Particulate Systems

Particle Insight
Dynamic Image Analyzer

A BRAND OF MICROMERITICS

Particle Size and Particle Shape

Particle Insight Dynamic Image Analyzer

Particle Shape for Characterizing Irregularly Shaped Particles

For many years, particle size analyzers have rendered results with the assumption that all measured particles are spherical. However, in many applications, the shape of particles can affect both performance and flowability in manufacturing. As a result, particle shape information about raw materials enables manufacturers to control their process with a much higher level of sensitivity than by using particle size measurements alone. As an example, using particle shape parameters such as smoothness, circularity, and aspect ratio for controlling a process enables a more predictable product outcome (i.e., flowability of a powder during the manufacturing process, effectiveness of abrasives, or the activity of a pharmaceutical powder).

The Particle Insight is a state-of-the-art dynamic image analyzer that is ideal for applications where the shape, not just the diameter, is critical information for predicting raw material performance. With numerous design features, the Particle Insight is capable of being used as a tool for particle research and method development where high resolution and rapid screening of thousands of particles are required. In addition, the fully automated Particle Insight is well suited for use in a full production environment where speed, accuracy, and ease of use with Pass/Fail shape control limits can be set. With its variety of shape parameters, the Particle Insight is the best solution for any particle shape need.

Wide Variety of Design Benefits

The Particle Insight offers **three model options** operating in a range suitable for a wide variety of industrial, biological, and geological specimens.

A camera with unique optics, high frame rate, and high resolution enables the analysis of tens of thousands of particles in seconds. Data for all **shape parameters are displayed real-time**. No need to wait for the analysis to be over to view results.

Select from 28 size/shape parameters that are best suited for the particle shapes being measured. This feature leads to a more accurate control of particles.

All analyzed particles have **thumbnail images** saved for post-run viewing and shape filtering to view only a specific selection of particle types. Individual particle images from captured parameters permit rare event detection.

Ability to compare different analyses via **histogram overlays** for all analyzed shape parameters to enable more accurate comparison between sample runs.

Data mirroring enables real-time security backup as well as a means to monitor from a remote location the live status of the production process.

Recirculating sample module and optics similar to laser diffraction systems enable statistically valid measurements in a very short amount of time. The standard system is compatible with both aqueous and organic fluids.

Three-dimensional analysis with random orientation results in the ability to measure all aspects of particles.

Full compliance to Electronic Records Signatures **21 CFR Part 11**.

Scattergram allows for the correlation of any two shape parameters for each particle analyzed in a run.
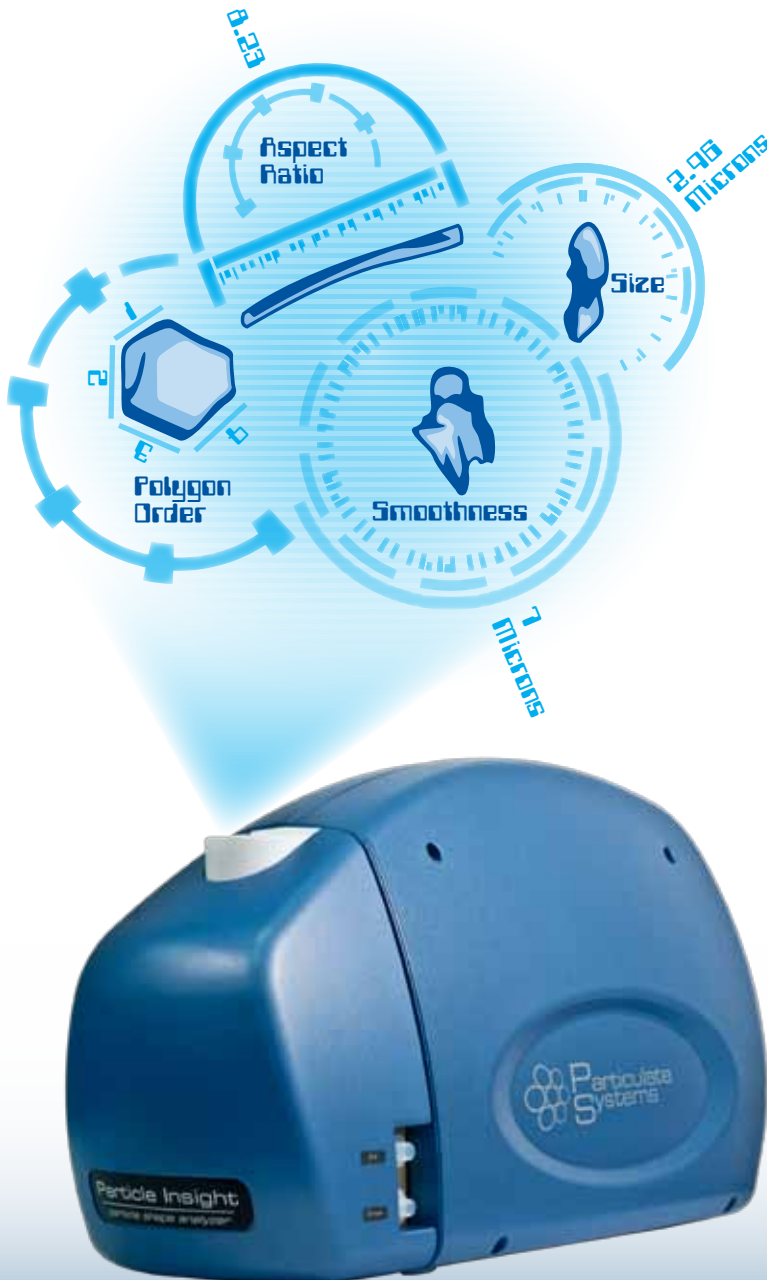
Typical Particle Insight Applications

Oil Contamination Monitoring

Early detection of wear particles in lubricating and hydraulic fluids is critical to having a proper predictive maintenance program. It is this early detection and identification of wear particles that permits the extension of engine life and can minimize down-time of equipment. The Particle Insight combines the classification of particles required by industry standards (ISO 4406, NAS 1638) with the reporting of up to 28 shape classifications for all particles identified. The instrument also provides particle thumbnails for each particle allowing the user to make more educated decisions on the quality of their lubricating fluids.

Fibers

Fiber particles are used in a vast array of applications ranging from adding strength to building materials to making effective filtration media. Particle analysis results expressed in equivalent spherical diameter do not give the user critical information needed to determine how fibers will perform in a final product. The Particle Insight can be used to calculate the fiber length and width along with the aspect ratio. Fiber curl (the degree of fiber curvature) can also be calculated. These measurements can be very useful in determining how fibers will interact with each other in a production process.

Protein Therapeutics

Aggregation is an inherent property of proteins and the detection of this collection of sub-visible particles is critical to ensure the effectiveness of these therapeutic proteins. The Particle Insight is a complementary technique to the USP <788> enabling the quantification and identification of select particles in any given set of ranges. In addition, thumbnail images can display for the user rare event particles found in these injectable fluids.

Abrasives

The surface roughness as well as the size of abrasive particles will influence the performance of the final cutting wheel or sandpaper. The Particle Insight can monitor raw abrasive materials not only on size but also on surface smoothness, a direct measurement that can be correlated to the particle's end use.

Toners

With the advancement of toner technology, there has been an expressed need to analyze not only the size of toner particles but also the shape. Shape of printing toners can impact the flowability during the production process as well as the effectiveness of the toner particles when in use. Controlling uniform shape of toners allows for more accurate color reproduction and more efficient toner use.

Pharmaceuticals

Particle shape can help in identifying and quantifying the different sub-components in a final product based on their differences in shape. Measuring particle smoothness over time can also enable the measurement of dissolution rate.

Particle Insight Advantages

- ☑ **High Speed, High Resolution**
- ☑ **Real-time Results**
- ☑ **Up to 28 Size and Shape Measures**
- ☑ **Particle Thumbnails**
- ☑ **Multirun Overlaying of Shape Data**
- ☑ **Sieve Correlation Capability**
- ☑ **Rare Event Detection**
- ☑ **Organic Fluid Capability**
- ☑ **Security and Regulatory Compliance**
- ☑ **Particle Shape Comparison**
- ☑ **Three Size Range Model Options**
- ☑ **Real-time Data Backup for Remote Viewing**
- ☑ **Automated Recirculating Sample Handling Module**
- ☑ **3-Dimensional Analysis with Random Orientation**
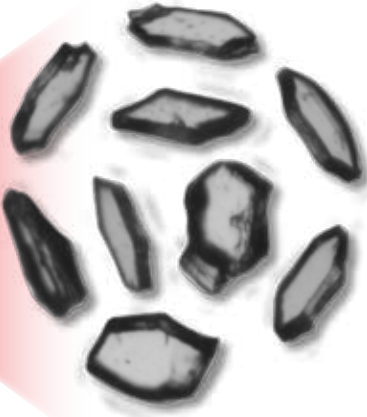
Particle Insight Features
Particle Insight Dynamic Image Analyzer

Thumbnail Extraction from Specific Points in Histogram

The Particle Insight employs two important features: random orientation and recirculation of the sample. These two features help to ensure a true representation of the sample, as well as accurate data.
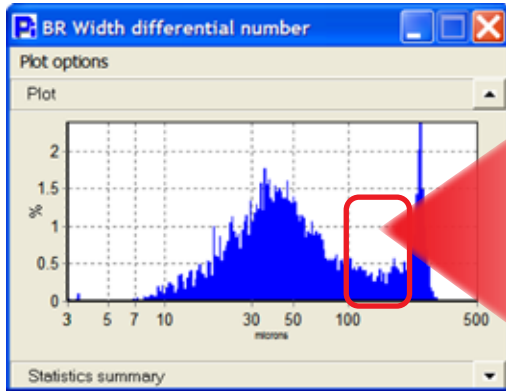
The Particle Insight allows the user to have a true analysis of all dimensions of the particles. In addition, the user is able to selectively see each particle that created a certain area of any shape histogram.

Compare Samples with Shape Overlays

The Particle Insight allows for sample-to-sample comparisons that can visually show the differences in shape aspects of particles. By overlaying sample histograms for all the available shape parameters, the user can compare different samples and make determinations based not only on size, but on shape as well.

Most particle size analyzers assume particles to be spherical without taking into account other critical shape factors. In the above example, the difference in two samples, similar in size when assumed to be spherical, are clearly demonstrated in overlays of both circularity and smoothness. Only a particle shape analyzer can render such critical shape information.

Scatter Plot Correlates Two Shape Measures

The correlation between any two shape results of the same sample can give the user unique information about their process and their particles. The correlation coefficient calculation can also be used as quality control criteria for process control. This Pearson coefficient is widely used as a measure of the strength of linear dependence between two variables.

In this example, 10,000 flake-like particles analyzed in just minutes show an important trait of the sample. As can be seen by the correlation, as the flakes become larger in size, they also become thicker.
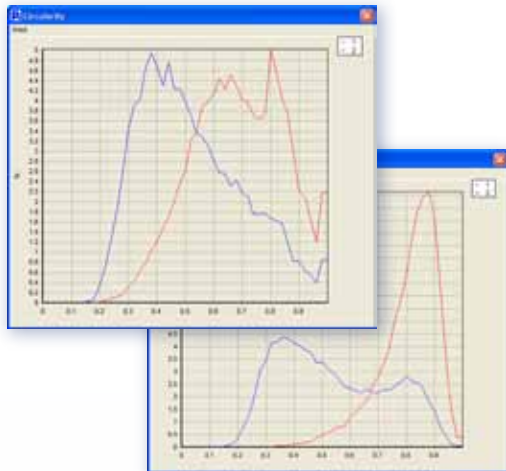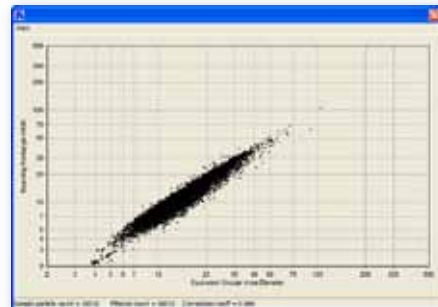
Process Monitoring

To simplify manufacturing process control, the Particle Insight incorporates a process monitoring feature that shows simple pass/fail indicators for any shape measurement. It is no longer necessary to control an incoming or outgoing process by particle size alone. This feature can also be used to classify particles as required by industry standards such as ISO 4406 and NAS 1638 for the oil industry, and USP <788> for therapeutics.

Data Generated in Either Graphical or Spreadsheet Formats

In addition to creating up to 28 shape result histograms in real-time, the Particle Insight can also display data and images in many formats. Statistical information can be shown and printed for all shape measures including sieve-correlations and the automatic creation of spreadsheet files enabling users to have shape information for each particle analyzed.
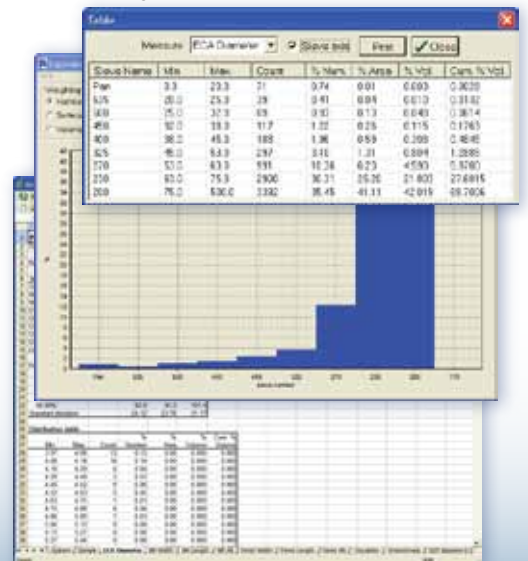
Dynamic Image Analysis

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Shape Model Descriptions

Circle Models
- Equivalent circular area diameter
- Equivalent circular perimeter diameter
- Bounding circle diameter
- Mean radius diameter
- Circularity
- Smoothness
- Compactness

Ellipse Models
- Equivalent elliptical area, width, length
- Bounding ellipse width, length
- Elliptical aspect ratio
- Ellipticity

Rectangle Models
- Bounding rectangle length, width
- Bounding rectangle aspect ratio
- Rectangularity

Polygon Models
- Polygon order
- Interior angle
- Convexity

Fiber Models
- Fiber length, width
- Fiber aspect ratio
- Fiber curl

Irregular Models
- Feret length, width
- Feret aspect ratio
- Surface uniformity

Three Size Range Model Options

Size Range
1 μm - 150 μm
3 μm - 300 μm
10 μm - 800 μm

A recirculating liquid system transports the suspended sample through the sample cell where a CCD camera takes an image of the sample, converts the image to a digital format, and sends the information to the software for final analysis.

FLOW DIRECTION

IMAGE RECORDED

CCD CAMERA

LIGHT SOURCE

Particulate Systems

Specifications

Three Model Options

Model Part Number	Size Range
P01/00000/00	3 μm - 300 μm
P01/00001/00	1 μm - 150 μm
P01/00002/00	10 μm - 800 μm

Physical	Height:	38.1 cm (15 in.)
	Width:	25.4 cm (10 in.)
	Depth:	63.5 cm (25 in.)
	Weight:	13.2 kg (29 lbs)
Electrical	Voltage:	100 - 240 VAC
	Frequency:	50 to 60 Hz
Environment	Temperature:	10 to 45˚C (50 to 113 ˚F), operating; -10 to 55 ˚C (14 to 131 ˚F), non-operating
Computer	Processor:	2 GHz CPU or superior
	Memory:	1 gigabyte of RAM
	Hard Disk Space:	60 gigabytes
	Monitor:	58.42 cm (23 in.) Flat Panel
	Media Drive:	Writable CD or DVD
	Interface:	IEEE 1394 (Firewire "A" type)
	USB connectors:	2 minimum
	OS Systems Supported:	Windows® XP
		Windows 7

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