Lithium ion secondary battery negative-electrode material SCMG™ (Structure Controlled Micro Graphite)

- **Product example**

  - **Battery capacity residual ratio (%)**
    - SCMG™
    - Natural graphite

  - **Charge/discharge cycle characteristics**
    - Hard carbon
    - Soft carbon
    - Artificial graphite

  - **Before cycles** vs. **After 300 cycles**

  - **Heat treatment facilities**

  - **Fine particles with carbon structure controlled**

**Our technologies**

- **Fine particle treatment technology**
  - Technology to control the particle size in accordance with various materials

- **Heat treatment technology**
  - Our original technology developed for manufacturing graphite electrodes
  - Primary calcination technology with atmospheric control
  - Secondary calcination technology to control the carbon structure

**We provide a negative-electrode carbon material that suffers no degradation by charge-discharge cycles.**
**Product example**

- Current collector for Lithium ion & battery electric double-layer capacitor

  - Current collector with high-conductivity carbon particles and binder coated on aluminum foil

  - Various patterns printable (Continuous coating, intermittent coating)

  - Design providing an anchor effect (Film thickness < 1 μm, Amount of coating < 1 g/m²)

  - Significant reduction of the interface resistance between the active material layer and current collector achieves lower resistance, fast charge/discharge, and longer life.

**Our technologies**

- **Material design technology**
  Optimum design of aluminum foil, carbon particle, and binder resin
  ⇒ Products that integrate metals, inorganics, and organics

- **Paint-making technology**
  Optimization of mixing and dispersion treatment of materials
  ⇒ Viscosity control, sedimentation prevention, measures to deal with coarse particles

- **Printing technology**
  Thin-film, uniform, and high-speed gravure printing technology
  ⇒ High quality, mass-production, cost competitive

- **Battery production/evaluation technology**
  Comprehensive evaluation of not only carbon coated foils but also batteries
  ⇒ Proposal of recipes to customers, resolution of technical issues

**DC resistance of lithium-ion battery**

- **Aluminum foil only**
- **SDX™ used**

- Positive electrode: LFP
- Negative electrode: SCMG™
- Separator: PP
- Electrolyte: EC/EMC/LiPF₆
- Capacity: 100 mAh
- Cell: Laminate-type

Quoted from Showa Denko Packaging website

**Gravure printing**

- Impression cylinder
- Print materials
- Plate cylinder
- Doctor blade: Drop the extra ink adhering to the plate cylinder

**Pouch LiB**

- 2,000 mAh

Quoted from Showa Denko Packaging website
LiB Packaging Materials 〜SPALF™〜

Product example

Example of SPALF™ constituents

- ONY (Nylon film)
- Adhesive
- Substrate treating agent
- Aluminum foil
- Substrate treating agent
- Adhesive
- CPP (Sealant film)

Development of Pouch LiB Application
2000 → 2015

Our technologies

- Paint (Coating technology)
  ◦ Thin film coating technology

- Laminate (Lamination technology)
  ◦ Lamination technology suitable for constituent materials

- Create (Molding technology)
  ◦ Die design technology to realize product shape
  ◦ Adhesive evaluation technology suitable for product applications

Characteristics of SPALF™
- Light weight
- Unrestricted product shape
- Good formability
- Insulation properties

Showa Denko Packaging (SPA) Corporate Philosophy: We can offer products created by “paint, laminate, create” technology to the world, and contribute to the development of society.
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<tr>
<th>Products · Technologies</th>
<th>Inquiry of the products</th>
<th>TEL &amp; FAX</th>
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<tbody>
<tr>
<td><strong>Anode Material for Lithium Ion Secondary Batteries</strong></td>
<td>Advanced Battery Materials Department</td>
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<tr>
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<td><strong>Carbon Coated Foil</strong></td>
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<td>SDX™</td>
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<td>Showa Denko packaging Co., Ltd.</td>
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