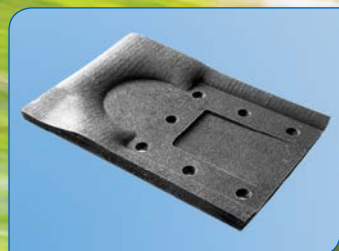


# L&L Products



Making  
automotive vehicles

*lighter, stronger,  
quieter*



## Applied engineering & materials science

L&L Products is a privately owned provider of highly innovative solutions to the automotive industry. For over half a century, our technology driven business to business company has formed long term relationships with our automotive customers and their supply partners, in order to develop and deliver materials, parts and technologies for acoustic, sealing, bonding and structural applications.

At L&L Products, we have unique and long term experience in static sealing, acoustic and thermal insulation, vibration damping, corrosion management and structural reinforcement for passenger vehicles and light trucks.

The solutions we offer are specifically and individually designed to work with the vehicle concept, helping to achieve the desired performance, regulatory approvals and manufacturing requirements of the automotive industry. Our product portfolio is aimed at preventing the intrusion of substances into vehicle body cavities and the interior, reducing vibration, increasing vehicle stiffness, bonding structural body components and providing local reinforcement.

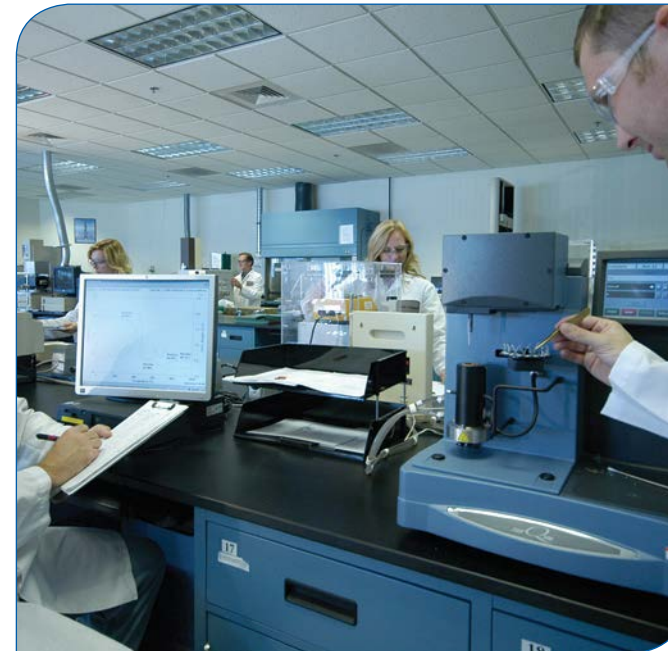
L&L Products has been able to maintain its technology leadership through continued and substantial investment in Research & Development. Our ability to combine advanced material science, innovative engineering design, finite-element-analysis, computer-aided engineering and new processing methods makes us unique in the industry. Our laboratory facilities allow validation of parts to standard automotive test methods, using the same equipment as OEMs. We can exchange CAE data with our customers, as we use the same software packages for vibration and crash simulations. This allows our designs to be readily integrated into theirs.

The fact that L&L Products has been awarded over 200 patents in the last 15 years clearly demonstrates our ability to produce innovative solutions in the areas of chemical formulations, engineering designs and manufacturing processes.

L&L Products is fully aware of the globalization of the automotive industry and is well positioned to provide local support in any location. Our factories in the USA, Brazil, central Europe, Turkey, India, China and Australia are compliant with the quality and sustainability standards TS 16949, ISO 9001 and ISO 14001. In addition to these plants, we operate another 16 strategically located facilities around the globe.



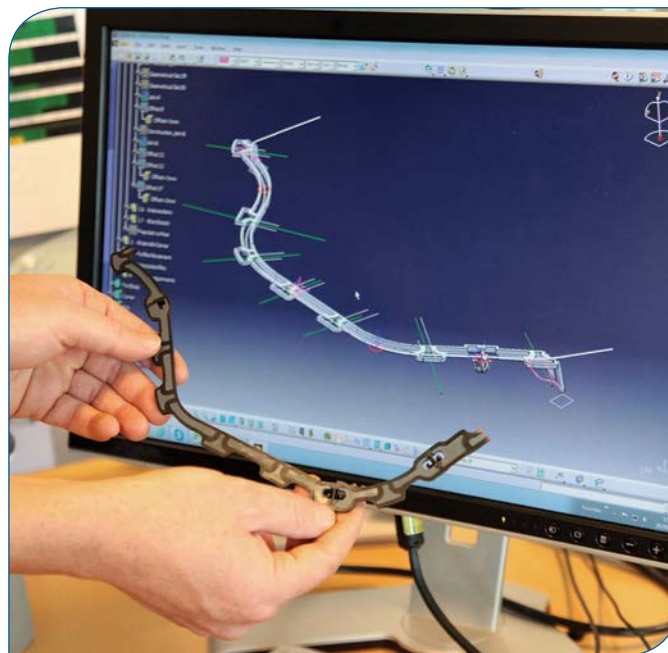
*L&L Products' wide material portfolio allows the optimum part design for each application.*



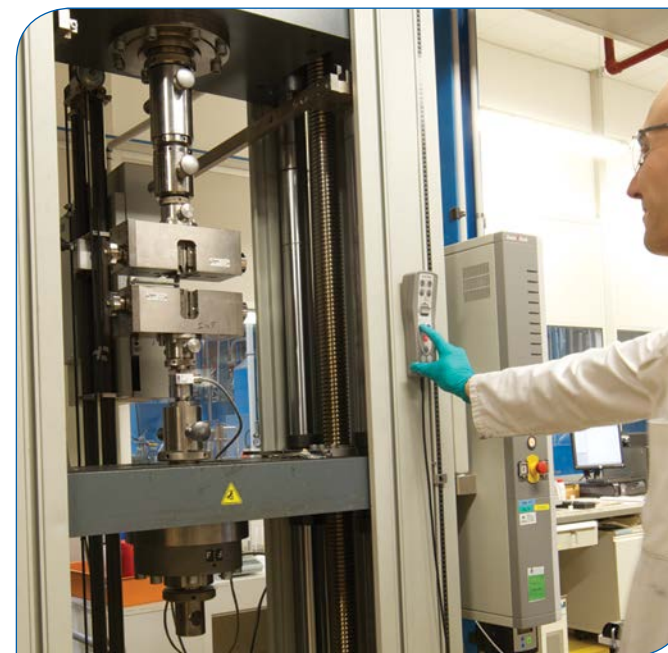
*We operate extensive Research & Development laboratories on four continents.*



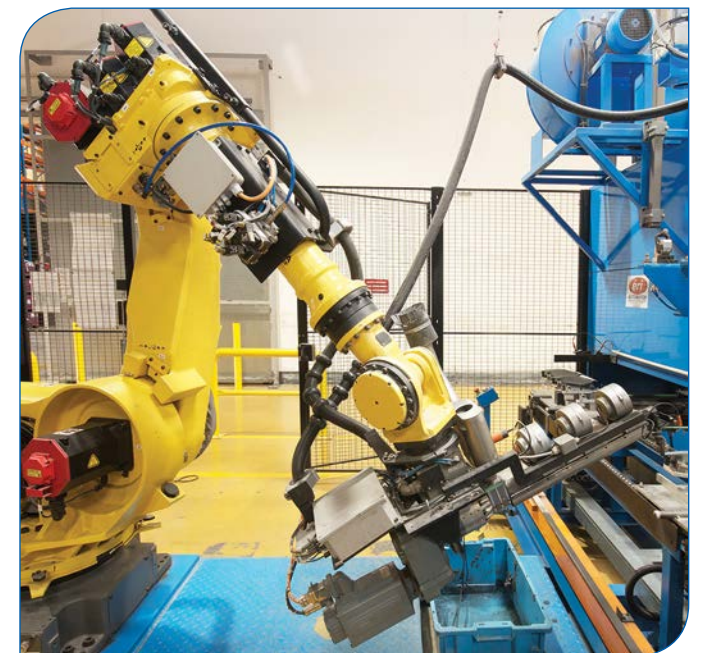
*We have production facilities in the USA, Europe, China, India, Australia, Turkey and Brazil.*



*Our CAE capabilities allow easy integration of part designs.*



*A wide array of test equipment is used to validate designs.*



*Sealants and adhesives are applied by robot with XiP.*



# Enabling lighter, stronger, quieter automotive vehicles

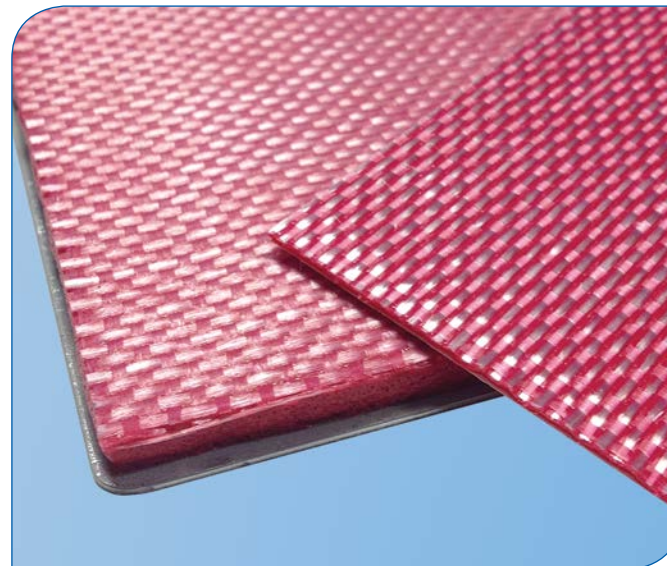
L&L Products has been working closely with the automotive industry for more than 50 years, providing solutions that make vehicles lighter, stronger, quieter and safer. Today we partner with the world's major automotive OEMs on a global basis.

We have automotive vehicle specialists based in all key vehicle design and production locations, who are able to provide expertise, support and customized technology to satisfy the diverse needs of the industry.

L&L Products keeps developing new materials, parts and technologies to match the increasing complexity of vehicle designs. With the exception of the DECI-TEX range of fibrous insulations, our automotive materials are solid at room temperature, and activated by the heat of the automotive industry's e-coat and/or paint ovens. Whether self-adhesive or dry-to-the-touch, our range of expanding sealants and acoustic damping materials as well as structural adhesives and Composite Body Solutions (CBS) can be supplied as finished parts, ready to be installed in the body assembly process, or they can be applied directly onto metal body components using L&L's patented XiP technology (Extrude-in-Place).

We start the process of developing a solution by gaining a clear understanding of the customer's needs. L&L Products works with the customer to reach their targets. These can be corrosion protection, weight reduction, noise and vibration damping, enhancement of structural and safety performance or a combination of several. We will develop a bespoke solution, which fulfils production requirements such as the need for faster cycle times, simpler processes, enhanced occupational health and safety and many more.

All our solutions are customized to meet the exact requirements of our customers, in any production location, for any vehicle design. We do not supply products off-the-shelf, but believe that any real solution must be individually tailored and adjusted to suit any type of production and assembly process.



*L&L Reinforce High Performance Composite Panel Stiffeners feature a structural foam with integral glass-fiber reinforcement. The material expands and cures in the e-coat oven. It increases panel stiffness and allows the use of thinner gauge metals..*



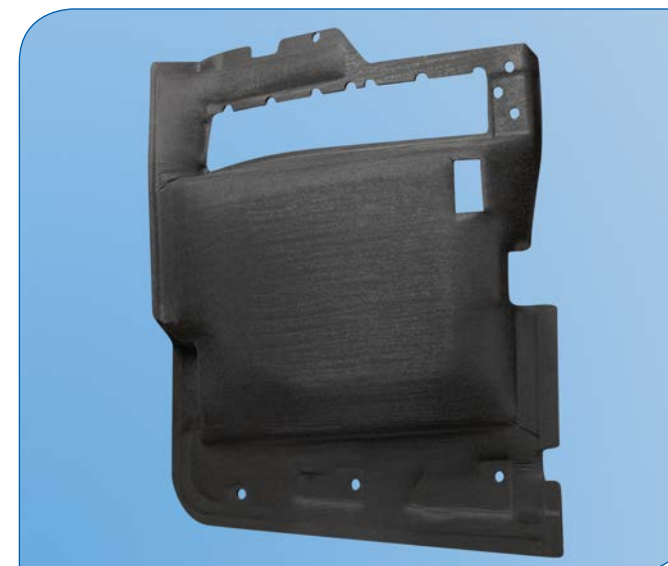
*L&L Reinforce heat-cured CBS parts are specifically engineered for each automotive application. CBS can improve body stiffness, reduce noise, enhance crash performance and reduce weight by allowing the use of thinner gauge metals.*



*The L&L Bond range of structural adhesives provides solutions for joining not only all common substrates in automotive body design, but also new materials used in lightweight constructions, such as aluminum, composites and thermoplastics.*



*L&L XiP is a robotized application process for the custom-formulated materials from L&L's Acoustic, Seal or Bond product ranges. After extrusion directly onto the metal part, the materials are dry-to-touch and solid, eliminating wash-out problems.*



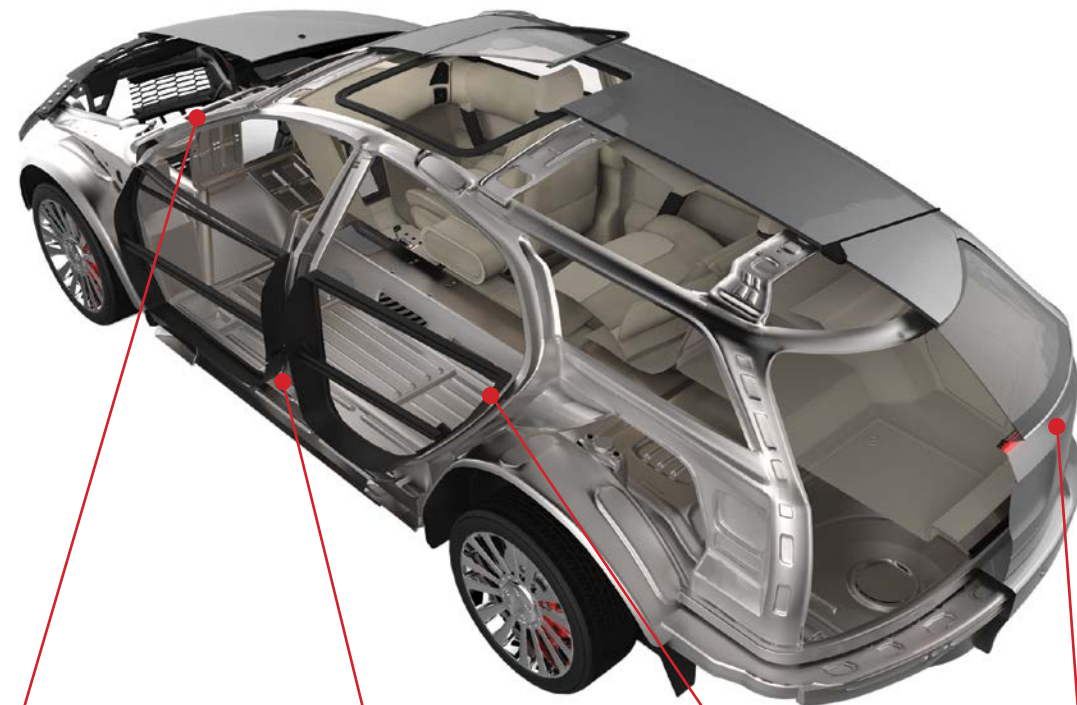
*L&L DECI-TEX systems provide automotive OEMs with significant enhancements in acoustic and thermal insulation within the vehicle interior, cabin system and engine bay. They save weight and cost at considerably better performance than competitor technologies.*



*L&L Seal heat-expandable baffle systems prevent corrosion and intrusion of dust or fumes into the car interior. They are available in a variety of part geometries, expansion rates and cell structures to suit specific design requirements.*



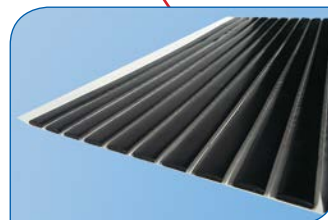
## Expanding sealants



Complex co-extrusions contain a carrier and attachment.



Bi-injection molded parts can fill complex cavity geometries.



Extruded pressure-sensitive tapes offer a high degree of flexibility.



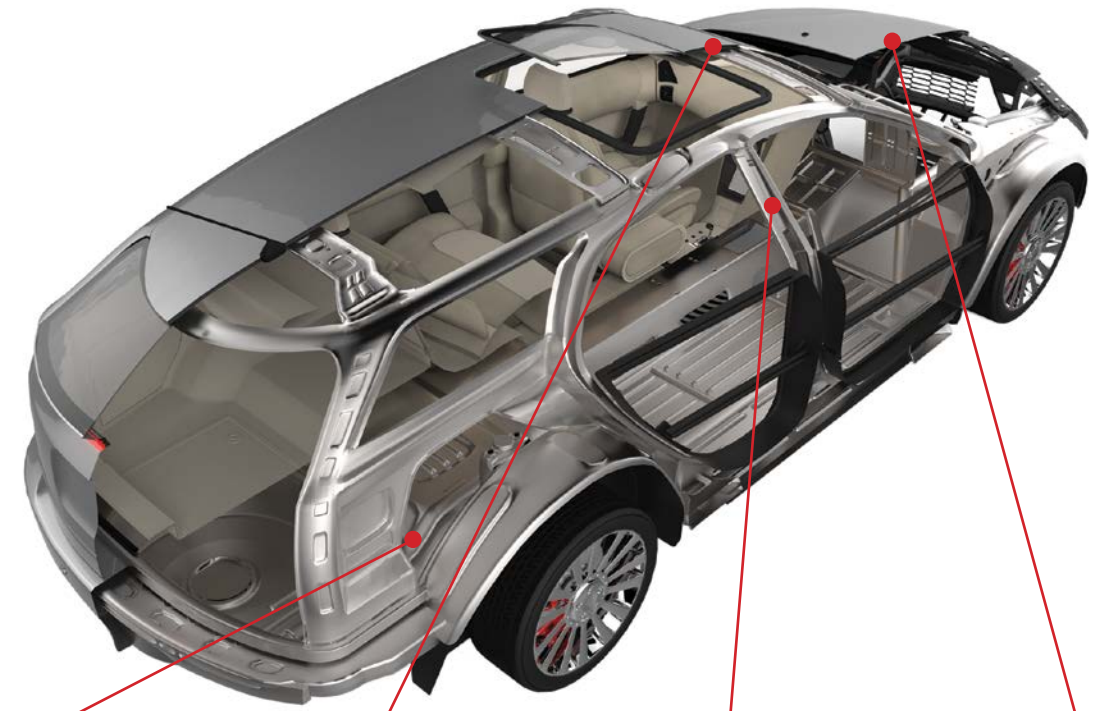
Expanding sealant applied directly onto metal parts with XiP.

## L&L Seal

L&L Products' expanding sealant technology is designed to completely fill and seal a cavity in the body structure to prevent the intrusion of water, air, dust and fumes into the interior. Our custom-formulated materials can be supplied in a variety of shapes, such as standard moldings and extrusions, but also specifically designed injection molded parts, with or without three-dimensional carriers, for even the most complex geometries. The heat-activated sealant parts are installed in the body-shop prior to the e-coat process. They permit the e-coat liquid to circulate freely, before expanding in the e-coat oven. Our range of formulations includes both rubber-based and ethylene-vinyl-acetate (EVA)-based

sealants, which offer a choice of different expansion rates, densities and cell structures. They have been engineered to have superior adhesion to a wide variety of substrates. L&L Seal provides a lightweight, high performance solution for corrosion prevention and sealing passenger and trunk compartments. L&L Products also offer a range of grades that are compatible with our proprietary XiP (Extrude-in-Place) technology, which allows robotic application of heat-activated expanding sealants directly onto metal parts. L&L XiP offers a highly repeatable process that is ideally suited to parts of high complexity. Typical applications are rear lamps and fuel fillers.

## Structural adhesives



Structural adhesive applied directly onto metal parts with XiP



Extruded structural tapes are easy to apply.



Structural adhesive films can even bond dissimilar substrates.



Adhesive films can be die-cut into specific shapes.

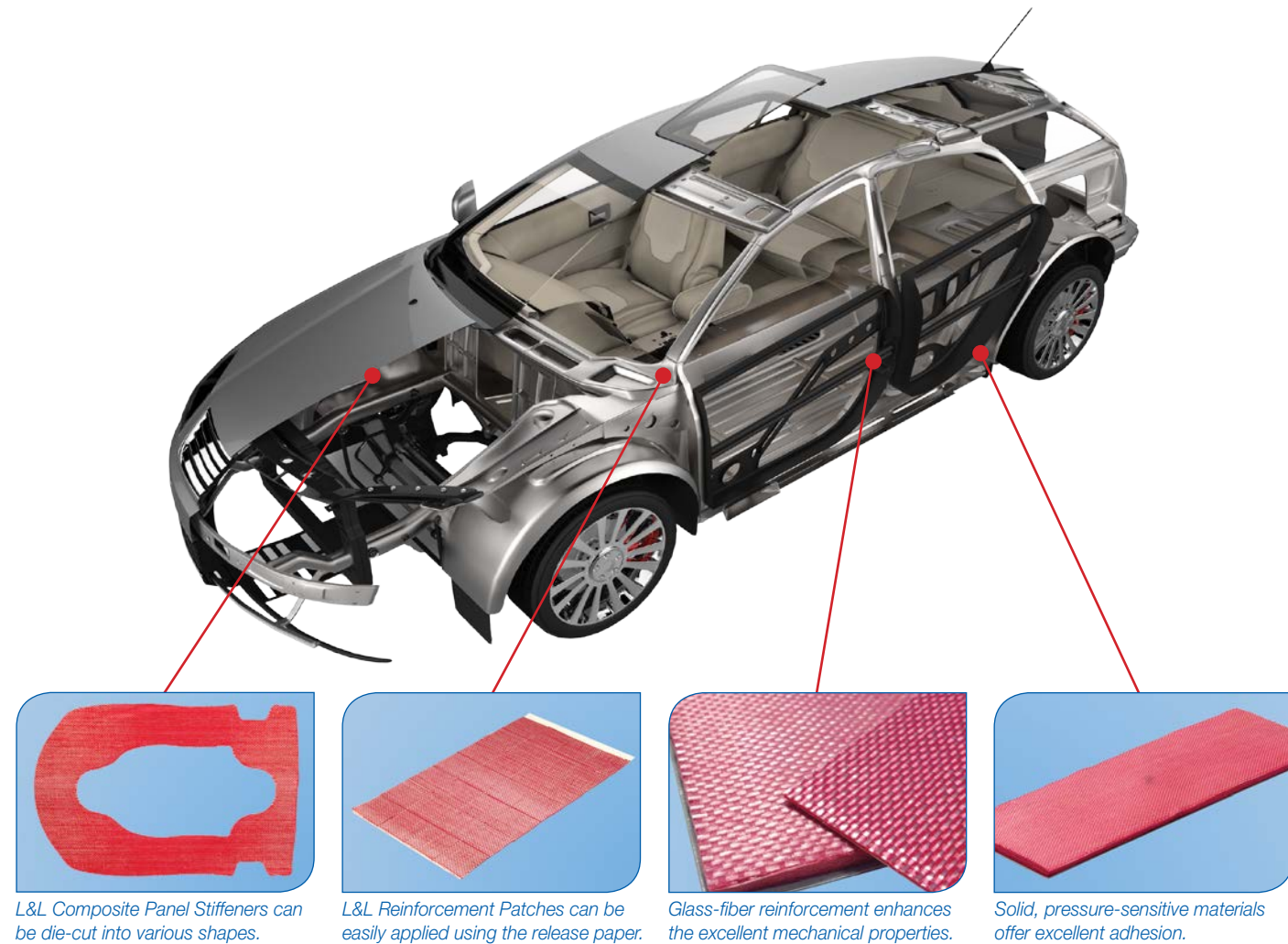
## L&L Bond

L&L Products' adhesive technologies are designed to create structural bonds between most construction materials used in the automotive industry. Continuing lightweighting initiatives cause the use of dissimilar materials in vehicle design. These substrate combinations often cannot be joined using techniques such as welding or riveting and require the use of structural adhesives. L&L Bond enables the use of lightweight substrate combinations whilst improving overall performance of the vehicle body structure. Our adhesives are capable of absorbing differential thermal expansion of the substrates due to their superior mechanical properties and can prevent galvanic corrosion issues.

We have developed a wide range of both heat-curing epoxy-based materials that are applied prior to the e-coat process, and a range of room-temperature curing single and two-component adhesives based on different chemistries such as PU, Epoxy hybrids and Methacrylates. L&L Products' adhesives are formulated to provide superior performance and durability on all substrates. Our adhesive experts can advise on the best joint design and adhesive choice for a specific application. We also offer a range of grades that are compatible with our proprietary XiP (Extrude-in-Place) technology, which allows robotic application of heat-curing adhesives for dry structural bonding directly onto metal parts.



## Localized reinforcement

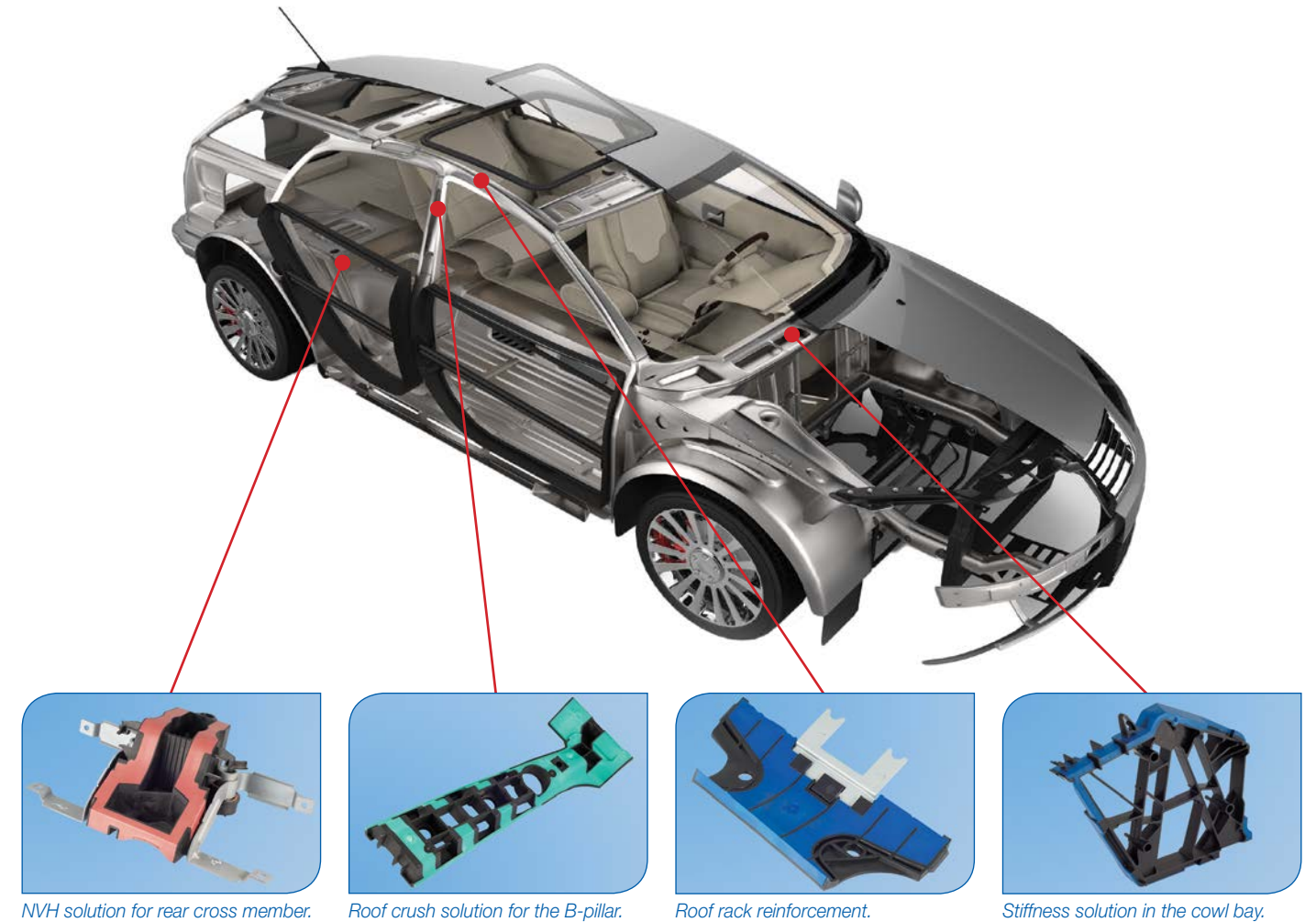


## L&L Reinforce

L&L Products' structural reinforcement materials improve vehicle body performance. Our products allow weight reduction through the use of thinner materials and permit localized strengthening of structural elements to eliminate issues such as metal fatigue. L&L Reinforce technology utilizes L&L Products' proprietary range of heat-activated structural foams and adhesives to assist the vehicle designers in achieving their weight and performance targets. Due to the nature of the full-surface bond, mechanical stress is spread over a larger area, eliminating point loads and minimizing peaks. Our composite panel stiffeners are made from a highly flexible, self-adhering material that features an integral

glass-fiber mesh reinforcement. They can follow complex part contours and have got excellent green-state adhesion, which eliminates the risk of wash-off in the e-coat bath. The panel stiffeners are applied by hand before the e-coat process. They expand and cure during the e-coat bake, developing the superior adhesion and excellent mechanical properties that make them a valuable enabler for lightweight body designs. Our materials can be used for local reinforcement of joints and sections, or to reduce bending of large body panels. L&L Products' technical experts will advise our customers on the right choice of material properties in order to avoid read-through problems on visible body panels.

## Structural reinforcement



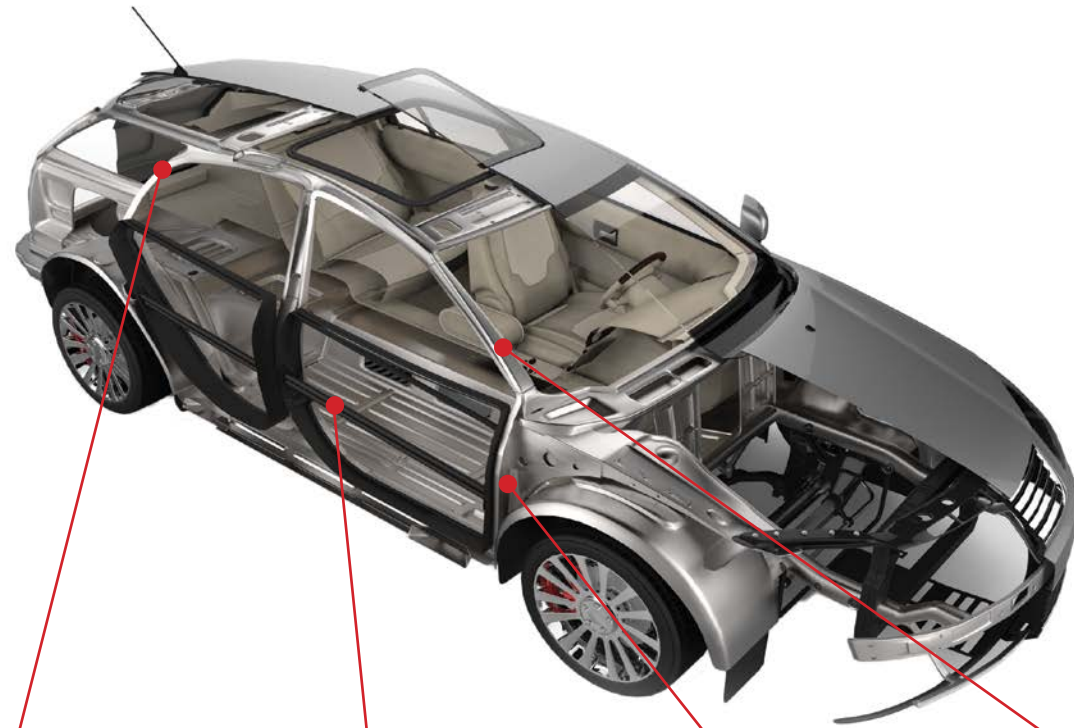
## L&L CBS

L&L Composite Body Solutions are a structural reinforcement technology that incorporates both a polymeric or metal carrier and one of L&L Products' structural foam adhesives. L&L CBS enables considerable improvements in vehicle body design, such as weight reduction, improved durability, reduced vibration, increased stiffness and enhanced crash worthiness. By equipping a three-dimensional carrier with an integral heat-activated adhesive, we design structural inserts that join the body parts around them in a way that is difficult or impossible to achieve by welding. The carrier allows the e-coat bath to circulate freely before the adhesive expands and cures in the e-coat oven. L&L CBS parts increase

the stiffness of joints and sections for NVH applications and provide section integrity and load path management. Their controlled deformation and energy absorption minimize mechanical load on the body structure, distributing it away from the points with highest stress and spreading it over a larger area. Our product development engineers use L&L Products' extensive CAE (computer-aided engineering) capabilities to design parts that can be easily integrated into the vehicle concept. By using the same software packages as the OEMs, we can simulate the effect that L&L CBS parts have on the vibro-acoustic and crash properties of the vehicle structure.



## Acoustic damping



Bi-injection moulded parts offer excellent damping properties.



Anti-flutter material applied directly onto metal parts with XiP.



High-expanding die-cut parts fill cross-sections for sound absorption.



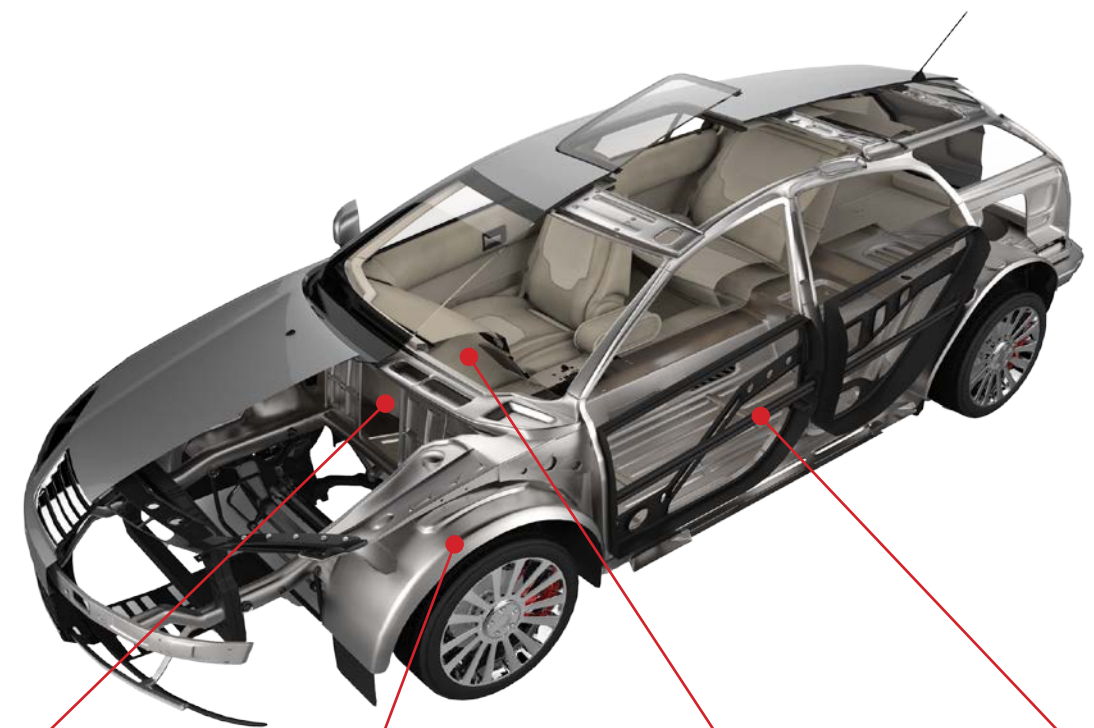
High-expanding cubes are highly versatile standard parts.

## L&L Acoustic

L&L Products' acoustic insulation solutions minimize noise levels in the car interior. Our heat-activated expanding materials fill and seal body cavities to absorb structurally borne vibrations and noise. With our extensive simulation capabilities, we can predict the effect that the parts will have on the vehicle properties, enabling designers to create quieter vehicles. L&L Acoustic technology also provides anti-flutter solutions, which are typically used on roof bows and door beams to minimize vibration from body panels. Our custom-formulated materials can be supplied as standard moldings or extrusions as well as specifically designed injection molded parts, with or without three-dimensional carriers, filling

and sealing even complex geometries. Our heat-activated acoustic parts are installed in the body-shop prior to the e-coat process. They permit the e-coat liquid to circulate freely, before expanding in the e-coat oven. Our range of formulations offers a choice of different expansion rates, densities and cell structures. L&L Products also offers a range of grades that are compatible with our proprietary XiP (Extrude-in-Place) technology, which allows robotic application of heat-activated expanding sealants directly onto metal parts. L&L XiP offers a highly repeatable process that is ideally suited to parts of high complexity. Typical applications are roof bows and door beams.

## Sound absorption



The DECI-TEX platform offers tunable, engineered sound absorption.



DECI-TEX M moldings offer optimal mechanical properties.



DECI-TEX T allows rigid, strong, three-dimensional molding.



DECI-TEX V produces flat parts with excellent acoustic properties.

## L&L DECI-TEX

L&L Products' fiber-based sound absorption technology offers precisely engineered acoustic solutions for customer-specific applications. In addition to providing better acoustic performance, DECI-TEX offers reduced weight, less material consumption and good thermal insulation. Our product platform consists of three different product categories. DECI-TEX V are vertically-lapped and lofted materials for the production of flat cut parts. DECI-TEX T are thermoformable acoustic sheet-like materials for the production of thin rigid molded parts. DECI-TEX M are molded vertically-lapped and lofted sound absorption materials for the production of variable thickness. L&L DECI-TEX is a ground-breaking

acoustic solution that is fully tunable to our customers' requirements. With our extensive simulation capabilities, we can predict what effect DECI-TEX parts will have on a vehicle's acoustic properties. The excellent mechanical properties of DECI-TEX mean that it maintains its superior performance longer than competitive products. The DECI-TEX capability includes a fully vertically-integrated technology and skill-base, which delivers greater value to our customers. Different fiber blends provide enhanced acoustics, stiffness, thermal performance and moldability. We offer the possibility to laminate acoustic facings with non-wovens, films, foils and adhesive backing.

# L&L Products

## Applied Engineering & Materials Science

L&L Products is a technology driven business to business company that has operated for more than half a century on the basis of building long term relationships with its customers and supply partners.

We have unique expertise in static sealing, sound absorption, thermal insulation, vibration damping, structural reinforcement and corrosion management for automotive, aerospace, commercial vehicle and industrial applications.

Our current portfolio of automotive products is aimed at reducing vibration, improving acoustic performance, eliminating corrosion and providing local reinforcement. The solutions we offer are exactly tailored to meet the vehicle design, regulatory approvals and manufacturing needs of our automotive customers.

We are ideally set up to provide customer specific solutions. To this end, we have a strong and continuous commitment in R&D facilities that span material science, computer aided engineering, finite element analysis, prototyping, testing, process technology and manufacturing.

With 16 strategically-located operating subsidiaries and production facilities in the USA, Brazil, Europe, Turkey, India, China and Australia, we are extremely well positioned to provide support locally to our global customer base. L&L plants comply with the quality and sustainability standards TS16949, ISO 9001 and ISO 14001.

