Composite Solutions for the Automotive Industry
Reduce weight. Reduce costs. Increase quality.

Henkel offers composite solutions for the automotive industry for cost-effective and reliable composite manufacturing.

**Composite matrix resins and binder**
- LOCTITE MAX series including binders and release agents for fiber-reinforced components.

**Composite adhesives**
- LOCTITE and TEROSON series for multi-substrate bonding and composite assembly.

**Process know-how and engineering**
- Full test service for High-Pressure Resin Transfer Molding (HP-RTM) in our Composite Labs.

**WHAT WE THINK THE PERFECT COIL SPRING SHOULD DO? LIGHTWEIGHT A VEHICLE.**
Resin Transfer Molding (RTM) Process for Composites

**Preforming**
The semifinished part is preformed with Loctite FRP 2000 Binder.

**Mold preparation**
The mold can be prepared with an external release agent like LOCTITE Frekote series.

**Resin injection & curing**
The components of the composite matrix resin LOCTITE MAX series are mixed and injected into the mold.

**Surface preparation**
The surface of the molded part is prepared for further processing.

**Bonding**
The finished part is assembled into place with tailored multi-substrate adhesives.
Henkel LOCTITE Frekote Solutions for Mold Preparation

<table>
<thead>
<tr>
<th>Frekote Mold Cleaners</th>
<th>Frekote Mold Sealers</th>
<th>Frekote Mold Release Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOCTITE FREKOTE 913WB</strong></td>
<td><strong>LOCTITE FREKOTE FMS</strong></td>
<td><strong>LOCTITE FREKOTE C-200</strong></td>
</tr>
</tbody>
</table>
| > Prevents dust recontamination  
> Easy application  
> Leaves an antistatic and streak-free mold surface  
> Non-flammable  
> Water-based solution | > High-gloss mold finish  
> Fast curing  
> Eliminates porosity and also micro-porosity  
> Use with FRP and steel molds  
> Easy to use | > Excellent fit for LOCTITE MAX series  
> Water-based solution  
> No contaminating transfer  
> No mold buildup |
| **Application:** | **Application:** | **Application:** |
| > Application temperature of 20°C to 40°C  
> Spray onto the mold out of the bottle | > Application temperature of 15°C to 35°C  
> Thermal stability of up to 305°C  
> Wipe on the mold  
> Apply 1 to 2 coats | > Application temperature of 20°C to 204°C  
> Thermal stability of up to 315°C  
> Application by spraying, brushing, or wiping on the mold  
> Apply up to 4 coats |

<table>
<thead>
<tr>
<th><strong>LOCTITE Frekote 915WB</strong></th>
<th><strong>LOCTITE Frekote 700-NC</strong></th>
</tr>
</thead>
</table>
| > Minimal mold building  
> Fast curing / easy application  
> High-gloss mold finish  
> Water-based solution  
> No dulling of the mold surface | > Excellent fit for LOCTITE MAX series  
> Slow room-temperature cure  
> High slip good for complex mold structures  
> High-gloss mold finish  
> Mild odor |
| **Application:** | **Application:** |
| > Application temperature of 20°C to 40°C  
> Wipe on the mold and buff out to a high-gloss finish | > Application temperature of 15°C to 135°C  
> Thermal stability of up to 400°C  
> Application by spraying, brushing, or wiping on the mold  
> Apply up to 4 coats |
Composite Matrix Resins

LOCTITE MAX series including binders and release agents for fiber-reinforced components designed for RTM with glass or carbon fibers enabling short cycle times suitable for automotive mass production.

Resin injection & curing
The components of the composite matrix resin LOCTITE MAX series are mixed and injected into the mold.

Process efficiency
- Fast curing allows demolding after 1 to 5 minutes
- Low viscosity ensures fast and efficient injection without stress to fibers
- Process speed can be adjusted with additives
- Internal mold release agent for reliable demolding

Mechanical performance
- High mechanical strength
- High toughness and durability
- Superior fatigue resistance under dynamic loads

Application areas
- Body (primary structure)
- Chassis (spring, stabilizer, wheel)
- Exterior (roof, hood, tailgate)
- Powertrain (driveshaft)

Key Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>LOCTITE MAX 2</th>
<th>LOCTITE MAX 3</th>
<th>LOCTITE MAX 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass transition temperature [°C]</td>
<td>115</td>
<td>135</td>
<td>200</td>
</tr>
<tr>
<td>Mold release</td>
<td>External / Internal</td>
<td>External / Internal</td>
<td>External / Internal</td>
</tr>
<tr>
<td>K1C [MPa m1/2]</td>
<td>1.2</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Tensile strength [MPa]</td>
<td>85</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Tensile modulus [GPa]</td>
<td>2.9</td>
<td>3.0</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Loctite FRP 2000 Binder
- Compatible with Polyurethane and Epoxy resins
- Low material consumption due to high strength
- Thermoplastic behaviour

WE THOROUGHLY CHECK EVERY PART TO SPEED UP YOUR PRODUCTION TIMES.
LOCTITE and TEROSON Composite Bonding Solutions

Henkel’s high-quality tailored adhesives are the perfect match for your production and assembly of composites or multi-substrates.

LOCTITE UK 2015
- Substrate: CFRP, e-coated steel and aluminum
- Developed for fast curing in serial production
- Good crash performance

LOCTITE UK 2032
- Substrate: CFRP, e-coated steel and aluminum
- Cold and warm curing possible, curing speed adjustable by heat
- High elongation and high strength

LOCTITE EA 9065
- Substrates: CFRP, steel, and aluminum
- Cold and warm curing possible, curing speed adjustable by heat
- High-strength adhesion and high impact resistance

TEROSON PU 1511
- Substrates: CFRP, e-coated steel, aluminum, various plastics
- Unlimited open time and fast curing at > 85 °C
- High elasticity, high strength, and outstanding adhesion performance

TEROSON PU 9214
- Substrates: CFRP, e-coated steel, aluminum, various plastics
- Curing by humidity
- High elasticity, good gap filling and weathering stability
- Solvent free

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Product</th>
<th>Technology</th>
<th>Process</th>
<th>Curing time [min]</th>
<th>Heat stability [°C]</th>
<th>Elongation [%]</th>
<th>Shear strength [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Bonding for multi-substrates</td>
<td>LOCTITE UK 2015</td>
<td>Polyurethane</td>
<td>2P / RT and 80°C</td>
<td>3 – 5 h</td>
<td>85</td>
<td>100</td>
<td>24</td>
</tr>
<tr>
<td>Structural &amp; elastic Bonding</td>
<td>LOCTITE UK 2032</td>
<td>Polyurethane</td>
<td>2P / RT and 100°C</td>
<td>1 - 3 h</td>
<td>85</td>
<td>&gt; 200</td>
<td>8 - 12</td>
</tr>
<tr>
<td>Structural bonding</td>
<td>LOCTITE EA 9065</td>
<td>Epoxy</td>
<td>2P / RT</td>
<td>240</td>
<td>200</td>
<td>&lt; 5</td>
<td>18-22</td>
</tr>
<tr>
<td>Structural bonding / fast curing</td>
<td>TEROSON PU 1511</td>
<td>Polyurethane</td>
<td>Micro encapsulated</td>
<td>0.5</td>
<td>150</td>
<td>&gt; 200</td>
<td>8-10</td>
</tr>
<tr>
<td>Sealing</td>
<td>TEROSON PU 9214</td>
<td>Polyurethane</td>
<td>1P / &gt; 85 °C</td>
<td>24 h</td>
<td>85</td>
<td>&gt; 250</td>
<td>&gt; 1.5</td>
</tr>
</tbody>
</table>

Technology toolbox for customized structural 2-part polyurethane adhesives:

<table>
<thead>
<tr>
<th>System</th>
<th>Open Time [min]</th>
<th>Elongation [%]</th>
<th>Tensile Strength [MPa]</th>
<th>E-Modulus [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8–12</td>
<td>&gt; 200</td>
<td>&gt; 9</td>
<td>&gt; 30</td>
</tr>
<tr>
<td>B</td>
<td>5–10</td>
<td>&gt; 180</td>
<td>&gt; 18</td>
<td>&gt; 300</td>
</tr>
<tr>
<td>C</td>
<td>30–60</td>
<td>&gt; 50</td>
<td>&gt; 20</td>
<td>&gt; 800</td>
</tr>
<tr>
<td>D</td>
<td>10–15</td>
<td>&gt; 2</td>
<td>&gt; 40</td>
<td>&gt; 3000</td>
</tr>
<tr>
<td>General interval</td>
<td>5–120</td>
<td>2–250</td>
<td>8–40</td>
<td>30–3000</td>
</tr>
</tbody>
</table>
Henkel Composite Solutions – Application Examples

Our resins, adhesives, and engineering services enable a wide variety of possible applications.

Composite Coil Spring

With LOCTITE MAX Series, composite coil springs become 45% lighter and as reliable as steel springs.

Multi-Substrate Bonding

LOCTITE and TEROSON adhesive and sealing solutions enable multi-substrate assemblies.

Composite Wheel

Increase the driving performance while making it lighter and durable with LOCTITE MAX Series.

LOCTITE MAX Series

With LOCTITE MAX Series, composite leaf springs become 65% lighter and as reliable as steel spring.

Composite Lab Europe

Testing facility for customer trials with HP-RTM in Germany, Heidelberg.

Composite Lab Asia

Testing facility for customer trials with HP-RTM in Japan, Isogo.

Engineering Services

Improve your capabilities for composite and adhesive designs with our engineering support.

Testing Capabilities

2D and 3D Test molds for customer trials close to series production conditions in Composite Lab.

For more information, please visit our website: www.composite-lab.com/applications