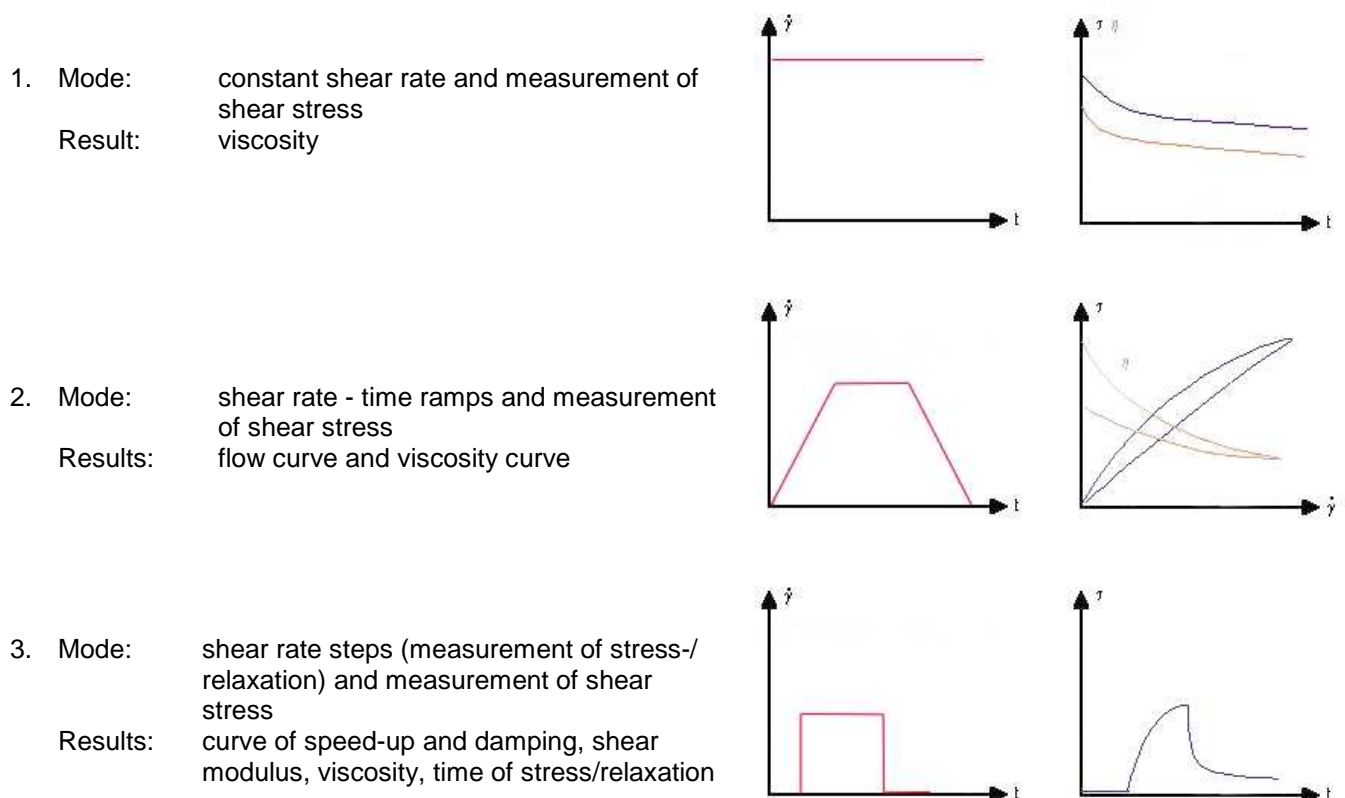
Price-Performance Ratio

Modular design allows also realization of a long-term investment strategy and successful adaptation in the future to the changing task settings in the field of measurement technique.

Test Methods

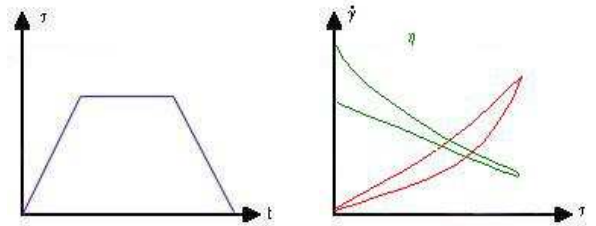
(depending on selected main version of the instrument)

Measurements with Controlled Rate (CR-Tests):

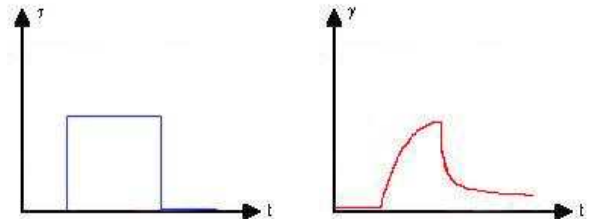


Measurements with Controlled Stress (CS-Tests):

1. Mode: Controlled stress - time ramps and shear rate measurement
 Results: flow curve, viscosity curve, yield point



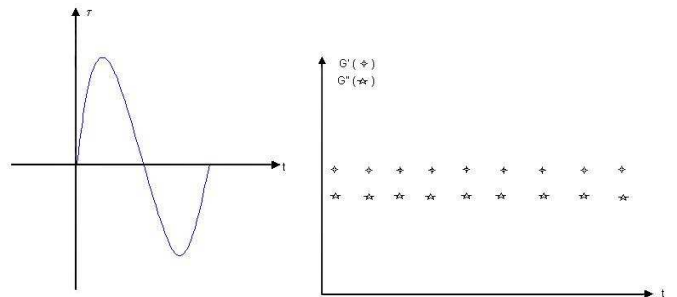
2. Mode: Controlled stress jumps (measurement of creep-/ retardation) and deformation measurements
 Results: creep diagram, elastic deformation



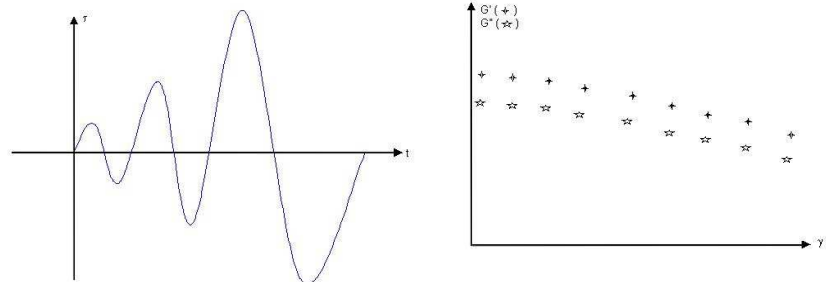
Measurements with Oscillation Tests

Settings of harmonic stress oscillations and deformation measurement:

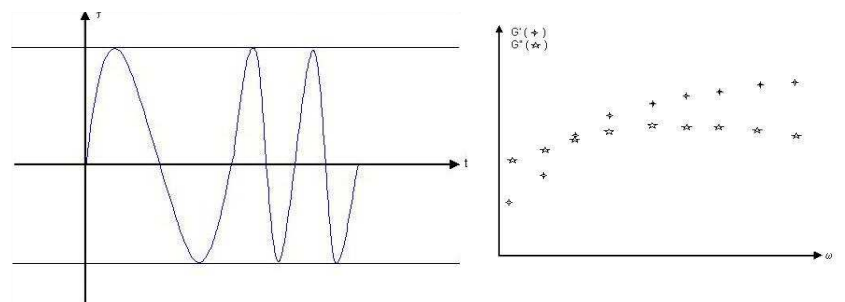
1. Mode: constant amplitude, constant frequency
 Results: Memory Modulus G' , Loss Modulus G'' , Complex Modulus G^* , loss factor $\tan \delta$ as function of time



2. Mode: amplitude sweep
 increasing amplitude, constant frequency
 Results: Memory Modulus G' , Loss Modulus G'' , Complex Modulus G^* , loss factor $\tan \delta$ as function of deformation

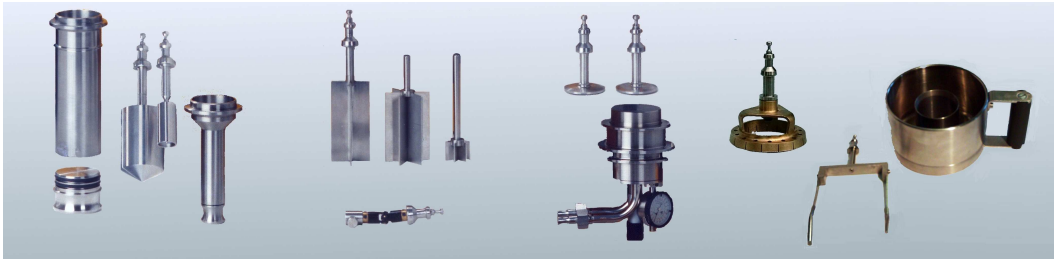


3. Mode: frequency sweep
 constant amplitude, increasing frequency
 Results: Memory Modulus G' , Loss Modulus G'' , Complex Modulus G^* , loss factor $\tan \delta$ as function of frequency



Measuring Systems

- Cylinder measuring system and cone-and-plate measuring system according to DIN
- Special measuring system (castle sensor and measuring cell for liquid concrete) for construction materials as well as for similar materials as for structure of product and flow properties
- Different blade measuring systems, first of all for yoghurt, dressings and dress



Several Examples of Application

(see our Homepage for more detailed information)

- Development and production of paints, varnishes and other coating materials as well as control of coating process
- Development and production of pharmaceuticals and cosmetics
- Development and production of food products particularly of chocolate and chocolate icing as well as dressings and dairy produce
- Development and production of lubricants
- Development and production of ceramic materials and coating process control of these materials
- Development and production of plastics, initial and intermediate products inclusive

Main Technical Data

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|----------------------|--------------------------------------|
| • Viscosity Range: | appr. 1 ... 3 * 10 ⁹ mPas |
| • Speed Range: | appr. 0 ... 1000 rpm |
| • Speed Accuracy: | appr. 0,015 rpm |
| • Torque Range: | appr. 0,1 ... 150 mNm |
| • Torque Resolution: | appr. 0,002 mNm |
| • Angle Range: | appr. -50 ... 300° |
| • Angle Resolution: | appr. 0,001° |
| • Frequency Range: | appr. 0,001 ... 10 Hz |
| • Temperature Range: | appr. -60 ... 375°C (total) |
| | appr. -60 ... 200°C (rotor) |
| | appr. -30 ... 375°C (cone/plate) |

Remarks to Viscosity Measuring Ranges

Viscosity measuring ranges for rotational measuring systems published through viscometer and rheometer producer are mostly theoretical measuring ranges. The measuring ranges are calculated with minimum torque, maximum speed of rotation and the geometrical data of the measuring system. That means, most published low viscosity values can be reached only at maximum speed of rotation and samples with Newtonian flow properties.

Upper viscosity values can be reached only with the necessary accuracy if the whole sample was filled into the measuring system in homogeneous condition without cavities, caused e.g. through air bubbles. Also the complete sample material must be thermostated to the measuring temperature very

well. In case of high viscous pastes we suggest to use cylinder measuring systems only up to viscosities of appr. 10^5 mPas, because filling the measuring cup without air bubbles is complicated very often. Therefore we suggest to use cone and plate measuring systems for high viscous samples. Within our "Suggested Measuring Range" it is possible to get accurate viscosity values in a larger range of speed of rotation. Additional rheological determinations are possible also in the necessary accuracy.

Temperature control

- thermostating unit / cryostat (-60°C ... 200°C rotor) / (-30°C ... 200°C cone/plate)
- peltier temperature control (-10°C ... 150°C)
- electric temperature control (+35°C ... 375°C)
- Software for PC-controlling and analysis incl. cable
- Software for controlling of thermostating unit / cryostat incl. Cable
- thermostating units of exclusive manufacturers