

Particle size



Zeta potential



Particle shape



Absolute molecular weight



Rheological properties



one
vision

Systems, services and solutions
for material characterization

Material characterization for industry

Malvern provides instrumentation and solutions that are used to characterize particulate systems and to determine the rheological properties of materials and manufactured goods across a wide range of industries. The company has pioneered a range of analysis techniques, including dynamic light scattering and laser diffraction - both industry standards for particle size measurement.

An extensive portfolio of technologies and products enables Malvern to serve all areas of manufacturing industry. The applications expertise accumulated since the company's foundation is available to all our customers. Malvern specialists are available throughout the world to assist with applications development and advise on and analyze difficult samples. Our own application laboratories in the UK, Europe, China and North America routinely run thousands of customer samples every year.

Particle and rheological characterization solutions

Particle size – critical when optimizing the performance of raw materials, intermediates and finished products.

Zeta potential – essential for assessing the stability of a wide variety of disperse systems.

Particle shape – a pivotal factor in gaining a clearer understanding of processes and process optimization.

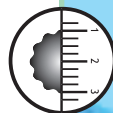
Molecular weight – a fundamental determinant of many physical properties including transition temperatures from liquids to waxes and from rubbers to solids and of mechanical properties such as stiffness, strength, viscoelasticity, toughness and viscosity.

Rheological properties – vital to understanding relationships between processing, end-use performance and structure of materials.

Reliable and accurate material characterization delivers a competitive edge in the research, development and manufacture of your products.

Symbols for functionality

Alongside every Malvern product featured here, one or more of the following symbols indicates the area or areas of material characterization for which the instrument has applications.



Particle size



Zeta potential



Particle shape



Absolute molecular weight



Rheological properties

Expert solutions

Malvern's comprehensive range of products for particle and rheological property characterization delivers precise and validated measurements on materials in many forms and concentrations. Malvern systems open the way to improved understanding and control of the products and processes involved in product development and manufacture: from fundamental research through manufacturing and quality control to end product testing.

Biotechnology • Food and Drink • Asphalt
Pharmaceutical • Cosmetics • Chemicals
 Mining and Minerals
 Power Generation
 Cement • Metal Powders
 Plastics and Polymers
 Surface Coatings
 Electronics • Ceramics

Excellence through experience

Since many Malvern systems are used in highly regulated environments, product validation and R&D traceability are priorities for our customers. Operating to ISO9001: 2000 with TickIt accreditation for software development, Malvern is a major supplier to the highly demanding pharmaceutical and chemical industries. Malvern's products play pivotal roles in high quality research and manufacturing throughout the world.

Validation

To ensure that we meet the needs of our customers in complying with the requirements of Regulatory Authorities such as the US Food and Drugs Administration (FDA) and the Medicines Control Agency (MCA), Malvern provides a comprehensive range of validation aids.

These aids, known collectively as QSpec Elements, start with a validation planning folder and follow a user's validation process through from installation and operation to the maintenance phase with annual OQ renewals and the provision of standards for ongoing Performance Qualification. For products subject to FDA regulation, we have solutions to help with 21 CFR Part 11 compliance.

World class service and support

Malvern offers professional yet personal service. Our goal is to increase your laboratory's productivity by providing you with the best possible support and information.

- Global network of sales and service personnel
- World-wide co-ordination for multi-national companies
- 24-hour on-call technical support from the Malvern Helpdesk
- Sample and application consultancy
- Customized product service and warranty packages
- Verification and validation support
- On-site training programs and web seminars

No other company offers more.



Mastersizer 2000

- Particle size measurement from 0.02 μ m – 2000 μ m
- Wide range of sample dispersion units for wet and dry analysis accommodates all sample types
- Modular system design enables rapid interchange between wet and dry measurement modes
- Automatic software configuration for each dispersion unit ensures ease of operation
- Integrated Standard Operating Procedures (SOP) aids method development and definition to ISO13320-1 guidelines
- Autosampler 2000 sample preparation station allows round-the-clock, unattended operation
- Software features include: results database, report designer, SOP wizard, custom parameter calculations, flexible data export, optical properties database, security access system, solution to 21 CFR Part 11 compliance

The Mastersizer 2000 combines advanced laser diffraction technology with a highly practical approach to routine particle characterization – it has become the instrument of choice for laboratory-based particle size analysis around the world. Fully automated, it measures powders, suspensions and emulsions, delivering robust results based on standardized procedures.



www.malvern.co.uk/ms2000



Zetasizer Nano

- Particle size measurement from 0.6nm - 6000nm
- Zeta potential measurement in the range 5nm -10 μ m
- Absolute molecular weight from 1×10^3 to 2×10^7 Daltons
- High concentration capability for the measurement of pigments, inks and emulsions
- High sensitivity for the measurement of highly dilute proteins and polymers
- Unique disposable capillary cell for zeta potential measurements to completely eliminate cross contamination
- Automated measurement using standard operating procedures
- MPT-2 autotitrator simplifies the measurement process, allowing rapid investigation of parameters that determine stability
- Wide range of sample cells available
- Software features include: security access, solution to 21 CFR Part 11 compliance, report designer, SOP wizard, flexible data export, results database, custom calculations

The Zetasizer Nano series simplifies the size measurement and stability characterization of a wide range of disperse systems and molecules in solution. A range of new technologies ensures optimum performance for all three parameters.



www.malvern.co.uk/zetasizernano



Spraytec

- **Wide Dynamic Range 0.1µm - 2000µm – ensures broad droplet size distributions can be characterized without constant lens changes**
- **Rapid 10kHz acquisition speed – allows pulsed spray events to be fully characterised**
- **Patented multiple scattering analysis – delivers accurate results even at high particle concentrations**
- **Robust, flexible design – ensures wide spray plumes can be easily accommodated**
- **Unique size history data display – provides a frame-by-frame analysis of each spray event, allowing the spray dynamics to be easily understood**
- **Meets the regulatory requirements for validation and 21 CFR Part 11**

The Malvern Spraytec system provides users with in-situ, real-time measurements of the particle size distribution of sprays and aerosols. Using the technique of laser diffraction, it has been specifically designed to address the unique requirements of spray characterization, yielding robust, reproducible results.



www.malvern.co.uk/spraytec

Sysmex FPIA-3000

- **Particle size measurement in range 0.8µm to 300µm**
- **High sensitivity shape measurement using multiple parameters such as Width, Length, Circularity, Aspect Ratio and Convexity**
- **Compatible with aqueous and non-aqueous suspensions and emulsions**
- **Patented sheath flow technology ensures all particles are in-focus, orientated and separated**
- **Images of all particles recorded**
- **Fully automated measurement procedure includes cleaning sequences and diagnostic checks**
- **Software features include: results database, report designer, security access, solution to 21 CFR part 11 compliance**

The Sysmex FPIA-3000 particle analyzer provides repeatable and routine characterization of particle size and shape for samples in suspension or emulsion. A unique scattergram data display enables various shape descriptors to be correlated against particle size and images of all particles in the sample are recorded to assist with data interpretation. The system is particularly well suited to applications where sensitivity to shape is required to detect differences between samples such as toners, abrasives, ceramics and pharmaceuticals.

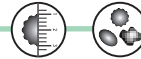


www.malvern.co.uk/fpia3000

Morphologi G2

- Particle size measurement in range 0.5µm - 1000µm
- High sensitivity shape measurement using multiple parameters such as Width, Length, Circularity, Aspect Ratio, Convexity, Elongation
- Images of all particles recorded
- Particle viewer allows sorting and filtering of particle images
- All software and hardware settings (focus, magnification, light intensity) controlled in standard operating procedures (SOPs)
- Software features include: results database, report designer, security access, solution to 21CFR part 11 compliance
- Sample preparation accessories for controlled dispersion

The new Morphologi G2 high sensitivity particle analyzer provides repeatable and routine characterization of particle size, shape and count. Based upon digital image analysis the Morphologi G2 is equipped with the renowned Nikon CFI 60 optical system coupled with a high resolution digital camera for high definition aberration-free images. Microscope-quality images and statistically significant histograms offer both qualitative and quantitative information in a single integrated package providing the very highest level of automation and validation of results.



www.malvern.co.uk/morphologi



Malvern Process Systems

- Patented high concentration analysis
- Full analyzer sample handling automation and real-time data link to plant control systems
- Designed for GAMP4 environment
- ATEX certified for intrinsically safe systems
- Applications throughout manufacturing industry
- An understanding of individual processes to deliver exact process solutions
- All analyzers can work continuously 24/7 with minimum maintenance and downtime

Malvern Process Systems focus on supplying intelligent process solutions for particle characterization. Advanced technologies are used to support process optimization and help improve product selectivity, productivity and process intensification. The analyzers are used in a wide variety of industries including toners, pharmaceuticals, cement, minerals, powder coatings, pigments, metal powders, and within processes such as milling, classification, spray drying, atomization, filtration, and granulation.



www.malvern.co.uk/insitec



Malvern Process Systems

technical specifications

Application	Analyzer	Process interface	Analysis time	Results
Online dry powder streams 0.5-1000µm	Insitec (laser diffraction)	Inline or online using Jetstream (Gas venturi eductor for continuous sample aspiration and dispersion) and Auger for high tonnage/abrasive powder streams	0.25s	Volumetric size distribution
Mobile atline or online, wet or dry particles 0.5-1000µm	Insitec (laser diffraction)	Voyager (Mobile unit using Jetstream interface for dry process streams and Gulfstream for wet process streams)	0.25s	Volumetric size distribution
Dry powder streams 100-3000µm	Parsum (spatial filter velocimetry)	Inline probe	30s	Chord length distribution
Particulate slurries 0.5-150µm	Insitec (laser diffraction)	Inline or online with Gulfstream (staged continuous venturi eductor)	0.25s	Volumetric size distribution
Particulate slurries 50-1000µm	Insitec (laser diffraction)	Outokumpu PSI 500 (coarse particle slurry diluted for measurement using two-stage stirred tank)	0.25s	Volumetric size distribution



Bohlin Gemini

- Unrivalled state of the art air bearing design and performance
- Continuous torque range from 3nNm to 200mNm (Gemini HR nano)
- Patented Rotonetic™ drive technology with a wider torque measurement range than conventional controlled strain rheometers
- High resolution digital torque mapping ensures consistent data independent of rotor position in all control modes
- Direct strain controlled oscillation monitors the sample's strain history and reduces experiment time
- Low inertia inductive motor technology allows more rapid position or speed adjustments than designs that use permanent magnets
- High sensitivity, low compliance and axially symmetric normal force measurement
- EasySwap™ technology enables the Bohlin Gemini rheometers to be easily configured with a range of temperature controllers including: Peltier devices (cylinders or plates) for measuring fluids, or a forced gas oven with optional liquid nitrogen cooling for measuring polymers, solids and melts
- Flexible, easy to use software enables rapid programming of complex test protocols and automated analysis

The Bohlin Gemini rheometers are advanced modular systems based on patented Rotonetic™ DSP adaptive control technology for true stress and strain controlled operation. Wide dynamic range of torque and speed combined with unsurpassed sensitivity, allows the Bohlin Gemini rheometers to measure materials from low viscosity, weakly-structured fluids to solids, without compromising measurement accuracy.



www.malvern.co.uk/gemini



Bohlin CVO

- Torque range 0.5µNm to 100mNm
- Integrated microprocessor-controlled electronics reduce bench space and optimizes sensitivity by eliminating external control cables
- Automatic gap zeroing and adjustment for accurate and reproducible gap setting
- Wide range of temperature control options allow measurement of many different samples including foods, coatings, pharmaceuticals, adhesives and asphalt
- Creep and oscillation modes are included as standard for measuring viscoelastic materials
- Flexible, easy to use software, allows rapid programming of complex test protocols and automated analysis

The Bohlin CVO rheometer is a compact air bearing rheometer with controlled stress and controlled shear rate modes. Housed in a spill-resistant case and with membrane keypad, it is an ideal choice for the busy QC or product development laboratory.



www.malvern.co.uk/CVO



Bohlin Visco 88

- Torque range 0.1mNm to 10mNm, speed range 20 – 1000rpm
- Fully portable with rechargeable battery and carrying case for on-site operation
- Ideal for bench-top or in-situ measurements
- Stand-alone or software-controlled operation
- Supplied with three DIN53019 concentric cylinder measuring systems as standard
- Quick interchange between concentric cylinder and cone & plate systems extends measuring range
- Thermal jacket allows the use of an external fluid circulator to control sample temperature

The Bohlin Visco 88 is an easy to use instrument that measures viscosity at single or multiple shear rates and is designed for routine testing QC laboratories or basic product development applications.



www.malvern.co.uk/visco88



Rosand RH2000

- Dynamic speed range >200,000:1 for measurements over a wide range of shear rates
- Rigid frame design provides compliance-free measurements
- Unique swivel head design gives easy access for sample loading and instrument cleaning
- Rosand twin bore principle for direct measurement of die inlet pressure and determination of absolute viscosity
- Accessories for die swell measurement under constant stress conditions eliminate discrepancies that result from sample creep
- Direct determination of shear and extensional viscosity under processing conditions
- Optional barrel materials are available for measurement of aqueous or chemically aggressive materials
- Easy to use software includes a wide range of test types to measure shear and extensional viscosity, as well as determining sample stability, wall slip and melt fracture

The Rosand RH2000 is a compact, bench-top rheometer that meets even the most taxing requirements of capillary rheometry. Both single and twin bore configurations include a digital drive system that gives unsurpassed speed control across an extended dynamic range.



www.malvern.co.uk/rh2000



Rosand RH7&10

- **Maximum Force: 100kN**
- **Dynamic speed range >400,000:1 for measurements over extended range of shear rates**
- **'H' frame gives better vertical frame stiffness than alternative designs allowing compliance-free measurement in transient tests such as pressure, volume and temperature determination**
- **Integral fume chamber with extraction assures operator safety**
- **Open architecture below barrel exit accommodates optional accessories such as die swell measurements, slot die system, melt strength (Haul-Off), post-extrusion oven**
- **Optional barrel materials allow measurement of aqueous or chemically aggressive materials.**
- **Easy to use software includes a wide range of test types to measure shear and extensional viscosity, as well as determining sample stability, wall slip and melt fracture**

The Rosand RH7 and RH10 floor-standing capillary rheometers feature a robust 'H' frame design to allow operation under high loading conditions. Twin bores as standard enable absolute shear viscosity measurements and simultaneous calculation of extensional viscosity.



www.malvern.co.uk/rh10



Standards

- **Malvern Quality Audit Standards for Mastersizer systems**
- **Zeta Potential standard for the Zetasizer range**
- **Single shot format eliminates any uncertainty in sample preparation**

A range of consumable standards is available for both particle size verification and zeta potential measurement. A range of certified Newtonian oil and a well characterized viscoelastic material (PDMS) allows verification of the rotational and dynamic operation of the rheometer.

www.malvern.co.uk/standards



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