

# Bettersizer S3 Plus



## HIGH PRECISION

- Exact measurement of small particles (from 10 nm) thanks to the patented double lenses technique
- Detection of coarse particles by means of camera technique (up to 3.5 mm)

## VERSATILE

- Simultaneous measurement of particle size & -shape
- Determination of the refractive index
- Wide range of applications: powder, suspensions and emulsions

## ...AND MUCH MORE

- Standard operation procedures
- Automatic adjustment of the optical system
- Best price-performance ratio

## PARTICLE SIZE AND -SHAPE

by means of static light scattering  
and dynamic image analysis

PARTICLE SIZE

PARTICLE SHAPE



Characterization of  
particles • powders • pores

## BETTERSIZER S3 PLUS - PARTICLE SIZE AND SHAPE IN ONE INSTRUMENT

The Bettersizer S3 Plus combines the advantages of both static light scattering and dynamic imaging analysis by means of a unique and innovative setup. The instrument offers a thorough and exact characterization with regards to particle size and shape ranging from the nanometer scale up to a millimeter scale. A live-feed from CCD-cameras before and during the analysis offers feedback about of the samples state of dispersion and a visual evaluation of the obtained data. All particles with sizes above 1  $\mu\text{m}$  can be photographed and analyzed online if requested.



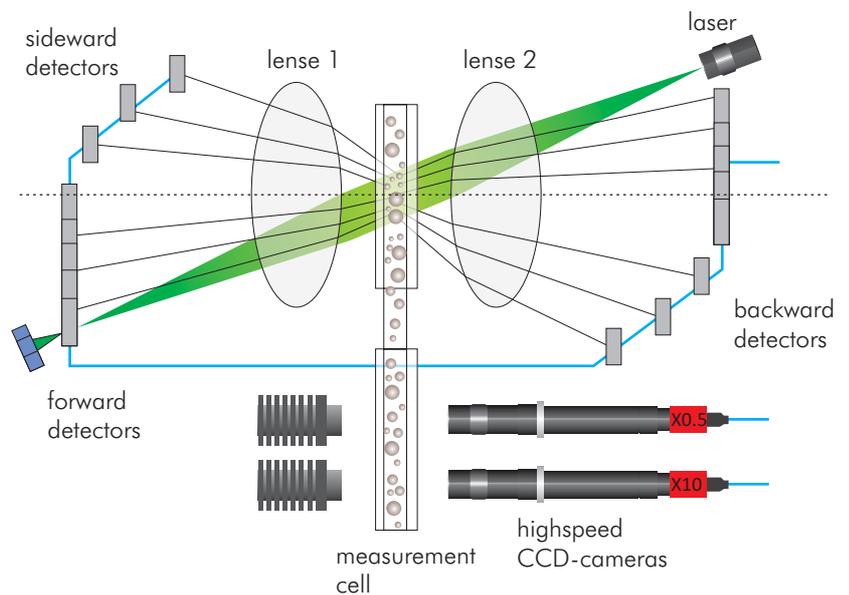
## PRINCIPLE OF MEASUREMENT

### Bettersizer S3 Plus at a glance

The Bettersizer S3 Plus is a static light scattering instrument which is further enhanced by two high-speed CCD cameras (magnification of x0.5 and x10) for taking images of the sample.

During analysis particles, which are dispersed in a medium of the operators choice, are pumped through two cuvettes. In the first one short-wave LASER light (532 nm) hits the particles and generates a characteristic diffraction pattern. This diffraction pattern of the beam is recorded with regards to the diffraction angle on the installed detector system.

The CCD cameras are constantly recording pictures in the second cuvette of particles in the range from 1 to 3.500  $\mu\text{m}$ .



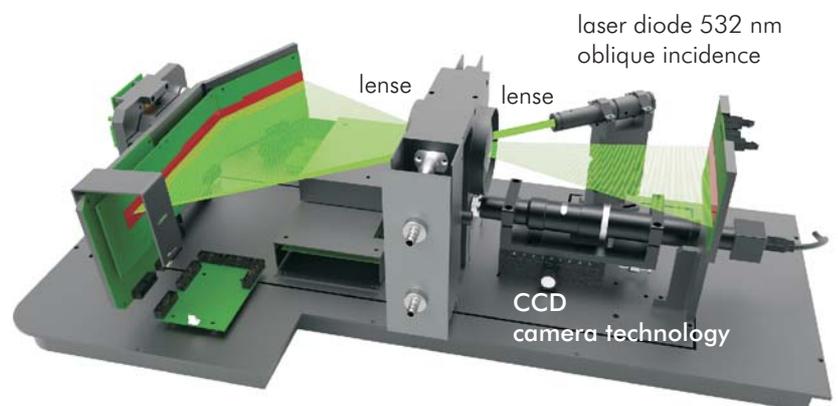
## TECHNOLOGY

### Patented Double Lens technique DLOIS

DLOIS (Dual Lenses & Oblique Incidence Optical System) is a new fourier-based technique patented by Bettersize. An additional lens between the cuvette and the laser changes the divergent beam into a parallel beam, allowing also for the detection of back-scattered light.

The use of only one laser gives a continual diffraction spectrum with consistent wavelength, while the oblique incidence of the beam combined with this special setup allows for detection in angles ranging from 0.02° to 165°. The DLOIS technology guarantees reliable data for particles at 10 nm diameter.

### DLOIS (Dual Lenses & Oblique Incidence Optical System)



### CCD camera technology

The optical imaging system consists of two high-speed CCD cameras and high-precision telecentric lenses. This allows for the recording and analysis of more than 10.000 particles per minute at very sharp resolutions and without shadowing effects. Both cameras can be run independent from one another or simultaneously for observing the sample or allowing online imaging analysis.

## MAIN ADVANTAGES

- ✓ Innovative Double Lense technique (DLOIS)
  - Precise analysis of small particles from 10 nm
  - Single laser technique for continual diffraction spectrum
- ✓ Integrated camera technology
  - Higher precision in the coarse region
  - Detection of agglomerates, air bubbles and oversize material
- ✓ Particle size and shape analysis in one instrument



## PARTICLE SIZE MEASUREMENT

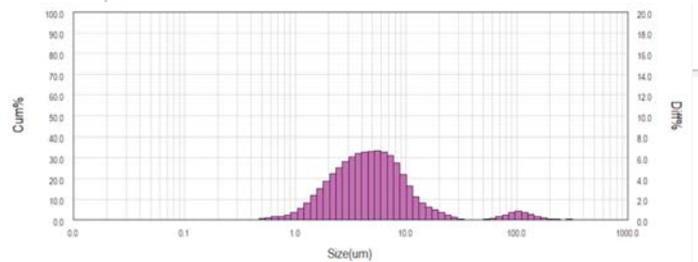
### Static light scattering according to DIN ISO 13320

The size distribution of fine particle collectives (nano-, sub-micro- and micrometer region) can be carried out precisely by means of the DLOIS technique. A wide range of diffraction ( $0.02^\circ$  to  $165^\circ$ ) in combination with a high detector resolution (96) is accessible. Analysis can be carried out according to Fraunhofer or Mie theory. Among others, helpful tools for a particle size analysis are found in the two cameras for a visual inspection of the quality of dispersion and the measurement of the refractive index for materials with unknown optical parameters.



### Combined method: Imaging analysis with light scattering

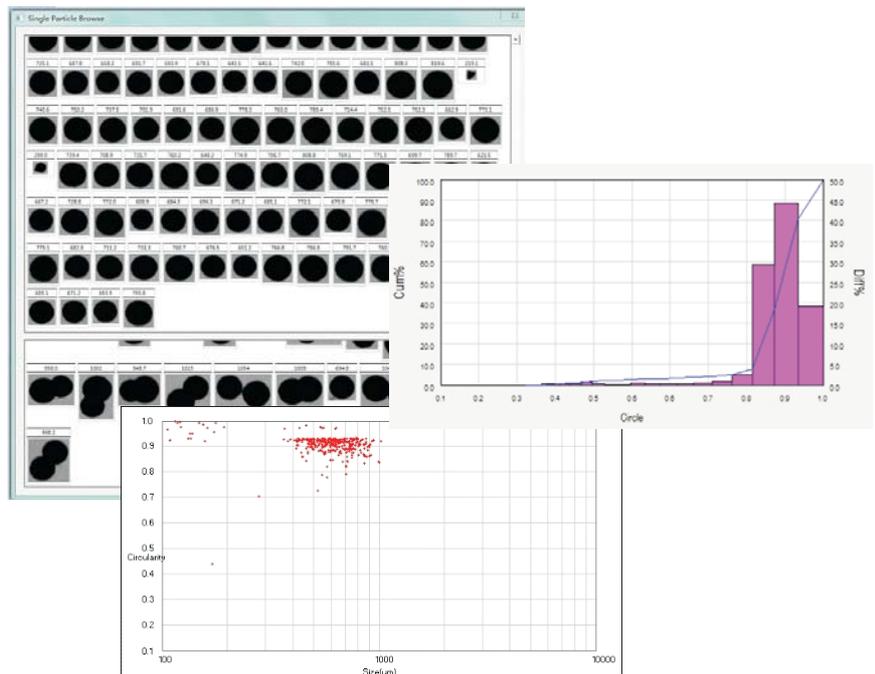
For particle collectives with a broad distribution and fractions in the upper micrometer range a combined analysis of static light scattering with the 0.5x CCD camera for exact recording of coarse particles is advised. This allows for the detection of less 3 mass-% oversize material.



## PARTICLE SHAPE AND EQUIVALENT DIAMETER DETERMINATION

### Particle shape analysis

Shape analysis can be carried out with two high-speed CCD cameras with magnifications of 0.5x and 10x respectively. They cover a range for particles sizes from 1 to  $3.500 \mu\text{m}$ , while particle shape analysis is possible at  $4 \mu\text{m}$  and above. The analysis is carried out in real time at a rate of 10.000 particles per minute, which are photographed, characterized and classified statistically. Both cameras can be used independently or simultaneously.



Apart from a variety of equivalent diameters (such as area, circumference, maximum (L) and minimum (D) Feret, etc) a number of special size parameters such as aspect ratio (length L/ width D), circularity and perimeter are calculated.

APPLICATIONS

building materials



personal care cosmetics



soils and sediments



glass and ceramics



carbon and oil



food and beverages



paints and inks



pharmaceuticals



polymers and metals



electronic



SPECIFICATIONS

Measurement principle	static light scattering + dynamic image analysis
Analysis	Fraunhofer or Mie
Size range	0.01 - 3500 $\mu\text{m}$
Number of size classes	> 100 (adaptable individually)
Time of measurement	< 1 min
Accuracy/Repeatability/Reproducibility	< 0.5 % / < 0.5 % < 1.0 %
Feeding/Dispersion/Volume	centrifugal pump/ ultrasonic bath (50 W) / 600 ml
Number of laser/-type/-wavelength/-powder/-class	1 / diode laser (DPSSL) / 532 nm (green) / 5 mW / class 1
Lenses design/-arrangement	F-Theta / double-lenses Fourier optic, oblique incident light
Effective focal length	223 mm, image analysis: 110 mm
Detector channels, -angle range	96 (forward, sideward and backward), 0.02 - 165°
Special features: additional determination of conformity	Particle shape (L/D, circularity...), refractive index 21 CFR Part 11, ISO 13320, CE
Data export	Excel, PDF, Word, JPG and others
Dimension/weight	820 x 650 x 320 mm (L x D x H) / 30 kg
Recommended computer specification	Windows 7 oder higher, Intel Core i5, 4 GB RAM, USB 2.0



Characterization of  
particles · powders · pores

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