

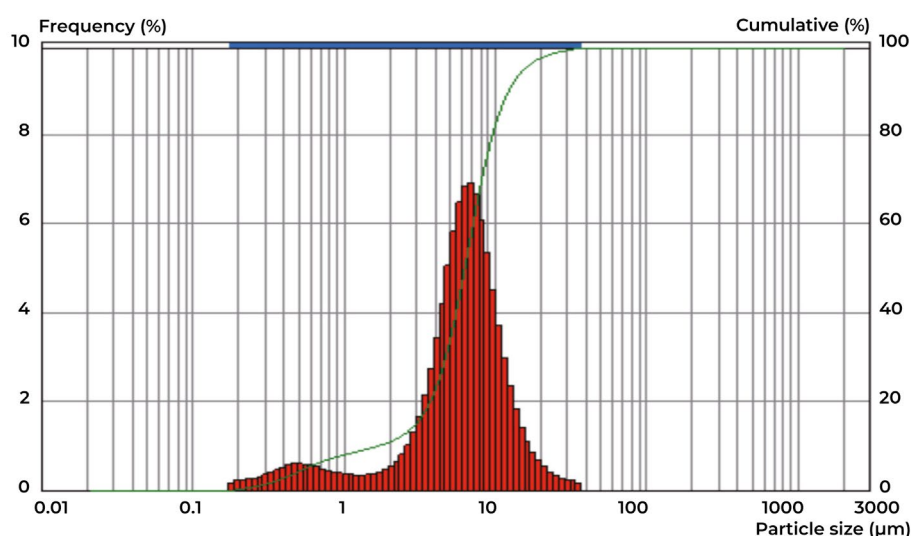
## Evaluation of the Physical Properties of Secondary Battery Materials

### Particle Size Distribution, Specific Surface Area/Pore Distribution Measurement

#### Example of particle size distribution measurement

Measurement of mixed samples yielded high-resolution and high-responsiveness data.

- Sample: Lithium cobalt oxide + high-conductive carbon materials
- Apparatus: Microtrac MT3300EX II
- Dispersion method: Dispersion medium: NMP  
Ultrasound bath: 2 minutes



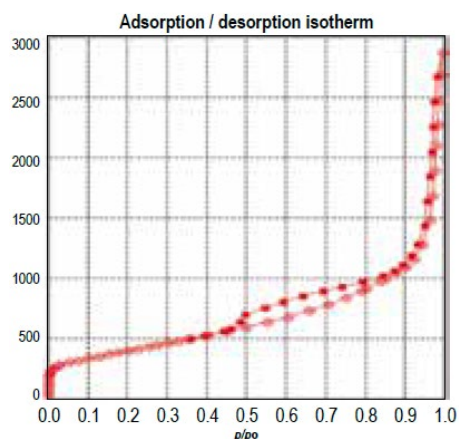
#### Example of electrode carrier evaluation

Evaluation of electrode carrier surface area for reduction of supported metal

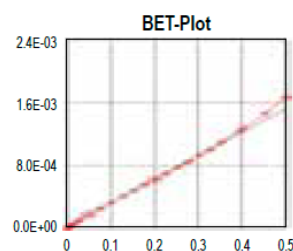
Evaluation of the aggregation status of primary particles

• Sample : High-conductive carbon material

• Apparatus : Automated Specific Surface Area/Pore Distribution Measurement System BELSORP-miniX



Start point 14 // End point 20  
 Gradient 2.9759E-03  
 Intercept 2.7467E-05  
 Correlation coefficient 0.9999  
 $V_m$  [cm<sup>3</sup> (STP) g<sup>-1</sup>] 332.96  
 $a_s.BET$  [m<sup>2</sup>g<sup>-1</sup>] 1.4492E+03  
 $C$  109.34  
 Total pore volume [cm<sup>3</sup>g<sup>-1</sup>] 4.1828  
 ( $p/p_0=0.990$ )  
 Mean pore diameter [nm] 11.545



## Application

### Particle size distribution measurement

- Cathode active materials  
Lithium cobalt oxide  
Lithium manganese oxide
- Conductive additives  
Acetylene black  
Carbon black
- Anode active materials  
Natural / synthetic graphite
- Separator

### Specific surface area / pore distribution, gas / steam adsorption measurement

- Evaluation of electrode catalyst carrier, reduction of supported metal
- Surface hydrophobicity / hydrophilicity evaluation  
Surface state  
Evenness / unevenness of surface state
- Differential adsorption heat evaluation
- Pore distribution / volume evaluation  
Nano-structure control

## Apparatus

### ■ Particle Size Distribution Measurement System Microtrac MT3000 II Series

- Measuring principle: Laser diffraction/light scattering
- Measuring range: 0.02-2800  $\mu\text{m}$
- Line-up consisting of 4 types for different measuring ranges (upgrading possible)
- Red three-beam semiconductor laser and unique detection mechanism
- Smooth switching between wet and dry measuring modes by adoption of an outer cell design
- Allows wet particle image analysis when combined with Microtrac PartAn SI



### ■ Specific surface area / Pore distribution measurement system BELSORP MINI X

- Measuring principle: Constant volume gas adsorption + AFSM
- Measuring range: Specific surface area: 0.01  $\text{m}^2/\text{g}$  -
- Pore distribution: Diameter 0.7-500 nm (Optionally: Diameter 0.35-500 nm)
- Automated measurement of gas adsorption isotherm by the constant volume method, and measurement of specific surface area and pore distribution by the BET multi-point method.
- Adsorbed gas:  $\text{N}_2$  and other non-corrosive gases
- Compact size, low price
- A pre-processor for adsorption measurement BELPREP VAC II / VAC III or BELPREP FLOW II is additionally needed.



For further information please contact us at:

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