The applications for lithium-ion batteries are expanding dramatically. Increasing capacity, extending life, reducing cost, and improving the safety of lithium-ion batteries are important areas of research. The components of LiB are roughly divided into the positive electrode, negative electrode, separator, and electrolyte solution. This poster introduces the analysis technology for each manufacturing process.

- **Evaluation of Compression Properties of Active Materials**
  - Table 1 Compression Test Results
  - Evaluation of the compressive strength of a single particle
  - Consideration of conditions for battery packaging and restraint pressure
  - Examination of manufacturing process conditions (change in strength during heating)

- **Evaluation of Bulk Density of Active Materials**
  - Average mass: 0.037 0.044 0.051 (Standard Deviation)
  - Diameter and Circularity

- **Evaluation of Particle Characteristics of Active Materials**
  - Abnormal particles are detected (foreign matter, agglomeration)
  - Acquire images of individual particles and check the shape
  - Detect trends and abnormal values by statistical analysis

- **Evaluation of Thermal Properties of Battery Materials**
  - Table 3 Result of the Height and Width Measurement between Electrodes

- **Evaluation of Contained Components in Electrolyte Solution**
  - Evaluation of contained components in electrolyte solution

- **Evaluation of Contained Components Electrolyte Solution**
  - Chromatogram comparison of NMP standard solution

- **Evaluation of Thermal Properties of Battery Materials**
  - Evaluation of Thermal Properties of Battery Materials

- **Non-Destructive Evaluation of the Internal Structure of the Battery Cell**
  - Observation and measurement of the cross section of an all-solid LiB negative electrode
  - Tomography: Distribution of active material TiO2
  - KPFM: Imaging the state of charge of TiO2

- **Non-Destructive Evaluation of the Internal Structure of the Battery Cell**
  - Observation and measurement of the cross section of an all-solid LiB negative electrode
  - X-ray CT can observe internal structure nondestructively
  - Can create cross sectional 2D and 3D images
  - Can be used to evaluate LiB current failure, foreign matter electrodes, charger/discharge degradation evaluation, etc.
  - Analysis time from several 10 seconds to several tens of minutes

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**Fig. 1** Chromatogram of separator and NMP standard solution

**Fig. 2** Evaluation of Coarse Particles in Active Materials

**Fig. 3** Evaluation of coarse particles in active materials

**Fig. 4** Evaluation of Bulk Density of Graphite Powder

**Fig. 5** DSC Measurement of Electrode Active Materials

**Fig. 6** DSC Measurement of Separators

**Fig. 7** Chromatogram of N-Methyl-2-Pyrrolidone (NMP)

**Fig. 8** Chromatogram comparison of NMP standard solution

**Fig. 9** Mapping analysis of active material on surface side of positive electrode cross section

**Fig. 10** All-solid-state LiB measurement site and KPFM measurement results

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**Table 1** Compression Test Results

<table>
<thead>
<tr>
<th>Sample</th>
<th>Test Results</th>
<th>Error</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiPOS</td>
<td>147 ± 3.8</td>
<td>0.069</td>
<td>0.068</td>
</tr>
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<td>LiPOS</td>
<td>147 ± 3.8</td>
<td>0.069</td>
<td>0.068</td>
</tr>
</tbody>
</table>

**Table 2** Evaluation of Median Diameter and Count

<table>
<thead>
<tr>
<th>Sample</th>
<th>Median Diameter (µm)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiPOS</td>
<td>32.7 ± 16.5</td>
<td>22.1</td>
</tr>
<tr>
<td>LiPOS</td>
<td>32.7 ± 16.5</td>
<td>22.1</td>
</tr>
</tbody>
</table>

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**Table 3** Result of the Height and Width Measurement between Electrodes

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Height (µm)</th>
<th>Width (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>0.045</td>
<td>0.034</td>
</tr>
<tr>
<td>Negative</td>
<td>0.045</td>
<td>0.034</td>
</tr>
</tbody>
</table>

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**Fig. 11** Result of the Distance Measurement between Electrodes

**Fig. 12** Cross-sectional image of an 18650 type LiB cell