SPECIALTY GRAPHITE FOR NEGATIVE ELECTRODES OF LITHIUM-ION BATTERIES

C-NERGY™ Graphite

C-NERGY™ L-SERIES is a specialty graphite range especially designed for negative electrodes of lithium-ion batteries.

### Key Features
- Enables the utilization of cheaper active materials in the negative electrode
- Enables reduced additive dosage in the negative electrode
- Reduction of global additives costs (in negative and in positive electrodes)
- No additional pre-dispersing unit is required
- No need for a dispersing agent
- Faster electrolyte absorption
- Higher production outputs

### PRODUCT CHARACTERISTICS

<table>
<thead>
<tr>
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<th>APPLICATION BENEFITS</th>
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</thead>
<tbody>
<tr>
<td><strong>Very High Purity</strong></td>
<td>• Increased battery safety&lt;br&gt;• Lower rejection rate&lt;br&gt;• Fully compatible with most electrolyte systems</td>
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<tr>
<td><strong>Very High Electrical Conductivity and Reversible Capacity</strong></td>
<td>• High energy density&lt;br&gt;• Extremely high cycling stability&lt;br&gt;• High charge acceptance&lt;br&gt;• Lower dosage required vs conventional graphite grades&lt;br&gt;• Reduced global additives costs</td>
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<tr>
<td><strong>High Density and Low Spring Back</strong></td>
<td>• High energy density&lt;br&gt;• High charge acceptance&lt;br&gt;• Minimal electrode expansion after pressing&lt;br&gt;• Improved electrode flexibility&lt;br&gt;• Facilitate the addition of other conductive additives</td>
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<td><strong>Very Efficient Electrolyte Wettability</strong></td>
<td>• Costs reduction thanks to faster dispersion in water based electrode slurry&lt;br&gt;• Costs reduction thanks to a faster electrolyte filling step in battery assembly&lt;br&gt;• Improved battery performance due to more efficient anode wetting&lt;br&gt;• Lower dosage required vs conventional graphite grades&lt;br&gt;• Reduced global additives costs</td>
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SEM picture of C-NERGY™ KS15L Graphite

www.imerys-graphite-and-carbon.com
The unique characteristics of C-NERGY™ L-grades give unmatched performance improvements in Li-ion batteries.

**Recommended C-NERGY™ L-grades dosage in negative active material: 2-8 wt%**.

C-NERGY™ L-grades build a graphite matrix that facilitates the addition of other conductive additives.

Better performances is obtained when C-NERGY™ L-grades are used in combination with ca. 1 wt% of C-NERGY™ SUPER C65 or C-NERGY™ SUPER C45 carbon black.

### Typical Product Properties

<table>
<thead>
<tr>
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<th>Ash (%)</th>
<th>Fe (ppm)</th>
<th>Cl (ppm)</th>
<th>SO₄²⁻ (ppm)</th>
<th>AMOUNT OF MAGNETIC PARTICLES/GRAM OF PRODUCT</th>
<th>TIME TO ADSORB DMC ELECTROLYTE SOLVENT (msec)¹</th>
<th>TIME TO ADSORB WATER (msec)¹</th>
<th>ELECTRODE DENSITY (g/cm²)</th>
<th>SPRING-BACK (%)</th>
<th>REVERSIBLE CAPACITY (Ah/kg)</th>
</tr>
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<tbody>
<tr>
<td>SFG15L</td>
<td>0.01</td>
<td>10</td>
<td>5</td>
<td>25</td>
<td>&lt;1</td>
<td>100</td>
<td>300</td>
<td>&gt;1.75</td>
<td>10</td>
<td>370</td>
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<tr>
<td>SFG15</td>
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<td>10</td>
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<td>3</td>
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</table>

More data available upon request

¹ Defined as time it takes to reach a contact angle of 0°

### Density of C-NERGY™ ACTILION 1 electrodes containing C-NERGY™ SFG 15L

- **2 % SFG 15L**
- **5 % SFG 15L**
- **8 % SFG 15L**

Binder material: 1.5 wt.% SBR/1.5 wt.% CMC

### Influence of C-NERGY™ SFG 15L on the cycling stability of C-NERGY™ ACTILION 1 electrodes

- **0 % SFG 15 L**
- **10 % SFG 15 L**

Lithium half-cells, 1C/3D (CCCV)

Binder material: 1.5 wt.% SBR/1.5 wt.% CMC

Electrode density: 1.7 g cm⁻³

Electrolyte: 1 M LiPF₆ in EC/EMC 1:3 (v/v)