Anton Paar

Modular Compact Rheometers

MCR 72
MCR 92

With a rheometer, you can follow the change in your sample's viscosity – from one measuring point to the next. You instantly gain deeper insights into your sample's deformation, flow behavior and structure – so you can change matters in your favor.

Starting out in rheometry, your two wisest choices are MCR 72 and MCR 92 from Anton Paar – real rheometer "pearls," streamlined for your daily lab routine, easy to use in a plug-and-play fashion and available at an accommodating price.

MCR 72 and MCR 92

See things change

The MCR series has opened more doors and created more testing possibilities than any other rheometer in the world. In keeping with this tradition, MCR 72 and MCR 92 now round off the family as your “entry tickets” to the world of rheology. To help you get rapidly acquainted with this exciting field and all its possibilities, MCR 72 and MCR 92 come with a wealth of application know-how and introductory materials you will only find at Anton Paar.

What can you do with a rheometer?

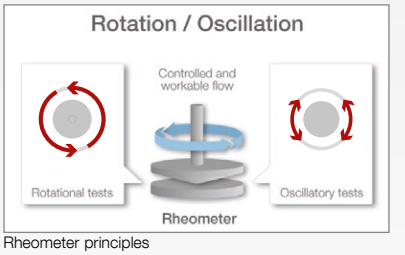
What is the difference between a viscometer and a rheometer?

Viscometers are simple devices. They are based on mechanical ball bearings or torsional spring bearings that rotate a measuring system (e.g., a bob or a spindle) in a single direction. They are ideal for fast and simple tests.

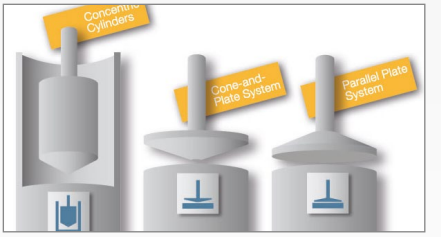
Rheometers reveal the full spectrum of a sample under the conditions you define.

For example: Rheological measurements show you the structure of a sample by providing insight into the viscoelastic behavior.

Rheometers are built to be more sensitive than viscometers. They have two measurement modes: rotational and oscillatory. Accessories such as plates, bobs, cones, heating, and cooling chambers make it possible to study the sample's properties under a wider range of conditions. Rheometers are an excellent tool for research, process, and product development as well as for quality control.



Rheometer principles



Measuring systems

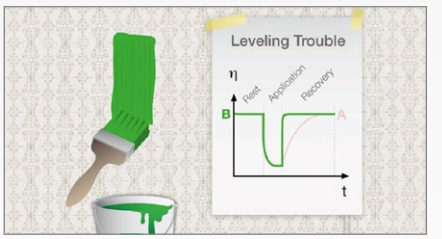
Test method	Industry
Rotation, Oscillation	General

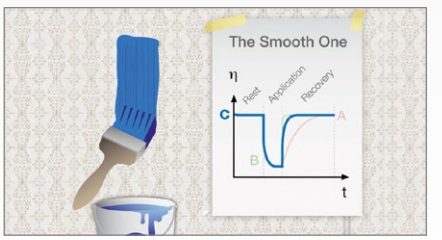
Will my paint have a nice glossy finish or will it show brush marks and drips?

One important quality factor of paint is the surface leveling and sagging behavior once it is applied, since a smooth, glossy and homogenous surface with no droplets or splashes is generally required. The structural strength of the paint should not be too high or too low, to be sure that the internal structure recovers in exactly the right time period to create a good finish. These characteristics are often referred to as thixotropic behavior. When developing or improving paint, the material's time-dependent rheological behavior has to be balanced to get the required result.

A rheometer can simulate this behavior in rotational mode using a structural regeneration test ("3 Interval Time Test/3 ITT").

These curves show a paint which sags (red), a paint which has trouble leveling (green) and a paint which has a good finish (blue)





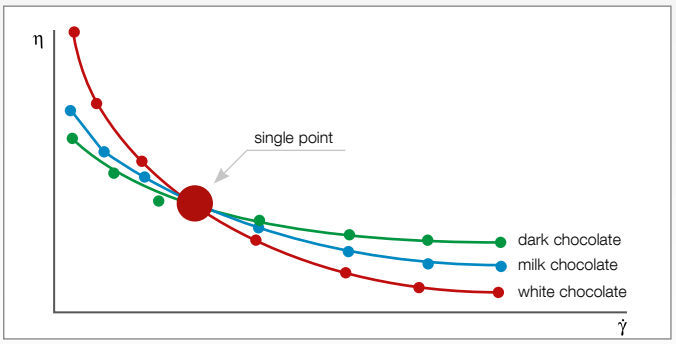
Test method	Industry
3 ITT Rotation	Paints/Coatings

Is a single-point measurement sufficient to describe the flow behavior of my sample?

For quality control, a single-point check might be sufficient. But in general, a single-point measurement provides limited information about the flow behavior of materials.

To describe a sample's flow behavior to its full extent you need a rheometer. From just one measurement, rheometers provide a flow curve in a wide speed and torque range. This curve shows the behavior of a sample under varying conditions, such as different shear rates and temperatures.

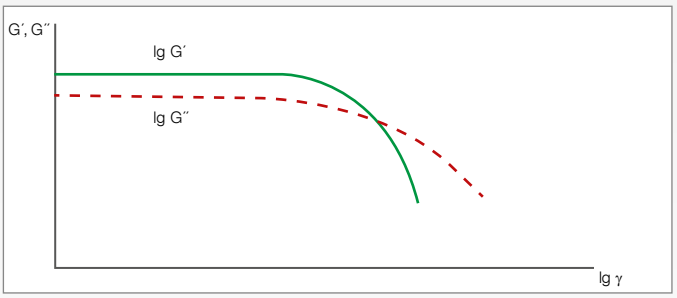
Test method	Industry
Rotation	General



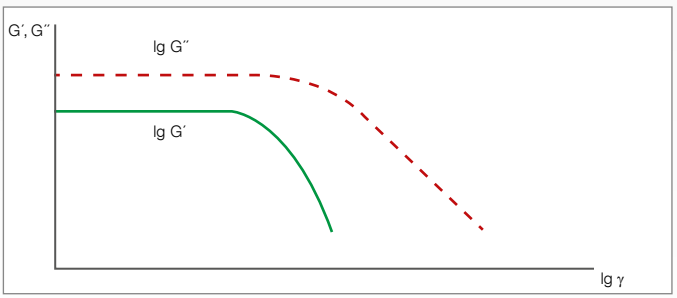
Viscosity curves of different types of chocolate compared to single-point measurements.

How can I determine the feel and long-term stability of my cream or ointment?

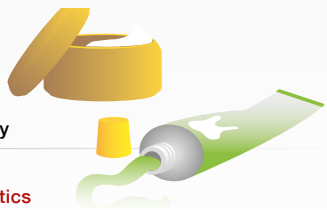
Long-term stability and the "feel" when a cream or ointment is applied on the skin are important quality criteria in the cosmetics and pharmaceutical industries. Using a rheometer, you can evaluate the elastic portion (G′) and viscous portion (G″) of a sample in an amplitude-sweep test. The relationship between these portions defines how strong the internal network of the sample is, which affects long-term stability and the way a cream feels on the skin when being applied.



Cream 1 has a gel-like or solid structure because the elastic portion G′ is higher than the viscous portion G″.



Cream 2 behaves more like a liquid as in this case G″ is higher than G′.

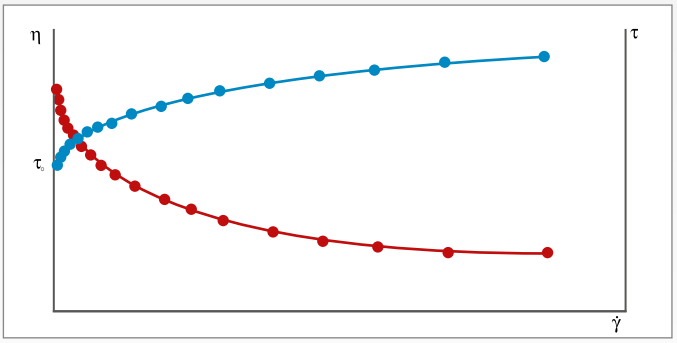


Test method	Industry
Amplitude Sweep Oscillation	Cosmetics

Is my slurry pumpable and flowable?

The processing and transport characteristics of slurries are strongly dependent on their rheological properties. With a rheometer you can simulate flow resistance in pipes and see the result as flow and viscosity curves. You can also determine the yield point in a flow curve (controlled shear stress mode) which will help you solve problems with slurries that are difficult to pump.

Test method	Industry
Controlled Shear Stress Test Rotation	Building Materials/Mining

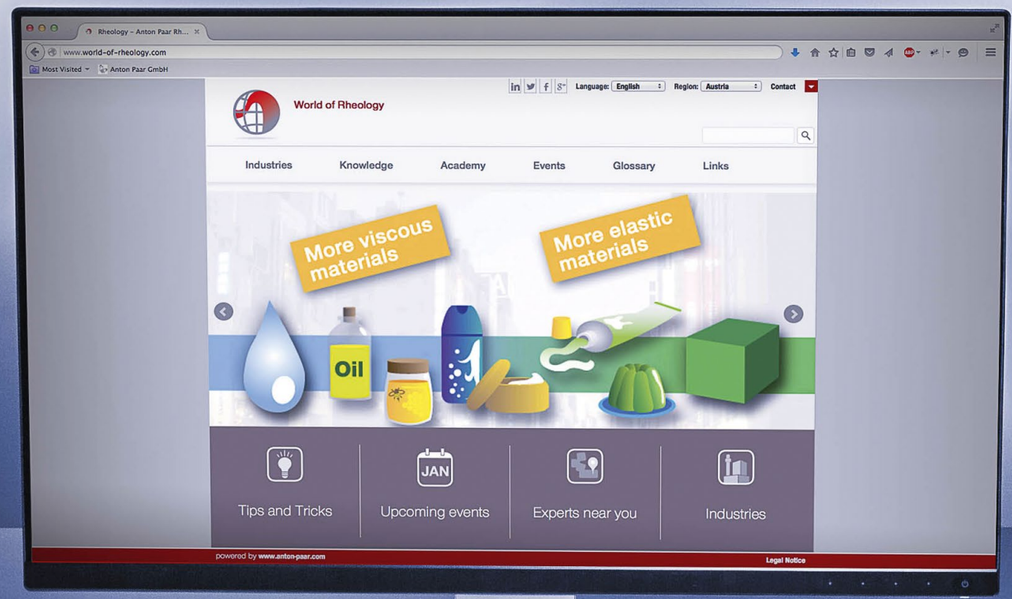


These flow and viscosity curves show the rheological behavior of a slurry. The yield point τ_0 can be calculated from the flow curve (blue). The viscosity curve (red) gives information about the flow behavior of a slurry when being pumped through pipes.

Welcome to the World of Rheology

Rheological measurements can give you so much more information about your products – but where to start and how to interpret the results?

To help you on your way to becoming a rheology expert, we give you access to a wealth of practical information on the www.world-of-rheology.com website. Here you can browse through entertaining eLearning courses, download application reports for your industry, register for a free webinar, or read through the “tips and tricks” sections.



Introducing Joe Flow, the virtual rheology expert

Let Joe Flow, our virtual rheology expert, be your guide to the exciting world of rheology. He will first guide you through the online course “Basics of Viscometry” to provide you with the basic knowledge of liquids in flow. Then you can learn about the basics of rheology and gain knowledge which will help you in your daily work.

Joe Flow’s book “Applied Rheology – With Joe Flow on Rheology Road” explains the laws of viscosity and elasticity and provides tips for avoiding errors in your measurements. This is a good reference for everyone starting out in rheology.

Further training

Anton Paar offers seminars and webinars to help you acquire the know-how you need to get the most out of your rheometer. Thanks to Anton Paar’s global network of subsidiaries and sales partners, you will find almost every course in our program offered in your area and language.

Your knowledge database

Are you interested in “time- and frequency-dependent measurements on printing inks” or the “rheological characterization of cheese”? These application reports and hundreds of others are available for a wide range of applications and samples on the World of Rheology website. They form a huge database of rheological know-how at your disposal.

The outstanding features of MCR 72 and MCR 92

Designed for your application

MCR 72 is equipped with a ball-bearing motor and provides measurements in rotational and also for special applications in oscillatory mode. MCR 92 provides measurements in both rotation and oscillation and has air-bearing motor technology. There is a wide range of accessories available for both models so you can build the setup which perfectly suits your application.

Unmatched reproducibility

Reproducible settings are essential for obtaining reliable and reproducible results. MCR 72 and 92 feature a motor-driven elevation mechanism and SafeGap (Austrian Patent AT 517074) technology, which ensure that the setting of the measuring gap is always identical for every measurement and exactly reproducible every time. Furthermore, the slow and precise setting minimizes any influence on the sample's structure.

Easy fitting of measuring systems

When changing between measuring systems, QuickConnect gives you great ease-of-use. This quick-fitting coupling allows one-handed connection of the measuring systems, and ensures fast, convenient system changes without the use of a screwing mechanism.

Most accurate temperature control

Temperature has the biggest influence on rheological measurements. To counteract this MCR 72 and MCR 92 can be used with several air-cooled Peltier temperature units. These CoolPeltier units with an integrated fan for counter-cooling are an accurate, fast and energy-efficient alternative to liquid-circulator counter-cooling systems.

25 years of experience in one motor

The air-bearing-supported synchronous EC motor of MCR 92 deploys a frictionless synchronous movement of the rotor inside that enables the most sensitive and therefore most precise movements. Whether investigating solids or low-viscosity liquids, your results are accurate across a wide viscosity range.

Clear view of the sample

The patented TruRay (EP3220127B1) technology, is a unique lighting concept which gives you a clear view of the sample and measurement surface. This is especially important when filling the measuring gap.

Automatic tool recognition and configuration

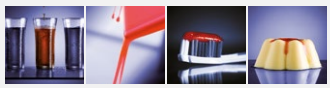
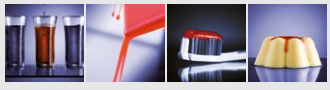
Toolmaster is the only completely contact-free automatic tool recognition and configuration system for rheometers. It recognizes measuring systems and temperature control units as soon as these are connected to the rheometer so you don't need to enter this data manually.

Step-by-step software

The intuitive RheoCompass software helps you find the templates you need, customize test and analysis definitions, export your data, and much more. You are guided through your first rheological measurements with predesigned but individually adaptable templates, including integrated videos for extra support.

Your application - Anton Paar solutions

	Application	Typical samples	Measuring procedure	Test types
	Paints & coatings	Architectural paints Wall paints Automotive paints Printing inks and pastes	Viscosity Yield/flow point Thixotropic effect Structural decomposition & regeneration Sedimentation/stability	Viscosity curve (ROT) Amplitude sweep (OSC) 3 Interval Time Test (ROT/OSC) Frequency sweep (OSC)
	Food	Chocolate Ketchup Mayonnaise Dairy products Sauces	Viscosity Yield/flow point Thixotropic effect Structural decomposition & regeneration Sedimentation/stability	Viscosity curve (ROT) Amplitude sweep (OSC) 3 Interval Time Test (ROT/OSC) Frequency sweep (OSC)
	Polymers	Polymer solutions Polymer melts	Viscosity Temperature behavior	Viscosity curve (ROT) Amplitude sweep (OSC) Frequency sweep (OSC) Temperature test (ROT/OSC)
	Petrochemicals	Drilling fluids Slurries and muds Crude oils Lubricants and greases	Viscosity Yield/flow point Thixotropic effect Structural decomposition & regeneration Temperature behavior Sedimentation/stability	Viscosity curve (ROT) Amplitude sweep (OSC) 3 Interval Time Test (ROT/OSC) Temperature test (ROT/OSC) Frequency sweep (OSC)
	Resins	Resins Adhesives Glues	Viscosity Temperature behavior	Viscosity curve (ROT) Temperature test (ROT/OSC)
	Pharmaceuticals	Salves and ointments Pastes and creams Emulsions, dispersions and suspensions	Viscosity Yield/flow point Thixotropic effect Structural decomposition & regeneration Sedimentation Long-term stability Temperature behavior	Viscosity curve (ROT) Amplitude sweep (OSC) 3 Interval Time Test (ROT/OSC) Frequency sweep (OSC) Thermal loop test (OSC) Temperature test (ROT/OSC)
	Cosmetics	Shampoos Shower gels Lotions and creams Hair gels Toothpaste Nail polish Makeup	Viscosity Yield/flow point Thixotropic effect Structural decomposition & regeneration Sedimentation Temperature behavior Long-term stability	Viscosity curve (ROT) Amplitude sweep (OSC) 3 Interval Time Test (ROT/OSC) Frequency sweep (OSC) Temperature test (ROT/OSC) Thermal loop test (OSC)

Temperature device	Temperature range	Materials	Measuring systems	Heating rate	Cooling rate
P-PTD 220/AIR	-10 °C to +220 °C			Up to 40 °C/min	Up to 40 °C/min
H-PTD 200/AIR/18P	-5 °C to +200 °C			Up to 40 °C/min	Up to 40 °C/min
C-PTD 150/XL/AIR/18P	5 °C to 150 °C			Up to 7 °C/min	Up to 7 °C/min

Measuring systems

Specifications	Units	MCR 72	MCR 92
Bearing	-	Ball	Air
EC motor (brushless DC) with high-resolution optical encoder	-	✓	✓
Rotation mode	-	✓	✓
Oscillation mode	-	✓[1]	✓
Direct strain controller	-	✓	✓
Direct stress controller	-	✓	✓
Maximum torque	mNm	125	125
Minimum torque, rotation	µNm	200	1
Minimum torque, oscillation	µNm	200	1
Torque resolution	nNm	100	100
Angular deflection, set value	µrad	1 to ∞	1 to ∞
Angular deflection, resolution	nrad	614	614
Step rate, time constant	ms	100	100
Step strain, time constant	ms	100	100
Minimum angular velocity [2]	rad/s	10^{-4}	10^{-4}
Maximum angular velocity	rad/s	157	157
Minimum angular frequency [3]	rad/s	10^{-3}	10^{-4}
Maximum angular frequency	rad/s	628	628
Minimum speed (CSS/CSR)	rpm	10^{-3}	10^{-3}
Maximum speed	rpm	1500	1500
Maximum temperature range	°C	-50 to +400	-50 to +400
SafeGap (Austrian Patent AT 517074), normal force limiter during gap setting	-	✓	✓
TruRay (Patent EP3220127B1), dimmable illumination of sample area	-	✓	✓
Connections		USB, Ethernet, RS232, analog interfaces, Pt100 port	
Dimensions	mm	380 x 660 x 530	380 x 660 x 530
Weight	kg	33	33
QuickConnect for measuring systems, screwless	-	✓	✓
Toolmaster, measuring system	-	✓	✓
Toolmaster, measuring cell	-	✓	✓
CoolPeltier, Peltier-controlled plate system with built-in cooling option that requires no additional accessories for counter-cooling	°C	25 below ambient but not lower than -10 up to +220 [4]	
Actively Peltier-controlled hood that requires no additional accessories for counter cooling	°C	-5 to +200 [4]	
CoolPeltier, Peltier-controlled cylinder system with built-in cooling option that requires no additional accessories for counter-cooling	°C	15 below ambient but not lower than +5 up to +150 [4]	
Virtually gradient-free (horizontal, vertical) temperature control	-	✓	✓
Electronic trim lock for the measuring system	-	✓	✓
Automatic gap control/setting, AGC/AGS	-	✓	✓
Rheometer software:			
Test designer	-	✓	✓
Report designer	-	✓	✓
User management	-	✓	✓

Also available as **EDU Edition** (for educational institutions only):

- MCR 72 or MCR 92 plus accessories with a special academic discount
- Free EDU Package and EDU Student Packages including lab equipment and educational material as well as office supplies and giveaways

Note:

[1] Depending on sample properties.
[2] Depending on measuring point duration and sampling time, practically any value is achieved.
[3] Set frequencies below 10^{-4} rad/s are of no practical relevance due to the measuring point duration >1 day.
[4] System temperature, sample temperature may vary. For measurements at very high or low temperatures a calibration in the sample gap is recommended.

Legend: ✓ included

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