Measurement of Mixed Nanoparticles

The completely new Single Nano Particle Size Analyzer IG-1000 uses a new particle size measurement technology "Induced Grating (IG) Method."

On the IG-1000, a diffraction grating is formed by the action of dielectrophoresis on particles, and after dielectrophoresis is suspended, the decay of the diffraction grating due to diffusion is detected as temporal changes in the intensity of the diffracted light. Since the diffusion speed increases the smaller the particle size becomes, and vice versa, the particle size can be found from these temporal changes in the intensity of the diffracted light.

The measurement of so-called nanoparticles having a particle size of 100 nm or less and a broad distribution has been very difficult by conventional measurement methods that use scattered light. The cause of this difficulty is considered to lie in the dependency on particle sizes that have a strong intensity of scattered light.

With nanoparticles, the intensity of scattered light caused by the size of particles in the same volume is roughly proportional to the particle size to the power of 3. When particles have a broad distribution, scattered light from large particles becomes extremely strong and scattered light from small particles becomes extremely small. As a result, the accurate evaluation of the information of small particles is considered to be difficult.

On the other hand, the new measurement technology, the IG method, uses diffracted light and not scattered light. Because the intensity of diffracted light signals (i.e. the square root of the intensity of diffracted light signals) caused by particles in the same volume is not dependent on particle size, the information of large particles through to small particles in even broad particle size distributions can be accurately evaluated. Table 1 shows the relationship between signal size and particle size in each respective measurement technology.

Particle size / Measurement technology	1nm	100nm
IG method	1	1
Scattered light method	$\frac{1}{1,000,000}$	1

Table 1. Relationship between signal size and particle size
* Comparison of all signal size caused by particles in the same volume

On the IG-1000, we measured a sample made by mixing two types of silica particles (label size 5 nm, 8 nm) containing single nanoparticles in a 1:1 ratio. Graph 1 shows a comparison of the measurement results in three forms; each particle type (5 nm and 17 nm) before mixing and the mixture of the two.

The measurement results of the sample made by mixing two types of silica particles containing single nanoparticles show a broad distribution that includes each of the particle size distributions. From this, we found that the particle size distributions of the particle mixtures are accurately shown.

The IG-1000 can accurately measure the particle size distribution of nanoparticles having a broad distribution, which has up till now been difficult by other methods.

Particle Distribution (Volumetric Basis)

Legend:
△ : 5 nm silica

● : 17 nm silica

○ : 5 nm + 17 nm silica (1:1 mixture)
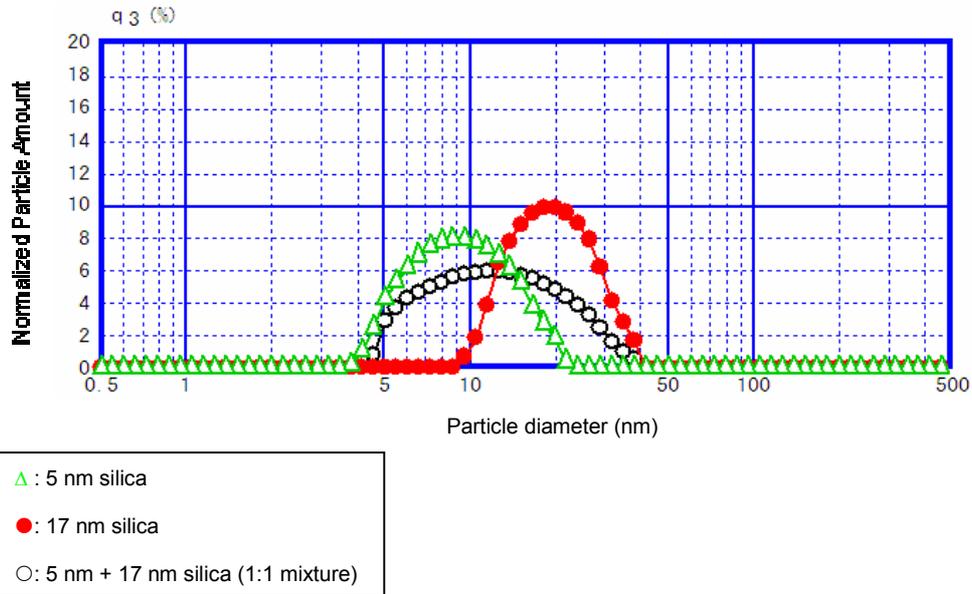
Graph 1. Measurement Results of Silica Mixed Particles

* Valuation of label size conforms to the specific surface area method.

NOTES:

* This Application News has been produced and edited using information that was available when the

data was acquired for each article. This Application News is subject to revision without prior notice.