Hexcel Case Study:
Audi R8 Carbon Fiber X-Brace

Hexcel and SECAR Technologie GmbH develop Audi R8 X-Brace with Hexcel HexMC®-i 2000

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Hexcel and SECAR Technologie GmbH develop Audi R8 carbon fiber engine bay X-Brace with Hexcel HexMC®-i 2000 molding compound

Hexcel's HexMC®-i 2000 carbon fiber/epoxy molding compound has been used in a novel overmolding process to produce a hybrid structure combining SECAR pullwound carbon fiber sections and Hexcel's highly structural, rapid curing HexMC®-i.

Excellent structural performance in a snap curing molding compound

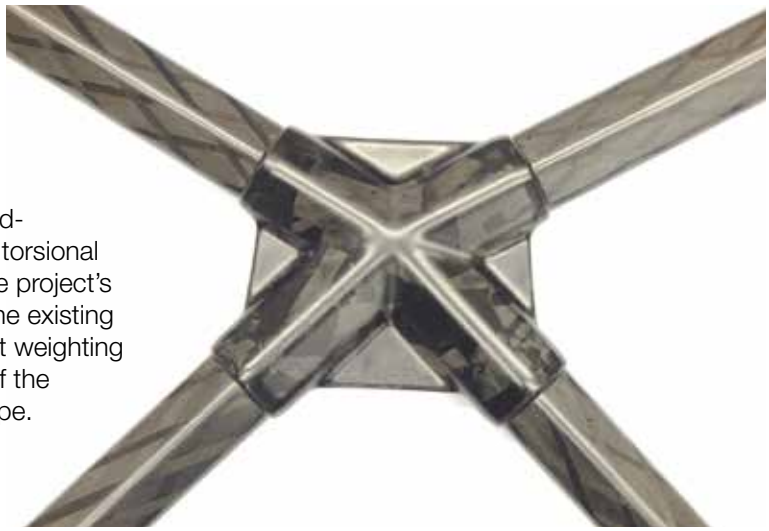
HexMC®-i 2000 is Hexcel's fast curing high performance molding material. Using high strength carbon fiber and the snap curing HexPly® M77 prepreg system, randomly orientated rectangular prepreg "chips" are assembled into a 2000gsm material that is designed for compression molding processes.

Well suited to molding complex 3D geometries and parts with varying thickness, HexMC®-i bridges the price/performance gap between low performance/low cost SMC and expensive, high performance autoclave prepreg technologies.

HexMC®-i materials can also be combined with continuous fiber products such as Hexcel's HexPly® M77 prepregs based on unidirectional fiber, non-crimp fabrics (NCF) or woven reinforcements, to increase the part strength and stiffness further.

Building on the success of previous process development projects, Hexcel's Automotive Business Unit approached Audi's composites development team in early 2016 with the aim of qualifying HexMC®-i into a production ready manufacturing process. With near perfect timing, this approach coincided with Audi conducting their own market evaluation of carbon fiber sheet molding compound (C-SMC) materials and led to the rapid selection of a suitable component.

Audi, Hexcel and SECAR Technologie GmbH, Hönigsberg, AUSTRIA joined forces to develop a composite engine bay brace for the high-performance Audi R8. This cross-shaped component braces the R8's mid-mounted V10 engine and provides increased torsional stiffness, enhancing the driving dynamics. The project's aim was to produce a composite version of the existing aluminum part that would offer significant light weighting as well as enhancing the visual appearance of the part by providing a more organic molded shape. (Process patented by Audi AG).



Snap cure press molding with a gentle touch

For the R8 X-Brace, foam filled pullwinding carbon fiber tubes were produced and then overmolded with HexMC®-i 2000 carbon fiber/epoxy molding compound to produce the central node and tube end terminations for direct mounting to the car.

One of the toughest challenges in the X-Brace development was consolidating the molding compound and ensuring the strongest adhesive bond with the thin walled (<1mm wall thickness) carbon tubes without crushing these pre-cured elements. Fortunately, the very high adhesive bond strength of Hexcel's HexPly® M77 resin system, produced a strong durable bond with no over-compression of the tubes.

SECAR and Hexcel were also able to optimize tool loading and press cure cycles to provide the optimum processing parameters for HexMC®-i with the M77 snap cure epoxy resin allowing **a weight reduction of 15% over the previous aluminum version**.

All metallic inserts for mounting the X-Brace were molded directly into the part during production, with the demolded part requiring minimal finishing before installation into the R8's engine bay.

One further benefit of HexMC®-i, due to the precise chopping of the prepreg "chips" and their random orientation in the material, is the distinctive and attractive visual surface finish that was another key requirement from Audi's development engineers

Bond strength tested to the limit

Following the production of the first prototype parts at SECAR, Audi took the testing process back in-house and subjected the new components to a rigorous program of static and dynamic load testing under room temperature as well as hot wet conditions. One of the customer's key concerns was being able to achieve a sufficiently strong bond to the pullwound tubes. Hexcel was pleased to see that all test requirements were satisfied as planned, with no adhesive film or additional bonding material used between the tubes and the HexMC®-i molding compound.

Successful qualification

The joint development program between Hexcel and SECAR clearly validated the light weighting opportunity and one-shot molding process for the new composite X-Brace and succeeded in qualifying HexMC®-i with Audi as an OEM.

"We were delighted with the success of the HexMC®-i overmolding process in such a highly visible finished part and are looking forward to supporting further developments in the very near future", comments Achim Fischereder, Director Sales and Marketing, Automotive, Hexcel.

"We see a lot of applications where we can combine the impressive characteristics of HexMC®-I with our innovative and high performance Pullwinding and Pullbraiding technologies. This is a unique combination and a good answer to increased performance requirements in the automotive market", adds Werner Stoeger, Sales and Marketing Director, SECAR Technologie GmbH.

Hexcel Product Family

HexTow®
Carbon Fiber

HexFlow®
Resins

HexMC® Molding
Composite

HexForce®
Reinforcements

Polyspeed® Laminates
and Pultruded Profiles

HexWeb®
Honeycomb Core

HiTape®
Advanced
Reinforcements

Modipur®
Polyurethane

HexWeb®
Engineered Core

HexPly®
Prepregs

Redux® & HexBond™
Adhesives

HexTool®
Tooling Material

HiMax™
Multiaxial
Reinforcements

For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

- HexTow® carbon fibers
- HexForce® reinforcements
- HiMax™ multiaxial reinforcements
- HexPly® prepregs
- HexMC® molding compounds
- HexFlow® RTM resins
- Redux® & HexBond™ adhesives
- HexTool® tooling materials
- HexWeb® honeycombs
- Acousti-Cap® sound attenuating honeycomb
- Engineered core
- Engineered products
- Polyspeed® laminates

For quotes, orders and product information call our sales office in Austria +43 7229 772-0. For other worldwide sales office telephone numbers and a full address list, please go to:

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HBI 439 JN18

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