

Particle size



Rheological properties



Zeta potential



Particle shape



Absolute molecular weight



Molecular size



Chemical imaging



Molecular conformation



Solution viscosity



Malvern
solutions

Material characterization systems
for increased productivity through
improved product quality and
process control

Material Characterization for Industry

Malvern recognizes and supports industry's continuing drive to optimize its products and processes. The company provides complementary material characterization tools that deliver inter-related measurements reflecting the complexities of particulates and disperse systems, nanomaterials and macromolecules. Malvern has a growing portfolio of patented technologies and the company's in-depth industry applications knowledge enables customers to achieve their competitive advantage. Importantly, the applications expertise accumulated since the company's foundation is available to every customer, in person and via a comprehensive knowledge base on the company's website. Malvern specialists throughout the world routinely assist with applications development and give advice on the interpretation of results. Our own application laboratories in the UK, Europe, China, Korea and North America routinely run thousands of customer samples every year.

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

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

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.

Absolute 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.

Molecular size – fundamental information about the size of proteins or polymers provides important data for research into macromolecules.

Chemical imaging – enables the identification and spatial localization of chemical species, this provides a greater understanding for the development and manufacture of chemically heterogeneous materials and products.

Molecular conformation – of key importance in all macromolecules - from understanding protein structure to the measurement of branching in polysaccharides or synthetic polymers.

Solution viscosity – provides a powerful insight into macromolecular properties and is an essential tool in the QC/QA of polymer production.

Functionality Symbols

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



Rheological properties



Zeta potential



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Molecular conformation



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Expert solutions

Malvern's comprehensive range of products delivers particle, rheological and spatial and chemical characterization data on materials in a variety of forms and concentrations. Malvern's systems open the way to improved understanding and control of the materials 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. All of our systems are manufactured in a facility that has been certified to ISO14001.

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 follow a user's validation process through from Installation and Operational Qualification (IQ/OQ) to the maintenance phase with annual OQ renewals and the provision of standards for Performance Qualification (PQ). 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 support at all levels. Our intention is to increase your laboratory's productivity through the creation of a working relationship for the lifetime of your instrument providing service support, training and information.

- Global network of fully trained service personnel
- World-wide co-ordination for multi-national companies
- Technical support from the Malvern Helpdesk via telephone or email
- Range of maintenance contracts for a range of requirements
- Verification and validation support
- Consultancy based on site training courses
- e-Learning training courses via the internet
- Classroom training courses
- Web Seminars
- Sample and application consultancy

No other company offers more.



Mastersizer

2000

Comprehensive particle size analysis

- Particle size measurement from 0.02–2000µm, without the need for splicing techniques or multiple lenses
- Unsurpassed instrument-to-instrument reproducibility, delivering reliable, robust results
- Precise control of wet and dry sample analysis via a range of easily interchangeable dispersion units
- Unique, user-configurable software interface ensures critical to quality parameters can be quickly reviewed
- Simplicity of operation and result reporting via SOPs reduces training requirements and delivers rapid sample measurements, increasing lab productivity
- Software includes: results database, report designer, measurement definition wizard, customer parameter calculations, data export, security system

The Mastersizer 2000 is the practical, proven solution to the particle sizing needs of industry, capable of accurately characterizing emulsions, suspension and dry powders. Incorporating Standard Operating Procedures (SOPs), it has set the benchmark for measurement reproducibility and ease of operation. From research to routine quality control, the Mastersizer 2000 delivers the results required to drive product understanding and quality.



www.malvern.com/ms2000



Spraytec

Spray dynamics revealed

- Wide dynamic range of measurement, from 0.1–2000µm
- Rapid 10kHz data acquisition rates provides a unique insight into atomization processes
- Patented multiple-scattering analysis delivers accurate, in-situ, concentration-independent results
- Large working range ensures that wide spray plumes can be measured without risking contamination
- Versatile design allows the system to be configured for specific application requirements
- Unique size history display and advanced averaging capabilities provide rapid data interpretation and ease of understanding of dynamic spray systems
- Full measurement automation via Standard Operating Procedures

The Spraytec delivers rapid, real-time, high-concentration spray particle size measurements over an extremely wide dynamic range. It delivers the knowledge required to fully understand how atomization is achieved, providing the ability to resolve and understand the source of any variability in the performance of spray systems.



www.malvern.com/spraytec

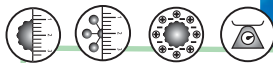


Zetasizer

nano ZS

Size and stability characterization

The sensitivity and performance to give you complete confidence in your results and the versatility to handle your applications.



- Maximum particle size range from 0.3nm - 10.0 microns
- Zeta potential and absolute molecular weight measurement in the same system without performance compromise
- 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
- MPT-2 autotitrator simplifies the study of stability by automating the change in pH, conductivity etc.
- Software features include: security access, report designer, Standard Operating Procedures, flexible data export

www.malvern.com/zetasizernano



Zetasizer

APS

Size and stability characterization

Enhances personnel productivity by automating measurements in industry standard 96- or 384-well plates.



- Improve productivity of protein and nanoparticle characterization while maintaining the ultimate in sensitivity
- Screen for optimal buffer conditions for protein solubility/stability
- Determine presence of aggregates and perform melting points on the same plate
- Simply insert your plate and press 'Start'. Walk-away automation does the rest
- Use simple graphical scheduling to define the measurement protocol in each well or group of wells
- Screening display of plate to highlight 'hotspots'
- Control plate and sample measurement temperature separately to maintain the protein in optimum condition

www.malvern.com/zetasizeraps



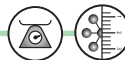
Zetasizer

μV

Size and stability characterization

- Rapidly and repeatably achieve the highest sensitivity using the smallest volume
- Use a recoverable sample of only 2μL; equivalent to 40ng of a 65kDa protein
- Fast, wide-range precision temperature control enables automated temperature trend measurements; ideal for melting point determination
- Simple to use measurement using Standard Operating Procedures
- Connect to a size-exclusion chromatography system to determine the hydrodynamic size of the eluting peaks without calibration

Characterization of size and molecular weight of proteins and macromolecules in nanogram quantities.



www.malvern.com/zetasizermicrov



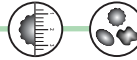
Sysmex

FPIA - 3000

Routine size and shape characterization

- Particle size range from 0.8–300µm
- Statistically significant size and shape data in one measurement with minimal user intervention and user bias
- Automated, easy-to-use, single click driven measurements with a typical measurement time of less than 3 minutes
- Dynamic wet dispersion system with patented sheath flow technology ensures all particles are in-focus, orientated and separated
- Compatible with aqueous and non-aqueous suspensions and emulsions
- A tool to validate other particle sizing techniques
- Images of all measured particles recorded
- Fully automated measurement procedure includes cleaning sequences and diagnostic checks

The FPIA-3000 offers high resolution, automated analysis of particle size and shape in a reliable, repeatable and routine manner eliminating any operator bias. The FPIA-3000 is particularly well suited to applications where size and shape information is needed to get a better understanding of product performance and process behavior.



www.malvern.com/fpia3000



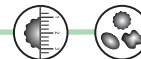
Morphologi

G3

Automated particle characterization system

- Particle size range from 0.5–10000µm
- Statistically significant size and shape data in one measurement with minimal user intervention and user bias
- Automated, easy-to-use, single-click driven measurements from dispersion through to results
- Compare and cluster data to find differences or similarities between multiple measurements
- Significant savings in time and labor compared to manual microscopy work
- Fully automated detection, enumeration and size classification of foreign particulate matter on filters.
- A tool to validate other particle sizing techniques
- Images of all particles recorded

The Morphologi G3 provides size and shape data through microscope quality images. A minimum of user intervention eliminates analyst-to-analyst and site-to-site variability. Whether you work in R&D, process analysis or quality control, the Morphologi G3 delivers reliable, repeatable and validated results in minutes, improving lab throughput and reducing measurement times.



www.malvern.com/morphologi



Malvern Process Systems

- Real-time particle sizing - whatever your application

A watchful eye to help optimize your process, Malvern Insitec analyzers can measure particle size distributions from 0.1-1000µm, wet or dry, at-line, in-line or on-line, including mobile or static solutions for most industrial applications. Using advanced laser diffraction technology pioneered and developed by Malvern, our comprehensive range of instruments is now standard in most particulate processing industries including toners, pharmaceuticals, cement, minerals, powder coatings, pigments and metal powders. Their rugged construction and robust technology reflect the exacting demands placed on analytical instrumentation that is in continuous, fully automated use in process environments such as milling, classification, spray drying, atomization, filtration and granulation.

Thousands of scattering patterns are taken every second and a full particle size distribution is updated every second. An Insitec analyzer can make more than a million measurements every year – effectively becoming your ever-watchful 'eye in the process'.



ALISS



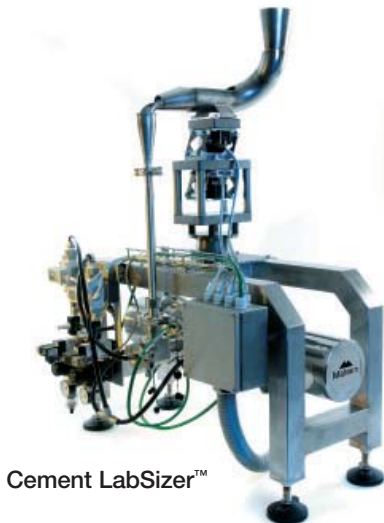
Voyager™



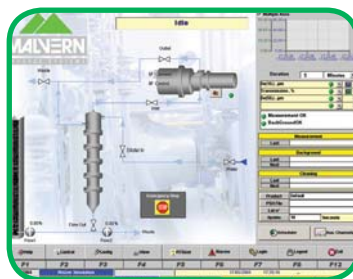
LPS



Insitec sensor



Cement LabSizer™



Malvern Link™



Parsum

Kinexus

Rotational Rheometer

- more rheology, less effort

- Pioneering 'expert system' to guide you through instrument set-up, sample loading, measurement and analysis, from enquiry to result
- Exclusive applications-led interface provides intelligent problem solving for sample, material or process problems
- Intuitive 'one click' operation for the ultimate user-friendly approach
- 'Plug and play' operation for all system components
- Multifunctional environmental controllers allow optimum measurement conditions for all materials
- Fully flexible control of key rheometer functions for the ultimate in rheological test and control capabilities
- Complete approach to critical data acquisition ensures robust and reliable rheological data for each sample
- Open frame design optimizes space for critical user interactions and for integration of modular components to meet your future measurement needs

Kinexus is a unique rheometer designed for tomorrow's research and business needs across all industries and application areas. Kinexus enables you to precisely analyze the flow and deformation properties of your materials – from liquids to solids; from processability to product performance; from temperature to time dependence; from simple viscosity to complex viscoelastic parameters.



www.malvern.com/kinexus



Bohlin

Rotational Rheometers

- proven rheological capability

- Patented Rotonetic™ 2 adaptive drive technology for true stress and strain controlled operation
- Wide dynamic range of torque and speed
- Unrivalled state-of-the-art air bearing design and performance
- Unsurpassed sensitivity and measurement accuracy, even for low viscosity, weakly structured fluids
- Flexible, easy to use software, allows rapid programming of complex test protocols and automated analysis
- Wide range of temperature control and specialist measurement accessories for all sample types, from paints and coatings to building materials; from personal care and pharmaceutical formulations to chemicals and petroleum products

From a busy QC or product development laboratory to the latest advanced rheological research, the Bohlin range of rheometers offer proven market solutions for all industries and material types – from asphalt to foodstuffs and from complex fluids to thermoplastic polymer melts.



www.malvern.com/bohlin



Capillary Rheometers

- process-relevant rheology for your materials

Rosand capillary rheometers characterize the rheology of materials under conditions directly related to processing - high force and high shear rate extrusion. Optimize your process conditions and material properties to ensure maximum efficiency and critical product functionality - from polymer melts to ceramics; from foodstuffs to inks and coatings.

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.com/rh10



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.com/rh2000



Viscotek

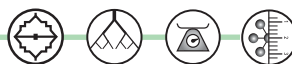
TDAMax

Setting the Standard for GPC

GPC/SEC System

- Complete, advanced GPC/SEC system with Triple or Tetra detection capability giving full molecular weight and size distribution information
- Comprehensive characterisation of all types of macromolecules - proteins, natural polymers and synthetic polymers
- Absolute molecular weight using Low Angle Light Scattering (LALS)
- Protein conformation, stability, aggregation and quaternary structure
- High-sensitivity Viscometer detector for intrinsic viscosity and structural information such as polymer branching
- Molecular size down to less than 1nm
- Powerful and flexible OmniSEC software with easy to use features and multiple calculation methods
- Copolymer, conjugates and blends fully characterised with UV-PDA option

The Viscotek GPCmax is a complete advanced detection GPC system for all macromolecular applications. The integrated TDA has temperature control to 80°C and all detectors in series for maximum signals. The GPCmax integrated solvent and sample delivery module is fully controlled from software.



www.viscotek.com/TDAMAX



Viscotek

DSV

- Solution viscosity up to 10 cp (mPa S), or 1-10 relative viscosity to ASTM D5225-98
- Provides Relative, Intrinsic, Specific and Absolute Viscosity with the ability to calculate molecular weight
- SASP – Semi automated sample preparation can be added to the measuring system for greater convenience and accuracy.
- All polymer applications including PET, PE/PP, PVC, Nylon, EPDM, Hyaluronic Acid, Cellulosics

A complete automated Dilute Solution Viscometer (DSV) system for the measurement of polymers in solution. Providing faster analysis, greater precision and less solvent exposure compared to conventional glass tubes. The system is self-cleaning and calibrating and has optional sample preparation capability.

www.viscotek.com/DSV



Chemical imaging system

- **Tool for Quality by Design** collecting NIR Chemical Imaging data on powders, granules, and tablets of all shapes and sizes
- **High sample throughput and statistically significant results**
- **Turns images to answers**
- **A tool for counterfeit detection**
- **Non-destructive analysis** – samples can be used in further testing
- **Automated data collection and analysis** - routine processing for QA/QC
- **Solid state with no moving parts** – robust enough to be used beyond the laboratory
- **Wide variety of imaging areas** – microscopic to macroscopic imaging as required by the sample
- **Programmable stage** available for unattended round-the-clock measurements of multiple samples, just set it up and let it go

Delivers valuable product quality information where traditional analytical techniques fail by answering the questions 'what', 'how much' and 'where'?

SyNIRgi NIR Chemical Imaging system takes the guess-work out of formulation development, speeds up the QA/QC process and streamlines manufacturing troubleshooting. Providing a clear picture of the spatial distribution of sample components, structural fingerprints are translated into non-subjective numbers.



www.malvern.com/nir-ci



Standards

A range of consumable standards is available to verify the performance of your instrument.

- **Malvern Quality Audit Standards for Mastersizer and Morphologi systems**
- **Latex standards for FPIA systems**
- **Zeta potential test sample for Zetasizer systems**
- **Nanosphere size standards for Zetasizer systems**
- **Newtonian oils for rheometers**
- **Viscoelastic reference material for rheometers**

How valuable is your data? To ensure data validity instruments should be challenged by an appropriate standard on a regular basis

www.malvern.com/standards



Malvern Instruments Limited

Groewood Road • Malvern • Worcestershire • UK • WR14 1XZ

Telephone: +44 (0)1684 892456 • **Facsimile:** +44 (0)1684 892789

Malvern Instruments Worldwide

Sales and service centres in over 50 countries. For details visit www.malvern.com/contact

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solutions

Advanced technology made simple

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