High performance Li-ion battery separator coating with AEROXIDE® fumed alumina

The SEM image shows a single AEROXIDE® TiO₂ P 25 aggregate.

- AEROXIDE® fumed metal oxides are produced by flame hydrolysis (AEROSIL® process).
- Available metal oxides are fumed alumina and fumed titania.
- The loose white powder consists of nano-structured aggregates.
- Upon dispersing, small particles with mean aggregate sizes of ca. 100 nm can be obtained.
- AEROXIDE® products provide a very narrow particle size distribution.
- AEROXIDE® products exhibit high chemical purity (total metal trace elements < 200 ppm).

Physico-chemical data of fumed aluminum and titanium oxides. The data represent typical values, no product specification.

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>AEROXIDE® Alu 6</th>
<th>Alu C</th>
<th>Alu C 805</th>
<th>TiO₂, T 805</th>
</tr>
</thead>
<tbody>
<tr>
<td>BET surface area</td>
<td>m²/g</td>
<td>55–75</td>
<td>85–115</td>
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Evonik is a global leader in specialty chemicals. As a worldwide manufacturer of high-quality silica and metal oxides, Evonik offers innovative solutions in the design of ultra-fine nanostructured particles as performance additives in Li-ion batteries.

AEROXIDE® fumed metal oxides from Evonik are used as additives in Li-ion batteries to increase the performance, lifetime, and safety of the battery.

A thin ceramic separator coating made of AEROXIDE® fumed alumina features the following benefits:
- Significant decrease in thermal shrinkage (increase in safety)
- Very thin and homogenous alumina layers (down to 1 µm) can be realized
- Design of thinner separators possible
- Less binder required

Even very thin ceramic coatings made of AEROXIDE® fumed alumina, down to 1 µm, feature a significant decrease in thermal shrinkage.

**Coating on Separator**

AEROXIDE® fumed alumina enables the preparation of ultra-thin (down to 1 µm), homogenous ceramic coatings which is not possible by the use of conventional coarser particles.

In addition, Evonik offers AERODISP® – ready-to-use alumina dispersions, tailor made for the specific coating application and compatible with a variety of different binders.

**Ceramic filler inside separator**

AEROXIDE® fumed alumina can also be used as ceramic filler inside separators, leading to excellent mechanical and thermal membrane properties combined with a high porosity.
AEROXIDE® Fumed Metal Oxides

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Particle size distribution of dispersed AEROXIDE® in water

Manufacturing of an AEROXIDE® filled separator made by the dry process
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