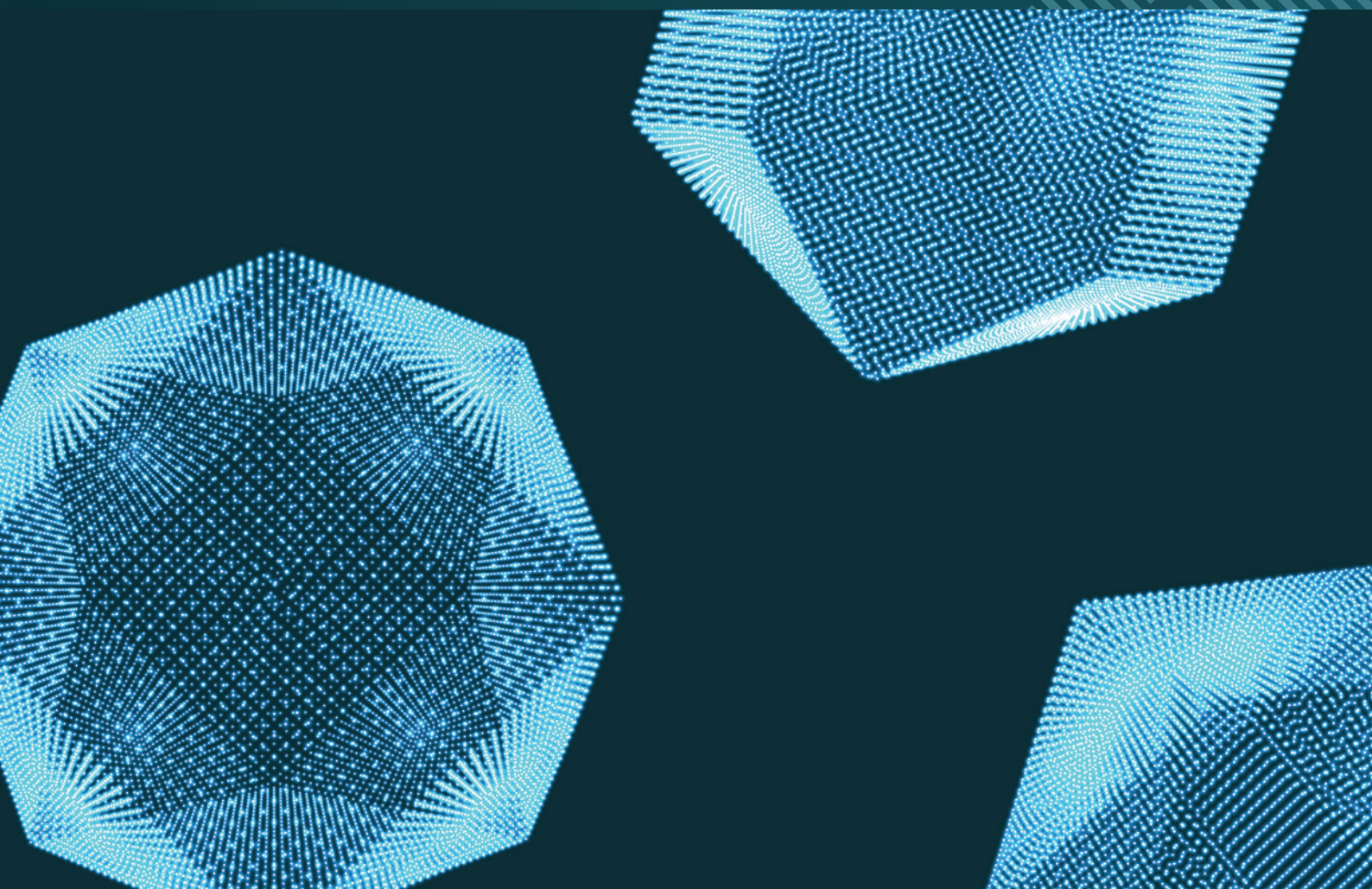# Malvern Panalytical
a **spectris** company

Analytical technologies for colloidal nanoparticles

Understand the physical and chemical properties of inorganic nanoparticles in colloidal suspensions

Expand analysis of nano-scale systems

Uncover insights into inorganic nanoparticle structure and function

Nanoparticles based on inorganic and metallic materials have become of great interest as heterogeneous catalysts, vehicles for therapeutics, tools for energy conversion and storage, sensors in (opto)electronics, novel coatings, and much more.

At Malvern Panalytical we offer several instruments for determining the properties of these nanoparticles in colloidal suspension. Here, we summarize these systems, and briefly describe why you should choose them.

Laser diffraction

Laser diffraction (LD) measures the angular variation in intensity of a scattered laser beam, and uses this to generate information on **size distributions**.

Using LD, you can measure particle sizes in the range 10 nm to 3500 µm, and generate curves for monomodal or multimodal distributions.

The **Mastersizer 3000** is a versatile, compact LD instrument that aligns with the analytical requirements and demanding workflows of today's laboratories.

Combining precision engineering and applications know-how, it delivers:

- Excellent analytical performance and robust, reliable data, for confidence in results
- Versatile software for developing and running a variety of methods
- Flexible reporting capabilities
- A small footprint, for optimum use of laboratory space
- Optional Auto-Lab for measuring up to 42 samples

This all delivers results you can rely on, whether you're a novice or an expert.

Light scattering

Light scattering measures the intensity fluctuations of scattered light resulting from the movement of nanoparticles in suspension, for two types of analysis:

- Dynamic light scattering (DLS) determines **size distributions**
- Electrophoretic light scattering (ELS) determines **surface charge (zeta potential)**

The **Zetasizer Advance** provides both measurement types, and offers:

- Nanoparticle size measurements from 0.6 nm to 15 µm, using multi-angle analysis (MADLS) for high resolution
- Adaptive correlation to identify large outlier particles
- Zeta potential measurements to predict dispersion stability
- 'Constant current zeta' technology to compensate for ion build-up
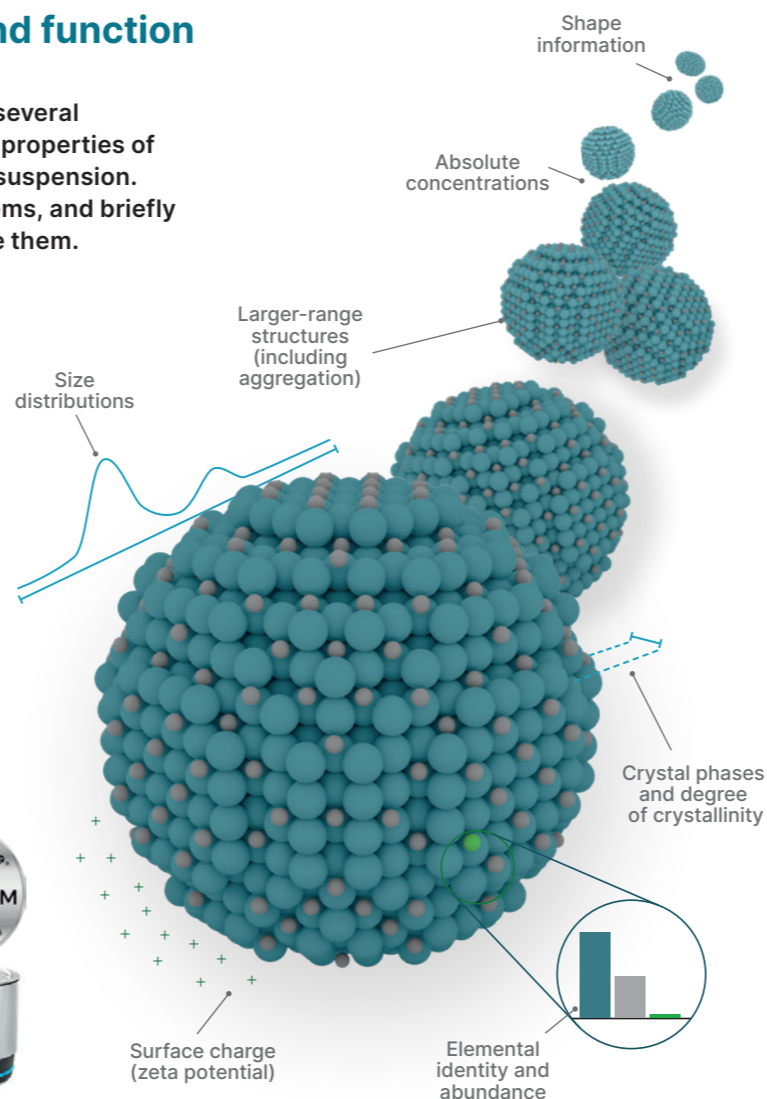
- Mixed-mode 'M3-PALS' methodology to avoid distorted results caused by electro-osmosis
- Non-invasive backscatter (NIBS) for sensitivity over a wide concentration range
- Simple operation for robust results with minimal training, and real-time data quality guidance

Zetasizer Advance models are easily upgraded and automated, making them a versatile option for all laboratory environments.

Shape information

Absolute concentrations

Larger-range structures (including aggregation)

Size distributions

Crystal phases and degree of crystallinity

Surface charge (zeta potential)

Elemental identity and abundance

Nanoparticle tracking analysis

Nanoparticle tracking analysis (NTA) visualizes individual nanoparticles to provide **absolute concentrations** and maximum-resolution **size distributions**.

Nanosight Pro is an easy-to-learn NTA system that provides rapid and accurate characterization of nanoparticles, offering:

- Size distributions from 10 nm to 1 µm (the high resolution makes it especially useful for multimodal distributions)
- Count-based particle concentrations
- Real-time tracking of particle motion, aggregation and dissolution
- Differentiation of fluorescing particles
- Intelligent software for streamlined measurements
- Minimal sample preparation and consumables for easy setup and low running costs

The result? A best-in-class NTA system for characterizing all types of inorganic nanoparticles.

X-ray diffraction

X-ray diffraction (XRD) works by measuring the intensities and angles of X-rays that are scattered by materials.

In addition to standard diffraction, two complementary methods are useful for nanoparticles:

- Wide-angle X-ray scattering (WAXS) provides information on **crystal phases and degree of crystallinity**
- Small-angle X-ray scattering (SAXS) provides information on **nanoparticle size and shape**

Our third-generation **Empyrean** is the ultimate in XRD instrumentation. It offers:

- MultiCore optics, PreFix X-ray modules, and batch automation for fast, precise changeover of experiments/samples
- Unbeaten data quality for all diffraction geometries and components
- Hybrid PIXel detectors for compromise-free detection
- Numerous options for non-ambient and in situ environments
- A system that is ideal both for teaching and advanced R&D

So with Empyrean you get all you need for XRD of inorganic nanoparticles – making it the ultimate future-proof laboratory system.

X-ray fluorescence

X-ray fluorescence (XRF) provides information on **elemental identity and abundance**, by virtue of the characteristic fluorescence 'fingerprints' produced when atoms are irradiated with X-rays.

Zetium is a wavelength-dispersive XRF system that offers unrivalled analytical performance for all types of application involving inorganic nanoparticles. It offers:

- Maximum sensitivity (down to 0.1 ppm)
- Detection and quantitation of elements from Be to Am.
- Combined energy- and wavelength-dispersive measurements, reducing analysis times by up to 50%
- Dust removal to minimize contamination and downtime
- Special software modules and templates for easy setup

- Small-volume airlock to reduce helium usage during analysis of liquids
- The Omnian module for analysis of materials lacking calibration samples

And as well as Zetium, we offer the Epsilon series for focused applications.

About
Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

Malvern Panalytical. We're BIG on small™

Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy

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