

## ACOUSTIC SPECTROSCOPY

Acoustic spectroscopy is useful if both particle size and zeta-potential need to be investigated. Acoustic spectroscopy measures the attenuation and sound speed of ultrasound pulses as they pass through concentrated slurries. The measurements are made over a wide range of frequencies and the resulting spectra are used to calculate the particle size distribution over a range from 10 nanometers to more than 10 micrometers.



## LIGHT SCATTERING

Light scattering is a popular technique for determining particle size. Dynamic light scattering can be used to measure smaller particles (less than a few microns) than is possible using static light scattering techniques.

**A Dynamic**  
Dynamic light scattering works by observing the Doppler shift of the incident light due to the Brownian motion of the suspended particulates. When a coherent light source shines on these particles, light will be scattered from the particles, but the frequency will be shifted because the particles are in motion (Doppler shift). The speed of the particles determines how much the frequency is shifted.



**B Static**  
Modern static light scattering instruments have become the method of choice in most industries due to their analysis speed, wide size range, ease of use, flexibility, and reproducibility. Static light scattering measures particle size by scattering light from the edge of the particle at an angle which is dependent on the size of the particle. Larger particles scatter light at relatively smaller angles than light scattered from smaller particles. From observing the intensity of light scattered at different angles, it is possible to determine the relative amounts of different sized particles.



## Particle size characterization

Accurate particle size characterization is essential in many processes in a large number of industries and research areas, including pharmacology, cosmetics, nanotechnology, paints, pigments, food science, ceramics, textiles, geological science, polymer science, environmental science, catalysis and powder metallurgical science.

The term "particle size characterization" can be used to cover size measurement only, or any combination of size, shape, zeta potential, surface area and other parameters. A wide range of instruments is available to facilitate particle size characterization and tailored according to individual needs and requirements.

This purchasing guide attempts to simplify the range of available particle characterization instruments by categorizing them according to type and function.

START  
HERE

## INTRODUCTION:

### Particle size characterization

The accurate measurement of particle characteristics is essential in many industrial and research processes. A large number of particle characterization instruments are available, offering a wide range of options and functions. It is important to select the appropriate instrument for your specific needs in order to ensure optimal results.

When purchasing a particle characterization instrument the first consideration should be what characteristics need to be measured. Laser diffraction instruments are widely used for size measurements only, image analysis instruments tend to be used for size and shape data, while acoustic spectroscopy instruments can be used to measure both size and zeta potential.

## NANOPARTICLE CHARACTERIZATION

The emergence and rapid evolution of the field of nanotechnology has created a requirement for particle characterization instruments capable of measuring particle sizes on the nanometer scale. Considerable effort has been devoted to developing instruments capable of measuring smaller and smaller particles, and a number of these are able to measure particles only nanometers in size.



## SURFACE AREA SPECTROSCOPY

Surface area spectroscopy determines the way a solid interacts with its surroundings, and is the most widely used means of characterizing porous materials. Since the surface area corresponds to the roughness of the particle exterior and its porous interior, gas sorption is the preferred technique to measure particle surface area.



## IMAGE ANALYSIS

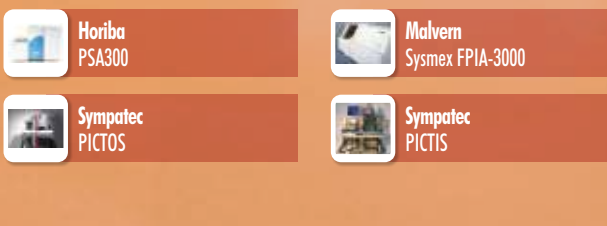
Image analysis is becoming an increasingly popular tool for particle size and shape analysis of powders. Modern image analysis systems for particle characterization are capable of analyzing tens of thousands of particles in a matter of minutes with sensitivity down to below 1 µm.

Image analysis can be dynamic or static, both of which are used in many industrial applications.

**A Dynamic**  
In dynamic image analysis, particles flow past one or more cameras. Dynamic image analysis generally has lower sensitivity than static systems.



**B Static**  
In static image analysis, particles sit on a slide moved by an automated stage for inspection by camera and microscope. Static image analysis systems provide greater sensitivity and operate on more sophisticated software for more complex investigations.



## LASER DIFFRACTION

Laser diffraction can be used for the non-destructive analysis of wet or dry samples, with particles in the size range of 0.02 to 2000 microns, and has inherent advantages that make it preferable to other options for many different materials.

Laser diffraction techniques are useful if only the particle size needs to be investigated.

**A Portable systems**  
Portable particle characterization instruments are useful when bench space is limited; offering efficient use of bench space, while preserving accuracy, precision, and resolution.



**B Standard systems**  
Standard systems are the mainstay of laser diffraction for the measurement of particle size.



**C Spray droplet size systems**  
Measurement of droplet characterization in sprays and aerosols relies on a specific form of laser diffraction requiring dedicated instrumentation.





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# PARTICLE ANALYSIS/ PARTICLE CHARACTERIZATION INSTRUMENTS

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