C060-E016

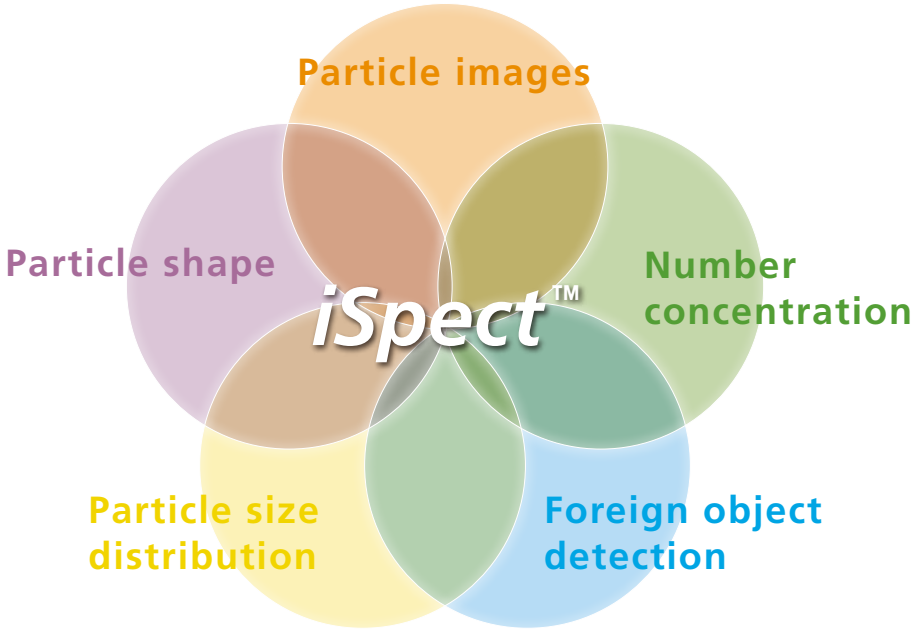
SHIMADZU
Excellence in Science

Dynamic Particle Image Analysis System

iSpect DIA-10

Comprehensive Particle Characterization

Shimadzu's iSpect DIA-10 Dynamic Image Analyzer combines particle size and image analysis technology to offer complete particle characterization. It can perform particle imaging, size analysis, and foreign object detection, and obtain size distributions and number concentration, in as little as two minutes.



Features

- Reliable particle detection system
- Unprecedented functionality and performance
- Easy operation

Reliable Particle Detection System

The system utilizes a microcell and advanced optics to accurately and efficiently detect particles. Using normal lenses, the apparent size of particles can be affected by the depth of the particle relative to the lens. The iSpect DIA-10 uses a telecentric lens that maintains a constant image magnification. This means that no matter where the particle is located in the field of vision, the system will accurately determine the size of the particle. The autofocus function increases the imaging efficiency*1 which makes it possible to accurately detect foreign objects and obtain repeatable number concentration.

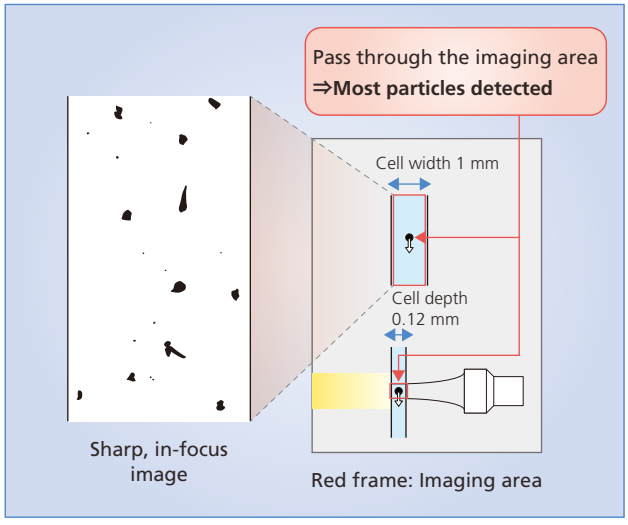
*1: The ratio of the number of sample particle images acquired to the number of particles in the sample that has flowed through the system.

Efficient Image Acquisition

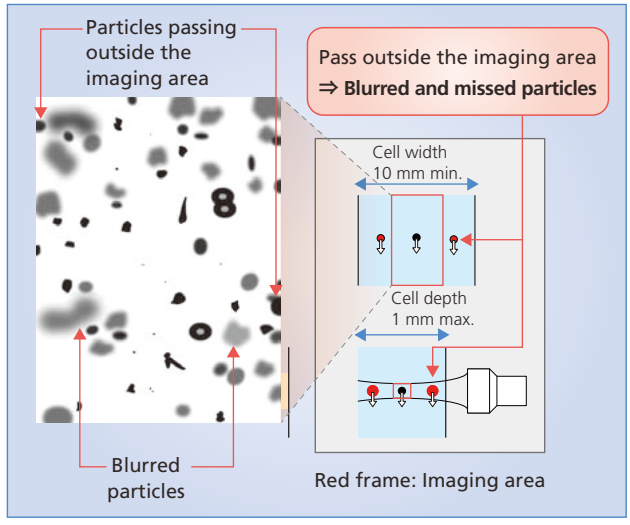
The microcell increases image acquisition efficiency by passing particles through a narrow imaging area, which optimizes the number of particles observed. Compared with a conventional cell and lens, the microcell clearly shows particle images and fewer particles pass outside of the lateral imaging area. This makes it possible to reliably detect particles and obtain highly repeatable number concentration (Coefficient of Variation (CV) ±5 %*2).

*2: When measured using a Shimadzu standard sample. Depends on the sample.

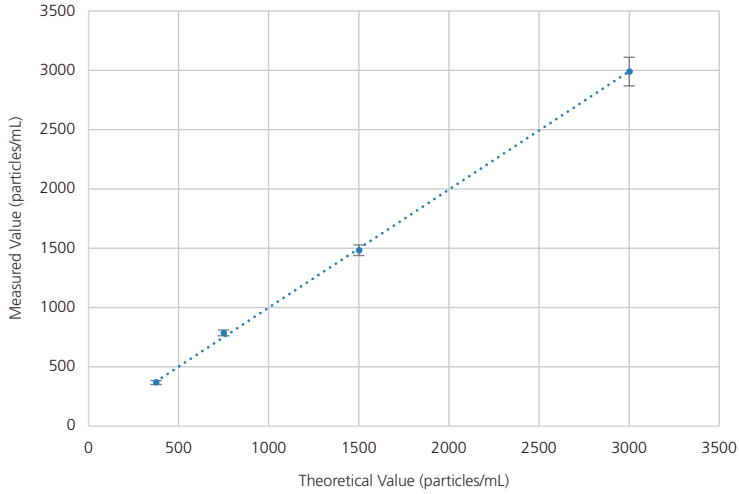
■ Microcell



■ Conventional Cell



■ Example of Number Concentration Measurement



Results of 6 Measurements (The ● mark is the mean, and the error bar is the standard deviation)

Unprecedented Functionality and Performance

Trace Sample Measurement

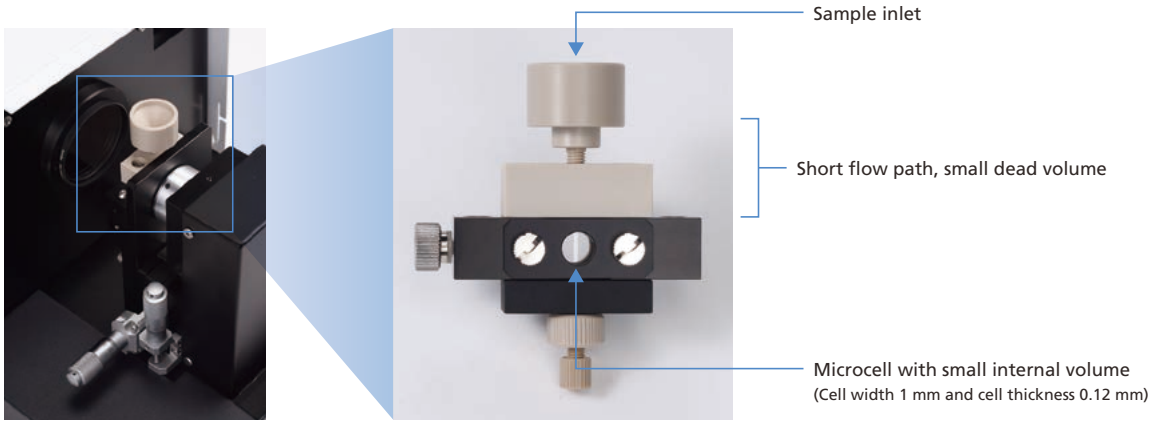
The system can measure sample as small as 50 µL, enabling it to handle trace samples. Samples can be set directly onto the system using a general disposable pipette tip to transfer a sample from a container. This allows simple operation while preventing contamination.

Flow Path Design Provides Small Dead Volume

Microcells with small internal volumes and small dead volume (less than 50 µL) enable cleaning solution to be reduced.

Reduced Use of Organic Solvents

The flow path has excellent resistance to organic solvents. Because of the small amount of organic solvent needed for measurement and cleaning, the system reduces waste and minimizes environmental impact.



Microcell unit

Autofocus Function for Easy Operation

The autofocus function eliminates the need for troublesome focusing and no flow of sample particles is required. By automating the focusing, data variation between operators is prevented, making measurement both easy and stable.

Compact, Easy to Install Design

The compact design (the measurement unit is about 22 cm wide and the pump unit is about 10 cm wide) allows installation in a small space.

Easy Operation

Measurement results are obtained in three steps. Pump operation and particle imaging are performed automatically according to the analytical conditions selected. In addition, particle images can be simultaneously monitored and measured in real time while the sample flows through the unit.

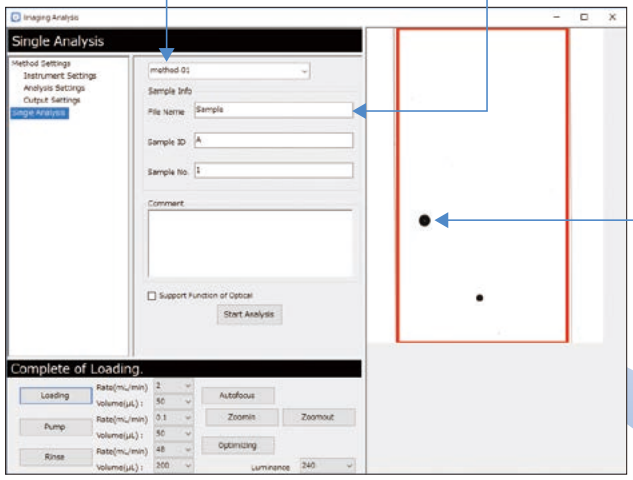
① Set sample

Set sample with a micro pipette

Sample setting is completed by just touching the pipette tip

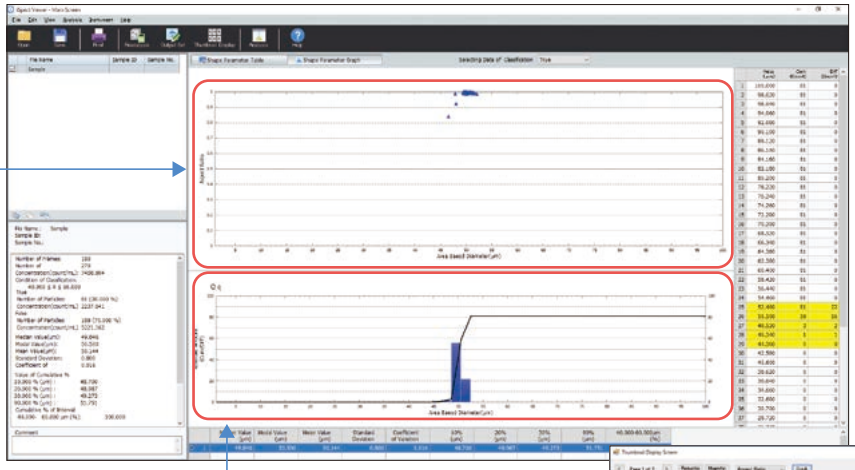
② Select analytical conditions

③ Input file name



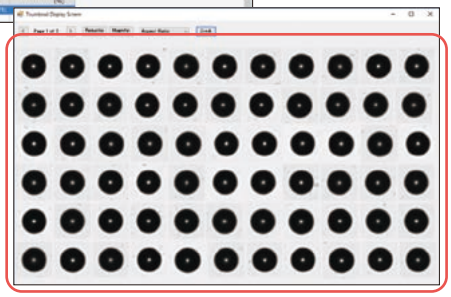
Real-time monitoring of particles during measurement

Display of automatic measurement results



Create a scattergram by selecting two optional measurement items*

Create a histogram (frequency distribution map) for any measurement item



Thumbnail display of detected particle images

* Measurement Parameters (13 Types)

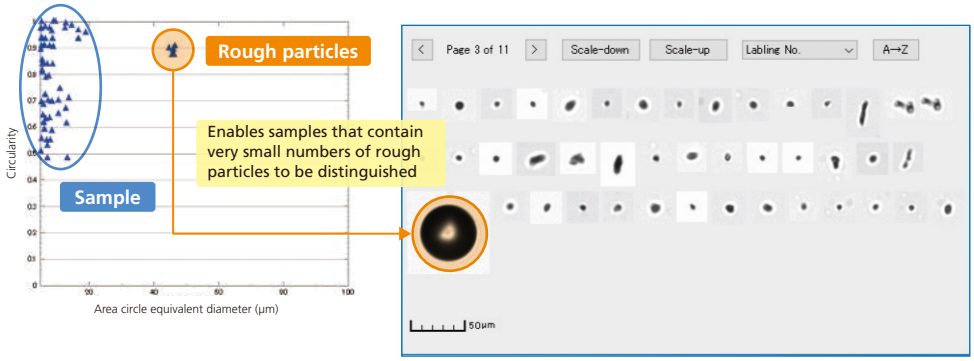
Area circle equivalent diameter, perimeter equivalent diameter, maximum length, maximum perpendicular length, vertical Feret diameter, horizontal Feret diameter, particle perimeter, envelope perimeter, circularity, aspect ratio, horizontal bounding rectangle aspect ratio, particle area, average brightness

Applications

Evaluation of Rough Particles in Paint by Image Analysis

Foreign object detection

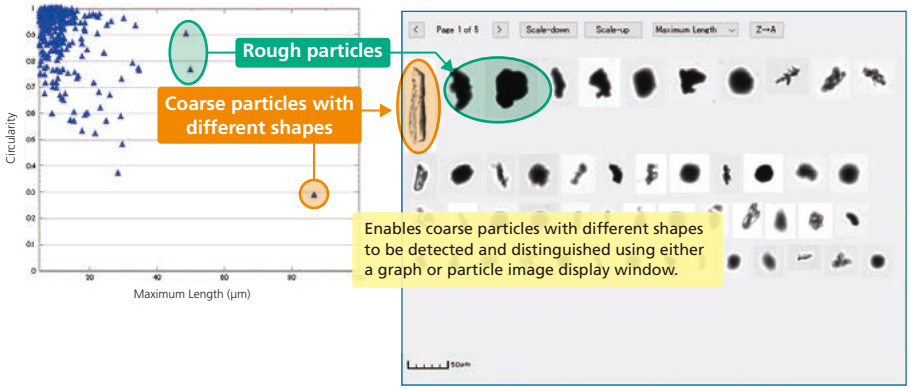
In the paint industry, it is important for pigment particles to be uniform to ensure that the paint has an even finish. The presence of foreign matter or rough particles in pigments can lead to quality issues. Through image analysis, particles with high surface roughness can be clearly detected and distinguished from smoother particles.



Detection of Coarse Particles in Lithium-Ion Battery (LIB) Cathode Material

Foreign object detection

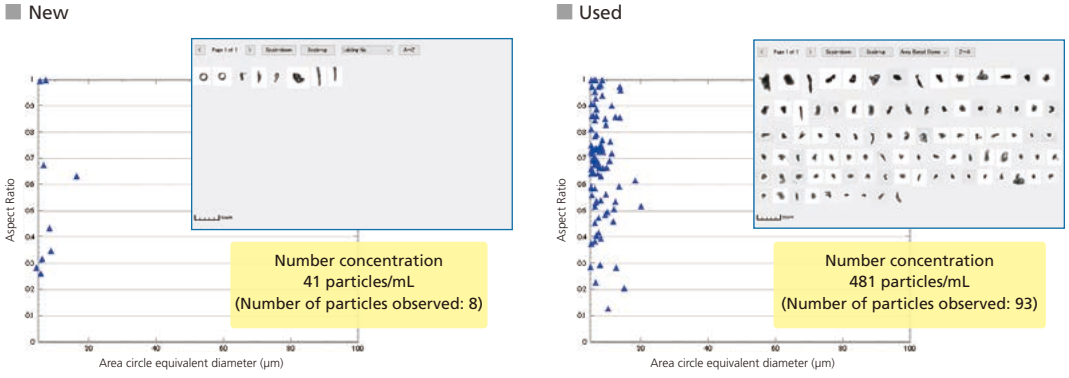
Coarse particles in powder used for LIB cathodes can lead to performance issues and degradation of the material. These particles can be detected and distinguished either through the image analysis window or a plot based on specific parameters. This allows the quality of the powdered raw material to be easily verified.



Evaluation of Particles in Cleaning Solutions for Metal Parts

Number concentration

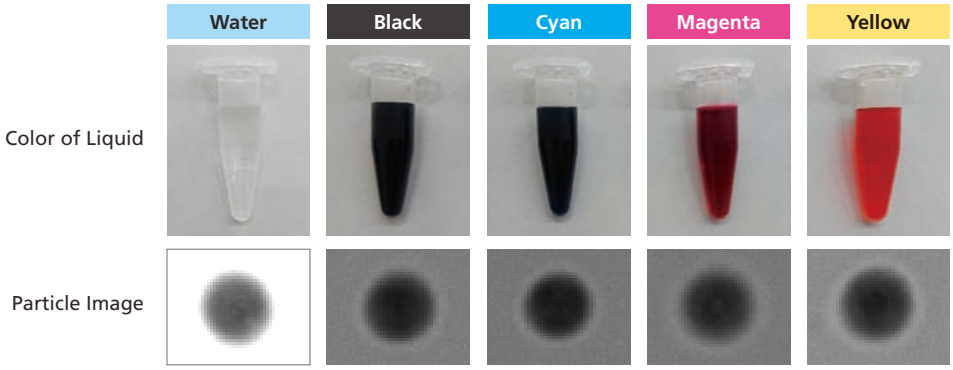
The waste produced after cleaning metal parts can contain insoluble particles that were not in the original cleaning solution. By measuring the insoluble particle concentration after metal components have been cleaned, the degree of contamination as well as potential environmental impact can be observed.



Evaluation of Foreign Matter in Paints by Image Analysis –Enables Measurement of Colored Liquid and Reduces Solvent Usage

Particle image

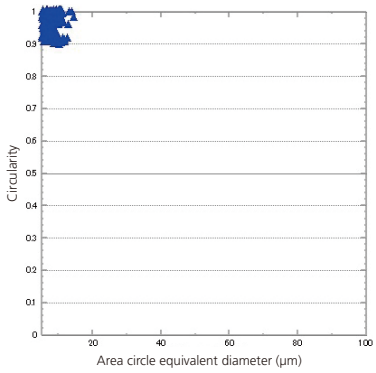
Particle images of latex particles in even dark, colored liquids can be obtained due to the short optical path length (120 µm).

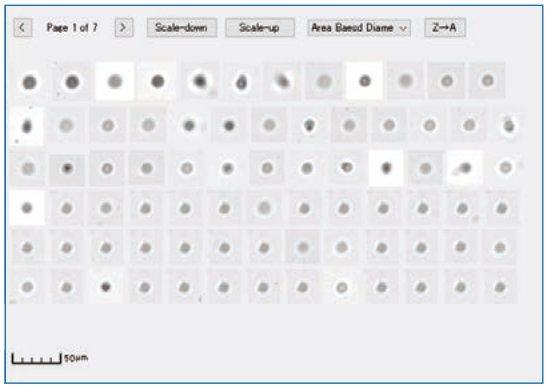


Particle Evaluation of Emulsions

Particle shape Particle size distribution

Particle uniformity is important for the quality of emulsions. It is affected by stirring and emulsification methods. The iSpect DIA-10 can check particle size, particle shape, and particle concentration to demonstrate the quality of emulsions in a single measurement.

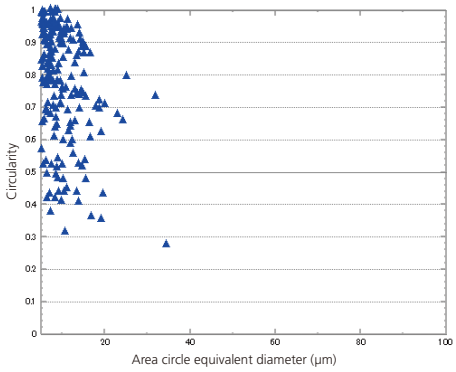




Evaluation of Paint Particles Dispersed in Organic Solvent

Particle shape Particle size distribution

Toluene and methyl ethyl ketones (MEK) are typically used as solvents for paints. Since the system is resistant to most organic solvents, including toluene and MEK, particle size and shape analyses of oil-based paints are possible. The amount of waste is also minimized because of the small sample volume required for measurement.



Specifications

Measurement Method	Dynamic image analysis method
Particle Size Measurement Range*1	5 to 100 µm
Number Concentration*2	Coefficient of Variation (CV) ≦ 5 %
Measurement Parameters	**Particle Size** Area circle equivalent diameter, perimeter equivalent diameter, maximum length, maximum perpendicular length, vertical Feret diameter, horizontal Feret diameter, particle perimeter, envelope perimeter **Shape Analysis** Circularity, aspect ratio, horizontal bounding rectangle aspect ratio **Other Parameters** Particle area, average brightness
Statistical Analysis Items	Average, standard deviation, CV, median (50 % value), mode value, user defined % value
Display Items	Particle image, histogram, scattergram, cumulative distribution, frequency/integration table, user defined area particle count
Required Sample Size	50 to 1000 µL
Pump	Syringe pump, flowrate 0.1 mL/min
Wetted Part Materials	Measurement unit: PEEK resin, fluorine resin, quartz, fluorine rubber Pump unit: Fluorine resin, glass
Power Supply Requirements	115 or 230 V AC, 100 VA, 50/60 Hz
Dimensions/Weight	Measurement unit: W223 × D465 × H205 mm, 10 kg Pump unit: W97 × D190 × H150 mm, 3 kg

*1: Performance guarantee range of area circle equivalent diameter. Measured using a Shimadzu NIST traceable particle size standard sample.
*2: Measured using concentration standard samples specified by Shimadzu.

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