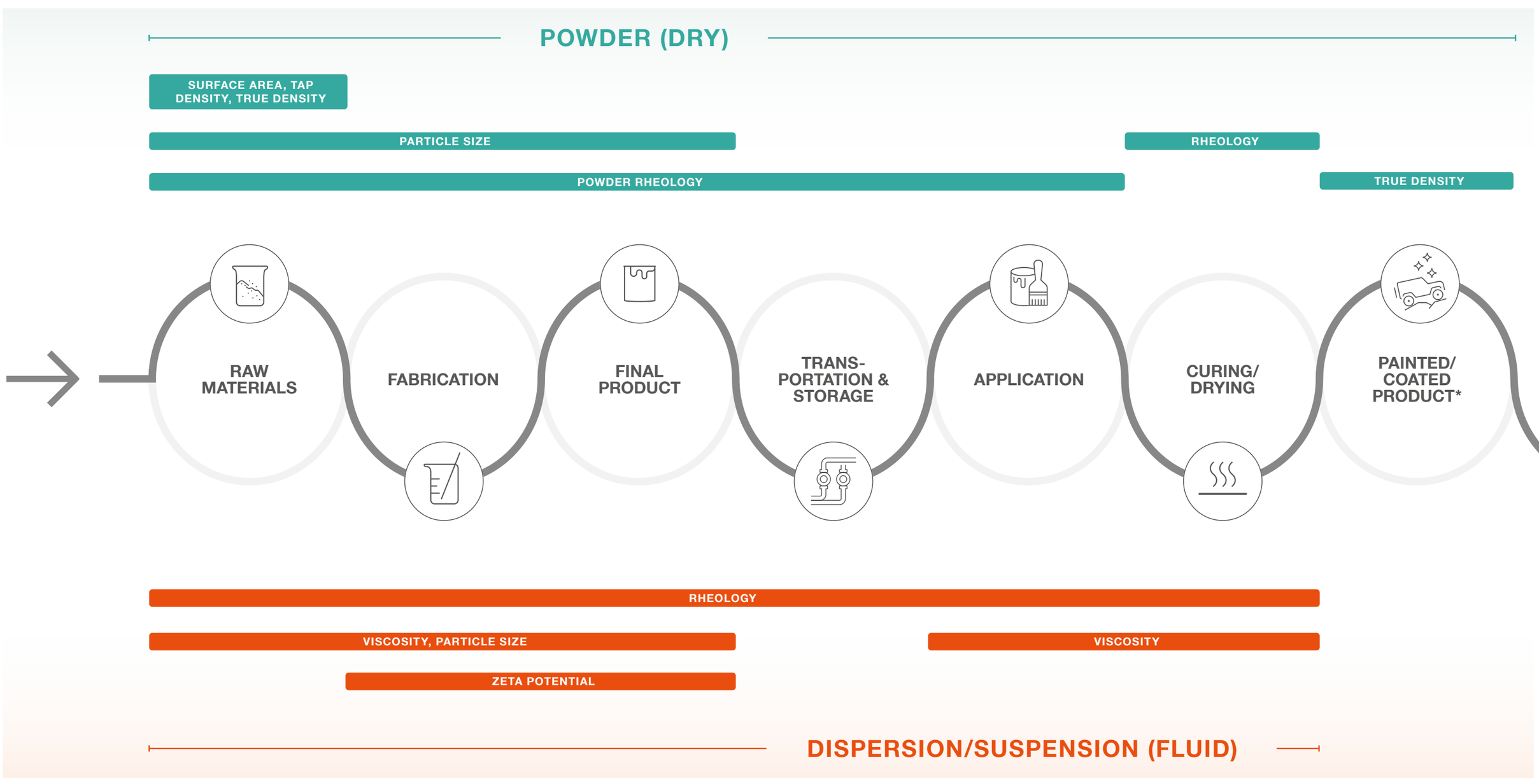
Anton Paar

Solutions for the paints and coatings industry

Material Characterization

Anton Paar offers a comprehensive portfolio of instruments for characterizing **paints** and **coatings** throughout the **complete life cycle** from the **raw materials** to the **applied product**.



* To characterize painted and coated products Anton Paar offers scratch testers, indentation testers, and Calotest instruments. For further information visit **www.anton-paar.com**.

SURFACE AREA

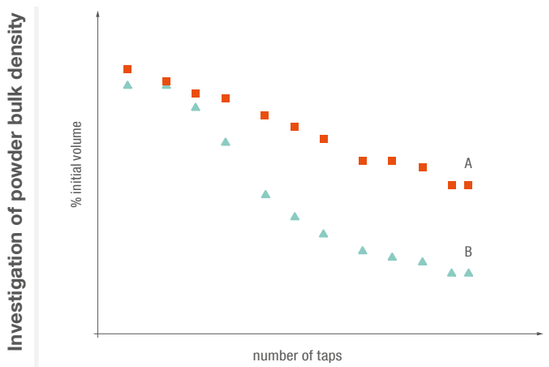
Investigation of powder surface area

The surface area of powder particles is not only a function of particle size, but also of shape, surface roughness, and porosity. The extent of the surface of pigments and fillers determines how much dispersant is required in paint, coating, and ink formulations. The surface area is determined by gas adsorption according to the BET method. High surface area compounds can be analyzed using nitrogen gas by either the vacuum-volumetric technique or dynamic flow method, while low surface area materials often require krypton gas for increased sensitivity.

TAP DENSITY

Investigation of powder bulk density

Tapped bulk density measurements can reveal powder volume filling and packing characteristics which are relevant to hopper use. It also gives insight into relative powder cohesiveness as formalized by Carr's index, the Hausner ratio, and Kawakita equations. The volume of a predetermined mass of powder is measured as a function of the number of automated taps (vertical lift and drop) of a cylinder on Autotap.



TRUE DENSITY

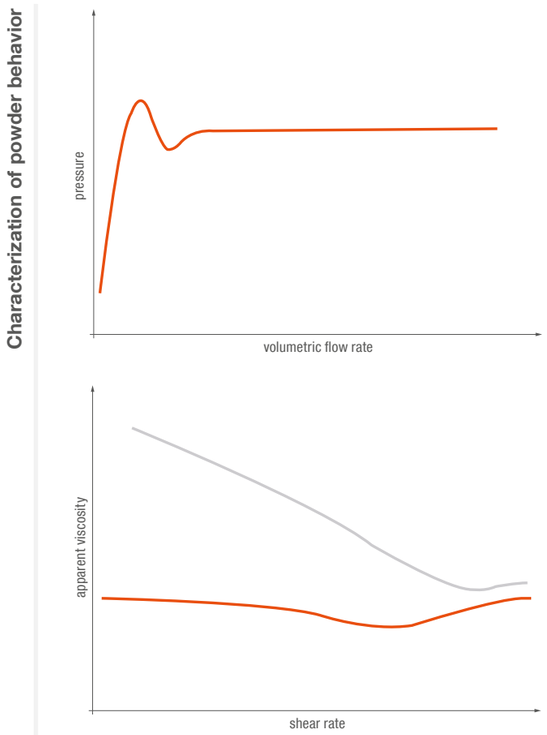
Determination of density of coating powders and pigments

The skeletal density of each ingredient in a coating powder needs to be known in order to calculate the theoretical powder coating density. This can be compared to the density of the coating powder blend of resin, pigments, fillers, and additives – as blended, after storage, and after curing. Differences in skeletal density for a given material measured with a gas pycnometer can indicate subtle differences in formulation such as resin-to-pigment ratio.

POWDER RHEOLOGY

Characterization of powder behavior

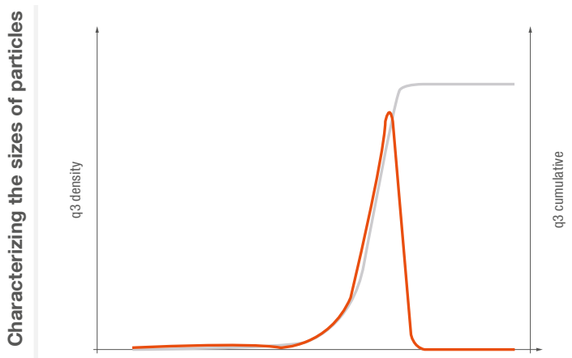
Powder rheology helps you understand the behavior of powders. It can be used as a quick quality control tool but also for in-depth powder analysis. Anton Paar's two different powder cells make it possible to analyze powders in whichever state they are during the process – from compacted and consolidated to fully fluidized. In this manner all steps of the process can be simulated, from mixing to storage, pneumatic transport, and spraying. Using powder rheology, the processing conditions can be optimized by determining the fluidization behavior, for example. It is even possible to measure shear-rate-dependent behavior when the powders are fluidized to simulate processes like pneumatic transport or spraying.



PARTICLE SIZE

Characterizing the sizes of particles

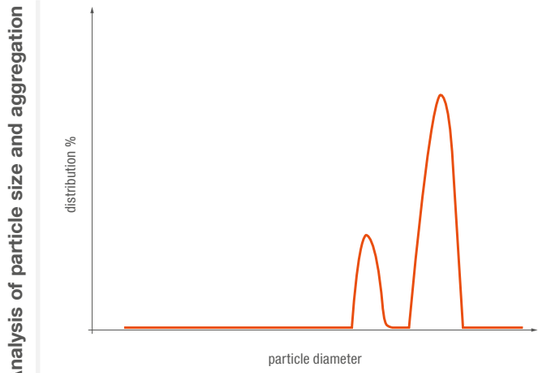
Anton Paar's PSA measures particle size using laser diffraction and can monitor particle size and particle size distribution in dry powders as well as in suspensions within one device. Particle size and particle size distribution have crucial effects on handling properties, application, and the curing process of paints and coatings. Fine particles with narrow particle size distribution pack more closely together forming thin films that maintain the aesthetic properties and durability typical for a thicker film. Larger particles tend to flow better and are relatively easy to control during application, but curing processes require a longer time and higher temperatures.
From the calculated volume-weighted distribution, many parameters can be determined, including the principal D-values (D10, D50, D90, D[4,3]), the span (indication about the broadness) as well as the percentage of particles in the size classes, which is important when checking the amount of fine (e.g. <10 µm) and coarse fraction.



ZETA POTENTIAL PARTICLE SIZE

Analysis of particle size and aggregation

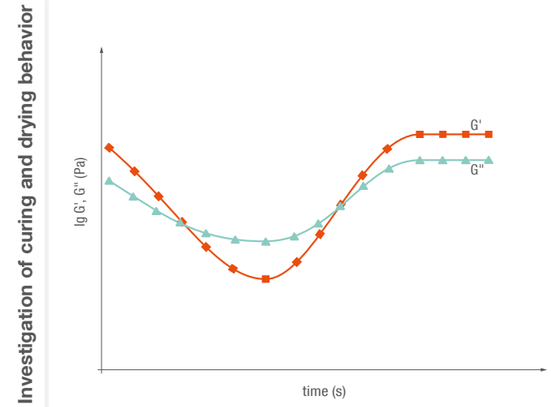
The size of dispersed particles and emulsion droplets is a key parameter for quality control of the final product. It further directly relates to properties such as appearance and uniformity of the coating layer. The Litesizer series of particle analyzers determines the particle size by Dynamic Light Scattering (DLS) and provides information about the particle size distribution of your product. Measuring the zeta potential is important to avoid aggregation of dispersed particles. High zeta potential values indicate a stable formulation and prevent agglomeration of particles and inconsistent coating performance. Litesizer 500 is capable of measuring the particle size and zeta potential within one instrument and the included transmittance tool provides information on whether your sample needs to be diluted or can be measured without further preparation.



VISCOSITY RHEOLOGY

Investigation of curing and drying behavior

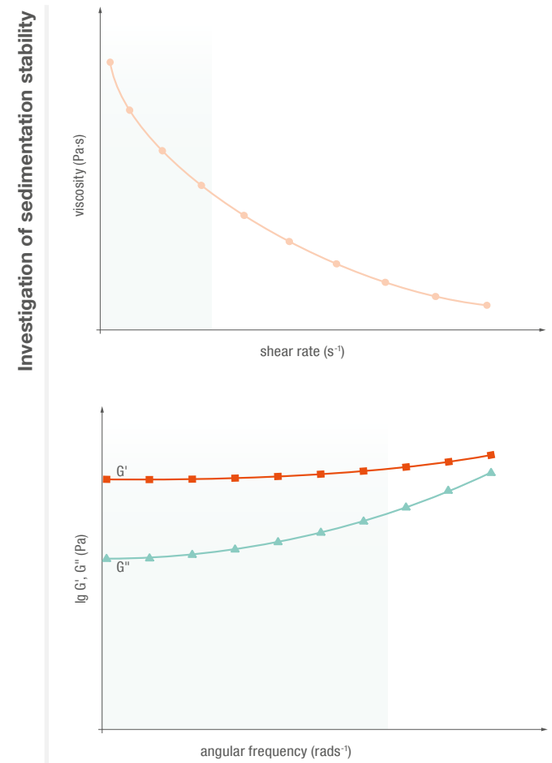
Shelf life/pot life, physical hardening, crosslink reactions, and all kinds of curing can be determined. In rotation, a time-dependent test is performed at a constant low shear rate or rotational speed to analyze pot life and the curing process. A typical measurement of pot life is the measurement of the viscosity over a given time until the viscosity is doubled. For analyzing the curing process, rotational measurements are limited to the point at which the sample cannot be sheared any longer. Using oscillatory tests the sample's change from a liquid to a solid state across all stages of reaction can be monitored. For the Anton Paar MCR Evolution series (MCR 102e, MCR 302e, and MCR 502e), various accessories are available which allow measurements of all kinds of curing/drying processes, e.g. UV curing. Additionally, it is possible to control the environmental conditions such as temperature and humidity during the measurement.



VISCOSITY RHEOLOGY

Investigation of sedimentation stability

To ensure a good stability against sedimentation of the solid parts of the material, e.g. aluminum flakes contained in an automotive paint, the sedimentation stability can be determined either on a short-time scale (rotation) or on a long-time scale (oscillation):
Rotation: To determine the short-term storage stability in rotation, a viscosity curve at low shear rates is measured (<1 s^{-1}). The higher the viscosity in the low-shear range, the better the stability.
Oscillation: To simulate the long-term stability of your paint and to avoid sedimentation or phase separation, a frequency sweep within the linear viscoelastic region must be performed. At low frequencies, the elastic portion of the sample should be above the viscous portion.

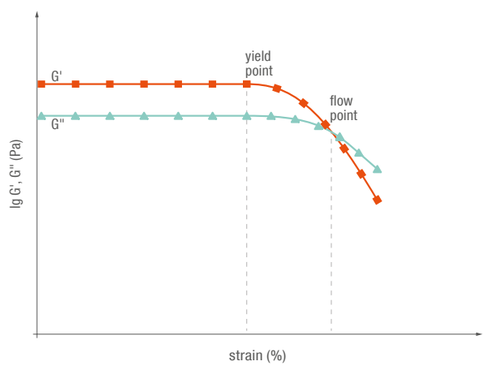


VISCOSITY RHEOLOGY

Yield/flow point determination

The yield point is of vital importance in quality control to figure out the force needed to start the movement e.g. in a pipe, through a pump, or from a nozzle. The yield/flow point can be determined in either a rotational or an oscillatory test:
Rotational: The yield point is determined by setting a shear rate ramp and observing the values in relation to the shear stress: The result is a flow curve. Rotational viscometers/rheometers often use mathematical models to calculate the yield point from a flow curve.
Oscillatory: An amplitude sweep is performed and the crossover point of the elastic and the viscous part (G' = G") is determined.

Yield/flow point determination

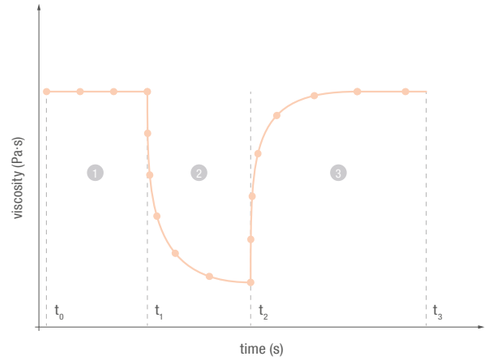


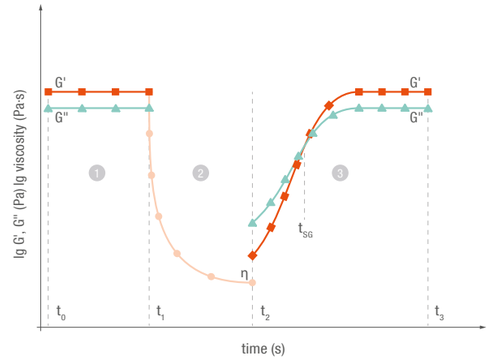
VISCOSITY RHEOLOGY

Analysis of sagging and leveling behavior

Structural regeneration as well as surface leveling and sagging behavior are significant quality characteristics for coatings. These characteristics are related to the so-called 'thixotropic behavior' which has an effect on the future appearance of the coating. Sagging and leveling behavior in the paints and coatings industry can be determined with the three interval thixotropy test (3iTT). This test can be performed in rotation, oscillation, or as a combination of both, depending on the instrument type and your needs. The test can be used to make sure the paint shows recovery within the right time without leaving brush marks or causing other leveling problems.

Analysis of sagging and leveling behavior



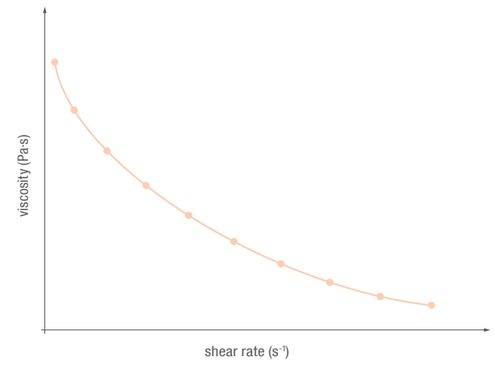


VISCOSITY

Analysis of viscosity (rotational)

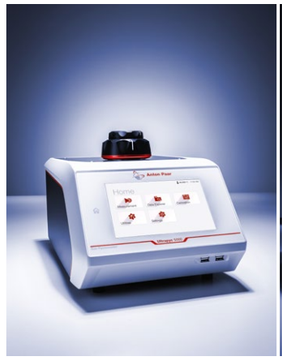
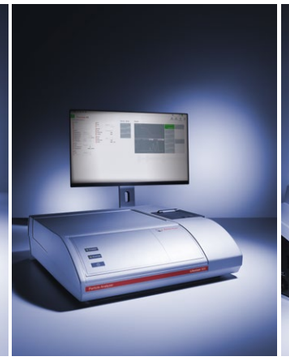
Viscosity can be determined at a single point with a rotational viscometer, which is perfect for a quick check at the production line. To fully understand the flow behavior of your sample, a viscosity curve is needed. Viscosity curves include both, low shear rates (or rotational speed), representing the sample's viscosity at rest (e.g. when stored in its container), and higher speeds representing the sample's viscosity during flow (e.g. when being brushed on the wall or processed using a dosing system). It is also possible to simulate the sample behavior at very high shear rates, e.g. during spraying.

Analysis of viscosity (rotational)



The whole world of particle characterization

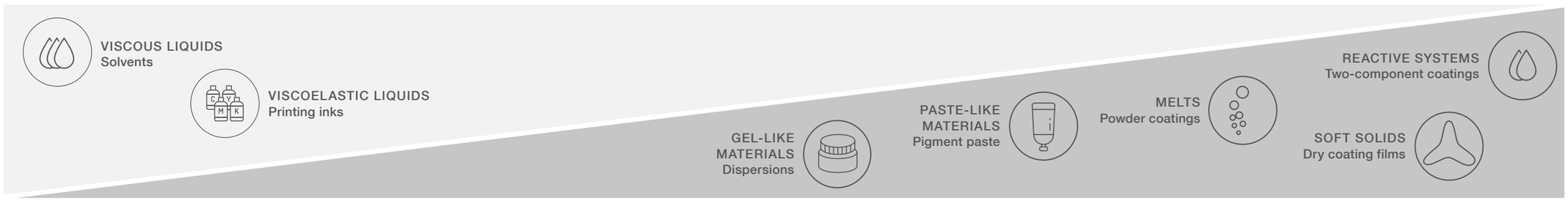
	SURFACE AREA	SURFACE AREA	SURFACE AREA	TAP DENSITY
				
	NOVAtouch	**Autoflow BET+**	**autosorb iQ**	**Autotap**
Description	Surface area measurement of powders by nitrogen adsorption	Rapid surface area measurement of powders by nitrogen adsorption	Surface area measurement of powders by krypton adsorption	Tapped bulk density of single-component powders and blends
Key features	- Up to 4 samples at one time - Includes sample preparation stations	- Up to 3 samples analyzed independently - Includes sample preparation stations	- Very low area capability - Up to 3 samples at one time - Includes sample preparation stations	- Automatic tap counter - Powder cylinder rotation - Lockable tap setting
Common test methods	- BET surface area (low pressure volumetric cryogenic gas adsorption)	- BET surface area (dynamic flow gas adsorption)	- BET surface area (very low pressure volumetric cryogenic gas adsorption)	- Tapped bulk density - Carr's Index - Hausner ratio
Measurement accessories			- External sample preparation unit	- Large volume adapter - Noise reduction cabinet

	TRUE DENSITY	PARTICLE SIZE	PARTICLE SIZE	POWDER RHEOLOGY
				
	Ultrapyc	**Litesizer**	**PSA**	**MCR Powder Cells**
Description	True density determination of dry pigments and paint films	Particle size and zeta potential measurements of liquid dispersions, resolution of different particle size classes within one sample	Determination of particle size and particle size distribution in liquids and dry products	Powder behavior characterization, simulating the conditions "as is" during the process and application
Key features	- TruLock chamber closure - PowderProtect mode - Optional temperature control	- 3 measurement angles - Patented cmPALS technology for zeta potential measurements - Continuous transmittance measurement	- Compact 2-in-1 design - Easy-to-use software - Multi-laser technology for a wide size range - High accuracy and repeatability	- Patented dust protection system - High sensitivity - Reduced operator influence (sample preparation) - Temperature and humidity control
Common test methods	- Gas pycnometry for true solid density	- Dynamic light scattering for particle size analysis - Electrophoretic light scattering for zeta potential measurements	- Laser diffraction for particle size and size distribution analysis	- Cohesion strength - Shear-rate-dependent measurement - Fluidization properties - Shear measurements
Measurement accessories		- Dosing system for automated pH-dependent measurement - Various cuvette types	- Autosampler - Small volume unit	- Different fluidization options - Temperature and humidity options

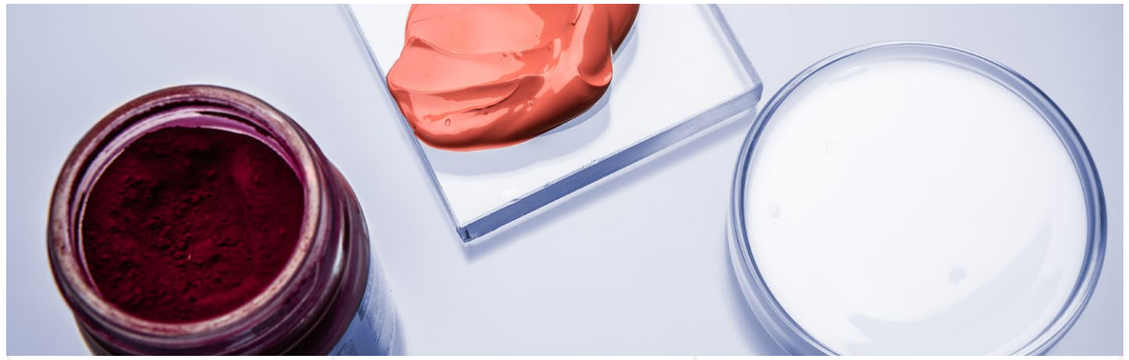
The whole world of viscometry and rheometry

	VISCOSITY		VISCOSITY | RHEOLOGY	RHEOLOGY			
							
	ViscoQC 100	**ViscoQC 300**	**RheolabQC**	**MCR 72**	**MCR 92**	**MCR 102e, 302e, 502e**	**MCR 702e MultiDrive**
Description	Single-point dynamic viscosity of high- to low-viscosity liquids for quick quality control	Multi-point dynamic viscosity of high- to low-viscosity liquids for quick quality control	Rotational rheological tests of materials ranging from low-viscosity to semi-solid samples	Rotational rheological tests with cup-and-bob, plate-plate, and cone-plate measuring systems for liquid to semi-solid samples	Rotational and oscillatory rheological tests with cup-and-bob, plate-plate, and cone-plate measuring systems – for almost all kinds of samples	Investigations into the viscoelastic properties of raw materials, formulations, and final products from QC to R&D	Complete material characterization in research and development
Toolmaster™*	✓	✓	✓	✓	✓	✓	✓
Magnetic/quick connect coupling**	✓	✓	✓	✓	✓	✓	✓
Common test methods	Single-point viscosity measurement	Flow/viscosity curve Yield point determination + Investigation of time-dependent behavior	Rotational test for yield/flow point determination + Rotational 3 interval thixotropy test (3iTT)	Rotational test for yield/flow point determination + Rotational 3 interval thixotropy test (3iTT)	Amplitude sweep and frequency sweep + Oscillatory 3 interval thixotropy test (3iTT)	Rotational and oscillatory measurements of solids + Powder rheology	Advanced oscillatory and rotational tests with one or two drive units + Full DMA capabilities in torsion, tension, bending, and compression mode
Measurement geometries	Relative spindles (L/RH), DIN/SSA spindles, vanes, glass rod	Relative spindles (L/RH), DIN/SSA spindles, vanes, glass rod	Concentric cylinders and cups, double gap, stirrers including Krebs stirrers	Cone-plate, plate-plate, cylindrical geometries	Cone-plate, plate-plate, cylindrical geometries	+ Solid fixtures for films, fibers, and bars, fixtures for extensional rheology	+ Three-point-bending, cantilever

* for automatic tool recognition and configuration to ensure easy handling and minimize user errors
** for easy one-handed attachment/exchange of spindles, bobs, and measuring systems



Selected solutions



Challenge	Solution	Benefit
The paint gets stuck while pumping or during application.	Analyze the yield point of your paints with a rheometer or a viscometer and lower the yield point so that less force is needed to initiate sample flow.	Zero downtime of your production plant thanks to a smooth and efficient transportation process during paint production
The UV-sensitive coating did not cure as expected and the surface shows scratches and bumps.	Simulate cross-linking reactions with different intensities of UV light while measuring the rheological properties.	A coating that cures within seconds under UV light and perfectly covers and protects the coated material
The paint does not achieve the desired final appearance (paint sheen).	Determine and adjust the pigment particle size.	A flawless product that shows the desired matt or glossy finish and is bought again by the satisfied end customer
The dispersion shows an unwanted tendency to aggregation.	Determine the zeta potential of the particles in your dispersion with Litesizer to improve your formulation and stabilize your production processes.	Speed up the production process and avoid possible drop-outs of precious batches due to early recognition of zeta potential issues.
The powder coating either doesn't cure nicely or cannot be transported pneumatically.	Determine fluidization and curing behavior, and correlate the influence of flow aids on fluidization as well as the curing process with powder rheology.	Increased customer satisfaction with powders that can be easily applied and show good curing behavior
The powder coating does not appear even.	Analyze the particle size distribution with a particle size analyzer and optimize this to achieve the desired outer appearance of the powder coating.	The powder coating shows high durability and meets the visual requirements.

To read about more challenges and solutions in paints and coatings production and discover our instrument portfolio, visit:

www.anton-paar.com/paints-coatings

Anton Paar
Certified Service

"We are confident in the high quality of our instruments. That's why we provide **full warranty for three years**."

Effective January 1, 2020, all new instruments* include repair for 3 years.
You avoid unforeseen costs and can always rely on your instrument.
Alongside the warranty we offer a wide range of additional services and maintenance options.

*Due to the technology they use, some instruments require maintenance according to a maintenance schedule. Complying with the maintenance schedule is a prerequisite for the 3-year warranty.

Service and support directly from the manufacturer
Our comprehensive service provides you with the best individual coverage for your investment so that maximum uptime is ensured.

SAFEGUARDING YOUR INVESTMENT
Regardless of how intensively you use your instrument, we help you keep your device in good shape and safeguard your investment – including a 3-year warranty.

THE SHORTEST RESPONSE TIMES
We know that sometimes it's urgent. That's why we provide a response to your inquiry within 24 hours. We give you straightforward help from real people, not from bots.

CERTIFIED SERVICE ENGINEERS
The seamless and thorough training of our technical experts is the foundation of our excellent service provision. Training and certification are carried out at our own facilities.

OUR SERVICE IS GLOBAL
Our large service network for customers spans 86 locations with a total of 350 certified service engineers. Wherever you are located, there is always an Anton Paar service engineer nearby.

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