

● **Instrument**

DUAL-CHANNEL PARTICLE SIZE AND SHAPE ANALYZER

Arjen van der Schoot

Ankersmid B.V. Shanghai Representative Office, Shanghai 200233, P. R. China
 Tel: 0086-21-64403331, E-mail: schoot@ankersmid.com

Fig. 1 shows a newly developed analyzer (Ankersmid CIS-100) that brings together two different measurement channels for accurate size and shape measurement of spherical and non-spherical particles. The size of spherical particles is measured by a HeNe Laser Beam; the size of non-spherical particles is analyzed by Dynamic Video Analysis of the particles' shape.

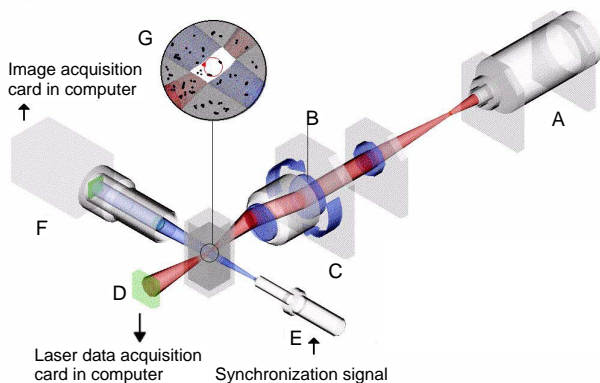


Fig. 1 One system, dual measurement channels, wherein A: He-Ne laser; B: wedge prism; C: scanner; D: PIN photodiode detector; E: strobing light source; F: CCD video microscope; G: focal volume of measurement.

Size Analysis

The laser channel uses the unique Time of Transition (TOT) theory for measuring the diameter of relatively spherical particles in dynamic flow. As a particle passes through the analyzer it temporarily blocks the rotating laser beam. A detector measures the exact time each particle obscures the laser beam. Because the rotation speed (v) of the laser beam and the time (t) the particle obscures the laser beam are known, the diameter (d) of the particle can be calculated:

$$d=vt.$$

As data are collected on single particles, size distribution results are of an exceptional high resolution. Another advantage of the TOT theory is that it is calibration-free; time, unlike intensity, does not need to be calibrated.

When measuring a spherical particle's diameter, measurement results should only include the results of *On-Center* hits and exclude *Off-Center* hits which give

incorrect information about particle size. The CIS-100's advanced software, as depicted in Fig. 2, can distinguish between the graphical results of *On-Center* and *Off-Center* hits, and disregards all *Off-Center* hits. In the same way that the analyzer's software can distinguish between *Off-Center* hits, it can also recognize other typical patterns in the results. Translucent and transparent particles can be effectively measured by the TOT method. Whereas many particle size analyzers will measure two particles instead of one transparent particle, Ankersmid analyzers' software recognizes the distinct graphical results these particles present and will adjust the outcome accordingly. A unique advantage of the analyzer is that no information about the sample's refractive index, its temperature, its viscosity variation or its electrical conductivity properties is required.

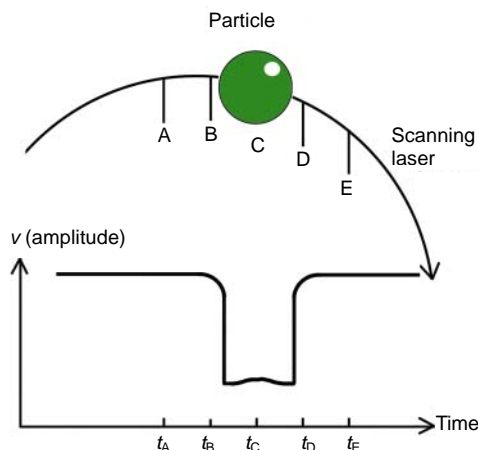


Fig. 2 Particle size is directly related to time.

Shape Analysis

The video channel analyzes the shape of non-spherical particles, including fibers, during dynamic flow. The shape analysis channel is equipped with a CCD video camera microscope for optimal image processing. Illumination is provided by a synchronized strobe light, and the acquired images are passed to a frame grabber card for analysis, and then displayed on a monitor for viewing. In this way thousands of sample images are collected within seconds. The images are placed on a pixel grid, and as the size of the pixels is known, the size of the particle can be determined by counting the number of pixels the particle covers on the grid.

The Ankersmid Wshape software, shown schematically in Fig. 3, enables fully automatic features such as rejection of out-of-focus particles, separation of touching particles, and automatic lighting correction that assist in optimising sample measurement. Software algorithms enable automatic, programmed calculation of 36 different parameters, including Feret diameter, area, perimeter, shape factor, and aspect ratio. The Wshape software also offers powerful shape filters that enable the measurement of specific particles within a complex mixture of different particles. All measurement results can be presented in multiple types of graphs and tables, and sample images can be stored for analysis at a later time.

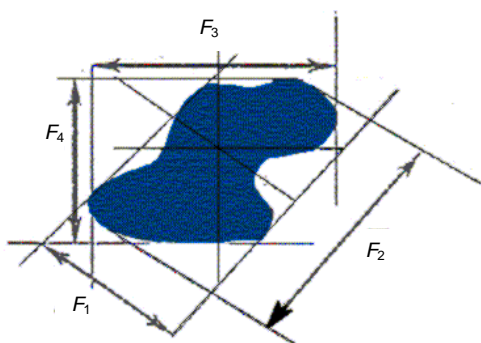


Fig. 3 Shape analysis of non-spherical particle.

The CIS-100 can be fitted with eight easily interchangeable measurement cells that enable dynamic measurement of wet, dry, surface, heated, and airborne particles. This wide range of measurement cells ensures that samples do not need to be adapted to the analyzer, but that the analyzer is adjusted to the requirements of sample specifications. In practice this greatly reduces the need for sample dilution, giving the Ankersmid Analyzer an edge in many difficult applications such as inks, emulsions, and slurries. The CIS-100 provides the best particle sizing solution for a diversified spectrum of applications. Fast and easy to use, the CIS-100 is an optimal tool for Quality Control and R&D laboratories.

Technical Specifications CIS-100

- Measurement range: laser channel 0.1–3600 μm
- Measurement range: video channel 2–6000 μm
- Concentration range: up to 10^9 particles/mL (for 1 μm particles)
- Laser: 2mW He-Ne, 632.8 nm
- Detector: silicon PIN photodiode
- Dynamic Range: 300:1
- Video camera: high resolution B&W CCD camera, 768 \times 493 pixels
- Illumination: synchronized strobe light with adjustable intensity and duration.