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OEM

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Demand for composites in the automotive industry is growing constantly. With an estimated CAGR for the 2013-2020 period of 29.2%, the Automotive market has the most growth potential in terms of volume for carbon fibre consumption.

Carbon fibre is no longer the exclusive preserve of luxury sports cars, and the BMWi3 is a perfect example of this development.

New regulations, especially in Europe, USA and China, are forcing car manufacturers to reduce CO2 emissions to lower the weight of their vehicles. It requires developing new materials strategies, new tools and increasing use of composites in interior, exterior and underbody applications while using a multi-material approach. In addition to this challenge, Europe imposes recycling or upgrading for end-of-life materials.

Strategic alliances, such as BMW and SGL, Jaguar Land Rover and Cytec, GM and Teijin, Ford and DowAksa, and Daimler AG and Toray Industries Inc., are focused on incorporating carbon fiber in mass production vehicles. Our Leadership Circle improves the collaboration between the entire value-chain. That is why, during JEC World in Paris, we will highlight an amazing collaborative project with OEMs - Bentley Motors Limited, Emerald Automotive LLC and Nissan Motor Manufacturing (UK) Ltd. The LX Programme is a strategic co-operation led by Sigmatex and supported by Axillium Research, in partnership with Caparo Advanced Composites, Cranfield University, Engenuity, Expert Tooling & Automation, Granta Design, Group Rhodes, LMAT, Surface Generation and Tilsatec.

We are delighted and proud to host two special keynotes for the event - Lee Bateup, Manager of Innovation & Patents, Bentley and Chris Berg, Strategic Programme Manager, Sigmatex.

The JEC Leadership Programs, created in 2013, are the only exclusive top managers' networking events dedicated to the composites industry. We look forward to seeing you in our next Automotive and Aeronautic composite circles, during JEC Americas in Atlanta (May 3-5, 2016) and JEC Asia in Singapore (November 15-17, 2016).

Daniel Ageda & Nicolas Baudry

Welcome on board!
Originally and briefly a hypersonic weapons systems designer for Her Majesty’s Government, Lee quickly moved to the realm of ballistic defence and the research, development and application of composite materials to the protection of people and structures. Since then he has had the opportunity to use his composite materials and manufacturing knowledge in a wide range of applications and sectors, including Marine, Infrastructure, Renewable Energy, Aerospace and Automotive, finally arriving at Bentley Motors in 2007. His role has recently expanded to include all aspects of Innovation at Bentley and he manages the introduction of new technologies and manufacturing methods for future vehicle programmes.

Chris is the Strategic Programme Manager at Sigmatex managing the global growth of the business through innovation in the long term and by supporting organic growth in the short term, he also heads up R&D at the global technical excellence centre in Runcorn. Chris is also programme lead on a number of significant research and supply chain development programmes that cover the extremes of the supply chain from fibre production to finished components.

Chris’ career in engineering spans both Academia and Industry working for start-ups and large corporations in a variety of roles from Toolroom Apprentice to Directorships in Engineering, Operations and Technical functions. He has supplemented his career with academic qualifications up to PhD level and has written and presented peer reviewed papers internationally.

His background lies in a number of Engineering fields through a desire for a holistic or systems approach as opposed to discrete disciplines and is often finding simple solutions to complex problems. Chris’ approach to his role at Sigmatex is to bring all his previous experience to the generation of Technical Textile solutions for the composites industry that meet the customer’s needs and requirements by working with them to understand their challenges and find appropriate solutions.

Automotive Composites Circle
OPPORTUNITY AND CHALLENGES IN THE AUTOMOTIVE COMPOSITES INDUSTRY

Light-weighting Excellence Programme (LX) in order to achieve vehicle weight reduction
The project consists in the development and production of modular, self loadbearing full-composite bus bodies for public transportation. These buses have the advantage of being able to be driven by diesel, trolley, CNG, hybrid or full electric engines. The glass fibre-reinforced sandwich composite used for the body is a thin, self load-bearing structure that also bears the entire load in the bus. Due to the modular architecture of the body, the composite parts can be produced cost effectively in higher series. What’s more, owing to the modular system, different lengths of bus bodies can be built from the same parts.

The first bus concepts were finished back in 2014 and the production of the first 50-part series is currently in process. In October 2015, 25 complete bus bodies were built and waiting for final assembly. Five completed buses (2 electric, 1 hybrid, 1 CNG and 1 trolley) are currently running in Budapest, Hungary. Further developments are in progress to improve the production output.

The benefits of this project are numerous: lightweight body, low emissions and fuel consumption, corrosion-resistant body and low maintenance costs.

Thanks to the modular body structure, cost-effective and fast manufacturing with RTM technology, the concept is extremely competitive with traditional metal body buses.

The process consists in preparing thermoplastic woven organo-sheet blanks cut into the final shape to minimize waste and avoid machining after thermoforming followed by overmoulding. Then, the blanks are heated to an optimized temperature and stacked accordingly. The next step involves transferring and laying the blanks quickly in the mould using a specific gripper. Afterwards, the mould is closed and the molten organo-sheet is overmoulded with PPGF40 (polypropylene + 40% glass fibre) using an ingenious injection process validated through simulation. The final part is a net-shape part.

Developed 100% by Faurecia, this programme was entirely conducted in-house from early engineering to final part validation, involving all the teams: design, CAE, materials, manufacturing engineering and laboratories. The programme was launched in April 2014 and is now almost finished. Most of the validation steps were performed for both the products and processes. With this project, Faurecia mainly targets the automotive industry. The first parts concerned are liftgates and tailgates, but front end carriers, seats and any visible or non-visible structural parts will also benefit from this innovation.

Weight is saved by combining in one part functions that are usually spread out into three parts, but also due to the improved interface between the reinforcement and the overmoulding material.
The lightweight decklid (or trunk lid) concept was developed as a study to compare the weight of decklids made from steel or aluminium versus a multi-material approach—in this case, a composite and carbon fibre RTM. Reducing the cycle time associated with the use of carbon fibre was also a key requirement. The material combination used in the Lincoln MKS decklid concept, which combines Continental Structural Plastics’ (CSP) TCA Ultra Lite and carbon fibre RTM, results in a decklid that is 13% lighter than its aluminium counterpart, and cost competitive. This concept also incorporates nylon (polyamide or PA) multi-directional glass fibre tape decklid brackets that are 50% lighter than steel counterparts.

The value of using composite materials is presented in terms of weight saved, which ultimately results in improved fuel economy and reduced vehicle emissions. In this instance, the TCA Ultra Lite outer component weighs 3kg, and the carbon fibre RTM inner component weighs just 2.1kg, for a combined total decklid weight of 5.5kg, a 0.80kg improvement compared to an aluminium decklid. The carbon fibre RTM structural inner component represents a number of breakthroughs in the use of recycled carbon fibre materials for costeffective serial production applications. This decklid is the result of CSP’s ongoing effort to work with OEM and supplier partners to achieve even greater weight savings with cost-competitive materials. This comes on the heels of CSP’s successful launch of TCA Ultra Lite, currently used for 21 body panel assemblies on the Chevrolet C7 Corvette. The collaborative team then turned to the use of carbon fibre for additional cost-effective weight savings. With its partners, CSP has developed a series of carbon and hybrid fibre-based RTM materials that provide the properties—as demonstrated through CAE analysis conducted in partnership with Altair Engineering—for rendering body panels consistently lighter and more cost-effective than similarly designed aluminium components. This concept was demonstrated for a decklid design on a Lincoln MKS.

Cost-competitive, lightweight decklid concept

Automobili Lamborghini (Italy)

Combination of C-SMC and patented application to Automotive A-class components

For the first time, chopped composites are going to be widely used for aesthetic purposes in the automotive industry. Lamborghini owns the patent to achieve A-grade surfaces out of C-SMC materials. The Lamborghini Huracàn carbon package no longer uses traditional 2x2 twill prepreg, but results from a combination of C-SMC and a patented manufacturing process, achieving an A-grade result. Lamborghini’s aim is to change the customer’s mindset, as far as carbon package is concerned.

The Forged Composite material application was launched in 2010 with the Sesto Elemento project, but it was then limited to structural applications. Today, Lamborghini’s engineers have worked to achieve the A-class surface requirement for automotive standard out of the Forged Composite material process. The main challenges encountered were the reduction of the edge vortex (not acceptable according to Lamborghini’s quality standards), the surface quality after moulding, the component paintability and the integration of the fixing systems in a one-step moulding process. In 2014, all the automotive tests were conducted successfully and the material was ready to be used and processed for a new Lamborghini project: the Huracàn carbon package.

The biggest achievement of this innovation is the fact that carbon fibre usage is extended to large production volumes, thanks to the use of the press moulding process. Despite the traditionally low production volumes of Lamborghini cars, this technology is capable of producing over 500 parts per day. Additionally, the C-SMC process is less expensive than traditional prepregs. Finally, a relevant and particularly interesting point considering the environmental impact is that it recycled fibres can be used in the raw material preparation autoclave curing process is expected to drive down the cost of the wheel by reducing production costs. This is due to the minimization of consumable bagging materials, as well as a reduced production time. In addition, due to the ability to control the curing process, the scrap rate will drop substantially.
Ultra-RTM: a cost-effective manufacturing technology for high-performance thermoset fibre composites

Audi AG (Germany) in partnership with LiteCon GmbH (Austria), Evonik Industries AG (Austria), Benteler-SGL (Austria)

During the past few years, Audi AG researched and developed a technology that allows a more cost-effective and high-performance manufacturing of thermoset fibre composites. The aim of this technology development was to combine a high-volume production process with the advantages of integral sandwich construction for large and complex fibre-reinforced plastic structural components. Together with LiteCon GmbH and Evonik Industries AG, this goal was successfully achieved as part of several advanced development projects. This technology could be implemented for the first time in the Modular Sports-Car System (MSS) new Audi chassis platform in cooperation with the series supplier Benteler SGL Composite Technology GmbH. The MSS is the newest chassis platform for the upcoming Audi R8 and the Lamborghini Huracan.

In the future, the rear shelf and the B-pillar inner reinforcement for the new-generation R8 Spyder will be manufactured as an integral reinforced sandwich component. This innovative approach for component manufacturing, internally known as the Audi ultra-RTM technology, includes the following key components: material development of fibre and fast-cure resins (1-2min cure time), sandwich technology with functional integration (inserts) and low-density foam cores (<150g/l), automated preforming and preform assembly and, finally, process development (ultra RTM) for large structural CFRP components (> 5-10kg). The key advantage is the possibility of combining all of these technological components. This makes it possible to use the advantages of differential construction for high-volume production with the lightweight and performance potential of a monocoque integral design (small series). The main challenge is the infiltration of complex parts with low-density foam cores, inserts and matrix systems with a small processing window. The key to success is to control the process with in-tool sensors during the resin injection step.

Structural module in thermoplastic composites for trucks

Solvay (France) in partnership with HBW Gubesch (Germany)

This project focuses on the front structural parts of a truck cabin. Largesized organosheets (2x1.2m) made of thermoplastic composite materials based on high-flow polyamide 6 and a woven glass fabric were developed for their extreme laminate strength and stiffness. Together with OEMs, Solvay designed all the thermoplastic composite firewall structural parts. For the simulation, Solvay supplied numerical laws and used an advanced material database for the Evolite composite, the PA6/short glass fibre material and the adhesive, as well as an advanced simulation for composites and assembly to predict strength, stiffness and the Partner: HBW Gubesch (Germany) fracture initiation area. To validate all these numerical laws, Solvay produced thermoplastic composite prototypes and tested them in dynamic conditions to correlate the simulation with the reality. Finally, the manufacturing step used an innovative process developed by HBW Gubesch. This one-shot process combines a stamping process (for organosheets) and a single pressing process (for structural ribs) to ensure a short manufacturing cycle.

In order to address these challenges, an industry consortium joined forces to design, manufacture and validate a composite firewall (front structural parts of the truck cab) offering a 25% weight reduction, that divided by two the number of parts compared to current metal designs without compromising performance.

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At the core of the pioneering frame around which the Intrado concept car is based are carbon-fibre reinforced plastic (CFRP) tubes which are as flexible as rope. By aligning and curing them with a mixture of carbon fibre-reinforced plastics, the resulting structure becomes rigid and strong.

The frame is formed from precisely-shaped continuous loops made from the newly-formed material. These serve as self-contained modular frames for the roof, hood and even the entire aperture for the door on either side of the car – which are then bonded to each other along their lengths at ambient temperature. The seals of the opening panels shut directly against these frames, further reducing weight and showcasing the carbon fibre whenever the doors, hood or trunk are opened.

Running along the length of the Intrado is a “floating” centre console beam. This beam provides the Intrado with its unique strength in addition to connecting the passenger compartment and powertrain with the carbon frame. It serves as a mounting point for essential controls and protective padding, and also supports the frame’s integration with the fuel cell powertrain and the passenger compartment. The unique qualities of the Intrado make it more repairable than typical carbon fibre structures as damaged sections, or parts of sections, can be repaired without using expensive tooling or ovens. The strength and rigidity of this central structure also allows body panels to be constructed from any material – giving designers greater flexibility.

By building the Intrado with advanced carbon fibre-reinforced composites, a 50% saving in the overall weight is achieved compared to similar steel structures.

During the production of endless carbon fibre-reinforced plastics (thermosets), a certain amount of residual carbon fibres is generated. To maximize the utilization of carbon fibres, special thermoplastic granulates with secondary carbon fibres as reinforcements have been developed (in cooperation with selected companies). The thermoplastic resins used are PA, PP, PPA, PBT/PET, etc. Apart from the improved mechanical properties, especially tensile modulus and tensile strength, there is a significant weight saving for every single part compared to glass fibre reinforcements.

Additionally, the new material can also be used in several applications such as intake silencers, engine covers, clutch pedals, bearing blocks, etc. Several secondary carbon fibre-reinforced thermoplastics have already been successfully developed and an application has already been launched in series production. The centre console carrier is used in the current Mini Clubman.
Collaboration : The Key to success!

Bentley, Emerald Automotive and Nissan all set to benefit from the Lightweighting Excellence Programme

Three UK-based automotive OEMs — Bentley Motors Limited, Emerald Automotive LLC and Nissan Motor Manufacturing (UK) Ltd — are working closely with the Lightweighting Excellence Programme (LX) in order to achieve vehicle weight reduction.

The LX consortium is seeking to enhance capability within the UK automotive supply chain to manufacture composite components in medium to high volumes, at affordable costs, by connecting the key functions of material supply, design and manufacturing. The LX Programme is a strategic co-operation led by Sigmatex and supported by Axillium Research, in partnership with Caparo Advanced Composites, Cranfield University, Enge- nuity, Expert Tooling & Automation, Granta Design, Group Rhodes, LMAT, Surface Generation and Tilsatec.

AMSCI was set up by the UK Government to help existing UK supply chains grow and achieve world-class standards while encouraging major new suppliers to set up manufacturing in the UK. A total project value of £7.15M of joint funding from AMSCI and industry will support the creation of 238 new jobs and safeguard 144 existing jobs between 2015 and 2021.

OEMs are now working on weight reduction to ensure compliance with stricter emissions standards. However, as the amount of technology demanded in today's passenger vehicles increases, so does the overall weight. Composite materials allow OEMs to counteract this effect through lightweighting and part consolidation, while maintaining structural integrity.

Source: www.sigmatex.com
For more information, visit the Lightweighting Excellence website

Toray and Toyota Tsusho to jointly promote carbon fiber recycling

Toray Industries, Inc. and Toyota Tsusho Corporation announced they will launch a joint carbon fiber recycling initiative to develop highly efficient recycled carbon fiber manufacturing technology using an innovative and energy-efficient thermal decomposition method.

The companies' joint proposal for this technology has been selected by the New Energy and Industrial Technology Development Organization (NEDO) as part of its FY2015 «Strategic Innovation Program for Energy Conservation Technologies.»

Toray and Toyota Tsusho’s proposal for highly efficient recycled carbon fiber manufacturing relies on an innovative and energy-efficient thermal decomposition method(*). In this method, combustible decomposition gas from matrix resin is used as the energy source for the thermal decomposition process, which typically consumes the most energy in carbon fiber recycling. As a result, the companies expect to achieve a large reduction in the amount of energy consumed in the recycling process.

With an eye towards future commercialization, the facility will demonstrate energy-efficient recycled carbon fiber manufacturing technologies while promoting the development of new applications for recycled carbon fiber. The successful development of recycled carbon fiber and its applications will require collaboration with a wide range of customers to explore the possibilities for specific types of parts and materials. Toray and Toyota Tsusho will leverage their respective expertise and know-how to jointly implement carbon fiber recycling initiatives and contribute to the creation of a recycling-oriented society for the entire carbon fiber lifecycle.

*Thermal decomposition method: A recycling method in which carbon fiber is recovered by heating carbon fiber composite materials and thermally decomposing the matrix resins weighting and part consolidation, while maintaining structural integrity.

More information www.toray.com
Carbon/flax hybrid automotive roof

The CARBIO project has developed a carbon/flax hybrid automotive roof with reduced weight, cost and environmental impact, and improved noise, vibration and harshness (NVH) characteristics.

The adoption of carbon fibre-epoxy composites to reduce vehicle weight presents significant challenges to the volume automotive industry. Compared to carbon, flax fibres are renewable, lower in cost, CO2 neutral and have excellent vibration damping properties. In addition, bio-epoxy resins based on cashew nut shell liquid (CNSL) can offer enhanced toughness, damping and sustainability over synthetic epoxies.

By creating a hybrid structure using flax-bioepoxy to replace some of the carbon, enhanced properties such as lower weight, cost, NVH and environmental impact can be gained. For example, a 50/50 carbon/flax hybrid biocomposite with equal bending stiffness to carbon fibre offers 15% lower cost, 7% lower weight and 58% higher vibration damping. The CARBIO project is part-funded by Innovate UK. The partners are Composites Evolution, SHD Composite Materials, KS Composites, Delta Motorsport, Jaguar Land Rover and Cranfield University.

More information: www.carbioproject.com

L&L products supports innovation & new challenges at BMW

BMW has launched in its new 7 series a car body construction that combines carbon fibre reinforced plastic (CFRP), aluminium and steel.

L&L Products has been an integral partner in the development of this solution. The bonding of dissimilar materials in car bodies requires structural strength with adequate elongation to account for the differences in thermal expansion of the materials. In addition, it is essential to protect against any galvanic corrosion that could be caused by the use of different materials. At the same time this problem had to be solved in an automotive environment of volume, repeatability, prevailing plant conditions (such as oily metal surfaces) and process targets (quick curing time: 2 minutes @ 170°C [338°F]).

More information: www.llproducts.com

a dynamic MARKET ...

L&L Products developed an adhesive film to solve this challenge by working closely with BMW, Hexcel, and the other programme partners. The unique skill set of materials science and application engineering that L&L Products provides, allowed it to deliver a customized solution to the programme.

More information: www.llproducts.com

A model car with roof made of a carbon composite based 100% on softwood lignin

A research team from Innventia, Swerea and KTH Royal Institute of Technology is demonstrating by means of a model car, that raw material from Swedish forests can also be used in batteries, which reduces the use of fossil-based materials and fuel.

The Swedish research institutes Innventia and Swerea are able to present the first model car with a roof made of a composite using carbon fibre based 100 percent on softwood lignin. In cooperation with researchers from KTH, the car has also been equipped with a battery in which lignin-based carbon fibre is used as the electrode material.

The car is toy size, a demonstrator manufactured on a small pilot scale, but this is a major step towards realising the vision of new lightweight materials from the forest as part of the future bioeconomy. The next step according to researchers is a process line on a pilot scale with continuous production in order to identify the challenges that always arise when scaling up. In addition, larger quantities of carbon fibre are required to evaluate composites and composite components. The work has been carried out as part of the BioInnovation strategic innovation programme, a joint venture on the part of VINNOVA, Formas and the Swedish Energy Agency.

More information: www.innventia.com

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More information: www.innventia.com
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Meetings and networking events for the composites industry.

- **Automotive**
  - Meeting the Challenges of Composites for the Automotive Industry
  - Insight into OEMs and supply chain's current challenges and opportunities

- **Aeronautics**
  - Meeting the Challenges of Composites for the Aeronautics Market
  - Participate to this exceptional Leadersip event will make a positive and significant impact on aerospace technology and efficient networking in the Asian market

**NEXT EVENTS**

- **JEC Americas**
  - Composites Show & Conferences
  - Atlanta, May 3-5, 2016

- **JEC Asia**
  - Composites Show & Conferences
  - Singapore, Nov. 16, 2016

- **JEC World**
  - Composites Show & Conferences

**Experience Composites**
- Aims to connect the world of composites and offer learning experiences.

- **JEC Forums**
  - Composites Innovation & Technology

- **JEC Asia**
  - Composites Show & Conferences
  - Singapore, Nov. 15-16-17, 2016

- **JEC World**
  - Composites Show & Conferences

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