

## Evaluation of the Physical Properties of Nano Materials

### Evaluation of Carbon Black Particle Size Distribution and Specific Surface Area / Pore Distribution

#### Overview

Carbon black is superior in terms of electrical and thermal conductivity and has been utilized for various industrial purposes (as a material for electrodes, a rubber/plastic filler, a pigment etc). Carbon black is known to have a complex structure, with the spherical particles assuming the form of a primary aggregate or a secondary aggregate (agglomerate). Here, physical properties of carbon black (granule size, surface state) will be evaluated from many angles, and the aggregation state analyzed.

#### Samples Measured

12 types of carbon black (granules for JIS Z8901 test)  
 Particle size range: 30 - 200 nm (microscopic measurement)  
 True density: 1.8 g/cm<sup>3</sup>

#### Apparatus

##### ■ Particle Size Distribution Measurement System

###### Microtrac MT3000 II Series

Measuring range: Particle size distribution  
 = 0.02-2000 μm  
 Compatible with JIS 8825-1 / ISO 13320-1

##### ■ Specific Surface Area / Pore Distribution Measurement System BELSORP MINI X

Measuring range: Minimum specific surface area  
 = 0.01m<sup>2</sup>/g  
 (N<sub>2</sub>, sample density)  
 Pore distribution = diameter 0.7-500 nm  
 Compatible with JIS Z 8830/ISO 9277, JIS Z 8831-2,-3/ISO 15901-2,-3 and JIS K 6217-7/ISO 18852



#### Discussion

##### ■ Particle size and slurry dispersion status evaluation

- The mean particle size determined by the gas adsorption BET method was equal to the slurry particle size determined by laser, thus indicating that the dispersing agent (neutral surfactant) manifested its efficacy including appropriate slurry formation.
- The particle size was slightly larger when determined by laser. This suggests the existence of a secondary aggregate within the slurry.

##### ■ Structure of dry form aggregation

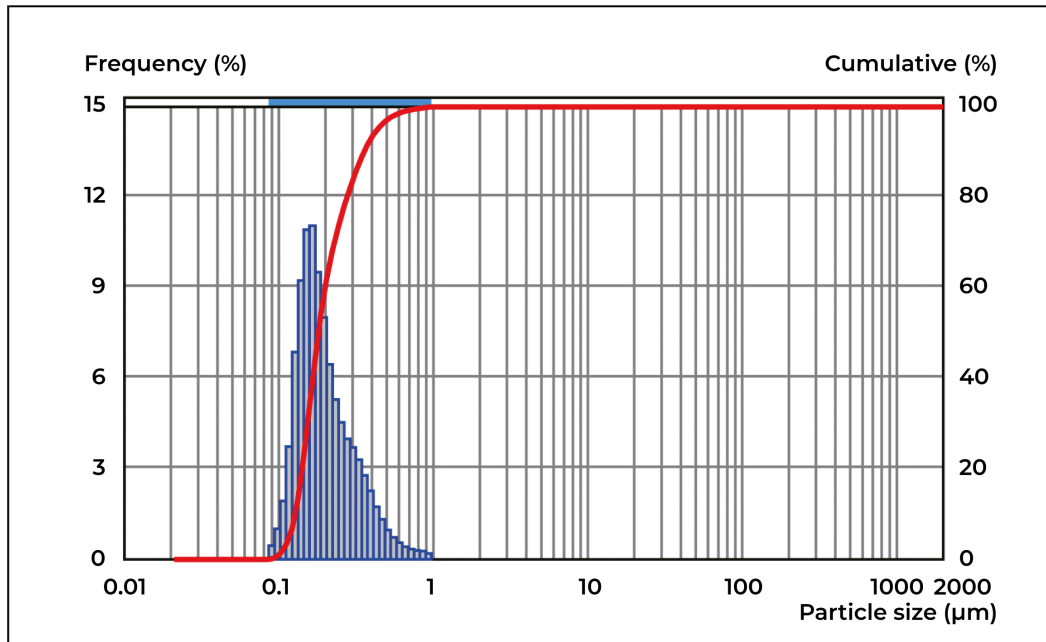
- Micro-pore (2 nm or less in diameter) was shown to be absent in the primary aggregate.
- The presence of pores (200 nm, 0.385 cm<sup>3</sup>/g) as the voids within the secondary aggregate was shown.

#### Conclusions

Multi-angle evaluation using the “laser diffraction / light scattering type particle size distribution measuring system” and the “fixed capability gas adsorption type specific surface area / pore distribution measuring system” allowed a more profound analysis of the physical properties of carbon black not possible with a single technique.

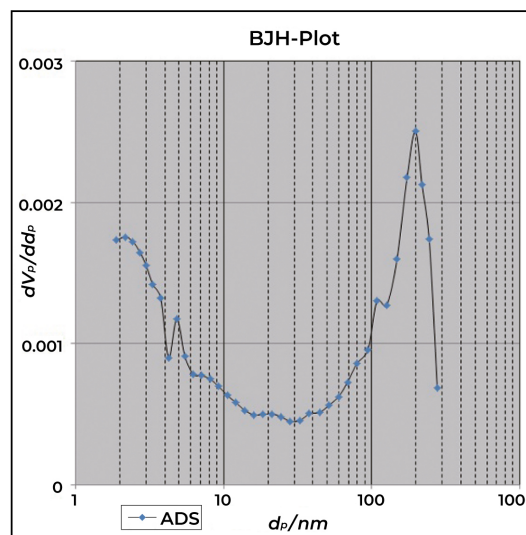
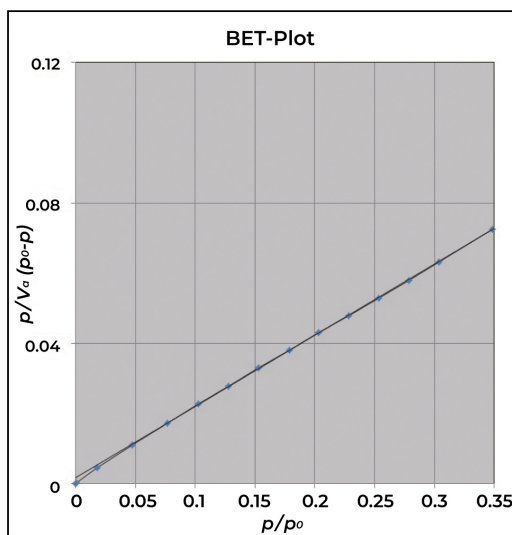
Results of Measurement

■ Microtrac MT3000 II



D50% = 179.8nm  
 Dispersion medium: Purified water  
 Dispersing agent: Neutral surfactant  
 Processing: Ultrasound homogenizer 150 W, 3 minutes

■ BELSORP MINI X



Specific surface area = 21.6 m<sup>2</sup>/g  
 BET mean particle size = 154.3 nm  
 Pore size = 200 nm  
 Void volume = 0.385 cm<sup>3</sup>/g

For further information please contact us at:

[www.microtrac.com](http://www.microtrac.com)