Powering the Future of EV/Hybrid Vehicles
Thermal Interface Materials, EMI Shielding and Electronic Component Housings

Parker Chomerics
ENGINEERING YOUR SUCCESS.
Solution Provider to the Electric and Hybrid Vehicle OEM Marketplace

With the growing demand for battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV), dissipating battery heat and providing protection against electrical interference have never been more pertinent. The Parker Chomerics family of thermal interface materials, coupled with our premier electromagnetic interference (EMI) shielding products, offers solutions for global OEMs and tier one suppliers of automotive modules.

1. Power Cables Connector
   CHO-SEAL® EMI elastomer gaskets for EMI shielding of power cable connectors.

2. Power Inverter/Converter Cover
   PREMIER™ electrically conductive plastics used for metal-to-plastic conversion. Eliminates up to 35% of weight of traditional die cast aluminum housings.

3. In-Vehicle Electronics
   CHO-SEAL® EMI form-in-place (FIP) gaskets for shielding electric traction elements within electronic housings.

4. Infotainment/Advanced Driver Assistance Systems
   PREMIER™ electrically conductive plastics used for metal-to-plastic conversion. Eliminates up to 35% of weight of traditional die cast aluminum housings.

5. Battery Pack
   THERM-A-GAP® Pads — gap fillers for additional support, vibration dampening or dielectric strength.

6. Battery Pack
   THERM-A-GAP® Gels — thermally conductive, one-component, fully-cured dispensable gels used between coils and aluminum chassis for effective heat transfer.

7. Battery Housings
   CHO-SEAL® EMI co-extruded elastomer gaskets seal batteries from the environment, dirt, debris, and fluids.
An OEM System Solution from Parker Chomerics

Although electric vehicles represent a greener and cleaner future, they come with a number of technology challenges for manufacturers and systems suppliers. Issues include dissipating heat generated by the battery pack, eliminating electromagnetic interference and reducing vehicle weight.

Battery Heat Management

Left unchecked, excessive heat causes faster battery wear, reduced performance (due to uneven temperature distribution) and reduced charge efficiency, not to mention the safety hazards associated with thermal runaway. Effective thermal management is therefore critical to optimizing battery performance and longevity, along with improved safety and reliability, allowing vehicles to travel greater distances and increasing the achievable run-time on a single charge.

The technique for delivering thermal management is often liquid cooling, whereby two cooling loops/coils typically serve various sub-assemblies of the battery to manage heat. While batteries and cooling fluid clearly do not mix, there are safety concerns with liquid cooling due to corrosion and leaks, which could lead to an electrical short. Therefore, thermal interface materials are dispensed between the coils and the aluminum chassis of the battery for greater safety. This delivers long-term thermal stability and performance, and also reduces the risk of an electrical short.

Thermally conductive, dispensable gel products are proven in the function of battery heat management. Offerings include one-component, pre-cured gels featuring a cross-linked structure, as well as two-component cure-in-place (CIP) gels which can also act as a potting compound and flow around complex parts. Both silicone and non-silicone gels are available depending on specific thermal conductivity requirements.

These compounds are particularly suitable in high volume markets such as automotive due to ease-of-dispensing using robotics or automation, thus considerably reducing cycle times and costs. They also enhance safety, by providing stability at temperatures up to 392˚F (200˚C).

Thermally conductive filler pads are also available depending on the design of the battery packs. These products are ideal for assemblies that might require some additional support such as vibration dampening. As a benefit for drivers during cold winter months, thermal interface gels and pads help the battery reach its optimum temperature and performance much quicker than without having these materials in place.

Electromagnetic Interference (EMI) Shielding

Beyond effective thermal management, another technology challenge is the need to shield against EMI. The cables that travel between the battery and engine, as well as the battery and charger, see high current produced at low frequency. This produces a large magnetic field that can negatively affect other electronics within the vehicle. High shielding attenuation is also required to protect the battery and its circuits from any incoming EMI.

To overcome these issues, a variety of EMI shielding elastomers or extruded gaskets can be used. EMI gaskets are filled with conductive particles and connect interfacing components to reduce the air gap and create a Faraday Cage that blocks EMI fields. Among many attributes, they resist compression set and accommodate low closure force.

Very often batteries also need to be sealed against environmental dirt, debris and fluids. Here, it is possible to deploy combined solutions to support EMI and environmental shielding/sealing.

Chomerics Division is part of the Parker Hannifin Corporation Engineered Materials Group and is a global leader in development and application of electrically and thermally conductive materials in electronics, transportation and alternative energy systems. Chomerics is the first choice in EMI shielding and thermal management solutions for automotive, information technology, medical devices, military, commercial and consumer electronics industries. For over 50 years, Chomerics’ strong portfolio has delivered cutting edge solutions to our global customers using technology built on core competencies in material science and process technology.

For battery applications requiring co-extruded gaskets, such as shielding the electric traction elements, special form-in-place (FIP) materials are available. Again, these lend themselves to robot dispensing, while the ability to create bespoke shapes is a further benefit.

Metal-to-Plastic Conversion

Replacement of metal housings with plastic versions can contribute to reducing vehicle weight and cutting manufacturing costs. Here, an electrically conductive plastic alternative can be exchanged for the battery electronic control unit’s (ECU) conventional die-cast aluminum housing. Metal to plastic conversions not only eliminate 33% of the housing weight, but also provide cost reductions of up to 65% by eliminating secondary operations such as assembly and machining.
### Featured Parker Chomerics Products

#### Battery Thermal Management and Cooling: Thermally Conductive Dispensable Gels

<table>
<thead>
<tr>
<th>Product</th>
<th>Features</th>
<th>Thermal Conductivity (W-m/K)</th>
<th>Product Type</th>
<th>Flow Rate (cc/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERM-A-GAP™ GEL T630</td>
<td>General use, lowest deflection force required, UL 94 V-0</td>
<td>0.7</td>
<td>One Part</td>
<td>10</td>
</tr>
<tr>
<td>THERM-A-GAP™ GEL T635</td>
<td>General use with very good thermal performance</td>
<td>1.7</td>
<td>One Part</td>
<td>8</td>
</tr>
<tr>
<td>THERM-A-GAP™ GEL T636</td>
<td>General use with excellent thermal performance, UL 94 V-0</td>
<td>2.4</td>
<td>One Part</td>
<td>8</td>
</tr>
<tr>
<td>THERM-A-GAP™ GEL 8010</td>
<td>Ideal for thin bond lines, UL 94 V-0</td>
<td>3.0</td>
<td>One Part</td>
<td>60</td>
</tr>
<tr>
<td>THERM-A-GAP™ GEL 30</td>
<td>Easily dispensable, high performance, UL 94 V-0</td>
<td>3.5</td>
<td>One Part</td>
<td>20</td>
</tr>
<tr>
<td>THERM-A-GAP™ GEL 45</td>
<td>Easily dispensable, high end performance</td>
<td>4.5</td>
<td>One Part</td>
<td>55</td>
</tr>
<tr>
<td>THERM-A-GAP™ TC50</td>
<td>Controlled dispensing, high end thermal performance</td>
<td>5.5</td>
<td>One Part</td>
<td>10</td>
</tr>
</tbody>
</table>

#### Battery Thermal Management and Cooling: Thermally Conductive Gap Filler Pads

<table>
<thead>
<tr>
<th>Product</th>
<th>Features</th>
<th>Thermal Conductivity (W-m/K)</th>
<th>Hardness (Shore 00)</th>
<th>Flammability Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERM-A-GAP™ HCS10</td>
<td>Economical solution, highest conformability</td>
<td>1.0</td>
<td>4</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>THERM-A-GAP™ 569</td>
<td>Great combination of thermal performance and conformability</td>
<td>1.5</td>
<td>10</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>THERM-A-GAP™ 570</td>
<td>Best for molding complex parts and vibration dampening</td>
<td>1.5</td>
<td>25</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>THERM-A-GAP™ 579</td>
<td>Lowest outgassing, excellent thermal performance</td>
<td>3.0</td>
<td>30</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>THERM-A-GAP™ 580</td>
<td>Lowest outgassing, best for molding complex parts</td>
<td>3.0</td>
<td>75</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>THERM-A-GAP™ 974</td>
<td>Excellent thermal performance, PSA available</td>
<td>6.0</td>
<td>86</td>
<td>N/A</td>
</tr>
<tr>
<td>THERM-A-GAP™ G974</td>
<td>Fiberglass reinforced for improved tear strength</td>
<td>5.0</td>
<td>86</td>
<td>UL 94 V-0</td>
</tr>
</tbody>
</table>

#### Battery Thermal Management and Cooling: Cure-in-Place Potting and Underfill Materials

<table>
<thead>
<tr>
<th>Product</th>
<th>Features</th>
<th>Thermal Conductivity (W-m/K)</th>
<th>Product Type</th>
<th>Hardness (Shore A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERM-A-FORM™ T647</td>
<td>Superior thermal performance while maintaining low modulus</td>
<td>0.9</td>
<td>Two Part</td>
<td>25</td>
</tr>
<tr>
<td>THERM-A-FORM™ T646</td>
<td>Provides combination of high thermal performance and low cost</td>
<td>1.0</td>
<td>Two Part</td>
<td>50</td>
</tr>
<tr>
<td>THERM-A-FORM™ T644</td>
<td>Very low modulus material for transferring heat from fragile components</td>
<td>1.0</td>
<td>Two Part</td>
<td>15</td>
</tr>
<tr>
<td>THERM-A-FORM™ T642</td>
<td>High thermal performance, ideal for underfilling, low outgassing</td>
<td>1.0</td>
<td>Two Part</td>
<td>70</td>
</tr>
<tr>
<td>THERM-A-FORM™ 1642</td>
<td>General duty material, economical thermal solution</td>
<td>1.0</td>
<td>Two Part</td>
<td>76</td>
</tr>
</tbody>
</table>
## Featured Parker Chomerics Products

### Electromagnetic Interference Mitigation: Elastomer EMI Shielding Gaskets

Gaskets for shielding of battery packs and battery management systems (BMS) as well as on board chargers.

<table>
<thead>
<tr>
<th>Product</th>
<th>Conductive Filler</th>
<th>Binder</th>
<th>Shielding</th>
<th>Corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHO-SEAL® 6502</td>
<td>Nickel-Aluminum</td>
<td>Silicone</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>CHO-SEAL® 6503</td>
<td>Nickel-Aluminum</td>
<td>Fluorosilicone</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>CHO-SEAL® 1298</td>
<td>Silver-Aluminum</td>
<td>Fluorosilicone</td>
<td>Good</td>
<td>Very Good</td>
</tr>
<tr>
<td>CHO-SEAL® 1285</td>
<td>Silver-Aluminum</td>
<td>Silicone</td>
<td>Very Good</td>
<td>Good</td>
</tr>
<tr>
<td>CHO-SEAL® 1287</td>
<td>Silver-Aluminum</td>
<td>Fluorosilicone</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>CHO-SEAL® 1215</td>
<td>Silver-Copper</td>
<td>Silicone</td>
<td>Excellent</td>
<td>Fair</td>
</tr>
<tr>
<td>CHO-SEAL® 1217</td>
<td>Silver-Copper</td>
<td>Fluorosilicone</td>
<td>Excellent</td>
<td>Fair</td>
</tr>
</tbody>
</table>

More products available, see Conductive Elastomer Engineering Handbook for complete list.

### Electromagnetic Interference Mitigation: Form-in-Place EMI Shielding Gaskets

CHO-FORM™ form-in-place elastomer products are dispensable form-in-place compounds designed for heat transfer without excessive compressive force.

<table>
<thead>
<tr>
<th>Product</th>
<th>Conductive Filler</th>
<th>Resin System</th>
<th>Number of Components</th>
<th>Cure System</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHOFORM® 5513</td>
<td>Silver-Copper</td>
<td>Silicone</td>
<td>Two Part</td>
<td>Thermal</td>
</tr>
<tr>
<td>CHOFORM® 5541</td>
<td>Nickel-Carbon</td>
<td>Silicone</td>
<td>One Part</td>
<td>Thermal</td>
</tr>
<tr>
<td>CHOFORM® 5550</td>
<td>Nickel-Carbon</td>
<td>Silicone</td>
<td>One Part</td>
<td>Thermal</td>
</tr>
<tr>
<td>CHOFORM® 5560</td>
<td>Nickel-Aluminum</td>
<td>Silicone</td>
<td>One Part</td>
<td>Thermal</td>
</tr>
<tr>
<td>CHOFORM® 5526</td>
<td>Silver</td>
<td>Silicone</td>
<td>One Part</td>
<td>Moisture</td>
</tr>
<tr>
<td>CHOFORM® 5528</td>
<td>Silver-Copper</td>
<td>Silicone</td>
<td>One Part</td>
<td>Moisture</td>
</tr>
<tr>
<td>CHOFORM® 5538</td>
<td>Nickel-Carbon</td>
<td>Silicone</td>
<td>One Part</td>
<td>Moisture</td>
</tr>
</tbody>
</table>

### Conductive Plastics: PREMIER™ EMI Shielding Plastics

Conductive plastics eliminate 35% of the housing weight (as compared to aluminum) and reduce cost by 65% while providing excellent hydrolysis resistance.

<table>
<thead>
<tr>
<th>Product</th>
<th>Filler Level</th>
<th>Flammability Rating</th>
<th>Surface Resistance (Ohm/sq)</th>
<th>Shielding Effectiveness (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREMIER® A220-HT</td>
<td>Low</td>
<td>N/A</td>
<td>4.50</td>
<td>60</td>
</tr>
<tr>
<td>PREMIER® A240-ST</td>
<td>High</td>
<td>N/A</td>
<td>0.20</td>
<td>85</td>
</tr>
<tr>
<td>PREMIER® A240-FRHF</td>
<td>High</td>
<td>UL 94 V0</td>
<td>0.25</td>
<td>85</td>
</tr>
<tr>
<td>PREMIER® PEI 140</td>
<td>High</td>
<td>UL 94 V0</td>
<td>0.45</td>
<td>85</td>
</tr>
<tr>
<td>PREMIER® PBT-225</td>
<td>Medium</td>
<td>UL 94 HB</td>
<td>10.0</td>
<td>80</td>
</tr>
</tbody>
</table>
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