SHIMADZU
Excellence in Science

Application Data Sheet

No. AD-0071

SALD-2300

Evaluation of Light Intensity Distribution and Particle Size Distribution of Mixture Particle

❑ Introduction

The particle size distribution analyzer is useful to confirm the size, width and number of peaks. Shimadzu's laser diffraction particle size analyzers, the SALD series, obtain particle size distribution together with light intensity distribution. The light intensity distribution shows the scattered light intensity from sample particles on each sensor element. The peak intensity gives information on whether the sample concentration is suitable or not prior to measurement. The light intensity distribution is the raw data, has unique pattern for different size distribution, and it can be used in pre- and post-measurement. Hence, it can be used to check whether the particle size distribution is correct or not, especially when measuring samples with unknown particle mixture . Here we introduce the analysis results of single and mixture samples with both the particle size distribution and the light intensity distribution.

❑ Samples

Two samples of different particle size distribution were used for the measurement. Figure 1 and 2 show the particle size distribution and light intensity distribution pattern of the sample with 10µm at 50% diameter size, whereas Figure 3 and 4 show 1µm particles at 50% diameter size.
Samples are White Morundam/WA (Al_2O_3 99.6%) #1500 and #8000 by Showa Denko K.K.
10µm sample : WA#1500, 50% diameter: 10.5±1.0µm by Sedimentation measurement method [1)]
1µm sample : WA#8000, 50% diameter 1.2±0.3µm by Electrical sensing zone method [1)]

❑ Measurement Condition

Instrument	: SALD-2300
Accessory	: SALD-MS23
Dispersing medium	: Pure Water
Dispersing agent	: 0.1% Sodium Hexametaphosphate
Sample form	: Suspension
Refractive index	: 1.75 - 0.20i

❑ Results and Discussion

- 10µm Sample

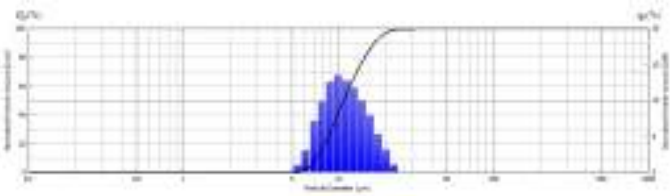

Figure 1: Particle size distribution of 10µm Al_2O_3

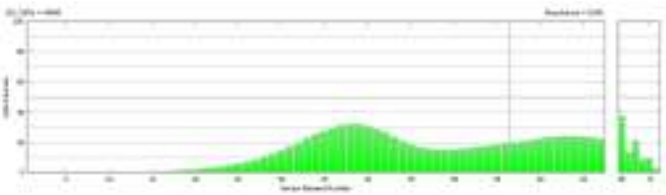

Figure 2: Light intensity distribution of 10µm Al_2O_3

- 1µm Sample

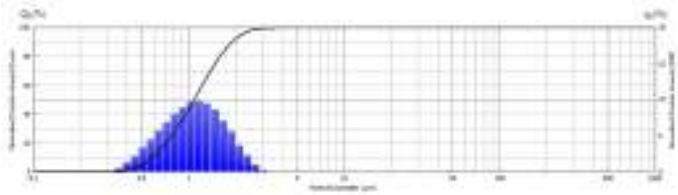

Figure 3: Particle size distribution of 1µm Al_2O_3

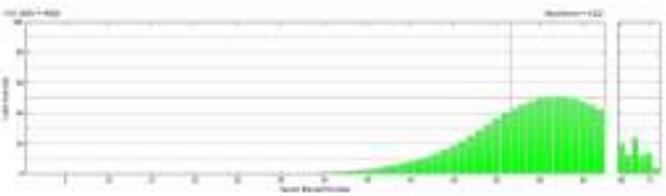

Figure 4: Light intensity distribution of 1µm Al_2O_3

The scattered light of bigger particles goes into smaller angle sensors, and smaller particles are detected by larger angle sensors. Particle size and distribution are estimated from raw data as shown in this light intensity graph.

Mixture of 1µm and 10µm

Figure 5 shows six different particle distribution curves. These samples comprised a mixture of 1µm and 10µm of Alumina (Al_2O_3) powder with different mixing ratio.
When the amount of 1µm particle is more than 17%, the measurement results are accurate at 1µm vol.% on the accumulative curve (Q3). When the amount of 1µm particle is less than 13%, the results of concentration become lower than actual concentration.
Figure 6 shows the light intensity distribution curves of six different samples having the same mixing ratio as in Figure 5. The light intensity distribution curve for 10µm and 1µm is shown in Figure 2 and Figure 4 respectively. The intensity of the peak between 60th and 65th (red arrow) shows the amount of 1µm powder has nearly equivalent intervals of 1µm mixing percentage.

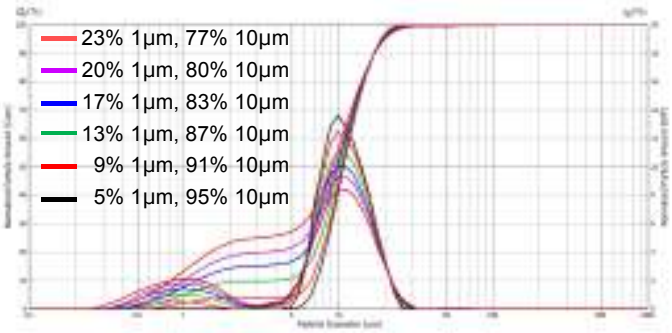

Figure 5: Overlay particle size distribution (5 – 23%)

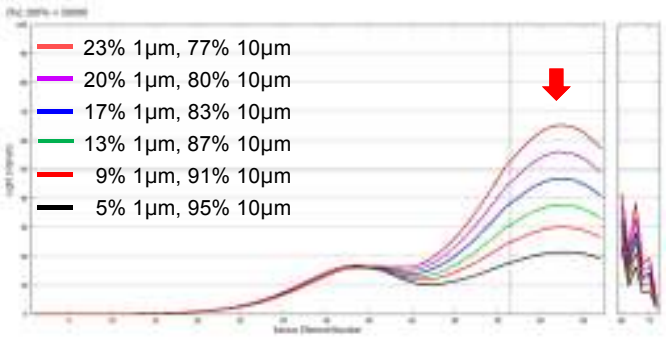

Figure 6: Overlay light intensity distribution (5 – 23%)

Figure 7 shows four different lower concentrations. The particle size distribution curves of 0 - 5% are the same, and there is no peak around 1µm (blue arrow). However, in the particle size distribution of 7% sample, small peaks are observed around 1µm particle. Figure 8 shows the enlarged distribution graph of 7% sample.

The light intensity distribution in Figure 9 shows the clear difference among four different concentration samples. We can confirm the difference between 0% and 1% by the light intensity distribution curves. (red arrow)

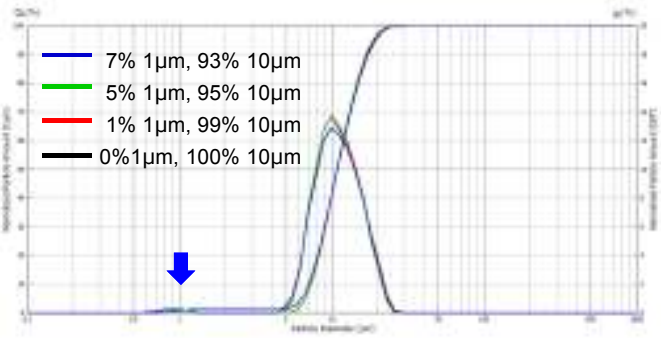

Figure 7: Overlay particle size distribution (0 – 7%)

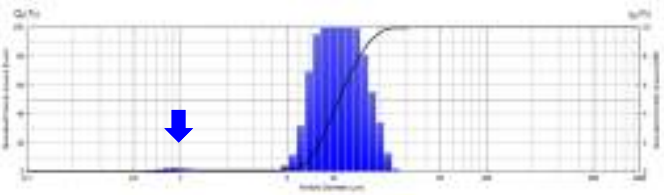

Figure 8: Particle size distribution of 7% 1µm sample

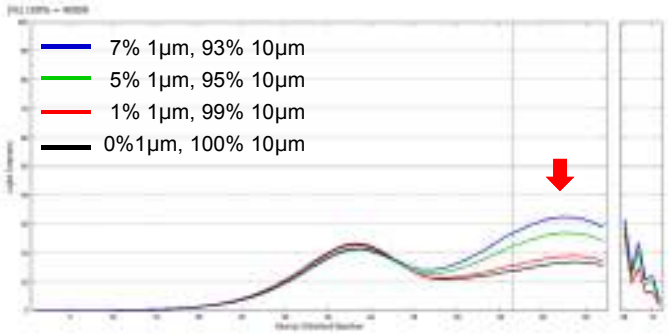

Figure 9: Overlay light intensity distribution (0 - 7%)

❑ Conclusions

The light intensity distribution pattern is an extremely useful tool to avoid inaccurate results in samples which contain smaller size contaminants or unknown samples. It is applicable in laser diffraction and scattering method to determine the accuracy of the results.

❑ References

1) Bonded Abrasive Micro Grain Sizes JIS R6001-1998

SHIMADZU
Excellence in Science

SHIMADZU (Asia Pacific) Pte. Ltd
79 Science Park Drive, #02-01/08, Cintech IV, Singapore 118264
www.shimadzu.com.sg
Tel: +65-6778 6280 Fax: +65-6778 2050