COMPOSITES SOLUTIONS FOR MOBILITY

JEC COMPOSITES PAVILION
Multiple materials. Infinite possibilities.

The future is a blank canvas, and at Magna art and science come together as we use new materials, unique composites and flexible design techniques to create lightweight, fuel efficient future mobility solutions.

Welcome to Mobility.
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Introduction

The Mobility of the future will be impacted by mega-trends like autonomous systems, electrification and other alternative drivetrains, digitization and big data leading to a general diversification of the market and a shift to integrated solutions. New materials and material solutions will have a significant role to adapt to and support these new trends with new technology solutions for future mobility concepts.

Composites play a key role in this array of new materials and technical solutions by offering a unique list of benefits compared to traditional materials. Superior mechanical properties, high strength-to-weight ratio, corrosion resistance, radar transparency and a high design freedom are only a few of the characteristics this multifaceted material solution offers.

A wide range of tailored solutions with very specific advantages can be achieved by combining two or more materials with markedly different physical or chemical properties in a way to act in concert. With a very high grade of design flexibility and the ability to simplify through a high level of integrative options, composites offer highly adapted solutions for these new challenges of mobility. In many cases they are the only solution and enabler for new technologies.

“Composites Solutions for Mobility” highlights the different benefits, applications and the growing relevance of composite materials for mobility today and tomorrow. The more significant benefits include:

- Lightweight Through High Strength-to-Weight Ratio,
- Design Freedom, Aesthetics & Flexibility,
- Resistance, Resilience & Transparency,
- Strength & Stiffness,
- Part Count Reduction & Functions Integration,
- Hybridization & Bonding With Other Materials,
- Fuel Storage For Hydrogen & LPG Powered Vehicles,
- Battery Housing & Integration on Electric / Hybrid Vehicles,
- Connectivity Integration.

To address the issues of the increasingly diverse and fast evolving transportation industry, JEC Group, under the motto “Composites Solutions for Mobility”, creates a platform to promote the benefits and applications for the growing relevance of composite materials and the solutions they offer for mobility today and tomorrow.

JEC Group is driving this new initiative along with its partners HEXCEL, MAGNA and MEDC (the Michigan Economic Development Corporation).

We invite you to discover the JEC Composites Magazine n°123, with a major focus on Automotive including the release of a special “Composites in Automotive” research report from Deloitte – “Automotive and composite materials: current state and forecast”.

For further information:
www.jeccomposites.com/content/jec-composites-pavilion

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Lightweight construction is increasingly important in the automotive industry, because a lower weight can reduce the carbon emissions per kilometer of conventionally powered vehicles. The driving range of electrical vehicles is also extended. In the “Automotive Lightweight Composite” growth field, manufacturers are therefore searching for innovative materials and material systems that help the customer make lighter vehicles. Composites create a virtuous circle allowing engines to become lighter due to lighter structures.

**Compression Molded Carbon Fiber Hood**

Class A Unidirectional Carbon fiber epoxy prepreg. Fast cure, high Tg (180°C) resin system with Zoltek 50k tow fiber, Integrated beam for cross-car stiffness, Inner panel versions in body color as well as exposed weave carbon, Outer 1.2mm [0,90,0], Inner 0.8mm [0/90].

**KEY BENEFITS**

- The composite panels are suitable for hoods, roofs and decklids offering a 30-70% mass reduction from aluminum and steel,
- The materials and process enable aggressive exterior styling while offering improved dent and ding performance and are corrosion-resistant and exceed pedestrian safety standards.

First ever, carbon fiber compression molded class A hood developed with Cadillac for the 2016 V-Series. This lightweight composite hood achieves a weight reduction of 30%-70% compared to aluminum hoods with increased stiffness and improved aerodynamics.
Flexibility of design is one of the major benefits enabled by composite materials. It allows the creation of more complex shapes and contours with a unique and consistent surface finish.

**KEY BENEFITS**

+ Light,
+ Strong,
+ Beautiful Components.

**Product was designed and developed in conjunction with Audi Sport. Responsibility Audi Sport. Overall Package. Responsibility CAC. Composite specific knowhow (Design/Tooling/Process/Manufacturing/Testing).**
DESIGN FREEDOM, AESTHETICS & FLEXIBILITY

Door panel

The carbon fiber door panel has outer panel produced in PCM and inner panel in autoclave.

KEY BENEFITS
+ More dynamic driving experience,
+ Enhanced safety performance,
+ Competitive cost as a sport car.

The product is developed for the first and only carbon fiber electric sports vehicle in China which has entered the serial production stage. The door panel is one sample out of the 28 parts that HRC has co-developed and manufactured.
Our composite leaf spring can achieve a weight reduction of almost 50% and 5 times more durability by the introduction of customized materials, design optimization and innovated manufacturing processes.

KEY BENEFITS

+ Textile-based carbon integrated into automotive exterior parts,
+ Opportunity to transform the automotive industry by reducing the weight of automotive parts and environmental impact,
+ Fuel efficiency increase.

To address the environment issue to gain fuel efficiency, international regulation is extending in automotive industry, so eco-friendly vehicles (mainly BEVs) are under development. In this regard, car makers ask for lighter and stronger materials to improve fuel efficiency and reach a higher durability.
This textile carbon fiber (TCF) composite fender validates the first-ever successful compounding and injection molding of a full-size automotive component with carbon fiber made from textile-grade PAN precursor. This fender prototype was created through an IACMI project with Oak Ridge National Laboratory, Techmer PM, and Michigan State University, with injection molding completed at the IACMI Scale-Up Research Facility (SURF) in Detroit, MI.

**KEY BENEFITS**

+ This fender shows that textile-based carbon fiber can be integrated into automotive exterior parts, offering an opportunity to transform the automotive industry by reducing the weight of automotive parts and the environmental impact while increasing fuel efficiency.

The fender was created to demonstrate the capability of the textile-based carbon fiber to serve the application needs for lightweight automotive parts at lower costs than before.

Partners:
Techmer PM,
Oak Ridge National Laboratory,
Michigan State University
COMPOSITES SOLUTIONS FOR MOBILITY

RESISTANCE & RESILIENCE

Waterpump
Bakelite® PF 6510.

KEY BENEFITS
+ Weight savings by metal replacement,
+ Cost reduction through elimination of finishing steps,
+ High heat resistance,
+ Chemical and dimensional stability.

Toothed Belt Sprocket
Bakelite® PF 1110.

Volkswagen.

German OEM.
STRENGTH & STIFFNESS

Composite materials offer higher specific strength and stiffness than other conventional materials. Readily available carbon fiber composites will match the stiffness and strength of high-grade aluminum in all directions, at less than two-thirds of the density. Specialist grades can double the strength and stiffness of steel in the fiber direction at a fifth of the density. The relative lightness of composite materials enables the use of bigger sections that are inherently stiffer and stronger for bending and torsion. This is a considerable advantage for engineered structures.

Hexion developed EPIKOTE™ Resin TRAC 06000 with EPIKURE™ Curing Agent TRAC 06130 to match all of BMW’s performance and production speed requirements in LCM and HP-RTM processing. The product cures in less than 2 minutes, enabling fast and cost-efficient part manufacture.

Tunnel reinforcement

Hexion developed EPIKOTE Resin TRAC 06000 with EPIKURE Curing Agent TRAC 06130 to match all of BMWs performance and production speed requirements in LCM and HP-RTM processing. The product cures in less than 2 minutes, enabling fast and cost-efficient part manufacture.

KEY BENEFITS

- CFRP weighs 60% lighter than steel,
- Very short cycle time in Liquid Compression Molding,
- Local reinforcement enhances torsional stiffness.

BMW uses carbon fibre reinforced composite (CFRP) for structural elements of the passenger cell as part of a hybrid construction scheme incorporating ultra-high-strength steels. This enabled the weight of the new 7-Series to be reduced by 130kg compared to its predecessor.
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**KEY BENEFITS**

+ CFRP weighs 60% lighter than steel,
+ Short cycle time in High Pressure Resin Transfer Molding (HP-RTM),
+ Increase of torsional and bending stiffness,
+ Compatible to steel and aluminum in hybrid constructions.
STRENGTH & STIFFNESS

Transmission Cross Member

Hexcel's HexMC®-i carbon fiber/epoxy molding compound, manufactured from UD prepreg chips that are randomly oriented and have longer fibers than standard SMC, providing higher performance. Made using Hexcel’s HexPly® M77 resin system that cures in 90 seconds for series production.

KEY BENEFITS

+ Macro tests demonstrate that this technology achieves the same stiffness and strength performance as aluminum, with weight-saving and function integration benefits,
+ Fatigue tests are currently ongoing to prove the durability performance,
+ In addition, this technology has the potential for zero waste production.

This project is a joint development with Alpex, IPPE (JKU) and Engel to develop a C-SMC transmission crossmember that is cost-competitive with aluminum and thermoplastic solutions.
Advantageous multi-material solutions are made possible by joining composite materials to metals: developing hybrid structures in the form of toughened composites with better balanced mechanical properties is crucial.

**Hybrid FRP/Metal Side Sill**

**Fast-cure prepreg with ability to cure and bond in a one step process to metals, including aluminum or steel with oily surface.**

**KEY BENEFITS**

+ Weight saving,
+ Enhanced safety,
+ Increased energy absorption,
+ Battery protection in a crash situation,
+ Production flexibility.
The liftgate on the 2019 Acura RDX is a lightweight, high-volume, integrated exterior closure system that replaces multiple steel and assembled components.

Composite materials offer the ability to add new functions to a part and reduce the number of sub-parts as well as the overall mass. Composites allow the integration of mechanical but also electronic features, lighting or identification. This features integration takes place at a level where steel does not have the ability to do so. The integration of functions is always conducted during the manufacturing operations and during the completion of the parts.

**Thermoplastic Liftgate**

The liftgate on the 2019 Acura RDX is a lightweight, high-volume, integrated exterior closure system that replaces multiple steel and assembled components.

**Partner:**

Honda R&D Americas, Inc.

**MAGNA**

**KEY BENEFITS**

+ Fully recyclable, the composite liftgate cuts vehicle weight, helping improve fuel economy and reduce CO2 emissions,
+ The composite liftgate modules are up to 25 percent lighter, making them ideal for SUVs and crossovers.

Honda R&D Americas partnered with Magna to develop a new liftgate module for the 2019 Acura RDX, which is regarded as the technology leader in the crossover segment. The seamless and contemporary design gives consumers an increased perception of quality.
What are Magna Exteriors’ main reasons for being involved in the JEC Composites Pavilion Initiative?
With the growing use of composites in automotive, it makes perfect sense to partner with JEC at the North American International Auto Show (NAIAS). While advanced materials have been a part of vehicle manufacturing for decades, the pull from our customers continues at an accelerated pace as they work to lower mass and improve fuel economy and emissions. This forum at NAIAS is a good opportunity to spotlight what composites can do to help carmakers meet their performance and design goals.

How do you see the future of composites in automotive?
We are at an interesting and important intersection for composites and technology as we move toward autonomy. Composite and resin materials enable us to integrate the various ADAS sensors needed for future mobility in an aesthetically pleasing and structurally compliant manner. For the light truck and SUV segments, advanced composites offer interesting alternatives around specific areas of the vehicle that have historically been metallic.

How are you responding to current market challenges?
Cost of advanced composite materials continues to be a challenge, especially when high-volume, mass production is required. Magna has proven expertise in materials science and we’ll continue to leverage our two Composites Centers of Excellence to partner with OEMs globally in the development and testing of new materials and applications.
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FUEL STORAGE OF HYDROGEN & LPG-POWERED VEHICLES

The use of alternative fuels, such as hydrogen, is becoming an increasingly sought-out solution to improve energy efficiency and reduce CO₂ emissions, especially in the automotive industry.

Pressure Vessel

Main idea was to use carbon prepreg fiber to save production time. By the use of MFTECH filament winding robot with the knowledge of CEA and the prepreg carbon from TCR we obtain a speed of winding close to 40 kg per hour. Next step will be 70 kg per hour.

H₂ Composite pressure vessel.

KEY BENEFITS

+ Light weight tank for fuel cell cars.

Partners:
CEA,
TCR Composites
ELECTRIC/HYBRID VEHICLES & CONNECTIVITY INTEGRATION

The main issue encountered by electric vehicles is their capacity to stay charged. The lighter the vehicle, the longer it can run. The weight of battery cases in particular can be reduced by using composite materials, while still maintaining safety and crash-resistance. Connected-car systems are rapidly developing thanks to the improved use of the right materials. Optimized safety and self-driving capacities are two of the major challenges facing the automotive industry.

GFRP Bracket for Wireless Charging 3,7 kW

The part is a GMT-GMTex Mix. The material used in press technologie allows the creation of a load optimized design and the combination with joining technologies as gluing and screwing by using inserts.

KEY BENEFITS

+ The bracket is made of Quadrant GMTex and GMT. This material allows a high mechanical protection of the carpad module and has no influence to the electromagnetic field.

This GFRP bracket had been developed for the vehicle integration of wireless charging.
As new technologies in manufacturing continue to evolve and improve, one state consistently leads the automotive industry in research, development and production. Michigan. Home to leading lightweight materials manufacturers and over 14,000 manufacturing facilities, more than three quarters of all U.S. automotive R&D happens in Michigan. Which makes our state the perfect place for auto manufacturers to produce profits.
Could you tell us about the Michigan Economic Development Corporation and its role in the composites industry?

The Michigan Economic Development Corporation (MEDC) is tasked with supporting business investment and job creation in the state of Michigan. Its Automotive Office was formed to support strategic development within the automotive and advanced mobility industries. Lightweighting of vehicles and other forms of transportation is key to ensuring improved fuel economy and safety. As a main area of strategic focus for an industry that is rapidly relying on electrified powertrains, composites will play a crucial role in providing lightweighting solutions, and the MEDC will be a partner in ensuring that R&D, Engineering, material and parts production, and vehicle integration and assembly will happen in Michigan.

What are the main reasons for wanting to be involved in the JEC Composites Pavilion Initiative?

The Auto Office of the MEDC has enjoyed a strategic partnership with JEC over many years, supporting the composites industry as it grows in the automotive industry. The North American International Auto Show (NAIAS) is a great opportunity to not only showcase the future of composites lightweighting in the automotive industry, but also to demonstrate Michigan's leadership through its materials suppliers, automotive parts and systems suppliers, and in industry innovation assets such as the Institute for Advanced Composites Manufacturing Innovation (IACMI) in downtown Detroit. Global industry leaders will be on hand at NAIAS for an entire week, and the JEC Pavilion, sponsored by the MEDC, will be a focal point for demonstrating the power and potential of composites in the auto industry for many years to come.

Knowing that Mobility is a strategic industry in Michigan, how do you see composites as an important player in that field?

As touched on briefly above, the move to highly automated vehicles will be supported by a parallel move to electrified powertrains. By providing high strength with lighter weight, composites will enable electric vehicles to travel farther between charges, thereby increasing efficiency, saving energy, and lowering costs. We believe that the vehicle of the future will optimize its use of high-strength, lightweight materials across the spectrum of options, and that composites will be a major contributor. It is important to Michigan's future automotive and mobility leadership that it also leads in providing lightweight material solutions. Leadership in composites will help the state achieve that vision.
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In partnership with:

Diamond Partners

Platinum Partner

Institute Partner

Composites Solutions for Tomorrow

Providing automotive engineers with solutions to reduce weight and enhance design in a cost-competitive way. Focus on body in white, suspension and chassis.

Discover more from the composites specialists

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The automotive sector is growing steadily worldwide. This new book, written by Deloitte for JEC Group, will tackle the concerns of regulations, technical innovation and the evolution of consumer expectations for composite materials in the automotive industry.
DON’T MISS OUR UPCOMING

JEC COMPOSITES INTERNATIONAL EVENTS

JEC WORLD
2019 The Leading International Composites Show
March 12-13-14, 2019 | PARIS-NORD VILLEPINTE, FRANCE

JEC FORUM CHICAGO
Conferences & Business Meetings
June 19-20, 2019 | CHICAGO, IL, USA
Aon Grand Ballroom at Navy Pier

JEC FORUM BANGKOK
Conferences & Business Meetings
July 3-5, 2019 | BANGKOK, Thailand
Chatrium Hotel Riverside

JEC ASIA
2019 International Composites Event
November 13-14-15, 2019 | SEOUL COEX, REP. OF KOREA

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