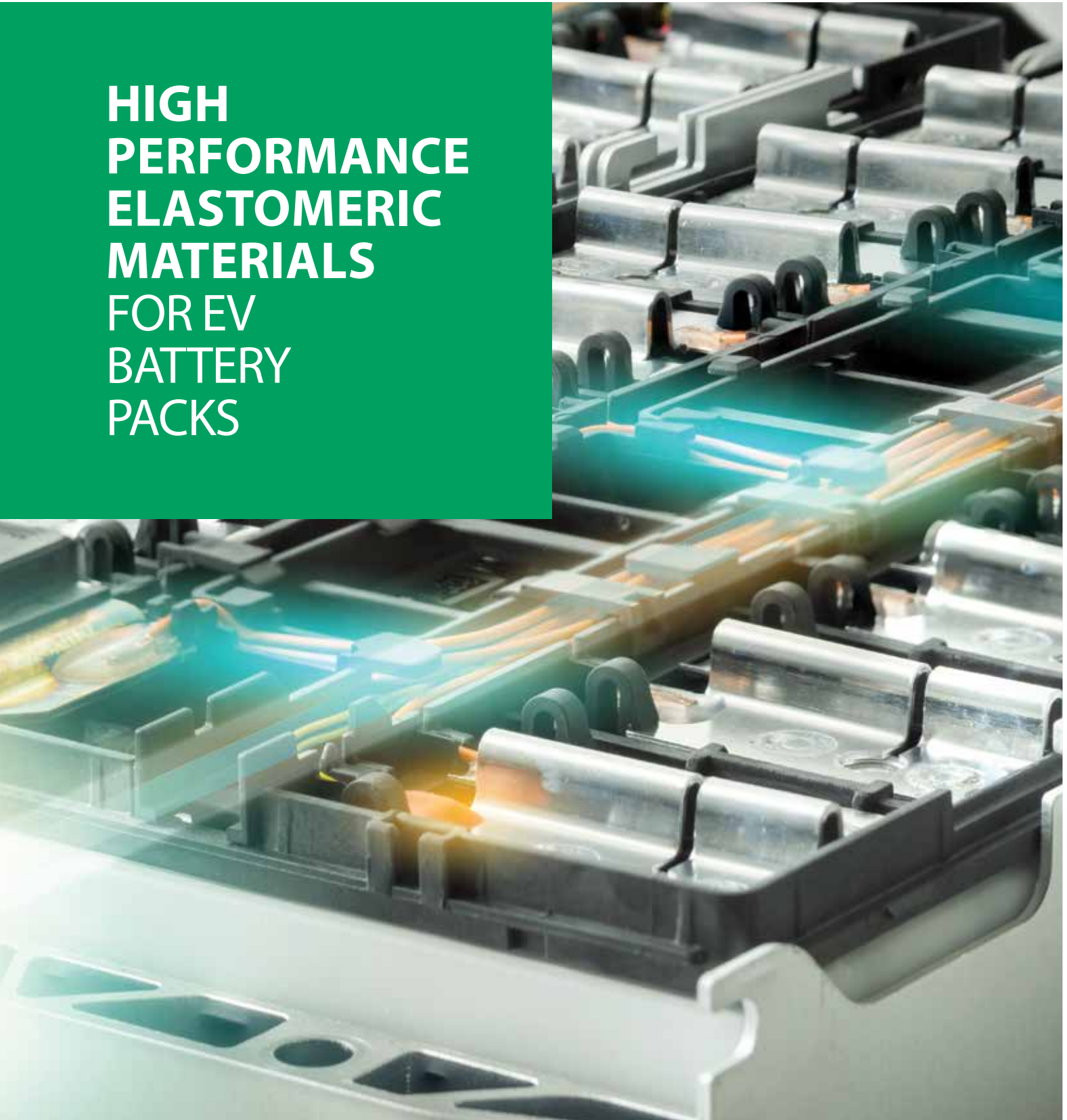


HIGH PERFORMANCE ELASTOMERIC MATERIALS FOR EV BATTERY PACKS



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.

CUSTOM MATERIAL OPTIONS FOR EV BATTERY DESIGNS

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.

- Battery Safety**

 - Thermal propagation delay is critical to high-powered next gen cells
 - While V0 may not be the biggest driver, flammability is still a key consideration
 - Reduce shock & vibration in the system
- Long Term Performance**

 - Low compression set
 - Uniformity of CFD curve over battery lifespan
 - Optimization of charge/discharge cycles to increase efficiencies and the lifespan of the battery
- Space Constraints**

 - Tighter tolerance for thickness and CFD
- Packaging/Weight**

 - Meet beginning and end of life (BOL & EOL) compression force needs with a maximum usable range that minimizes incompressible space
- Assembly Automation**

 - Meet tackiness requirement for optimal cell stack assembly automation



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

SAFETY

Thermal Propagation Delay, Shock and Vibration Protection

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
- 2 Power Distribution Unit Seal
- 3 Battery Pack Seal

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

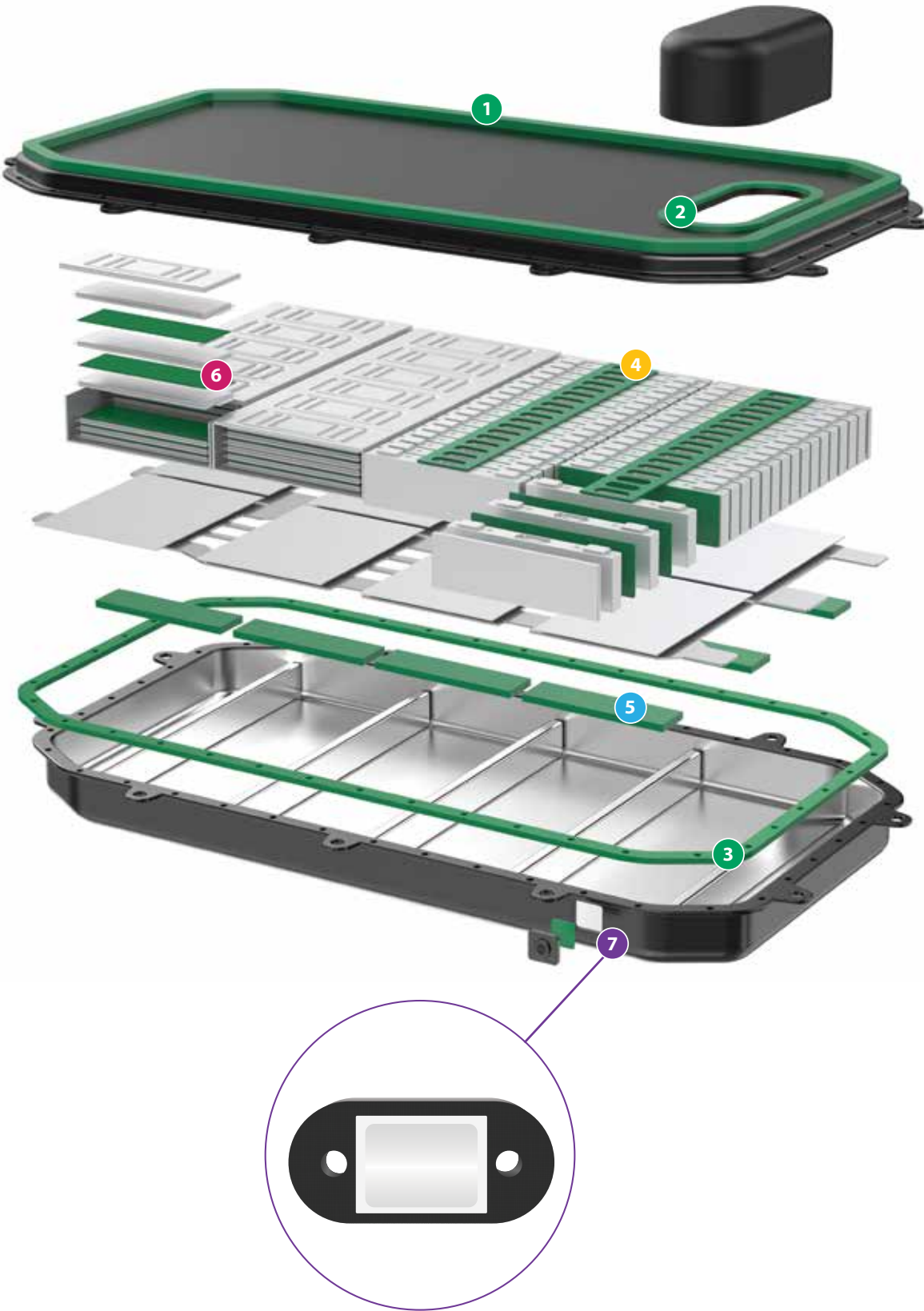
- 6 Cell Pads

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

DeWAL® multi-functional venting membranes equalize pressure and protect against dust and debris ingress, bursting for rapid pressure relief if needed.



4790-92

PORON® Polyurethane

Extra 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

Soft
Compression Management
Dimensional Stability
Reliability and Performance

4701-50

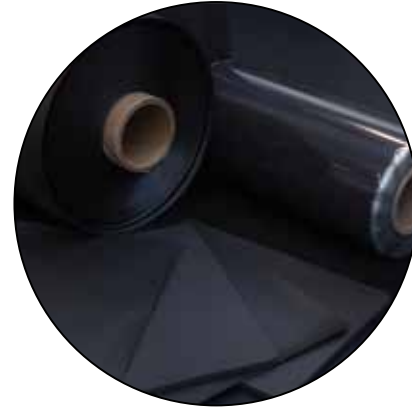
PORON Polyurethane

Firm
Compression Management
Dimensional Stability
Reliability and Performance

4701-43

PORON EVExtend® Material

Compression Management
Dimensional Stability
Thermal and Electrical Insulation



BA100

BISCO® Silicone

Ultra Soft
V0 Flame Retardant
Heat Shielding

BA200

BISCO Silicone

Extra Soft
V0 Flame Retardant
Heat Shielding

BA300

BISCO Silicone

Soft
V0 Flame Retardant
Heat Shielding

BA400

BISCO Silicone

Medium
V0 Flame Retardant
Heat Shielding
Environmental Sealing

BA500

BISCO Silicone

Firm
V0 Flame Retardant
Heat Shielding
Environmental Sealing

BA600

BISCO Silicone

Extra Firm
V0 Flame Retardant
Heat Shielding
Environmental Sealing

PCL350

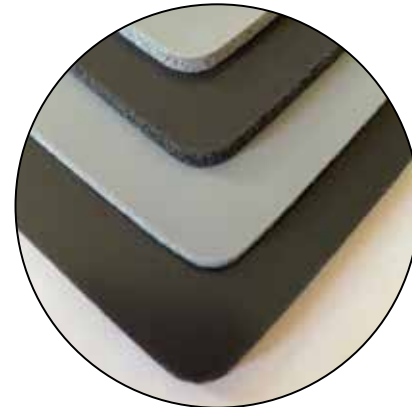
ProCell™ EV Firewall Material

Thermal Propagation Delay

PCL400

ProCell EV Firewall Material

Thermal Propagation Delay



V Series

DeWAL® ePTFE Membranes & Laminates

Venting & Sealing

DW232DV

DeWAL PTFE

Dual Stage Vent

DW202/212BV

DeWAL PTFE

Burst Vent



POLYURETHANE MICROCELLULAR FOAMS



Compression Set Resistance



Stress Relaxation Resistance



Energy Absorption



Low Outgassing



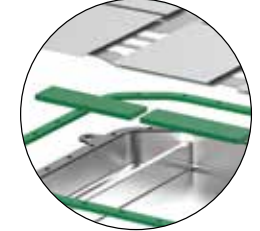
Chemical Resistance



Flame Retardant

PORON polyurethane offers superb compression set, constant pushback force and long-term dimension stability.

It is a durable choice for compression management, sealing, cushioning or vibration protection.



Cooling Plate
Spring Pad



Cell-to-cell
Compression Pads



BMS Spring Pad

SILICONE MICROCELLULAR FOAMS



Compression Set Resistance



Superior Flame Ratings



Chemical Resistance



Energy Absorption



High Thermal Stability

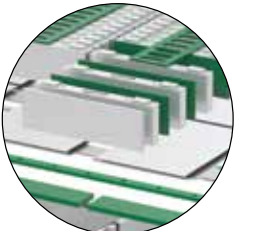


Dielectric Properties

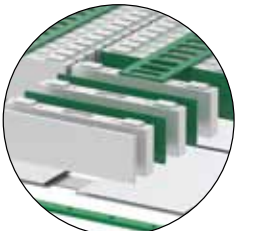
Exceptional performance, thermal stability and resiliency to mechanical fatigue make BISCO silicones a reliable choice for gasketing, cushioning and insulation. Our ProCell™ EV Firewall materials offer enhanced thermal properties to mitigate against thermal runaway on both a cell and module level.



Battery Pack Seal &
Environmental Sealing



Thermal Propagation
Protection & Compression



Prismatic Cell
Venting Seal

FILMS & TAPES



Air Permeability

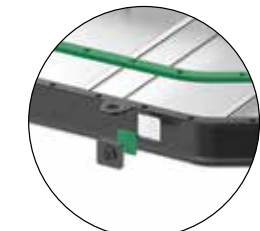


Chemically Inert

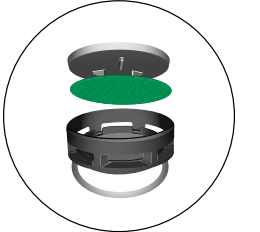


Pressure Equalization

Offered in a wide range of densities and thicknesses, DeWAL® PTFE and UHMW PE membranes offer good airflow, protect from ingress and repel water.



Burst Vents



Dual Stage Vents

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

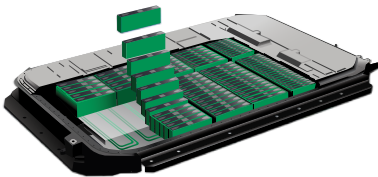
Rogers supports leading OEMs and Tiers with customized material solutions that both meet customer specifications and solve critical problems related to modern battery designs.

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



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.

Cell to Chassis



Immersion Cooling



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 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.

800V Architecture



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, RDA, DMA, TMA
- Peel Testing (Adhesive Characterization)

Analytical Capability

- GC/MS & FT-IR

Application Testing

- Hot Plate
- Impact Testing
- Nail Penetration
- 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

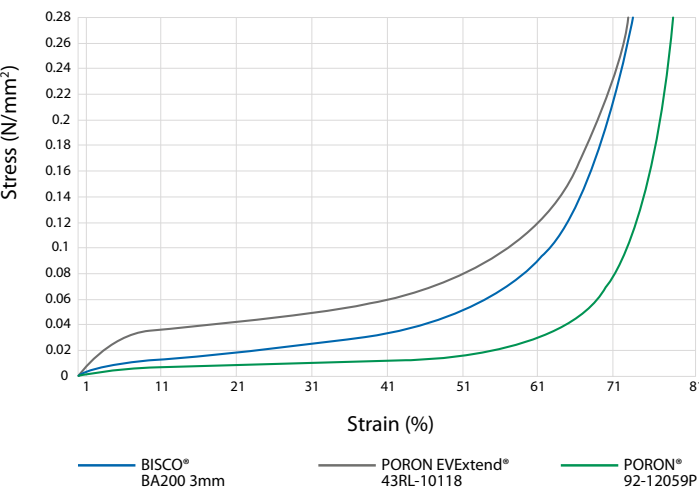
End of Life (EOL) Pressure: 300kPa

Number of Cell Pads per Module: 13

Number of Cells per Module: 12

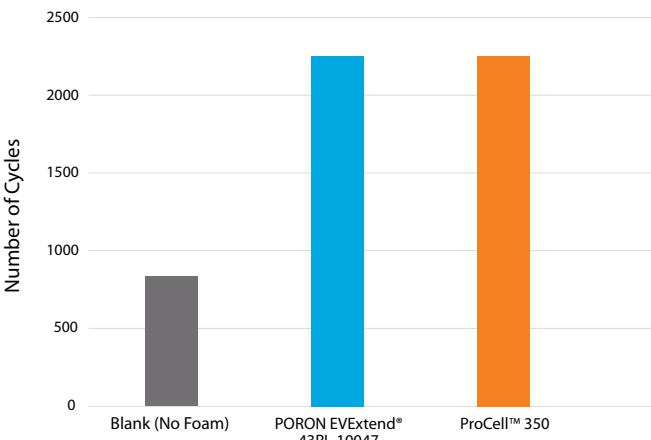
Number of Modules: 6

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

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

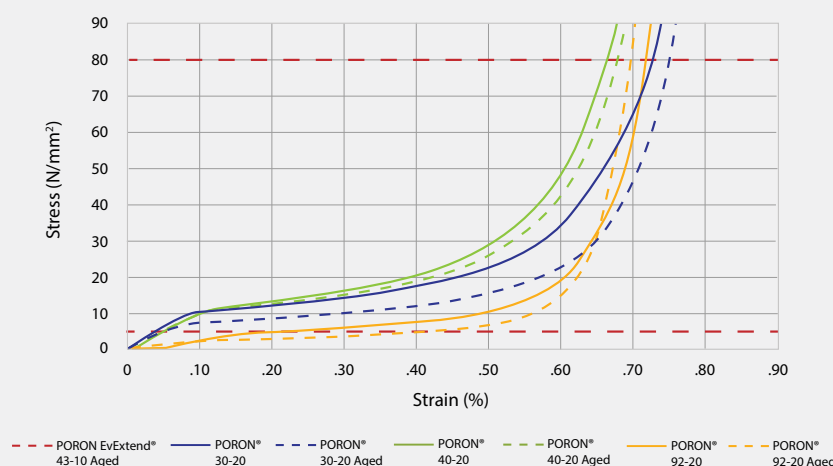
TECHNICAL AND DESIGN SUPPORT TOOLS TO OPTIMIZE BATTERY PERFORMANCE

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.



<https://tools.rogerscorp.com/ems/battery/index.aspx>

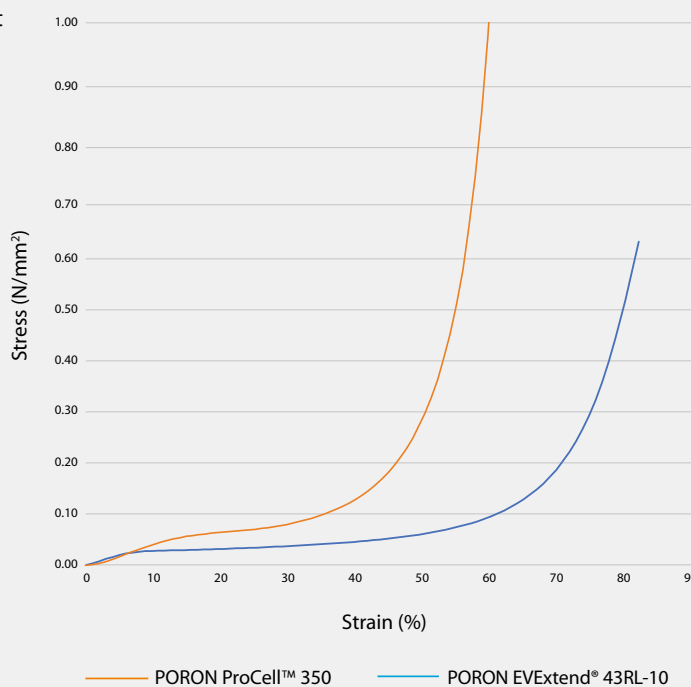


Compression Force Deflection (CFD) Tool

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



<https://tools.rogerscorp.com/ems/cfdcurve/index.aspx>

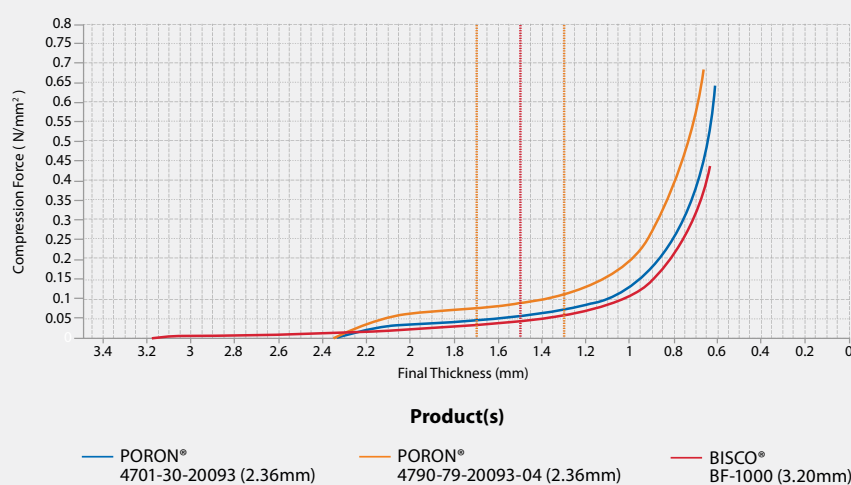


Gap Filling Tool

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



<https://tools.rogerscorp.com/ems/gapfilling/index.aspx>

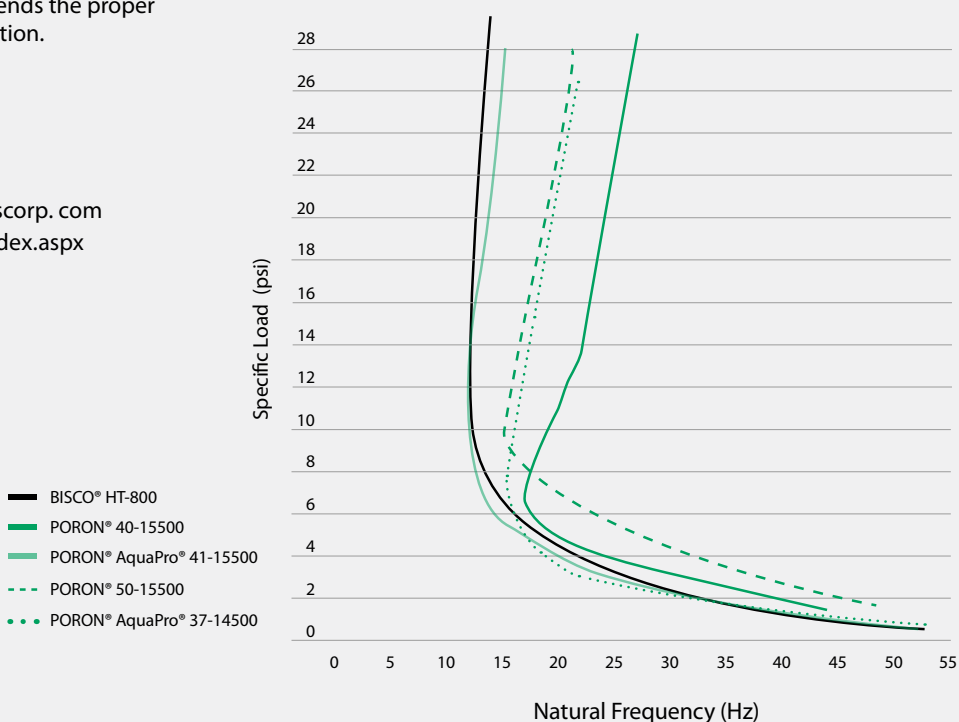


Vibration Isolation Tool

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



<http://tools.rogerscorp.com/ems/vibration/index.aspx>



ABOUT ROGERS CORPORATION

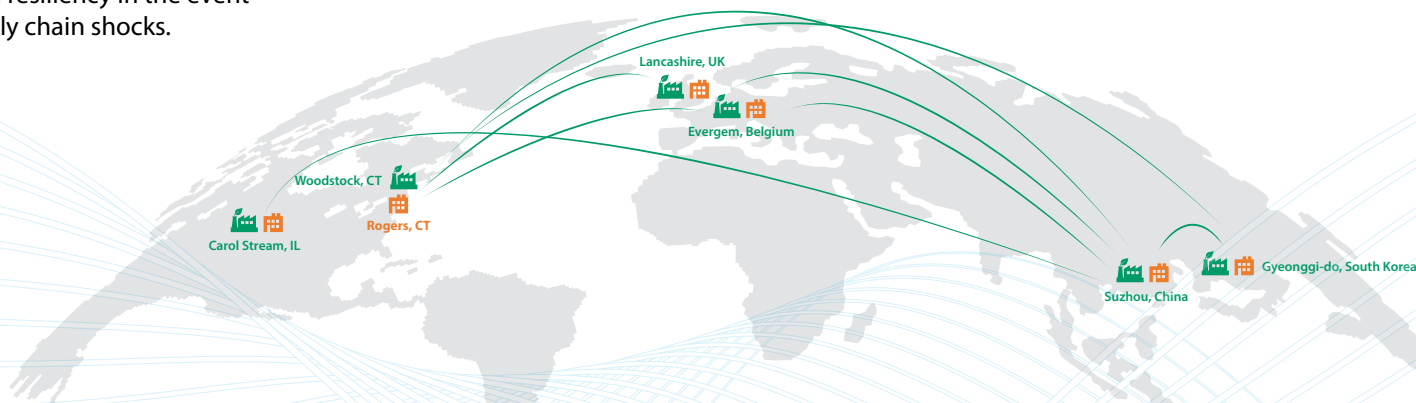
Rogers Corporation (NYSE:ROG) is a global leader in engineered materials to power, protect and connect our world. Rogers delivers innovative solutions to help our customers solve their toughest material challenges. Rogers' advanced electronic and elastomeric materials are used in applications for EV/HEV, 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.



North America

Elastomeric Material Solutions HQ
One Technology Drive
Rogers, CT 06263
Tel: 630.784.6200

Europe

Rogers BV
Evergem, Belgium
Tel: 32.9.2353611

Asia

Rogers Japan, Inc.
Tokyo, Japan
Tel: 81.3.5200.2700

Rogers Korea, Inc.
Gyeonggi-do, Korea
Tel: 82.31.360.3622

Rogers Taiwan, Inc.
New Taipei City, Taiwan
Tel: 886.2.8660.9056

Rogers Technologies Singapore Inc.
Singapore
Tel: 65.6747.3521

Rogers Technologies, Co.
Shanghai, China
Tel: 86.21.6217.5599

Rogers Technologies, Co.
Shenzhen, China
Tel: 86.755.8236.6060

Rogers Technologies, Co.
Suzhou, China
Tel: 86.512.6258.2700

Email

solutions@rogerscorp.com



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.