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AUTOMOTIVE INDUSTRIES

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SikaReinforcer

joins steel shells, body inserts, and steel rolled profile

High strength bonding adhesives

allow new approach to design of structural parts

Foams and adhesives to address vehicle **noise, vibration,** and harshness **challenges**

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"A SikaReinforcer application does not need the welding robots and quality checking which are necessary for steel solutions. The parts can be easily assembled with simple clips. This means that the technology can be implemented at any point in the design, setting up and production cycles if necessary."

– Denis Souvay, Sika Global Product Manager Body Shop Adhesives and Sealants EMEA/Global

Structural foams reinforcing and replacing metal in crash zones

By: Ed Richardson

A combination of structural foam and fiber-reinforced polymetric body inserts is providing equal crash performance to aluminum and steel inserts, while offering savings on weight and assembly complexity.

The expandable structural foam component of SikaReinforcer joins steel shells, body inserts, and steel rolled profile. It is also suitable for other sill constituents, such as aluminum panels, fiber reinforced composite shells or organosheets and other internal reinforcement profile constituents including aluminum extrusion profiles or polymeric extruded and pultruded profiles.

Automotive Industries (AI) asked Denis Souvay, Global Product Manager Body Shop Adhesives and Sealants EMEA/Global what the advantages of structural foam are over metal reinforcing.

Souvay: The use of structural foam, high strength bonding (HSB) or SmartFlow adhesives frees up designers to approach load transfer and absorption in structural parts during a crash event differently.

Denis Souvay, Sika Global Product Manager Body Shop Adhesives and Sealants EMEA/Global.

The advantages of three-dimensional plastic part technology include the curing of components after assembly, and the bonding of materials which cannot be joined using conventional welding techniques.

AI: What are some key trends driving increased use of insert/reinforcement solutions?

Souvay: There are significant savings in capital outlay and production line complexity. A SikaReinforcer application does not need the welding robots and quality checking which are necessary for steel solutions. The parts can be easily assembled with simple clips. This means that the technology can be implemented at any point in the design, setting up and production cycles if necessary.

AI: Are there different requirements for electric vehicles (EVs)?

Souvay: Sika supplies heat-conductive adhesives and materials for encapsulating and insulating electrical systems. These help ensure that the vehicles of the future will be safer, longer-lived, and more efficient.

In EVs where the battery must be protected from intrusion on all sides during a crash, the SikaReinforcer technology is one of the potential alternatives to the commonly used aluminum extruded profiles or steel cold rolled housings.

Research and development are ongoing through our Advanced Resins unit.

Sika also partnered and worked extensively with the Automotive Center Südwestfalen in the ECoS (Electric vehicle: Crash-optimized Sidefloor structures) project.

The project target was the virtual development of innovative sill reinforcement concepts for underfloor battery protection in crash cases.

Placement of EV batteries in the underbody fundamentally changes the requirements for crash structures. The traction battery increases the vehicle total weight and changes the center of gravity.

There is a basic conflict between optimizing the size of the battery for range and ensuring there is sufficient crumple zone protection.

Simulation models were used to analyze the changed load paths and deformation behavior compared to internal combustion engine-driven cars and to develop different solution concepts in principle.

The concept development was informed by a comprehensive market and technology analysis of current electric vehicles.

Changes in requirements were illuminated compared to combustion vehicles, crash physics and deformation behavior.

OEM responses to these challenges were then analyzed. This found significant differences in the vehicle architecture and the load path design, which consist of structures in the underbody and sill.

The most common approach was found to be the use of a high-strength sill with internal aluminum extrusion profiles. This design leads to various challenges, such as profile connection, the compensation of thermal expansion and the avoidance of contact corrosion.

SikaReinforcer overcomes the main challenges. Advantages include lower weight, simplified body assembly and better thermal conductivity – leading to cost savings compared to legacy technologies.

The ECoS study can be found at: https://acs-innovations.de/leistungen/verbundprojekte/ecos2021

AI: Is the technology being used in production?

Souvay: The technology is well accepted in the market. It is being used by a number of OEMs. In use, the technology has been proved to perform to specification and to age well. Customer feedback is used to guide future design, using technology to enhance the driving experience.

Sika works with other technology companies which are able to contribute to the unique selling point of plastic reinforcing.

AI: Where is the development focus for SikaReinforcer?

Souvay: The current focus is on sustainability: use less energy to produce and assemble the parts in the car body (e.g., Low bake E-coat ovens), source raw materials with zero emissions, and work on the circular design of the components

AI: Please explain the technology in a bit more detail.

Souvay: SikaReinforcer technologies combine a customized fiber reinforced thermoplastic carrier with a highly performing engineered epoxy heat activated structural bonding material.

Traditionally these have been SikaReinforcer structural foams, but the newest solution uses SikaPower structural adhesive, which has superior mechanical properties, providing better protection in the event of a crash.

During assembly, the structural inserts are placed inside the cavities of the body-in-white of the car. When the car body goes through the E-coat oven, the heat activates the SikaReinforcer or SikaPower material, which then expands and cures.

Due to superior adhesion to the surrounding metal structure, the result is a hybrid composite structure with excellent performance.

This technology enables designers to tailor reinforcement solutions that improve the performance in stiffness or crash protection in specific areas of a car body structure or contributes to the overall structural integrity of a vehicle. In addition, SikaReinforcer parts help address vehicle noise, vibration, and harshness (NVH) challenges.

AI: What are the benefits?

Souvay: SikaReinforcer structural inserts enable lightweight body structures without compromising the overall performance of the application. In general, the SikaReinforcer applications enable our customers to enhance the performance of a 100% metal design by reducing the complexity of an application and at the same time saving weight at equivalent performance versus a 100% metal design.

In addition, costs can be saved versus a metal solution due to less need for stamping dies for metallic parts.

AI: How is the performance of a structural insert or reinforcement solution being validated?

Souvay: The Sika product development team uses its expertise with advanced computer aided engineering (CAE) simulation tools to design a two-component engineered part. The simulation will always be confirmed on the complete CAE model of the OEM.

CAE simulation is used to anticipate problems before physical tests of stiffness or crash protection are performed on the complete car or a sub-model assembly. The CAE simulation methodology is showing excellent levels of correlation between CAE simulation and real tests.

AI: What differentiates Sika solutions from others in the market?

Souvay: Sika has a proven expertise in material development and is able to adapt quickly to any evolution in specification, such as sustainability, low bake or no bake requirements.

Sika also has a global footprint in development and production.

We have also been developing and producing structural insert parts for the past 15 years.

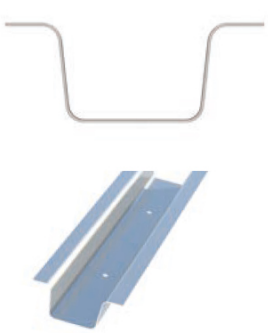
AI: What can we expect in the Innovation pipeline for OEMs?

Souvay: In order to provide an alternative to SikaReinforcer parts with structural foam, Sika developed a unique solution using a pumpable structural adhesive instead of epoxy structural foam to further enhance the crash performance of steel structures.

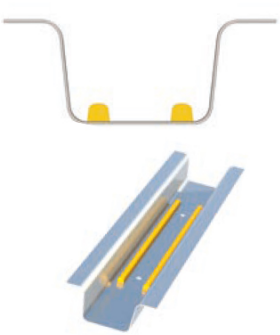
This unique HSB (High Strength Bonding) technology is used to improve the performance of press hardened steel components.

SikaPower SmartFlow technology allows the structural adhesive to be injected at the end of the body-in-white assembly process in sections which have been fitted with plastic parts. AI

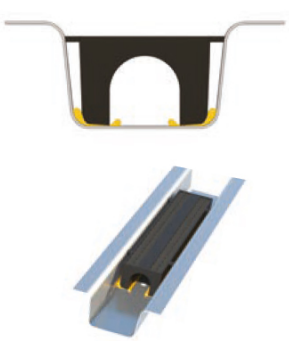
ASSEMBLY PROCESS FOR HSB APPLICATION



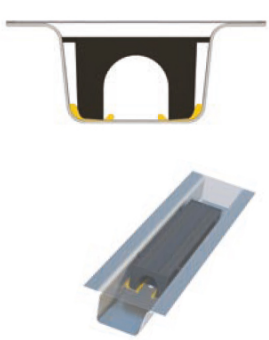
STEP 1
Prepare cavity.



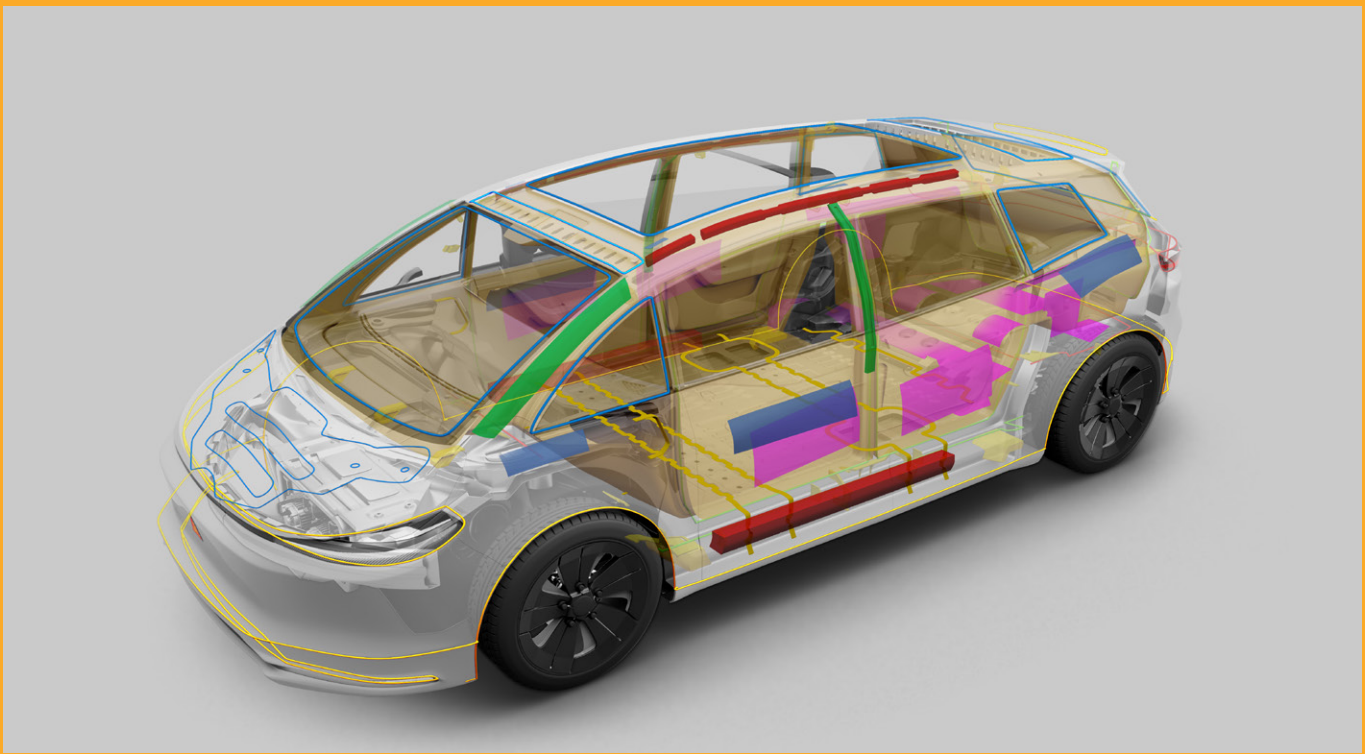
STEP 2
Predetermined volumetric beads of SikaPower® are applied.



STEP 3
SikaStructure® (engineered carrier) element inserted; adhesive beads compressed.



STEP 4
Cover plate assembled. Following e-coat dip assembly cures in existing e-coat Oven cycle.



>50% OF VEHICLES ASSEMBLED ANNUALLY USE SIKA PRODUCTS.

SIKA OFFERS AN UNMATCHED RANGE OF INNOVATIVE ADHESIVE AND SEALANT SOLUTIONS FOR VEHICLE BODY STRUCTURES, ACOUSTIC PERFORMANCE, E-MOBILITY COMPONENTS AND INTERIOR/EXTERIOR ASSEMBLY. SEE FOR YOURSELF AT SIKAAUTOMOTIVE.COM.

SikaPower® **SikaPower® MBX**	High-strength bonding for crash-durable and structural applications on conventional and non-conventional substrates - including mixed-material bonding
Sikaflex® **Sikaflex® UHM**	High-performance, primerless PUR adhesives for bonding a wide variety of substrates, including lightweight and dissimilar materials
SikaBaffle® **SikaDamp®**	Lightweight acoustic solutions in engineered parts or efficient bulk application to provide cavity sealing and sound isolation in critical noise paths
SikaReinforcer®	Precision-engineered, lightweight, crash and structural reinforcement inserts, integrated to create lighter-weight, high-performance structures
SikaForce® **SikaBiresin®**	Highest-performing thermal interface and thermal conductive adhesives for battery assembly including materials for potting and encapsulation of electronic components
SikaMelt® **SikaTherm®**	Lamination, flocking and assembly adhesives enable attractive, soft feel surfaces while meeting requirements for low emissions, easy application and short cycle times

BETTER VEHICLES START WITH SIKA

LIGHTER | STRONGER | SAFER | QUIETER | GREENER

BUILDING TRUST