C060-E004

Access to your success
SHIMADZU

IG-1000

Shimadzu
Single Nano Particle Size Analyzer

iG Induced Grating Method

Shimadzu's own revolutionary particle size measurement method

Voyaging into the Single Nano Region

IG-1000

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Single Nano Particle Size Analyzer

High-Sensitivity Analysis of Single Nanoparticles

Optical signals emitted by the diffraction grating formed by the particles, not scattered light emitted by the particles, is used for measurement, so even in the single nano region, a sufficient S/N ratio can be obtained and stable measurement with good reproducibility is possible.

Resistance to Contamination

The new measurement principle is resistant to contamination, so even if the sample is mixed with small amounts of foreign particles, information about the particles to be analyzed is captured reliably. This means that the filtering of samples in order to remove coarse particles is not required.

High Reproducibility

The new measurement method ensures high reproducibility and the acquisition of stable data. In particular, high reproducibility for particle sizes of less than 10 nm removes the uncertainty and vagueness of particle analysis in the single nano region. Also, comparison with raw data of diffracted light is possible, so rough validation of the measurement results can be performed simply.

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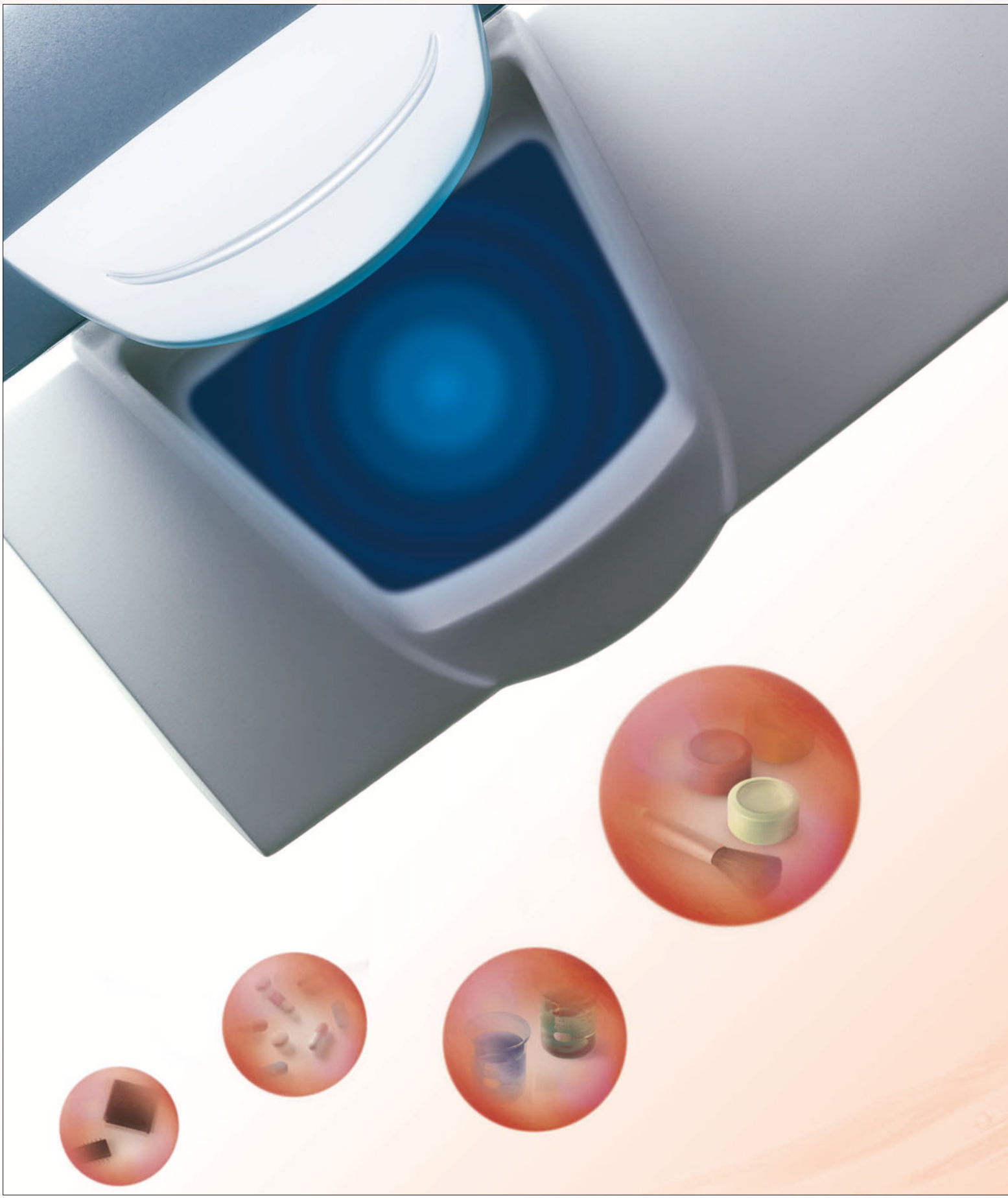


Voyaging into the Single Nano Region

The IG-1000 Single Nano Particle Size Analyzer: An Instrument That Goes Beyond the Single Nano Region and Enters the Sub-Nano Region

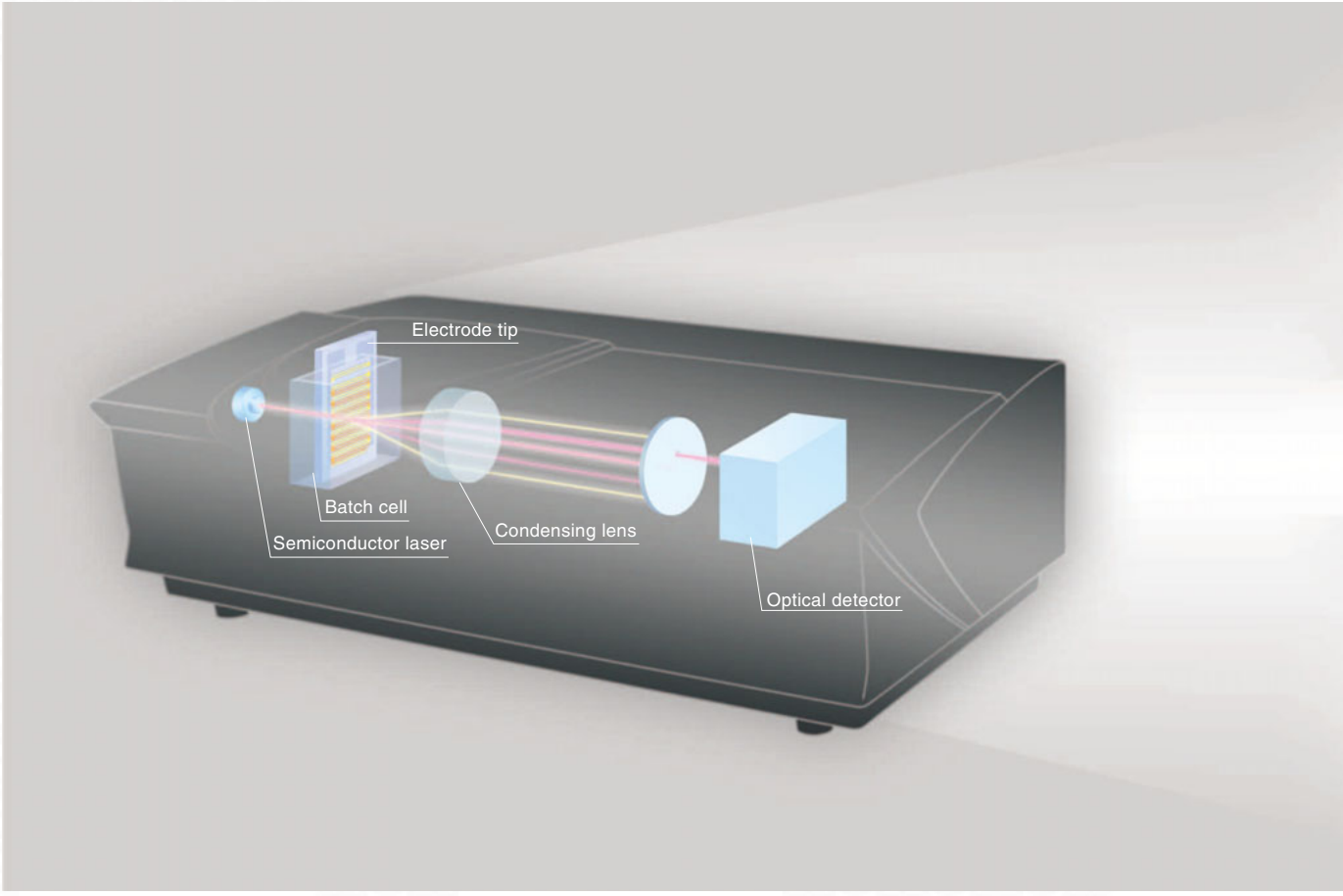
This instrument uses the induced grating (IG) method, which is based on a new principle for measuring the size of nanoparticles using the phenomenon of dielectrophoresis and diffracted light.

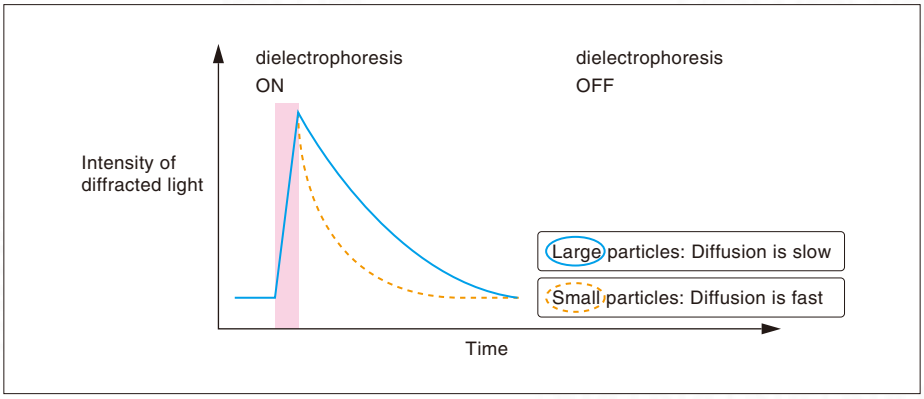
With dynamic light scattering, the conventional method, the light scattered by particles decreases sharply for particle sizes of less than 100 nm. Furthermore, in the single nano region (i.e., particle sizes of less than 10 nm), there are physical restrictions that make it difficult to detect scattered light, and the measurement of particle sizes also becomes difficult. The IG method does not use scattered light ;as a result, it is free from these physical restrictions, and does not require the input of the refractive index as a measurement condition. It therefore allows the size of nanoparticles to be measured simply and with high sensitivity. It is particularly effective in the analysis of single nanoparticles.

The Principle Behind the Clarity

What Is the "Induced Grating Method"?

The concentration of nanoparticles expresses itself as the amount of change in the refractive index of the medium. Consequently if a cyclic concentration distribution of the particles is formed in the medium by an external force, it functions as a diffraction grating. If the external force is removed, the diffraction grating disappears. With the IG method, the decay process of this particle density diffraction grating is measured via the change in intensity of the diffracted light, and a diffusion coefficient is obtained.

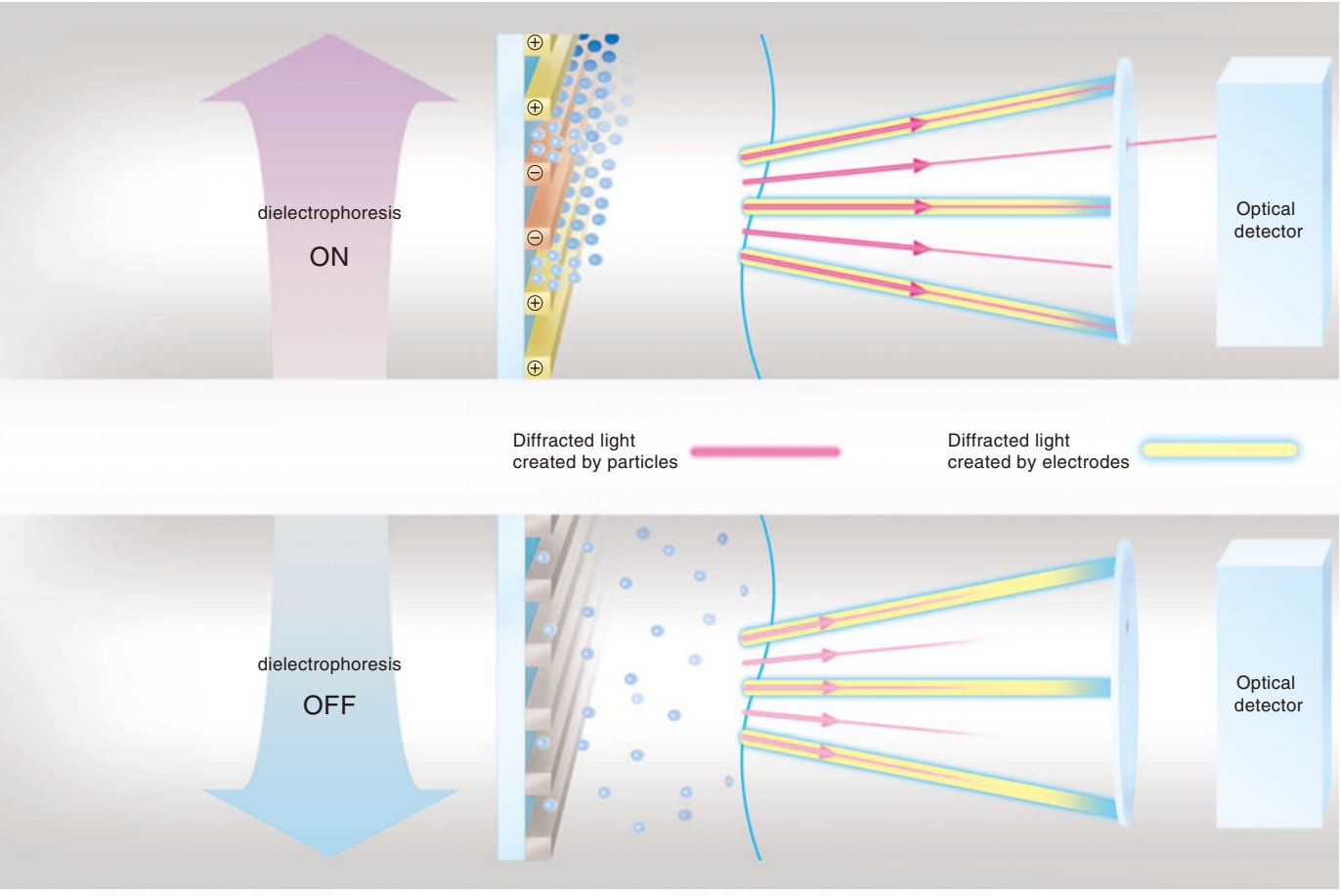




Variation in Intensity of Diffracted Light over Time

Diffraction Grating Consisting of Microscopic Particles Formed by dielectrophoresis

An alternating voltage is applied to cyclically arranged electrodes, and a cyclic concentration distribution of microscopic particles is formed in the liquid by dielectrophoresis. Although the cyclic concentration distribution of microscopic particles acts as a diffraction grating (a particle concentration diffraction grating), if the alternating voltage is stopped, the grating diffuses and disappears (patent pending).



Key Point of IG Method
-Precision Measurement Achieved with Modification of Electrode Configuration-

The cyclically arranged electrodes also function as a diffraction grating. The diffracted light created by this electrode diffraction grating is weaker than the diffracted light created by the particle concentration diffraction grating. In order to precisely measure the changes in the primary diffracted light resulting from the diffusion of the particle concentration diffraction grating, it is essential that the positions of the two forms of primary diffracted light do not coincide. For this purpose, the electrode configuration is modified as shown in the figure so that the pitch of the electrode diffraction grating is half that of the particle concentration diffraction grating (patent pending).

Detailed Visualization of Reliable D

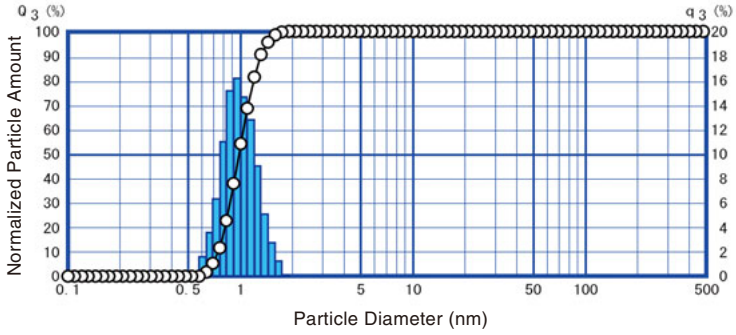
Measurement Data

The following data was obtained by analyzing various sample particle groups of various sizes using the IG-1000 single nano particle size analyzer.

Fullerene Hydroxide

Fullerene hydroxide, which is a typical material of samples in the single nano region, can be analyzed with high reproducibility.

Particle Size Distribution (Volumetric Basis)

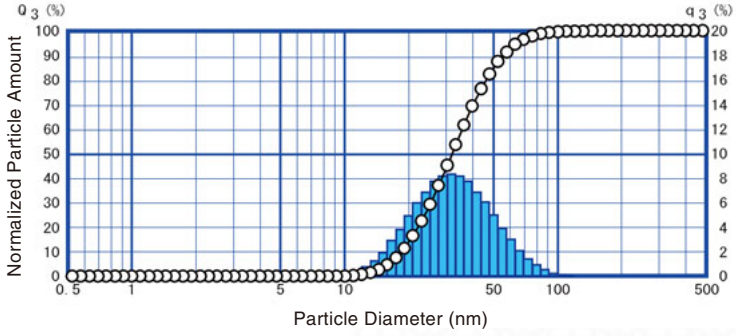


(Sample provided by Prof. Kokubo of Osaka University)

Silica Sample with Broad Distribution

Even with samples covering a wide distribution, there is no bias toward larger particles, and the existence of smaller particles is captured accurately.

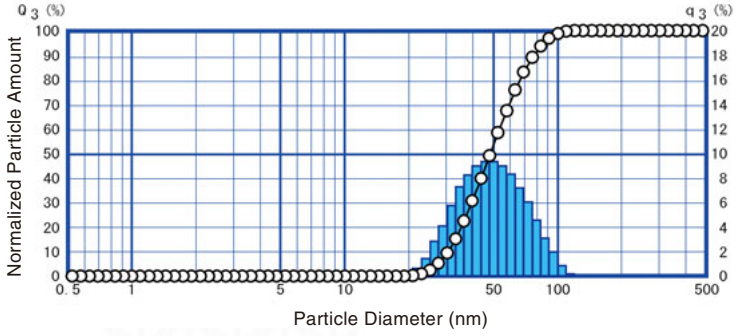
Particle Size Distribution (Volumetric Basis)



Samples Containing Contamination

Measurement results are not affected by minute quantities of contamination. (The example shows the results obtained for a sample with a distribution centering on a diameter of 50 nm that contains a 1% concentration of 1-μm particles.)

Particle Size Distribution (Volumetric Basis)



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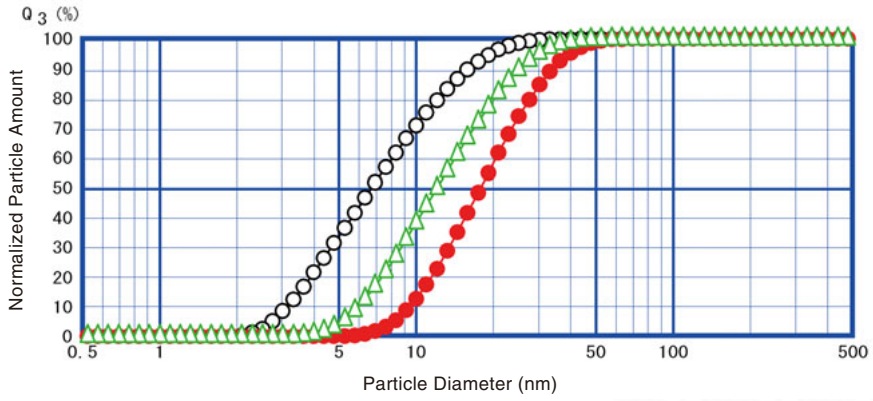
Analysis of Mixed Samples

Mixed samples can also be evaluated. The IG method uses the diffusion of the diffraction grating created by particles; therefore the signal size does not depend on the particle size. This means that evaluation of mixed samples is possible. With methods based on scattered light, even if the volume is the same, the signal size is proportional to the cube of the particle diameter, so the evaluation of mixed samples is difficult.

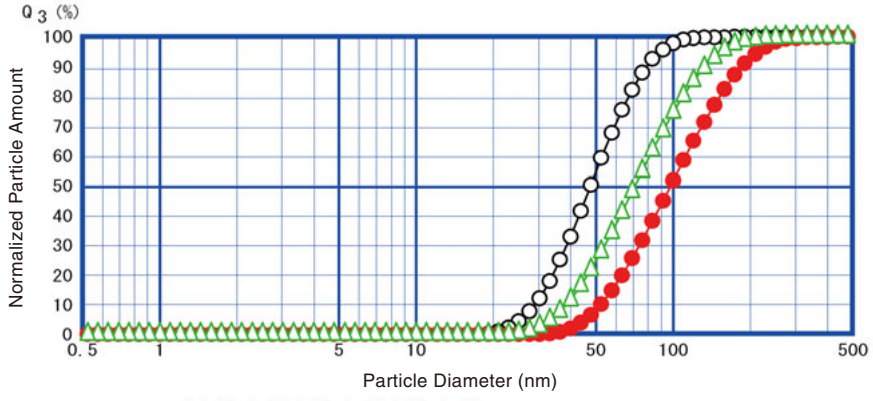
Colloidal silica

Particle Size Distribution (Volumetric Basis)



Polystyrene latex

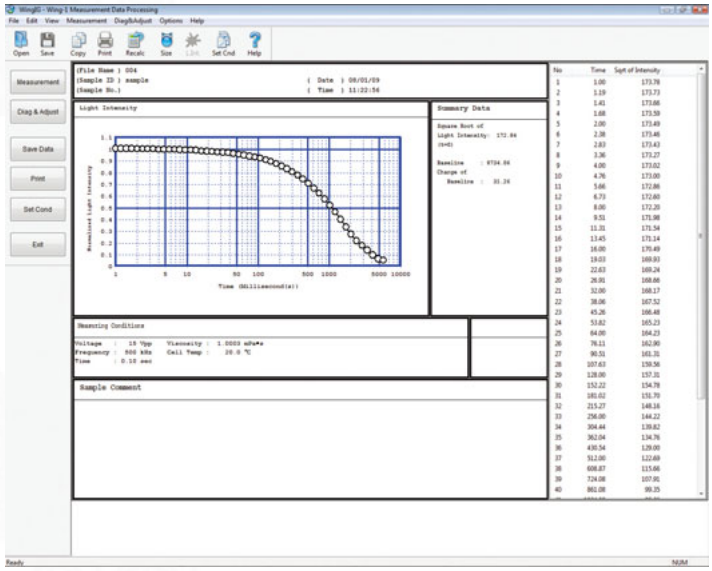
Particle Size Distribution (Volumetric Basis)



Powerful Functions for Supporting

Applying Data on Changes in the Intensity of Diffracted Light (Decay Process)

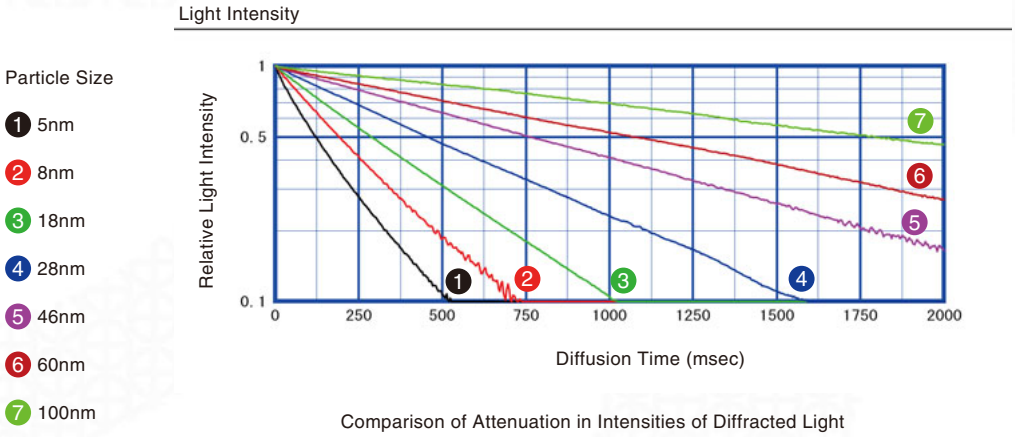
In addition to the measurement results for particle size distributions, data on changes in the intensity of diffracted light (i.e., the decay process) can also be used. This data can be output to Excel, allowing users to try out their own analytical techniques.



Window of Wing-1 Control Software

Measurement Results Validated Using Changes in the Intensity of Diffracted Light (Decay Process)

If the particles are relatively small, the attenuation gradient is relatively high, whereas if the particles are relatively large, the attenuation gradient is relatively small. This means that the relative (average) sizes of particles can be ascertained at a glance.



Comparison of Attenuation in Intensities of Diffracted Light

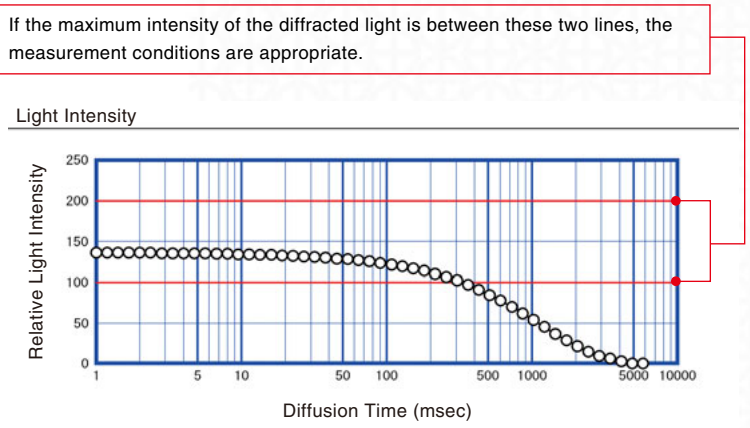
Measurement

Optimal Measurement Conditions Checked with Intensity of Diffracted Light

Setting the following three parameters is required. The optimum parameters are selected using six levels of condition setting files.

Application duration: 10 to 1,000 ms
Applied voltage: 5 to 35 Vpp
Frequency: 100 kHz to 1 MHz

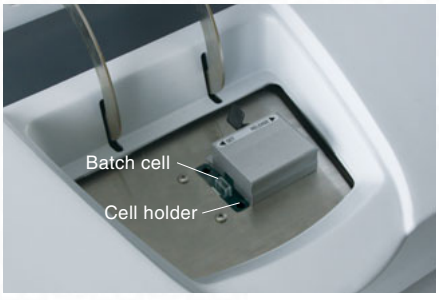
It is possible to check whether or not the optimum measurement conditions are set using the optical intensity level and the upper and lower limit lines displayed on the screen.



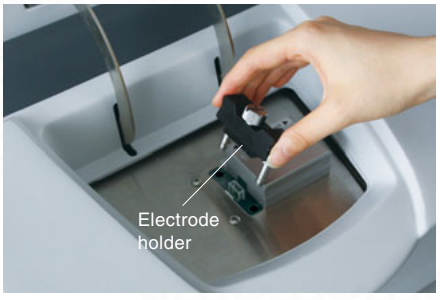
Window for Checking the Level of the Diffracted Light Intensity

Samples Set with Three Simple Steps

A simple workflow allows measurement to be performed smoothly.



1. Inject the sample (a liquid containing dispersed microscopic particles) into the batch cell, and insert the batch cell into the cell holder.



2. Insert the electrode holder from directly above the batch cell.

3. Move the lock lever to the SET position. After this, you just have to close the lid and press the measurement button to start operation.

Specifications

Hardware

IG-1000		P/N:347-61500-10
Measurement Principle		Induced grating (IG) method
Measurement Range		0.5 to 200 nm
Measurement Time		30 sec (from the start of measurement to the display of results)
Sample Liquid Volume		250 to 300 µL
Measurement Unit	Light Source	Semiconductor laser (wavelength: 785 nm; output: 3 mW)
	Light-receiving Unit	Photodiode
	Cell	Batch cell (material: Pyrex glass*1)
Output Terminal		Serial output (connector type: D-Sub, 25 pin, female)
Operating Environment		Temperature: 15°C to 35°C
		Humidity: 20% to 80% (without condensation)
Power Supply		AC 100V / 115V / 230V ±10%, 50/60 Hz
Size and Weight		600 (W) x 400 (D) x 200 (H) mm, approx. 15 kg

*1: Do not use the kind of solvents that may damage Pyrex glass.

* : Measurement is possible as long as the conductivity of the sample liquid does not exceed 400 µS/cm (microsiemens per centimeter). (For example, saline and seawater cannot be used for measurement unless they are greatly diluted.)

PC

OS	Windows Vista (SP1 or later) or Windows XP (SP2 or later)
CPU	Must satisfy requirements of operating system.
Memory	Must satisfy requirements of operating system.
Display	Must satisfy requirements of operating system.
Printer	Must satisfy requirements of operating system.
Hard disk drive	Must satisfy requirements of operating system.
CD-ROM drive	Required for software installation
Serial port	1 port for connecting with IG-1000

* : PC set should be supplied locally.

Standard Accessories

Part Name	Part Number	Quantity
Power cable (for 100V or 115V / for 230V)	071-60815-08 / 071-60814-05	1
Fuse, 2A (100 / 115V) / 1A (230V)	072-02004-19 / 072-02004-16	2
RS-232C Cable	088-50913-11	1
Electrode Tips (set of 5)	347-61530	1
Cells (set of 2)	347-61531	1
Cell Packing	347-61389	5
Electrode Cleaners (set of 50)	347-61561-02	1
Electrode Holder/Cell Stand	347-61372	1
Electrode Cleaning Receptacle	347-61373	1
Air Blower	086-78801-01	1
Cell Cleaners (set of 50)	347-61562-01	1
Wipers, 15 x 15 cm (set of 150)	086-72609-01	1
Coupler (hose side)	035-60929-18	2
Hose Band	037-61019-01	4
Instruction Manual	347-06826	1

Special Accessories

Part Name	Part Number	Notes
Micropipette	046-00330-06	Volume adjustable in the range 10 to 1,000 µL, 1 box of pipette tips (set of 96)
Replacement Pipette Tips	046-00331-14	1 box of pipette tips (set of 96)

Parts Required for Installation

The following parts are required for installation of the product.

Parts Purchased from Shimadzu

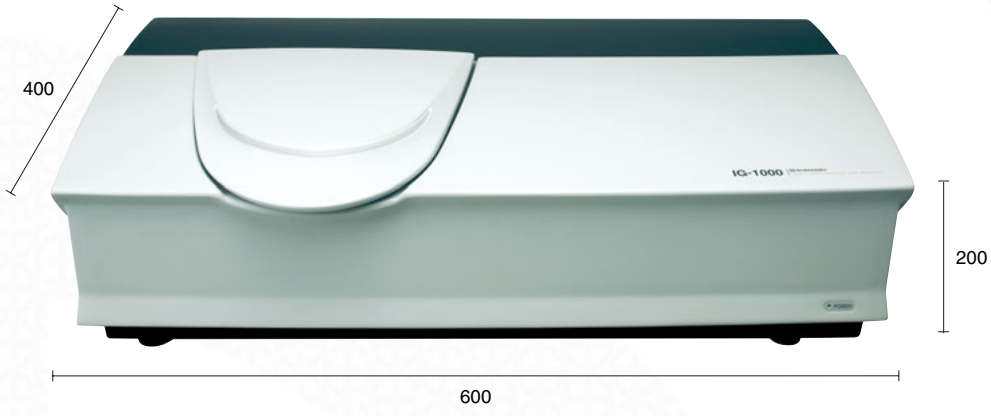
Part Name	Part Number	Notes
Reference Sample Set	347-61015	Reference samples (particle size: 50 nm), 2 vials
WingIG	347-64470	Specialized IG-1000 software.

Parts Provided by the Customer

Name	Specifications
Micropipette*	Required to inject samples into the cell. Provide a micropipette that can measure out 200 µL with an accuracy of 5%.

* : Sold by Shimadzu as a special accessory and can therefore be ordered from Shimadzu if necessary.

Dimensions (mm)



A Particle Size Analyzer That Can Ha

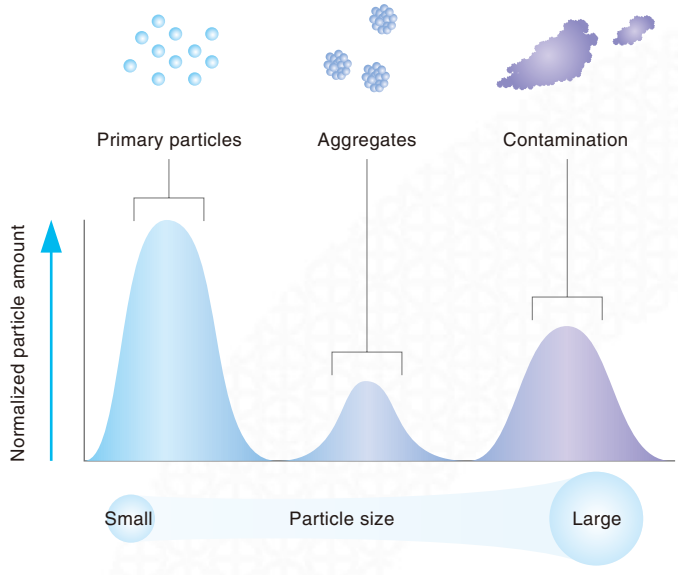
Nanoparticle Size Analyzer

SALD-7101

Measurement of Changes in Particle Size Due to Diffusion, Aggregation, and Dissolution

In addition to primary particles, aggregates and contamination can be analyzed at the same time.

- Leads the world in its use of a 375-nm ultraviolet semiconductor laser.
- Measurement range: 10 nm to 300 µm
- Measurement principle: Laser diffraction/scattering method



Features

- The particle size distribution in the range of 10nm to 300µm can be measured at 1-s intervals.
- The particle size distribution can be measured in a wide particle concentration (volume concentration) range of a few ppm to 20%.
- The particle size distribution can be measured in highly viscous liquid media.
- Particles in film can be analyzed.
- The sizes of microbubbles and nanobubbles can be measured in real time.

ndle the Nano to Micron Range

SALD-7101 System Configuration

PC

Measurement Unit (Optical System)
SALD-7101

Provided with standard software.

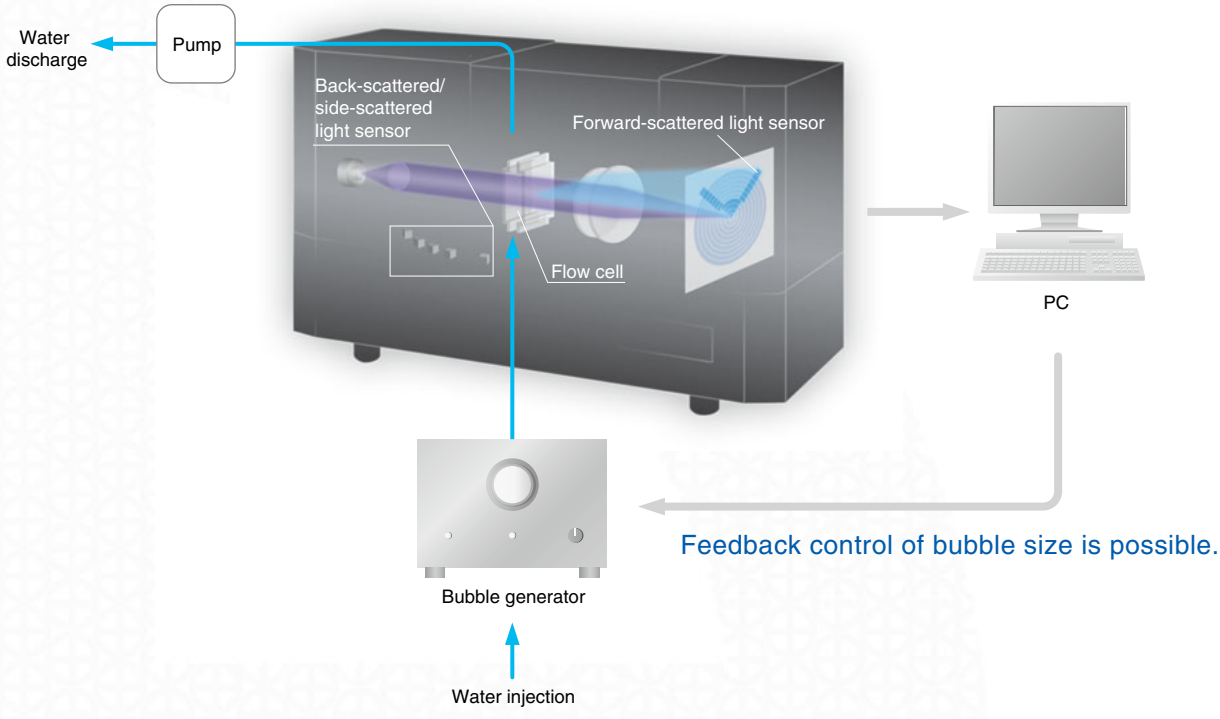
Multifunctional Sampler
SALD-MS71

Batch Cell
SALD-BC71

High-Concentration Sample Measurement System
SALD-HC71

Microbubble and Nanobubble Size Measurement Using SALD-7101

Measurement is possible with one range that encompasses both nanobubbles and microbubbles. This instrument can perform real-time measurement and can therefore be used as a monitor.



Lineup of Particle Analyzers

Laser Diffraction Particle Size Analyzers

SALD-3101	(measurement range: 0.05 to 3,000 μm)
SALD-2201	(measurement range: 0.03 to 1,000 μm)
SALD-301V	(measurement range: 0.1 to 350 μm)
SALD-201V	(measurement range: 0.25 to 350 μm)

JQA-0376

Founded in 1875, Shimadzu Corporation, a leader in the development of advanced technologies, has a distinguished history of innovation built on the foundation of contributing to society through science and technology. We maintain a global network of sales, service, technical support and applications centers on six continents, and have established long-term relationships with a host of highly trained distributors located in over 100 countries. For information about Shimadzu, and to contact your local office, please visit our Web site at **www.shimadzu.com**

SHIMADZU

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Printed in Japan 4199-10803-30ANS