

Zeta potential & Particle size distribution

Dipl.-Ing. Jürgen Gassmann, Dipl.-Ing. Konrad Güth

Fraunhofer-Institut für Silicatforschung ISC – Projektgruppe für Wertstoffkreisläufe und Ressourcenstrategie IWKS

Zetasizer Nano ZS & MPT-2 (Malvern Instruments Ltd.)



Dynamic Light Scattering → particle and molecule size

This technique measures the diffusion of particles moving under Brownian motion, and converts this to size and a size distribution using the Stokes-Einstein relationship. Non-Invasive Back Scatter technology (NIBS) is incorporated to give the highest sensitivity simultaneously with the highest size and concentration range.

Laser Doppler Micro-electrophoresis → zeta potential

An electric field is applied to a solution of molecules or a dispersion of particles, which then move with a velocity related to their zeta potential. This velocity is measured using a patented laser interferometric technique called Mixed-Mode Measurement Phase Analysis Light Scattering (M3-PALS). This enables the calculation of electrophoretic mobility, and from this the zeta potential and zeta potential distribution.

Particle size and molecular size

- Measurement principle: Dynamic Light Scattering (DLS)
- Measurement range: 0.3 nm – 10 µm (diameter)
- Minimum sample volume: 12 µL
- Accuracy: +/- 2% (NIST latex standards)
- Sensitivity: 0.1 mg/mL (Lysozyme)

Zeta potential

- Measurement principle: Electrophoretic Light Scattering (ELS)
- Measurement range: ±500 mV
- Minimum sample volume: 20 µL
- Accuracy: 0.12 µm*cm/V*s for aqueous systems (NIST SRM1980 standard)
- Sensitivity: 10 mg/mL (BSA)

Mastersizer 3000 & Hydro MV & Aero S (Malvern Instruments Ltd.)



Laser diffraction → particle size distribution

The Mastersizer 3000 uses the technique of laser diffraction to measure the size of particles. It does this by measuring the intensity of light scattered as a laser beam passes through a dispersed particulate sample. This data is then analyzed via Mie or Fraunhofer scattering theory to calculate the size of the particles that created the scattering pattern.

Wet and dry dispersions

Accurate particle size distributions for both wet and dry dispersions, measuring over a wide dynamic range from the nanometer to millimeter particle size. Impact disperser using ventury jets for measuring robust agglomerated particles in air. Wet dispersion in aqueous and non-aqueous solution. Low dispersant volume needed, suitable for small sample size. In-Line sonication probe and agitator, for rapid agglomerate dispersion.

Automated wet dispersion unit (Hydro MV)

- Maximum particle size: 0.01 – 2100 µm
- Dispersant volume: 120 mL
- Chemically compatible with a wide choice of organic and inorganic dispersants
- Automated dispersant supply
- In-line sonication probe

Dry powder dispersion unit (Aero S)

- Particle size: 0.1 – 3500 µm
- Dispersion pressure range: 0.1 – 4.0 bar
- Pressure setting precision: ± 0.1 bar
- Pressure setting accuracy: ± 0.03 bar
- Feed rate: 0 – 58 m/s²