HIGH PERFORMANCE ELASTOMERIC MATERIALS FOR EV BATTERY PACKS

To request an EMS Design Kit, scan QR Code. The kit includes free Material Samples, Thermal Runaway Solution Analysis and Battery Pad Product Selection Tool.
EV batteries present numerous challenges for design engineers seeking ways to extend range while achieving safety targets and minimizing complexity, volume, and weight. Rogers partners with OEMs and Tiers to improve and optimize battery performance by rapidly developing custom elastomeric material solutions unique and critical to each EV program.

<table>
<thead>
<tr>
<th>Battery Safety</th>
<th>Long Term Performance</th>
<th>Space Constraints</th>
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<tbody>
<tr>
<td>• Thermal propagation delay is critical to high-powered next gen cells.</td>
<td>• Low compression set</td>
<td>• Tighter tolerance for thickness and CFD</td>
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<td>• While US may not be the biggest driver, flammability is still a key consideration.</td>
<td>• Uniformity of CFD curve over battery lifespan</td>
<td>• Meet beginning and end of life (BOL &amp; EOL) compression force needs with a maximum usable range that minimizes incompressible space</td>
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<tr>
<td>• Reduce shock &amp; vibration in the system.</td>
<td>• Optimization of charge/discharge cycles to increase efficiencies and the lifespan of the battery</td>
<td>• Meet tackiness requirement for optimal cell stack assembly automation</td>
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**ROGERS EV DESIGN SOLUTION PORTFOLIO**

Built to withstand the stresses of fluctuating compression and temperature, Rogers materials are designed to reliably hold a consistent force, keep battery cells aligned, seal against dust and fluid and isolate the damaging effects of vibration.

**Environmental Seal** 1
Cell-to-Chassis Battery Seal

**Battery Pack Seal** 3
BISCO® silicone offers high reliability and repositionable sealing performance in the battery system.

**Cell Seal** 4
Prismatic Cell Venting Seal
BISCO silicone provides a seal between the vents and exhaust channel, allowing hot gas to exhaust via a designated path.

**Cushion and Spring** 5
Cooling Plate Spring Pads
PORON® polyurethane and BISCO silicone materials enable long-term cooling performance.

**Battery Cell Pad** 6
Cell Pads
Procell™ EV Firewall provides both compressibility and thermal propagation protection. PORON polyurethane and BISCO silicone materials deliver consistent push back force to optimize battery cell life and performance.

**Pressure Equalization** 7
Venting Film
Dyna-V® multi-functional venting membranes equalize pressure and protect against dust and debris ingress, bunting for rapid pressure relief if needed.

**ADVANTAGES OF USING ROGERS TECHNOLOGIES**

- **Battery Life Extension**
  Uniform Cell Compression, Electrical Insulation, Superb Sealing Performance

- **COST REDUCTION**
  Flexibility for Adjustment of Gross Battery Capacity, Decrease of Warranty Risk

- **Saftey**
  Thermal Propagation Delay, Shock and Vibration Protection
PORON® Polyurethane

Extra Soft
Compression Management
Dimensional Stability
Reliability and Performance

4790-92
PORON® Polyurethane

Soft Compression Management
Dimensional Stability
Reliability and Performance

4701-30
PORON® Polyurethane

Very Soft
Compression Management
Dimensional Stability
Reliability and Performance

4701-40
PORON® Polyurethane

Firm Compression Management
Dimensional Stability
Reliability and Performance

4701-50
PORON® Polyurethane

PORON EVExtend® Material
Compression Management
Dimensional Stability
Thermal and Electrical Insulation

BA100
BISCO® Silicones

Ultra Soft
V0 Flame Retardant
Heat Shielding

BA200
BISCO® Silicones

Extra Soft
V0 Flame Retardant
Heat Shielding

BA300
BISCO® Silicones

Soft
V0 Flame Retardant
Heat Shielding

BA400
BISCO® Silicones

Medium
V0 Flame Retardant
Heat Shielding
Environmental Sealing

BA500
BISCO® Silicones

Firm
V0 Flame Retardant
Heat Shielding
Environmental Sealing

BA600
BISCO® Silicones

Extra Firm
V0 Flame Retardant
Heat Shielding
Environmental Sealing

PCL350
ProCell® EV Firewall Material
Thermal Propagation Delay

PCL400
ProCell® EV Firewall Material
Thermal Propagation Delay

V Series
DeWAL® PTFE Membranes & Laminates
Venting & Sealing

DW202/212BV
DeWAL® PTFE
Bund Vent

DW232DV
DeWAL® PTFE
Dual Stage Vent

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BISCO® Silicones

Ultra Soft
V0 Flame Retardant
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Dual Stage Vent

Extrusion & Coextruding

Compression Set Resistance
Stress Relaxation Resistance
Energy Absorption
Low Outgassing
Chemical Resistance
Flame Retardant

Cell-to-cell Compression Pads
Cooling Plate Spring Pad
BMS Spring Pad
Battery Pack Seal & Environmental Sealing
Prismatic Cell Venting Seal

Air Permeability
Chemically Inert
Pressure Equalization

MEMBRANES & LAMINATES

Poron® Polyurethane

Offers superb compression set, constant pushback force and long term dimensional stability.

Exceptional performance, thermal stability and resiliency to mechanical fatigue make BISCO silicones a reliable choice for gasketing, cushioning and insulation. Our ProCell® EV Firewall materials offer enhanced thermal properties to mitigate against thermal runaway on both a cell and module level.

Offered in a wide range of densities and thicknesses, DeWAL® PTFE and UHMW PE membranes offer good airflow, protect from ingress and repel water.
Rogers High Performance Elastomeric Materials For EV Battery Packs

ROGERS PARTNERS WITH OEMS AND TIERS TO DESIGN THE FUTURE OF VEHICLE ENERGY STORAGE

Rogers supports leading OEMs and Tiers with customized material solutions that both meet customer specifications and solve critical problems related to modern battery designs.

Solid State Batteries

Solid state battery cells tend to swell more than conventional cells due to their chemical composition. Proper pressure management via cell compression pads is critical for optimal functionality of the battery.

Cell to Pack

Cell to Chassis

Vibration and shock may cause battery capacity loss and mechanical degradation in lithium-ion cells. Compression materials placed between the cells can aid in mitigating this effect by protecting battery cells in cell-to-pack and cell-to-chassis designs.

Immiscibility

Indirect cooling is the most popular thermal management solution today. However, direct, or immersion cooling, is also a viable option to handle higher thermal loads. In immersion cooling the batteries and supporting components are immersed in a dielectric cooling fluid which is continually circulated to promote heat transfer. For pouch and prismatic applications, the use of compression pads for pressure management is still desired.

800V Architecture

800V architecture delivers the same power level as conventional 400V with a lower current, which shortens charging time. 800V also reduces the current required to deliver a given amount of power by half and supports the use of more powerful electric motors. Its architecture enables the use of lighter and smaller components and less copper, resulting in weight reduction and an improvement in efficiency. The architecture requires materials with a high dielectric strength and thermal performance that both protect critical components and mitigate against thermal runaway propagation.

ROGERS BATTERY LAB & TECHNICAL SERVICES

The Rogers Battery Lab and Technical Services teams provide EV design engineers with the expertise and resources needed to support the process of battery design and material selection, such as aiding in the streamlining of design cycles, validating proper compression management and battery stack configuration.

Imaging Capability

- Scanning Electron Microscope

Cell Level Testing

- Flammability Testing
  - UL Burn Chamber & FMVSS302 Fixture
- Compression and Tensile Testing
  - -40°C to 200°C
- Thermal Analysis for Polymer Properties
  - TGA, DSC, DMA, TMA
- Peel Testing (Adhesive Characterization)

Analytical Capability

- GC/MS & FT-IR

Application Testing

- Hot Plate
- Impact Testing
- Fatigue Testing
- Capacity Fade/Cell Cycling
- Airflow and Water Sealing
- Stress Relaxation and Creep
- Thermal Conductivity / Thermal Imaging

TECHNICAL SERVICE & DEVELOPMENT INSIGHT

Case Study: Designing Cell Pads

Specifications Provided by the Customer:

- Cell Format: Pouch
- Cell Thickness: 10mm
- Cell Expansion: 10%
- Beginning of Life (BOL) Pressure: 40kPa
- End of Life (EOL) Pressure: 300kPa
- Number of Cell Pads per Module: 13
- Number of Cells per Module: 12
- Number of Modules: 6

The greatest improvement in life extension provided by Rogers battery cell materials.

Selecting Materials, Customization

The consideration of compression force deflection is critical when choosing a battery cell pad material.

Measurement of Battery Life Extension

- 70Ah pouch cells
- 1C charge and discharge rate
- Temperature = 45°C
- Test to 80% capacity retention

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**Battery Pad Product Selection Tool**

The Battery Pad Product Selection Tool provides product recommendations based on a user’s unique design requirements. It is intended to be used as a starting point for material selection.


**Gap Filling Tool**

The Gap Filling Tool guides users to a selection of the best PORON or BISCO materials for water, dust, and environmental sealing applications.


**Compression Force Deflection (CFD) Tool**

Using stress strain data, the CFD Curve Tool helps in the identification of the BISCO or PORON materials that meet your engineering requirements.


**Vibration Isolation Tool**

The Vibration Isolation Tool recommends the proper Rogers materials for vibration mitigation.

ABOUT ROGERS CORPORATION

Rogers Corporation (NYSE:ROG) is a global leader in engineered materials to power, protect and connect our world. Rogers delivers innovative solutions to help our customers solve their toughest material challenges. Rogers’ advanced electronic and elastomeric materials are used in applications for EV/HEV, automotive safety and radar systems, mobile devices, renewable energy, wireless infrastructure, energy-efficient motor drives, industrial equipment and more. Headquartered in Chandler, Arizona, Rogers operates manufacturing facilities in the United States, Asia and Europe, with sales offices worldwide.

For more information, visit www.rogerscorp.com
Rogers and its global converter network provide supply chain and logistics support for serial production programs.

A network of global manufacturing sites and converter networks provide resiliency in the event of supply chain shocks.

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To request an EMS Design Kit, scan QR Code.
The kit includes Free Material Samples, Thermal Runaway Solution Analysis and Battery Pad Product Selection Tool.

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