

## NEW BUILDINGS & INFRASTRUCTURE WORKGROUP STUDY ON ENERGY STORAGE SYSTEMS ON-CAMPUS COMMUNITY OFFICES OPEN IN 2018

» PAGE 04

» PAGE 14

» PAGE 16

### NEW GERMAN DEVELOPMENT CENTER

# INJECTION MOLDING MACHINE MANUFACTURER YIZUMI AT THE RWTH AACHEN CAMPUS

Yizumi is by quantity the third-largest manufacturer of injection moulding machines and the second-largest manufacturer of die casting machines in China and the world. Yizumi just founded a development center in Germany on the RWTH Aachen Campus to start up with preliminary development work and, in close cooperation with its Chinese colleagues, to steer the implementation towards products suitable for industrial use. AZL interviewed Richard Yan (CEO) and Hans Wobbe (CSO) from the new AZL Premium Partner Yizumi.

**AZL: Asia, especially China, is the world's largest demand region. What is your perspective on the market from the point of view of a Chinese machine manufacturer?**

**Richard Yan:** The Asian market, especially our home market China, is growing at an enormous rate. We participate strongly in this, as Yizumi was founded only 15 years ago and now builds about 1,000 machines per month. By contrast, the European market, which is dominated by Central Europe, is rather stable, but is characterized by

» *I can clearly see the lightweight construction with multi-material systems in the top focus.*

advanced technologies and innovative trends. So far, we have been less present, but we have formulated this as a goal in our strategy.

**Which technological trends do you regard as most important?**

**Hans Wobbe:** I can clearly see the lightweight construction with multi-material systems in the top focus. Equally important, however, is the trend towards individualization - the key word here is additive processes. In addition, all technologies that promise surface finishing, whether optical or haptic, are future-proof.

**What technologies does Yizumi rely on in the field of lightweight design with plastics?**

**Richard Yan:** We introduced the basic foaming of plastics some time ago, based on MuCell technology. In addition, we are uniquely positioned

opment potential here in a swivel-platen machine that combines the Mg-Thixomolding with the plastic. The combination technology of injection moulding with polyurethane is also on our agenda, together with a European partner.



Fig.: Plastics News photo from K 2016 Yan and Wobbe

with our injection moulding, die casting and thixomolding activities. This means that any combination is possible.

**Hans Wobbe:** In particular, we are thinking here of lightweight construction technologies based on organic sheet thermoforming or UD tapes. But die casting of structural components made of magnesium also has future potential.

**What role do combination technologies play?**

Due to our product range, the metal-plastic combinations will play an important role. We see a lot of devel-

**Your company has now founded a subsidiary in Europe for the first time, on the RWTH Aachen Campus. How would you like to use the Institute network?**

**Richard Yan:** From our point of view, the institute network in Aachen is unique. Before we decided on the RWTH Aachen Campus, 6 alternative university locations were scanned in terms of technological breadth and technical depth. With a clear distance to all other places, Aachen came first at the end. For all of our planned innovation areas, the technical know-how is available and is represented by institutes with a high reputation. We will use this by

network-based developments, of course also using the equipment available in the technical centers.

**How do you see the competitive advantage?**

**Hans Wobbe:** We are the only company in our industry to be located directly on a university campus with a development centre. There is no better environment for innovation! We will merge this advantage with the speed of innovation and the cost advantage of the Chinese parent company in the later mass production.

**How do you want to get involved in the AZL company network, and which partnerships do you want to build?**

**Richard Yan:** Our goal is to actively participate in the AZL company network in all projects that overlap with our strategy.

**Hans Wobbe:** In particular, we intend to initiate new projects in the future from our side. We see the resulting partnerships ideally always consisting of material manufacturers, institutes, end users and mechanical and plant engineering. Our experience has shown, that the best results are achieved in such a combination of proven experts. This is why we are planning to expand our current offices on the RWTH Aachen Campus into a fully equipped development center with our own technical center in the coming years.

### CONTENTS

#### COOPERATION BETWEEN FRAUNHOFER AND CONBILITY INITIALIZED BY AZL

For the commercialization of tape-placement systems with in-situ-consolidation by using laser, VCSEL or IR heat sources..... 2

#### INTERVIEW: DR. JÜRGEN WESEMANN OF FORD RESEARCH & INNOVATION CENTER

Providing insights into lightweight trends of the automotive market ..... 3

#### AXIA AND EXEL COOPERATION INITIALIZED BY AZL STUDY

Axia and Exel start into a cooperation for new composite building solutions ..... 4

#### iBOSS – AN INTELLIGENT PLUG & PLAY APPROACH TO SPACECRAFT ENGINEERING AND SERVICING

The sustainability of space technologies has been brought into the focus of innovations by SLA of RWTH University ..... 6

#### BYK: FIRST COUPLING AGENT FOR CARBON FIBER REINFORCED COMPOSITES

The additive is used in carbon fiber reinforced vinyl ester and unsaturated polyester resins..... 7

#### INTERVIEW WITH AUTOMOTIVE TIER 1 F.TECH

F.tech participates in the AZL Partner Network to explore opportunities for future composite applications..... 8

#### RESISTANCE PROJECTION WELDING OF CONTINUOUS FIBER REINFORCED PLASTICS

RWTH Aachen University develops welding process for direct welding of endless fiber-reinforced plastics for lightweight construction ..... 10



Right to left: Dr. Michael Emonts and Dr. Kai Fischer (AZL Managing Directors); Dr. Michael Effing (Senior Advisor)

## EDITORIAL

## DEAR READERS

Welcome to our second paper edition of AZL NewsLIGHT – the newsletter of the international AZL Lightweight Network. The AZL Partner Network today counts more than 85 partner companies, representing the entire lightweight production value chain from all over the world. Our nine partner research institutes of the RWTH Aachen University work on more than 100 lightweight projects from carbon and glass fiber production, design and testings as well as all relevant processing and post-processing technologies for composite-based materials.

During the last years, this network continued its close collaboration in joint and bilateral development projects, market studies and industrial workgroups as well as in joint business development activities.

With the AZL NewsLIGHT, we invite you to read about latest news of the international industrial and scientific lightweight community and its joint and individual activities in automotive and buildings and infrastructure markets and other lightweight applications.

For 2018, we have exciting activities ahead: We will open the AZL hub – our community office at the Production Engineering Cluster on the RWTH Aachen Campus, one of Europe's largest research landscapes. With exclusive offices and co-working spaces, this hub will offer space for direct exchange and initiation of joint projects with the RWTH Aachen community and the AZL Network. After finalizing our Joint Market and Technology Study on new potentials for composite technologies in Buildings & Infrastructure which involved more than 25 companies, we initiated the new AZL Workgroup with an open meeting with 90 participants. This group will collaborate in regular meetings on a joint roadmap. In our new study on energy storage systems, we will follow a comparable study approach to analyze established and emerging storage systems, in particular with regard to the materials used and the technologies for the production of key components.

Enjoy reading on more activities to come and contact us with your ideas and requests.

Sincerely,

Dr. Kai Fischer  
Dr. Michael Emonts  
Dr. Michael Effing

## CONBILITY GMBH AND FRAUNHOFER IPT HAVE STARTED LONG-TERM COOPERATION

For further development and commercialization of Fraunhofer's tape-placement and tape winding systems with in-situ-consolidation by using diode laser, VCSEL or IR heat sources

The "PrePro 2D" machine system for example (fig. 1) allows for the automated tailored tape placement of UD laminates with in-situ consolidation which can be used for subsequent thermoforming or as stiffening structures in injection molding processes. The machine comprises a rotating and translational table which is moved relatively to the applicator station. The Table is scalable according to the requirements of customers. Standard table diameters are 1200 mm or 2000 mm. The applicator station can be equipped with a single or with multiple spool applicators.

Because of the large process area, a 9 kW IR heater is used for the insitu-consolidation process.



Fig. 1: „PrePro 2D“ machine system for tape placement of tailored blanks and laminates with in-situ consolidation © Fraunhofer IPT

Furthermore, the award-winning "PrePro 3D" tape placement and winding applicator (fig. 2) is available as modular product with decentral control system (including closed-loop control of energy input into the processing zone) for the "plug-in" implementation in existing robot systems or machine systems by standard interfaces for the



Fig. 2: „PrePro 3D“ applicator for modular integration into existing production systems © Fraunhofer IPT

communication with the master control system. Conbility provides the single applicator as well as turn-key ready systems including the robot and handling systems.

Unique selling point of the PrePro 3D system is its multifunctional range of usage: it accomplishes laser-assisted thermoplastic tape placement, IR-assisted thermoset prepreg placement and dry fiber placement: 3 technologies included in one single modular system.

During the JEC exhibition in Paris (March 6th – 8th 2018), Conbility GmbH will present its new "VCSEL-Tape-Placement and -Winding Applicator" (Fig. 3), developed in cooperation with Fraunhofer IPT and Philips Photonics.

This applicator uses an integrated VCSEL-Laser-System as heat source which has been developed by Philips Photonics. This tape-placement and winding applicator can also be integrated as modular "plug-in" system into industrial jointed-arm and linear gantry robots in variable manufacturing cells. Using the new VCSEL-Laser as heat source

(VCSEL: Vertical-Cavity Surface Emitting Laser) leads to significant lower investment and process cost in comparison to other laser systems. Furthermore, the VCSEL laser system can accomplish controllable in-process adjustments of the laser-spot geometry as well as the intensity distribution within the spot size during the process (in-process control of laser-spot geometries and intensities) for the first time. The new system with 2 kW laser power and 10 separate emission zones which can be controlled separately will be shown at JEC in Paris 2018 as new product of Conbility GmbH.



Fig. 3: VCSEL-Tape-Placement and -Winding Applicator © Fraunhofer IPT

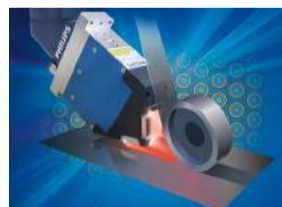
**During the JEC World 2018:**  
Showcase of VCSEL-Tape-Placement and -Winding Applicator

Thomas Weiler | Conbility GmbH | Technology Consultant | thomas.weiler@conbility.com

## NEW LASER SYSTEM FOR COMPOSITE MANUFACTURING

From Philips Photonics

Philips Photonics presents a new high power laser module at the JEC World 2018 show in Paris, optimized for the specific process and module size requirements of fiber/tape placement or winding applications. The new laser module delivers more than 2 kW of infrared power with a power density of more than



140 W/cm<sup>2</sup>. This enables fast layup speed for various types of fibers and tapes, including also high temperature thermoplastic materials. With only 49mm width, the new laser module is extremely compact and fits well into typical tape placement geometries. It is typically equipped with an integrated concentration optics for 25mm wide tapes, thereby enabling layup of narrow 3D forms.

The new laser module can be used in tape placement heads for single tapes. Moreover, because of its compact size,

stacking of many of the new laser modules is possible, supporting thereby also configurations where many tapes are applied in parallel, enabling very high productivity production. Because of the dynamic programming of the spatial heating profile, still the flexibility to produce with narrower layup width is maintained in such a configuration.

The new laser module is based on Philips Photonics' established range of industrial high power VCSEL laser sources (Vertical Cavity Surface Emitting Laser).

These robust and compact laser modules deliver directed large-area beams of infrared power and are easily integrated into industrial heating applications and production processes.

An electronic driver system enables precise power control and fast switching. As a unique feature, individual emission zones of the source can be controlled independently. Thereby dynamic programming of the spatial



heating pattern is possible, enabling an unprecedented level of process flexibility and control.



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### AZL WORKGROUP: PIPES & VESSELS

The Composites Pipes and Vessels workgroup is one of AZL's product-oriented workgroups. The goal of the workgroup is to link the demands and requirements of OEMs and part manufacturers with the novel solutions of machine material and technology developers – basically connecting the market "pull" with the technology "push". During the different meetings, the workgroup will more and more associate with technology decision makers. In future meetings, the workgroup will prepare a Customer Pain Point list, focus on OEMs and Tier 1s, and prepare a new solution list and hidden application list for composite pipes and vessels.



coming soon:  
>> composite-pipes-vessels.com

AZL in cooperation with Fraunhofer IPT | Your Contact: Tido Peters | tido.peters@ipt.fraunhofer.de

**Next Workgroup Meetings:**  
June 7th & October 11th, 2018

## INTERVIEW WITH FORD

## >> Glass-fiber reinforced plastics offer opportunities for components in the chassis, such as springs.

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The Ford Research & Innovation Center is located close to RWTH Aachen University in Aachen.  
For NewsLIGHT#11, Dr. Jürgen Wesemann from Ford Research & Innovation Center Aachen,  
provides insights into lightweight trends of the Automotive Market.

**AZL: Which major lightweight trends do you observe in the automotive market?**

**Dr. Jürgen Wesemann** When the discussion about BEVs (Battery Electric Vehicles) emerged, there were opinions that for electrified vehicles higher costs for light weighting would be justified: Lighter vehicles consume less energy so that the targeted range can be realized with a smaller and therefore less expensive battery. This triggered a strong interest in substantial weight savings also by the use of very costly materials, specifically C-fiber composites. However, battery prices were and are still falling. Furthermore, a part of the kinetic energy is recovered during braking so that the energy used to accelerate a higher mass is not completely lost. Beside other aspects, this leads to the conclusion that light weighting for future vehicles is still important but that it is not obvious whether its role will further increase. Accordingly, there is now more

emphasis on weight reduction at reasonable cost.

**What is the consequence of the trend you describe for the choice of materials and processes in the automotive industry?**

The material class with the probably biggest growth rate is hot-formed steels. In modern steel vehicles the body in white consists of up to more than 30% of these grades. Nevertheless the overall use of steels is moderately sinking. On the other hand, the share of Aluminum in body and chassis is constantly increasing. By producing more than 1 Million Aluminum bodies per year Ford is leading the way. The use of plastics and composites is relatively stable but there are some changes: the interest in C-fiber reinforced plastics for bigger structures in mass produced vehicles seems to decline. It is more and more realized that composites with a high content of C-fibers are a fantastic material for low volume

products, and customization. However, costs restricts its use for high volume production. Therefore, the focus is rather on plastics and composites reinforced with glass-fibers. Injection molding is a very efficient process for thermoplastic materials but depending on application also materials like organo-sheets and thermosets come into play.

**What opportunities and challenges do you see for composites in serial applications?**

The key challenges are costs due to high raw material prices but for thermosets, of course, also the high cycle times. Furthermore, the recycling is more difficult than for metals. Former investments and the limited design know-how for plastics and composites complicate the move from metal to plastic structures. However, there exist also unique opportunities compared to sheet metal such as consolidation of parts and the integration of functions. Engineers

have to further progress to learn how to utilize the design opportunities plastics and composites offer – the one-to-one replacement of a metal part by a plastic or composite is rarely efficient. Improved CAE tools will be of great help for this. Upcoming opportunities for glass-fiber reinforced plastics are for example in the chassis for components such as springs, where composites are very attractive for weight saving and good NVH (Noise, Vibration, Harshness) behavior. Especially for expensive fibers such as C-fibers the identification and development of applications demanding a low fiber amount for cost effective use is needed to enable the penetration of the high volume market.



**The Ford Research and Innovation Center is located in Aachen. Which cooperation potential do you experience due to your proximity to the RWTH Aachen Campus?**

The proximity to the RWTH Aachen University with its excellent institutes and institute spin-offs was a key reason for Ford to locate the headquarter of the European research in Aachen. Since more than 20 years, Ford has very intense and fruitful co-operations with several institutes including the great majority of RWTH and Fraunhofer institutes being partner of the AZL. The Campus initiative with several clusters being relevant for the automotive industry provided additional value for Ford and we welcome that several of our suppliers decided to engage in Aachen – partly they are even consolidating their European research on or next to the Aachen Campus.

## LASER-PROCESSING OF HYBRID AUTOMOTIVE PARTS

Fraunhofer ILT and its project partners successfully demonstrate production of a hybrid composite-metal roof bow for BMW 7 series.

For multi-material lightweight applications, processing of different materials such as composites and metals and their hybrids is necessary. In the HyBriLight Project, funded by the Federal Ministry of Education and Research, a consortium of 9 companies developed an inno-

plates made of steel which can be spot-welded to the car body. The connection between composite and metal is changed from adhesive joining and riveting to an innovative laser-based joining approach. Therefore the metal connecting plates are pretreated with ultrafast

process is enabled by a special variothermal mould which allows preheating the metal connection plates and process control via integrated sensors during the process. In order to save costs the carbon fiber reinforced thermoset material from the original part is replaced by a thermoplastic PA6 Matrix with long glass fiber reinforcement. To maintain the stiffness and strength of the part, the roof bow is partially reinforced with carbon fiber UD-tapes. The cycle time for the compression molding process is about 75 seconds. Afterwards the demonstrator is trimmed with a single mode fiber laser using a novel high speed scanning system. A multi-pass cutting approach enables cutting the multi-material mix in a single process step with minimized heat-input. The demonstrator part shows the successful integration of novel laser-based processes into a close-to-industry process chain.

**Kira van der Straeten** | Fraunhofer Institute for Laser Technology ILT | Project Engineer | kira.van.der.straeten@ilt.fraunhofer.de



Fig.: Hybrid roof bow ©Fraunhofer ILT

vative hybrid roof bow which demonstrates the successful implementation of novel laser-based processes for lightweight production. All basic information like dimensions and mechanical requirements of the demonstrator roof bow are based on the original part of the BMW 7 series.

The roof bow consists of a fiber-reinforced plastic bar connected to two metal connecting

lasers in order to create a spongy surface topography. The joining process itself takes place during a compression molding process of the plastic bar. The molten polymer is pressed into the generated structures, hardens and creates a strong and reliable joint based on mechanical interlocking between the two materials. The laser-based hybrid joint withstands shear stress of nearly 50 MPa. The joining process

## NEW TECHNOLOGIES FOR LIGHTWEIGHT PRODUCTION BY ASAHI KASEI

Asahi Kasei launched the Asahi Kasei Europe R&D Center in CHEMPARK Dormagen to provide technical expertise and service to the European automotive industry.

The R&D Center will furthermore develop new product grades and applications in the field of engineering plastics, synthetic rubber (S-SBR) for tires, coating, electrolyte solution for lithium-ion batteries (LIB) and lightweight composites for the European market. Asahi Kasei's broad range of products is displayed in AKXY™, a concept car firstly presented in May 2017. With SunForce™ and Textile Composites, the Japanese technology company introduces innovative lightweight solutions to the automotive industry.

**Drivable concept car AKXY™** Asahi Kasei and GLM Co., Ltd., an electric vehicle manufacturer, jointly developed a drivable concept car called AKXY™, showcasing a wide array of automotive-related materials and technologies from Asahi Kasei. Focussing on contribution to safety, comfort, and

the environment, AKXY™ is equipped with a wide variety of Asahi Kasei materials, components, and systems, numbering 27 in total. AKXY will be presented to the European audience in autumn 2018.



Fig.: AKXY™ Fuji

**SunForce™ V-0 expanded beads** SunForce™ is the world's first expanded beads material certified with the plastics flammability standard UL94 V-0. Asahi Kasei developed SunForce™ by using its expertise in proprietary polymer and foaming technologies. SunForce™ is developed from Asahi Kasei's Xyron™ modified polyphenylene ether (m-PPE) engineering plastic with a

non-halogen formulation. Even though it is a foam, it shows very high flame retardance. Thermal stability, high precision and design ability properties make SunForce™ a perfect material for lightweight solutions for the automotive industry.

**High performance Textile Composites material by using continuous fiber** Polyamide fiber and glass fiber are combined together to form a filament yarn.

The commingled yarn is then woven in to a cloth-like textile composite as a base material.

This enables design flexibility. Because the base material is cloth-like, molded parts with complicated shapes can be formed. Moreover, high interface strength has been achieved between the material of press-molded textile composite and injection-molded material in hybrid molding.

**Hiromi Nakafutami** | Asahi Kasei Europe GmbH | General Manager, Research & Development Center | hiromi.nakafutami@asahi-kasei.eu

## COOPERATION

## COMPOSITE-BUILDING SOLUTIONS FOR SMART HOMES

After meeting during the AZL study on Composites in Buildings and Infrastructure, Axia and Exel start into a cooperation for new composite building solutions.

Axia, producer of organosheets and composite S/W panels (laminated panels) and Exel, producer of high-performance composite building structures join forces to create a next generation for composite solutions in the field of high energy efficiency houses and smart home solutions.



Fig.: Justin Jin (Axia) and Mikko Lassila (Exel) joining forces

Besides the mutual representation in the Korean and European market, Axia and Exel are jointly developing new solutions including kinetic architectural systems, easy and durable connections, and "smart home" solutions.

More partners providing solutions for coating, fire resistance, design and architecture as well as structural engineering are welcome to join.

Have a look and feel of this cooperation during JEC World: At the Building Planet, Axia and Exel will present a demonstration unit with Axia's composite panel and some Exel's profile.

## INITIAL WORKGROUP MEETING COMPOSITES IN BUILDINGS &amp; INFRASTRUCTURE

After finalizing the study on Composites in Buildings & Infrastructure, the AZL founded a new workgroup. On January 25th, 2018, the kick-off meeting "Composites in Buildings & Infrastructure" was held with 90 participants from 58 companies, who discussed topics and initiatives for the workgroup roadmap including process and manufacturing technologies, fire safety regulations, materials as well as standards and norms.

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**Next Workgroup Meeting:**  
September 4th, 2018



## AXIA DEVELOPED COMPOSITE SIP AND STEEL HYBRID HOUSE SYSTEM

Composite SIP (Structural Insulated Panel) with CFS (Cold Form Steel) hybrid building system is developed. The Composite-Steel fastening system for highly structural connection is invented by Axia.

Axia Materials Co., LTD. (please visit [www.litetex.com](http://www.litetex.com) or [www.pixelhaus-composite.com](http://www.pixelhaus-composite.com)), an Organosheet as well as Composite SIP (Structural Insulated Panel) for building solutions manufacturer, announced new development of LitePan Composite SIP with CFS (Cold Form Steel) hybrid structure house systems. CFS house is a well-known building structural system for excellent seismic resist with pre-fabricated housing capability. But the many processes of insulation and water proof finishing job of CFS lead to higher cost than conventional

building materials.

This Composite-CFS Hybrid house system was developed together with Korean CFS company, Steelite Co., LTD., to bring the maximum value of energy insulation, fast construction, cost saving, sustainability, and earthquake and hurricane proof structure. And this LitePan SIP- CFS house system eliminated the usage of OSB or Plywood and this solved the worry on long term durability on these organic wood materials.

But this Composite to CFS hybrid building system needed many new developments especially on the connection details between Composite and CFS and also on the solution for different CTE (Coefficient of thermal expansion).

Axia invented Composite-Steel connecting fastening system to have 1,400Nm (1,302 ft.lbf) for pull out strength for each fastener connec-



tions and this property contributed the strong enough connections to CFS to pass required structural performance of this villa.

Also all the connections were engineered to have proper CTE matching between Composite SIP and CFS.

All the CFS were prepared in factory with punched holes and CFS walls were pre-assembled with various forms including C and H shapes. And LitePan SIPs were delivered on site as precut with its average dimension of 2.7m x 9.0m.

The process of connections was done on-site by hand tools only and all

LitePan SIPs were enveloped and completely sealed the whole area of this Villa using Axia's LiteTex composite profile with structural glue system to have a monocoque system. The total construction of Composite-CFS hybrid system took 1 week while conventional system takes more than 6 weeks in this island.

By this dramatic save of time and labor the total cost of this villa construction was decreased by 20% more than original plan.

This Villa is approved to have 1-hour fire proof, hurricane resist and earthquake resist structure. By additional structural property of LitePan SIP, this villa is using only 50% of CFS comparing to conventional 100% CFS structural design.

**Justin Jin** | AXIA | CEO/ President | [justin@axia-m.com](mailto:justin@axia-m.com)

## ECONCORE FOCUSSES ON NEW HONEYCOMB CORE DEVELOPMENTS

The need of replacing complex, heavy and expensive parts in high demanding applications becomes more and more evident. At this moment, EconCore's R&D team is advancing on developments with high performance thermoplastic materials using the continuous ThermHex honeycomb process. Several new engineered thermoplastic materials like modified PC's, PA66's, PPS were successfully tested and are being developed at the newly refurbished EconCore's R&D facilities. EconCore is entering into the final phase of validating these materials and targets this year new application developments in markets of automotive, aerospace, transportation and building & construction.

Pre-development work with these high performance thermoplastic materials resulted in very interesting application cases already earlier this year: lightweight photovoltaic panels ([www.econcore.com/en/news](http://www.econcore.com/en/news)) and aircraft stowage modules ([www.econcore.com/en/news/](http://www.econcore.com/en/news/)).

Thermoplastic Sandwich preforms, called Organosandwich, made of glass fiber reinforced thermoplastics skins (referred often as to "organosheet" or, from German, "organoblech") offer a unique set of properties and are the latest development from EconCore. Integration of the honeycomb core production with in-line lamination of composite skins allows producers to minimize handling operations and to reduce production costs of with thermoplastic sandwich materials. Furthermore, finishing (e.g. lamination of decorative layers) and

post-processing (e.g. thermoforming and overmolding) operations can be integrated in the process of production of the final sandwich part.

In close cooperation with machine building partners, EconCore started up their customized R&D cast extrusion system in their headquarters in Leuven, Belgium.

With this new equipment, EconCore can accelerate and expand their R&D projects. More important, the possibilities of support of EconCore's licensees on their developments will improve even further. The extruder covers an operating width up to 450mm, a throughput of 150kg/h and has a dryer integrated which perfectly fits the needs of the R&D team. It was designed to work with most thermoplastics (PP/PE/PC/PET/PA6/PA66/PPS...) within the ThermHex process.

There is an increasing number customers who produce glass fiber composite parts with closed moulding processes. ThermHex Waben GmbH, the daughter company of EconCore, provides now with the "THPP80-V" core an improved PP honeycomb for closed moulding processes, like the vacuum resin injection moulding process (VRIM).



**Tomasz Czarnecki** | EconCore NV | Chief Operating Officer | [tomasz.czarnecki@econcore.com](mailto:tomasz.czarnecki@econcore.com)

## MARKET &amp; TECHNOLOGY STUDY COMPLETED: COMPOSITES IN BUILDINGS AND INFRASTRUCTURE

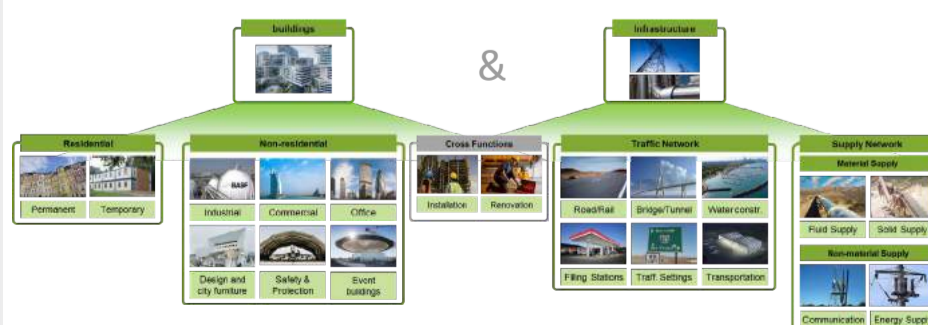


Fig.: Key Market Segments identified in the first phase of the market & technology study

In a 10-months joint study on new potentials for composite technologies in buildings & infrastructure, the AZL together with more than 25 involved companies analyzed markets and technologies in a structured approach to broaden the knowledge on business opportunities for composite technologies. The study resulted in 20 key segments as well as 438 applications with high market potential. 25 of these were analyzed in technological details, another 11 were analyzed as business cases. In January 2018 this initial collaboration was transferred into an AZL industrial workgroup which will meet every six months to turn insights from the study into a long-term collaboration.

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# GREATER EASE WHEN BUILDING WITH CONCRETE

## KRAUSSMAFFEI EXPANDS THE TECHCENTER TO INCLUDE THE REBAR PULTRUSION SYSTEM

Fiberglass rebar holds great appeal thanks to its corrosion resistance, low weight and high tensile strength | KraussMaffei's TechCenter offers a unique research program to develop new processes and applications in pultrusion | Significantly faster production speeds than the conventional tub or pull-through processes

By commissioning the second pultrusion system in the TechCenter of the Reaction Process Machinery division in Munich, KraussMaffei is expanding its expertise in the field of pultrusion, the process for continuously manufacturing fiber-reinforced plastic components. The newly developed rebar system is ideally suited for manufacturing fiberglass-reinforced rebar for concrete elements in the construction industry. Together with the first pultrusion system of the TechCenter – an iPul system for flat sections – KraussMaffei now offers its customers a unique research environment to develop and test new processes and applications in pultrusion.

### Growth market in pultrusion

"Pultrusion is a simple way to produce cost-effective profiles, there are hardly any turnkey offers and it is a growth technology. In addition, we are knowledgeable about fibers, metering technology and associated process technology," as Sebastian Schmidhuber, Head of Development for Reaction Process Machinery at KraussMaffei, states, explaining the motivation of KraussMaffei to enter the pultrusion market a year ago. The result of the most recent development work is the iPul system that was launched in 2017, which opened up new applications in pultrusion with significantly higher production speeds than the usual conventional tub or pull-through processes. Therefore KraussMaffei is now expanding its TechCenter to include a second pultrusion system, a rebar system to manufacture pultruded rebar.



Fig. 1: Corrosion-resistant and lightweight: pultruded rebar offers a great potential in the construction industry © KraussMaffei



Fig. 2: The TechCenter at KraussMaffei now offers a rebar pultrusion system in addition to the iPul system for flat sections © KraussMaffei

### Major potential in construction industry

Pultruded rebar based on epoxy and reinforced with glass or (conceivably) with carbon fiber offers an enormous potential in the construction industry. "They are corrosion-resistant compared to classical steel reinforcements. Therefore, the overlaying concrete layers can be considerably thinner," Schmidhuber explains. Further advantages include the low weight and consequently cheaper transport, the easier handling at the construction site and the fact that the fiber-reinforced rebar can be produced endlessly and wound onto drums at the end of the pultrusion system. Typical application areas are in infrastructure, for example, in bridges or in road construction or in environments susceptible to corrosion in functional buildings.

To date, finding a means of efficient production has been point of failure of an implementation suitable for series production. "The classic production speeds for rebar in the conventional tub or pull-through processes are still at relatively low haul-off speeds, in some cases under 0.5 m/min. With the new iPul system, we are aiming at up to six times faster speeds in our TechCenter and therefore offer a cost-effective alternative to conventional steel reinforcements," Schmidhuber said. KraussMaffei works closely with Evonik, which has specifically developed an ideally suited epoxy resin for this application. Additional partners are Thomas Technology (radius pultrusion) and Alpex (mold technology).



Sebastian Schmidhuber | KraussMaffei | Development Manager | Sebastian.Schmidhuber@kraussmaffei.com

## EXTRUDED PROFILES USING SKYI LFT FOR LIGHTWEIGHTING

SKYi is successful in development of innovative profile extrusion using Long fibre thermoplastic (LFT) as additive in plastic. Extruded profiles using Long fiber thermoplastics has high potential to reduce the weight by replacing metal in application requiring extremely high strength and stiffness.

Using PP-LFT, we could extrude hollow profiles with high stiffness



Fig. 1: Extruded pipe using SKYi LFT

for replacing safety metal bars for commercial vehicles with potential by reducing more than 10 kg weight. Further, it shows possibility to extrude hollow profiles for use in construction industry for light weighting as well as sustainable solution which can be non-corrosive and recyclable.

**Most Innovative Enterprise Award** SKYi was named the most Innovative Enterprise at the CII Industrial Innovation Summit organised by Confederation of Indian Industries (CII) and Department of Industrial Promotion and Policy (DIPP), Govern-



Fig. 1: Cut section of extruded profile

ment of India in New Delhi. CII Industrial Innovation Awards were instituted by CII in 2014 to recognize and celebrate innovative Indian enterprises across industry segments. These premier awards seek to recognize and honour the Indian Industry's brightest stars and to identify the top Innovative Organizations & Start-ups in the country. The award by CII is testimony to SKYi's commitment to

research and development.

**Plastindia 2018** SKYi is participating in Plastindia 2018, which is largest and the most significant exhibition on plastic across the globe. More than 2000 of the world's finest Plastics businesses from across the planet come to Plastindia to showcase. It has footfall of around half million visitors.



Dr. Sachin Jain | SKYi Composites Pvt. Ltd. | Director | sachin.jain@skyi.com

### COOPERATION

## MAJOR ADVANCEMENT IN PULTRUSION

Covestro, KraussMaffei and IKV pave the way to an industrial production of polyurethane composites.

*The pultrusion process offers tremendous potential for the efficient and continuous mass production of composite sections. Three partners from industry and academia have now enhanced the productivity of the process and the product quality, by that paving the way to a wider industrial use.*

In close collaboration, Covestro, KraussMaffei and the IKV Institute of Plastics Processing at RWTH Aachen University have enhanced the chemistry and technology of pultruded polyurethane composites to significantly increase productivity as well as process and product quality. Processors can now cut costs considerably compared to the previous method.

Polyurethane resins offer significant advantages over established pultrusion materials, such as epoxy, unsaturated polyester and vinyl ester resins. Their low viscosity, good fiber wetting and high reactivity support faster processing speeds than epoxies, which reduces manufacturing costs. Another advantage is their considerable flexibility: The reaction time and viscosity of polyurethane resins can be varied widely, permitting the reproduction of even very thin component geometries.



Fig. 1: Pultrusion technology is well suited for the continuous production of fiber-reinforced profiles. Source: Covestro

In the new iPul machines from KraussMaffei, the fibers are no longer impregnated in an open process, but rather by a metering machine in a closed injection chamber. The new technology supports precision temperature management during curing and thus increases production speeds. Thanks to the injection chamber and metering device with newly



Fig. 2: Pultruded composites are already being used for thermally insulated window profiles. Source: Jiangsu Top Composite Technology Co., Ltd.

engineered mixing head, a wide variety of polyurethane resins can now be processed.

One of them is the polyurethane system Baydur® PUL of Covestro. It is a liquid, two-component system for fabricating highly durable sections that display outstanding thermal insulation properties, among other things. Thus it is perfectly suited e.g. for use in insulating window frames.

For their efforts in promoting the wider industrial use of pultrusion with polyurethane resins, the three partners received the 2017 FSK Innovation Award for polyurethanes from the Specialist Association of Foamed Plastics and Polyurethanes (FSK), in the category "Technology – Processing and Chemistry".

**Benedikt Kilian** | Covestro Deutschland AG | Processing Development | benedikt.kilian@covestro.com

## HENKEL TO SHOWCASE ITS COMPREHENSIVE COMPOSITE EXPERTISE AT JEC WORLD 2018

As a global solution provider to OEMs and Tier 1 suppliers, Henkel continues to drive significant progress in sustainable light weighting technologies with new composite and adhesive products and extended global Composite Lab capabilities. Further with a 10-year production backlog and new aircrafts increasingly counting on light-weight composites, both Henkel's expertise in process automation and its high-impact solutions for the aerospace industry are in high demand.

Among the highlights for the automotive industry on display will be Henkel's new Loctite MAX 5 matrix resin for carbon fiber reinforced composite wheels. The new technology is designed to replace aluminum in this demanding chassis application and builds on the recent success of Loctite MAX 2 for use in glass fiber reinforced leaf springs. The new resin combines high temperature resistance, excellent toughness and long-term durability with rapid mold filling, thorough fiber impregnation and high curing rates for cost-efficient large volume production.



To serve up to 40,000 new aircrafts over the next two decades, this growing demand for high-impact solutions, Henkel has started the construction of a new production facility for aerospace materials at its site in Montornès del Vallès, Spain. The facility will include new buildings and equipment for additional production and warehouse capacities to further support key trends in the industry such as light weighting and automation. Due to the proximity to several sites of global key customer Airbus, Montornès will become Henkel's European hub for the aerospace industry.

At JEC World 2018 on Booth G48 in Hall 6, Henkel's specialists will be available to discuss the benefits of the company's broad product portfolio and global service capacities for composite applications in automotive and aerospace.

*Advanced potting compounds offering improved micro-cracking resistance, optimized density/strength ratios and flame retardancy for honeycomb sandwich structures will be in the spotlight of Henkel's exhibit for aerospace solutions at JEC World 2018.*

**Guido Adolph** | Henkel Adhesive Technologies | Global Key Account Manager Aerospace | **Konrad Brimo Hayek** | Henkel Adhesive Technologies | Senior Business Development Manager – Chassis, ADAS & Safety

## iBOSS – AN INTELLIGENT PLUG & PLAY APPROACH TO SPACECRAFT ENGINEERING AND SERVICING

In 2018, the project "intelligent Building Blocks for On-Orbit Satellite Servicing and Assembly" (iBOSS) accompanied by its "new space" company iBOSS GmbH, heads for ground qualification of its core technology, working towards the 2020 goal of in-orbit demonstration.

With upcoming private and commercial aerospace companies entering the playing field of "New Space", the sustainability of space technologies has been brought into the focus of innovation. Common satellites are highly integrated and monolithically in their design. Maintaining them in space is not



Fig. 2: iSSI – intelligent Space System Interface (© SLA of RWTH University)

feasible and in case of failure of a single component, the mission is impaired, if not compromised.

Higher sustainability and cost efficiency of satellites hence goes hand in hand with the capability to provide on-orbit service.

The iBOSS project substitutes today's satellite design with a modular system that is maintainable and upgradeable in space. This new satellite architecture uses standardized building blocks called iBLOCKs. They are connected to each other via interfaces building up the satellite in a modular way.

The project granted by the German Aerospace Center (DLR) is funded by the German Federal Ministry for Economic Affairs and Energy. Originally started in 2010 by the University of Berlin (TUB), the Research Center for Informatics in Karlsruhe (FZI) and the RWTH Aachen University's Institute of Structural Mechanics and Lightweight Design (SLA) and the Institute for Man-Machine Interaction (MMI)

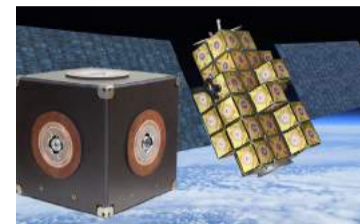


Fig. 2: iBOSS satellite and standardized building block iBLOCK (© SLA of RWTH University and RIF e.V.)

the project aims for in-orbit demonstration in 2020.

The iBOSS GmbH has been founded in 2017 by Prof. Dr.-Ing. Kai-Uwe Schröder, Dipl.-Ing. Jörg Kreisel and Dipl.-Ing. Thomas A. Schervan. The start-up's primary function as IP holder is the development of the business area and partner network. The company is offering iBOSS key technologies: First the intelligent

Space System Interface (iSSI), a 4-in-1 orbit interface providing a rigid mechanical connection and transfer of electric power, data and thermal heat. Second the standardized CFRP lightweight structure with maximized integration flexibility. It is complemented by the iBOSS Solutions GmbH accumulating the know-how with focus on R&D, founded by Prof. Dr.-Ing. Kai-Uwe Schröder and Prof. Dr.-Ing. Jürgen Roßmann.

For the years ahead, partnerships with industry and academia will be vital to keep iBOSS on fast-track. Modular satellites have the potential of being a disruptive technology taking aerospace to the next level towards "New Space", making aerospace technology more flexible, sustainable and cost-efficient.



**Thomas A. Schervan** | Institute of Structural Mechanics and Lightweight Design (SLA) | Research Assistant | thomas.schervan@sla.rwth-aachen.de

### PLANNED FOR 2019: AZL EXECUTIVE NETWORKING EVENT @ INTERNATIONAL PARIS AIR SHOW LE BOURGET



During the AZL Annual Partner Meeting 2017, the AZL Partner Companies emphasized Aerospace to be focused as another high-potential market for composites in the joint AZL activities. Following this request, the AZL is planning an Executive Networking Event during the International Paris Air Show Le Bourget bringing together executives from the composite and aerospace industry in an exclusive evening event with keynote presentations and a networking dinner as well as a joint visit of the show on the second day.

17 June 2019

## AZL CONNECTING WITH COMPANIES FROM ZHEJIANG PROVINCE IN CHINA



Fig.: China Delegation

In November 2017, AZL visited the Zhejiang province in China together with a group of German experts for Industry 4.0 and production technology, organized by the German Federal Association for Economic Development and Foreign Trade (BWA). During the Shaoxing and the Taizhou Expert Conference, the AZL team presented the Aachen lightweight activities to Chinese representatives from politics and industry. In individual visits, the AZL team met companies such as Dahua Technology, Geely Holding, Green Building System, Chiho-Tiange, JMT Mould and Xingtai Mould and identified poten-

tial cooperation between Chinese companies and the AZL and its industrial network in the field of automotive, production technology as well as buildings and infrastructure.

This visit as well as upcoming visits, are preparing the joint trip with AZL Business and Premium Partners to China in 2019.

**YOUR CONTACT:** Marina Biller | Head of Partner Networking Services | +49 241 8904382 | marina.biller@azl-aachen-gmbh.de

### AZL GOES US AND CHINA: UPCOMING AZL B2B NETWORKING EVENTS ADDRESSING REGIONS



Each year, the AZL Partners focus one target region and target market for their B2B Networking activities. After visiting Poland in 2017, USA was voted by the Partners to be the focus region in 2018 and China the region to be addressed in 2019. In October 2018, AZL Business and Premium Partners will network with American and composite companies during a Networking Event taking place during CAMX show in Dallas, Texas and joint visits of the show. The AZL team will collect details and analyze trends, markets and innovations on site and will provide this information to all AZL Business and Premium Partners. Activities in China will be communicated soon.

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06 October 2018 @ CAMX

# ALIANCYS LAUNCHES NEOMOULD 2017-S-1 RESIN

## Toolmaking made easy

Aliancys is introducing the new Neomould 2017-S-1 resin for manufacturing composite tooling. The unique resin characteristics enable to make molds that perfectly mirror the surface and dimensions of the plug. The thixotropic nature of the resin allows for excellent application on vertical surfaces without sagging. For that reason the resin is highly suitable for making thick parts in one go.

For cost-effective manufacturing of composite components in small to medium sized production



series (up to 500-1000 parts per year), composite molds are broadly used across the industry. While they bring the designer the ability to create unique shapes, composite tools also enable the manufacturing of large components like wind turbine blades, boats, and façade panels for buildings.

Compared to tools manufactured in steel, the production of composite tools is fast and versatile. For these reasons composite molds have built a track record of performance already over many years.

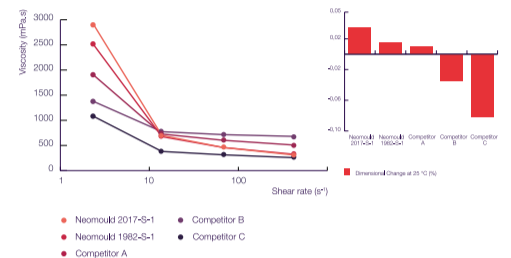
**Tool Manufacturing made easy.** Aliancys is now introducing the unique Neomould® 2017-S-1 resin, setting new standards in composites tool manufacturing and bringing multiple benefits to the professional toolmaker. The zero-shrinkage feature of Neomould® 2017-S-1 resin enables to make parts that perfectly mirror plug surface and dimensions.

At the same time the processing of the resin is fairly easy and robust. Because of the thixotropic nature of Neomould® 2017-S-1 resin and high viscosity at low shear rates, the application on vertical surfaces can be done without sagging. The low viscosity at high shear rates, makes the resin easy to apply in Hand lay-up and Spray-up processes. The combination of an enhanced thixotropic profile and optimized curing characteristics, make the resin suitable for producing thick parts (up to 12 layers of glass in one go).

**Great Support.** Aliancys has developed a new Neomould® tooling brochure for guiding customers through the toolmaking process. Additional training and technical support are available for customers through Aliancys technical experts.

*"Our customers want to make composite components with unique shapes, taking advantage of the great design flexibility these materials offer", comments Rob*

*van de Laarschot, Head of Technical Service at Aliancys. "For them this means that the shape and surface quality of the mold must be perfectly aligned with the original plug. Aliancys can build on years of experience working with composite tooling materials, helping our customers to manufacture the perfect tool that can be used for making quality parts in consistent high volumes."*



**Thomas Wegman** | Aliancys Nederland BV | Marketing Manager | [thomas.wegman@aliancys.com](mailto:thomas.wegman@aliancys.com)

# LAMILUX X-TREME PRODUCTS: MINIMUM WEIGHT, MAXIMUM STRENGTH

In the fast lane with lightweight design

Side walls, roofs and floors in commercial vehicles, caravans, buses and similar need to be extremely light, yet very stable, impact-proof and thermally resistant while also guaranteeing tensile strength and a rigid structure under heavy loads. With time-tested LAMILUX X-treme products made of carbon-fibre-reinforced composites, this is not only possible, it's standard. This composite material also allows sports equipment such as snowboards to fulfil potential.

LAMILUX X-treme impresses thanks to excellent structural properties, extreme robustness and low weight with everything matched to the application in question. The reinforcing glass or carbon fibres in the material are positioned in a uniaxial, biaxial, triaxial or multi-directional arrangement, depending on needs. This alignment process determines how strong the material is, making it perfect for any set of requirements.

This enormous increase in strength can also ensure signifi-

cant savings on material thickness. Less is truly more with LAMILUX X-treme – more lightweight to be precise. This characteristic is crucial for performance in vehicle construc-

tion and sports equipment. Everyone wants to save energy, yet no-one wants to curb their speed.

**High-strength and thermally resistant** LAMILUX X-treme and LAMILUX X-treme Carbon absorb any load and tension forces acting on sandwich



Fig.2 : LAMILUX X-treme texture

panels when used on extensive surfaces in side walls, roofs and flooring, making the whole structure resistant to torsion. This becomes clear when the carbon-fibre-reinforced polymer is compared to other materials used as sandwich face sheets: it is up to 50 per cent lighter with a tensile strength three or four times greater than steel or aluminium.

The low thermal expansion in this composite material ensures large structural components can be produced without bubbles or distortions emerging in the long term. The low thermal conductivity in products and the consequent optimised insulation in refrigerated bodies make powerful arguments for the material's use in refrigerated trucks.

**High impact resistance** However, all such properties are not

of any use to the commercial vehicle industry if the material is unable to take mechanical stress loads caused by shock and impact. X-treme products not only withstand such loads, but usually resist them in a way that completely prevents major damage and downtimes due to repairs in most cases. The material even manages to endure hail storms and adverse weather conditions, making it ideal for both body interiors and exteriors. LAMILUX fibre-reinforced composites are produced in a continuous, automated production process. Five separate production lines guarantee minimum delivery periods while providing consistently optimum quality which can be reproduced at any time. Then X-treme product range can be manufactured in widths up to three metres while the length of sheets or rolls are tailored to customer requirements.



**Sascha Oswald** | LAMILUX | Product Manager | [sascha.oswald@lamilux.de](mailto:sascha.oswald@lamilux.de)

# BYK'S FIRST COUPLING AGENT FOR CARBON FIBER REINFORCED COMPOSITES PAVES THE WAY FOR FUTURE TECHNOLOGIES

**BYK's first Coupling Agent for Carbon Fibers:** BYK-C 8013 is the world's first coupling agent for carbon fibers. The additive is used in carbon fiber reinforced vinyl ester and unsaturated polyester resins. Transverse and flexural strength are significantly increased and thus the freedom of design is enhanced.

Thermoset Carbon fiber reinforced plastics (CFRP) are used when the need for high material strength meets the demand for lightweight properties of the composite parts. Examples for these applications comprise aerospace and automotive industry, electro mobility, and wind energy applications.

Besides epoxy based thermosets, vinyl ester and unsaturated polyester based composites play a significant role in this field. Even though carbon fibers improve the mechanical properties of the plastic material, a further improvement of strength is always desirable. As can be seen from an EM picture of a failure in a CRFP laminate (Fig. 1), the carbon fibers do not expose any resin left-

vers at their surface, i.e., the adhesion between the resin matrix and the fiber leaves room for improvement.

**How Coupling Agents help to Overcome Limitations** Coupling agents provide a bridge builder function between particulate filler or fiber materials and an organic resin matrix by establishing strong bonds to the surface of the filler/fiber and cross-linking into the matrix during the thermoset curing process. This additional bridges between the two components of the formulation provides increased mechanical robustness of the final composite material.

**BYK-C 8013 is Designed to Improve Vinyl Ester and Unsaturated Polyester based Carbon Fiber composites** The structure of BYK-C 8013 provides two tailored functional groups: (i) A reactive double bond that can easily participate in a radical cross-linking process, and (ii) a surface active group with optimized affinity towards carbon fiber surfaces. The effect can also be made visible in the electron microscopic picture (Fig. 2).

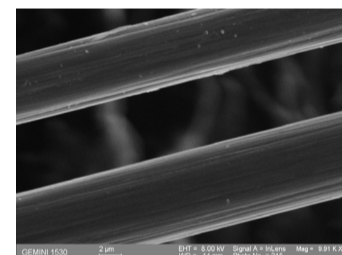


Fig.1: No coupling effect - Adhesive failure

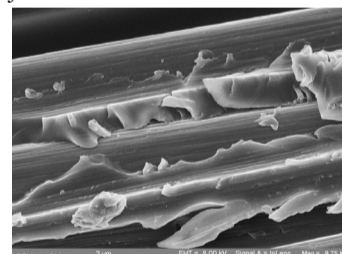


Fig.2: Coupling effect with BYK-C 8013 - Cohesive failure in the matrix

**Lee Gunning** | BYK-Chemie GmbH | Head of Technical Service Advanced Composites | [LeeRobyn.Gunning@altana.com](mailto:LeeRobyn.Gunning@altana.com)



Fig.1 : LAMILUX X-treme coach side

cant savings on material thickness. Less is truly more with LAMILUX X-treme – more lightweight to be precise. This characteristic is crucial for performance in vehicle construc-



## AZL JOINT PARTNER PROJECT "ULTRA-FAST MANUFACTURING OF TAILORED COMPOSITE BLANKS" - FOLLOW-UP PROJECT 2018

To increase resource-efficiency in the production of continuous fiber-reinforced plastics, the manufacturing of scrap-optimized blanks with defined fiber alignment ("tailored composite blanks") on basis of unidirectional semi-finished products (thermoplastic tapes, tow-pregs or dry-fibers) offers high potential compared to textile-based pre-products. Nonetheless, today's production systems for the manufacturing of tailored composite blanks are limited in throughput per system and their scalability. The project aims to realize a novel machine solution for the high-volume production of tailored composite blanks with output rates in the range of 500 kg/h. After finalizing the project by May 2018, the follow-up project will be presented at the Annual Partner Meeting in June 2018.

**Your Contact:** Thomas Weiler | [thomas.weiler@azl.rwth-aachen.de](mailto:thomas.weiler@azl.rwth-aachen.de)

**Next Date: May 15<sup>th</sup>, 2018**

## ASHLAND PRESENTS ITS RESIN PORTFOLIO FOR THE TRANSPORTATION MARKETS



1. oil sumps, engine co-overs, and battery carriers
2. headlamp carriers/housings
3. low density/class A body panels
4. structural parts
5. interior parts

Plus additional product range for ortho, pure maleic, maleic modified resins and vinyl esters

At Ashland, we're always solving the toughest material challenges. That means making composites that help you make world-class products: stronger, lighter, tougher, more fire resistant and more attractive.

As the world's leading provider of resin systems and additives for SMC and BMC, we bring exceptional product knowledge, technical support and industry insights to customers in a host of markets.

Ashland continues to expand its SMC capabilities in Europe. Next to the 1,000 kN press and analytical equip-

ment installed in the European R&D lab back in June and the acquisition of Etain plant, Ashland is now focusing on strengthening its business development and technical teams to support customer & market needs.

Ashland offers an extensive resin portfolio for the Transportation market based on unsaturated polyester resins, vinyl ester resins, and low-profile additives with brands such as Arotran™, Derakane™ and Neulon™.

See the graph to see some of our specific applications.



**Daniel Blanco** | Ashland | Business development manager SMC/ BMC Europe  
dblanc@ashland.com

## FARPLAS LIGHTWEIGHT APPROACH APPLICATION OF NATURAL FIBER REINFORCED PLASTICS TO HYBRID COMPOSITES - FIAT DOOR PANEL

Farplas is the leading interior and exterior trims supplier for all automotive OEMs in Turkey. It is dedicated to improvement based on innovation and technology. The company has won Turkish İnova Leagues '2017 Innovation Strategy Award' given by 'Turkish Exporters Association'. Lightweight has been one of the major innovation strategies. Although known as an injection



*Fig.: The transparent NFRP door panel illustrates the position of 'NFR-HTC Door Pocket'*

molding company, 'integrated state of the art' technologies and usage of novel materials are adapted to 'lightweight focused' production capabilities. Fiber form line for hybrid thermoplastic composites, Microcellular physical and chemical foaming of plastics, Infrared cured joining of

complex trims and in mold decoration are some of them.

In 2017 Farplas R&D has finalized 2 Hybrid Thermoplastic composite (HTC) projects with Fiat-Tofas Turkey as the OEM partner. Both projects were funded by The Scientific and Technological Research Council of Turkey. One of the HTC projects comprised metal replacement using Lanxess laminates and thermoplastics. The other HTC approach implied a thermoformed NFRP (natural fiber reinforced thermoplastics) Door panel and adaption of the 'NFR-HTC Door Pocket'. Karel Tool Maker was our partner in this work.

The NFR-HTC Door Pocket benefits from the sustainable and eco route due to 50% Natural Fiber in composite sheet. Back injection step in Fiber Form process is a very important part of the composite providing stiffness and barrier against adverse environments, it protects the edges of the composites from mechanical abrasion and shares load with NFRP composites.

To understand the adhesion development through overmolding, a



*Fig.: Farplas NFRP doorpocket*

non-isothermal screening procedure for bonding molten polypropylene (PP) to an IR heated thermoformable NFRP sheets has been developed. The method has been implemented to optimize boundary process temperatures for good bond formation as a function of NFRP sheet composition while optimizing IR heating system and injection cycle.

Our approach is a good example of highlighting different specs of HTC products such sustainability and NVH.

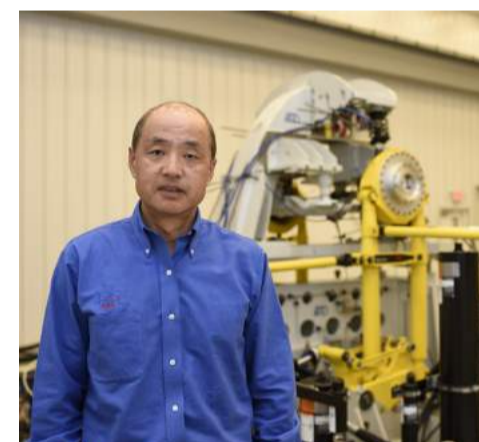


**Yavuz Emre Yağci** | Farplas A.S. | R&D Specialist |  
e.yagci@farplas.com

### INTERVIEW

» **Regardless of the powertrain, lightweight is one of the most important design targets from our OEM customers**

**Dr. Bing Liu** | F.tech R&D North America Inc.  
President | bliu@ftech-rd.com



The F.tech Group is a global automotive Tier 1 providing chassis, support structures, and pedal assemblies for mass production. Since 2016, the R&D division of F.tech is part of the AZL Partner Network exploring opportunities for future composite applications.

**AZL: Why do you invest in composite technologies?**

**Dr. Bing Liu** Lightweight has been, and continues to be one of the most important design targets from our OEM customers, regardless of the choice of the powertrain – combustion engine, electric motor, or hybrid. To meet their demand as the tier-1 chassis supplier, F.tech has built up the technologies for designing and manufac-

turing highly-optimized metal components. However, the composite material technology is quickly advancing and we see a good potential. Therefore we want to follow the technology, evaluate the application potential in our products, and build up our own expertise in order to enable ourselves to use the technology. That's why we invest in composites research, and we really like the open collabora-

tion approach which is found here in Europe.

**What are the bigger trends in the automotive chassis market?**

The transition to the use of global platforms by OEMs has significantly changed how we work with them. This means we must support their local R&D teams as well as to deliver products globally. Another challenge is that the part

requirements must be set considering many more markets and vehicle variants than in the past.

Additionally, some customers are looking for use to develop products from more of a suspension system level requirements, rather than individual component requirements. This can help with the efficiency of the vehicle development, but it also creates further optimization

opportunities for suppliers like us.

These big shifts in our business can create some opportunities for new technologies like composites because they are fundamentally different in so many ways from the traditional metal parts.

### AZL WORKGROUP: HIGH-PERFORMANCE SMC



coming soon:  
» [high-performance-smc.com](http://high-performance-smc.com)

The drive to further weight savings and significant reduction in CO<sub>2</sub> emissions require a next generation of High-Performance SMC (Sheet Molding Compound) with short and continuous fiber reinforced systems using both carbon and glass fibers with customized resin compounds. The AZL partners confirmed the need for a material data base for high-performance SMC, which will be the project for upcoming meetings. Additionally, AZL initiated a Joint Market and Technology Study that provides in-depth knowledge on applications and technologies, key challenges and technological solutions. The study consortium is still open to join.

More information at » [lightweight-production.com](http://lightweight-production.com)

**YOUR CONTACT:** Dr. Michael Effing | Senior Advisor |  
+49 241 80 23 887 | [michael.effing@azl-aachen-gmbh.de](mailto:michael.effing@azl-aachen-gmbh.de)

**Next Workgroup Meetings:**  
June 6th, 2018 & November 14th, 2018

### AZL @ JEC WORLD

As part of the renewed partnership between the Aachen Centre for Integrative Lightweight Production (AZL) and JEC Group, the AZL, its 9 Partner Institutes as well as the sponsors Hille and MaruHachi and the industrial Partners Conbily and Code PS will be present at the JEC World in Paris for the 4th time, on the exhibition ground "Composites in action" to exhibit their innovative products.

March 6-7-8, 2018  
**JEC WORLD 2018**  
The Leading International Composites Show

Meet the AZL team: **Hall 5A, Booth C55** and join the conference "Buildings and Infrastructure: the high-potential market for composites"

» *An extraordinarily valuable event: Very good presentations with excellent content and speakers. Great audience and time for networking. Interesting tours over the IAA automotive show and perfect organization. We are looking forward to the next event.*



**Heinrich Lingnau** | A. Schulman GmbH  
| Managing Director

## AZL EXECUTIVE B2B NETWORKING EVENT @ IAA | SEPTEMBER 2017

During IAA, the leading automotive trade show, more than 50 high-level participants met in Bad Homburg for the AZL Executive Networking Event. The idea of the event was to bring together automotive and lightweight senior executives with key representatives in the automotive and composite sector to discuss the future trends in lightweight.

Four keynote speaker introduced the event with their view on lightweight technologies in the automotive applications.

Dr. Stefan Kienzle, Director; Lightweight, Materials, Manufacturing, Group Research & Sustainability at Daimler AG; Dr. Jürgen Wesemann, Manager

Vehicle Technologies & Materials at Ford Research & Advanced Engineering Europe; Dr. Bin Wei, Manager Lightweight at NIO and Dr. HeeJune Kim, Project Leader Composites at LG Hausys R&D Center.

In a panel discussion, the speakers discussed the importance of lightweight in view of e-Mobility and autonomous driving.

In the subsequent networking dinner, the participating 13 presidents and vice presidents, 28 executives and 12 senior managers representing composite and automotive companies, connected and discussed in an easy and uncomplicated atmosphere. On the following day, a guided

tour over the IAA Trade Show gave insights into new automotive trends provided by exhibitors of the New Mobility World: Tata Steel, IBM and Google. The Tier 1's Faurecia, Plastic Omnium and Magna gave insights into their lightweight strategies.

The next Executive Networking Event is planned for IAA Cars in 2019.

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## POLY-DCPD, A NEW RESIN FOR HIGH PERFORMANCE COMPOSITE RADOMES

A composite with superior dielectric properties and very high RF transparency

Telene SAS (France) developed a new DCPD based resin system/formulation for radomes.

Radomes are the covers for antennas and radar system, which protect these often fragile systems against external influences such as wind, rain and hail. Radomes are in many cases produced as fiber reinforced plastic structures, sizing from small spherical or flat shapes of less than 1 meter, to very large 3D structures with a diameter of 10 meters and more.

Telene SAS and Thales (Netherlands) worked together to develop a composite system, based on the poly-DCPD resin technology of Telene. Thales is using composite materials for the radomes of radar and antenna systems that they develop and produce, mainly for the defense industry, where a maximum transparency for Radio Frequency (RF) is required.

Today, mainly formulated epoxy systems and glass fiber are used for standard radomes, but for high end radomes more exotic (and expensive) materials like quartz fiber and cyanate esters are applied.

The cooperation between Telene and Thales showed that the use of the very low viscous DCPD based resin system/formulation in vacuum infusion results in a radome material that outperforms the current best-in-class materials for radomes, such as quartz and cyanate esters; the latter resin systems requiring more expensive manufacturing technologies such as prepregs and autoclaves.



In the table below, the dielectric properties of poly-DCPD composite materials are compared to the state of the art materials for radomes:

Resin Type	Reinforcement Type	Dk @10GHz	tan delta@10GHz
epoxy *	glass fiber fabric	>4,5	>0,011
poly-DCPD **	glass fiber fabric	3,39	0,007
epoxy *	quartz fiber fabric	3,4 - 3,8	0,009 - 0,011
cyanate ester *	quartz fiber fabric	3,2 - 3,35	0,001 - 0,009
poly-DCPD **	quartz fiber fabric	2,76	0,08

\* Data from website TenCate Advanced Composites  
\*\* Data measured by Thales

Apart from the excellent RF-transparency, poly-DCPD based composites have high impact resistance, fracture toughness, hot wet resistance and high HDT: all properties that are required for high performance radomes.

Telene and Thales are working now on the development of new radome systems for the next generation of radar systems of Thales.

**Ben Drogd** | Telene SAS | info@telene.com



## POLYURETHANE INNOVATION FOR AUTOMOTIVE COMPOSITE APPLICATIONS

Huntsman's portfolio of RIMLINE® and VITROX® resins are combining high productivity with excellent durability.

Global business competition in automotive has reached new heights and the demand on manufacturers to sustain their competitive edge while securing long-term growth has never been greater.

The Polyurethanes division of Huntsman drives the innovation in Polyurethane composite resins, addressing current and future automotive demands for lighter, safer and more durable car parts and components.

Huntsman's RIMLINE® resin system is the best choice for customers seeking to combine high durability with high productivity. The resin's high-toughness supports versatile parts design with thinner profiles and provides strong impact resistance without the need of mat reinforcement. Fast curing time of <90 seconds makes it a resin system of choice in high volume applications like package trays, under carpets, sun shades, interior trims, hood inner panels, pillars, etc. The portfolio of RIMLINE® resins can be tuned to fit specific



Fig. 1: P6 Car Frame Source: Huntsman

needs of RTM, Pultrusion, LFI, Sprayed Honeycomb and RIM application processes. Because they can achieve different levels of high glass temperatures (T<sub>g</sub>) up to 230°C and have a high toughness with excellent durability, VITROX® resins are very suitable for applications where cure-on-demand is required in combination with high mechanical performance.

VITROX® resin allows a long injection window with limited pressure build-up and fast cure without compromising excellent mechanical properties.

VITROX® resin grades are typically used in applications such as HP-RTM, Pultrusion, Filament winding, Infusion and CIPP for manufactured vehicle components like pillars, leaf springs, spoilers, seat frames, rear and front bulkheads and body sides.

To provide customers with unique chemical and processing compatibility in composite sandwich structures, Huntsman introduced VITROX® foam core – an MDI-based foam delivering additional mechanical strength, lightweight and complex design options to composite sandwich structures.

Partner with Huntsman Polyurethanes global network of experts to explore new composite horizons and benefit from innovative chemistry, state-of-the-art prototyping and physical testing capabilities.

**Irina Bolshakova** | Huntsman Corporation | Market Manager Automotive and Transportation EMEA | Irina\_bolshakova@huntsman.com

## AZL WORKGROUP: HIGH-SPEED RTM MATRICES

RTM is the current state of the art technology in high volume production of thermoset composite parts. For this purpose, the AZL has founded the workgroup "High-Speed RTM Matrices" which meets every six months. The aim of the workgroup is to enhance the trust in the RTM technology and the composite industrialization in general. A consistent Model Material Data Sheet (M-MDS) for RTM resins has been developed for speeding up process and part developments. The next projects that address the need for e.g. near process test methods, hybrid/sandwich constructions, automated preforming or material, machinery and process databases for fast cost evaluations will be defined in upcoming meetings.

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**Next Workgroup Meeting: November 13th, 2018**

## LOAD PATH OPTIMIZED DESIGN OF COMPOSITE STRUCTURES USING TAILORED TEXTILES

At ITA, a novel design concept for load-optimized composite parts based on Tailored Textiles is being investigated and shows promising results.

Up to now, lightweight construction with fiber-reinforced plastics (FRP) has mainly been achieved by taking the geometry of a metal component and substituting the material with quasi-isotropic FRP-laminates. Such structures, often referred to as "black metal", do not fully exploit the excellent specific mechanical properties of the composite material. This leads to unnecessarily high material usage and thus to increased component costs.

In order to address this problem, effective design concepts must be developed that focus on the load-optimized application of the material. At ITA such a concept based on innovative reinforcement fabrics,

so-called Tailored Textiles, is investigated. These fabrics feature integrated local reinforcements that allow the component properties to be specifically adapted according to the load paths. The reinforcements can be integrated during the fabric production, which saves cost-intensive follow-up processes such as cutting and stacking.

The general approach is to integrate the novel design concept into the conventional product development process for composite parts. The first step is to create a preliminary laminate design. The load paths are identified by topology optimization according to a defined load case. Subsequently, the positions for necessary reinforcement structures are derived. Based on these information and a given production scenario (e. g. planned quantity), a tool developed in-house identifies suitable Tailored Textile technologies. For this purpose, possible component concepts resulting from the combination of different reinforcement structures are generated according to the boundary conditions of the technologies. The local reinforcements of the most suitable combinations are subsequently worked out in detail. Finally, the identified concepts are evaluated regarding their lightweight and economic potentials by comparison to a quasi-isotropic concept. The investigations at ITA have shown that the use of Tailored Textiles allows a weight reduction of approx. 30 %. In combination with the reduction of necessary follow-up process steps, the component costs can be decreased by up to 25 %.

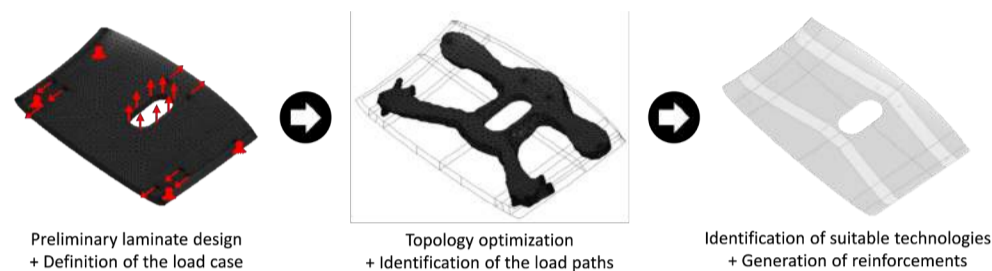


Fig.1: Process for the load-optimized design of FRP-components using Tailored Textiles

Carsten Uthemann | Marius Wiche | ITA of RWTH Aachen University | Research Assistants | carsten.uthemann@ita.rwth-aachen.de | marius.wiche@ita.rwth-aachen.de

## RESISTANCE PROJECTION WELDING OF CONTINUOUS FIBER REINFORCED PLASTICS

Researchers at RWTH Aachen University develop welding process for direct welding of endless fiber-reinforced plastics (FRP) for lightweight construction

Structures made of FRP are often connected to the overall system by metallic connection points or have functional surfaces made of metal. Joining technology is therefore a key technology and the subject of numerous investigations. At present, a connection between metals and plastics can only be made reliably by means of mechanical joining processes or adhesives. Mechanical joining processes usually cause fiber damage in the FRP. The direction-dependent material properties are strongly negatively influenced by this. On the other hand, structural bonding offers only limited ductility and therefore fails brittle without being able to detect imminent failure

at an early stage. In addition, the adhesive only joins the joining partners to each other superficially, which is why the application of force to deeper lying fibre layers is insufficiently carried out via the matrix. Although different approaches to the production of plastic-metal composite parts are being investigated, there is still a need for a joining process that adequately meets the technical and economic challenges of joining metal and fibre-reinforced plastics.

A joining process has been developed which enables direct welding of (fibre-reinforced) plastics to metals by resistance projection welding. In this way, continuous fiber-reinforced

plastics can be processed without damaging the fibers. In particular, the fabricators can continue to use existing resistance welding systems in the usual way, with minor modifications if necessary. An insert is integrated locally into the (fibre-reinforced) plastic as part of the FRP manufacturing process: Small metallic pin structures are applied to a carrier plate and penetrate the fibres and the surrounding plastic. The insert allows a current flow through the electrically non-conductive resin and thus ensures indirect weldability of foreign materials.

Different designs for the metallic inserts have been investigated and tested. The invention will be further developed in the framework of an AiF project with the support of industrial partners

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Fig.1: Hybrid joint of FRP and steel via small scale form-fitting elements

## FUNCTIONALIZATION OF CFRP LIGHTWEIGHT CAR BODY STRUCTURES BY INTEGRATION OF LASER AND INJECTION MOLDING TECHNOLOGY

With the inter-disciplinary BMBF cooperation project "OPTO-Light", the adhesive-free bonding of thermosetting and thermoplastic FRP was implemented for the first time in large-series production with cycle times of less than 3 minutes. The developed process chain of prepreg compression molding, laser pretreatment and injection moulding enables the load and waste of continuous fiber-reinforced hybrid plastic components to be produced in an integrated production cell with a cost reduction potential of more than 20 %. The demonstrator made of carbon fiber-reinforced epoxy shell element and glass fiber-reinforced PA6 ribbed structure was derived from the current BMW i3. The 200-tons injection molding machine with turning plate CXW 200/380 provides the basis of an innovative three-stage process chain, which produces fiber-reinforced thermoset-thermoplastic hybrids for high-volume structural applications.

AZL and its project partners were awarded with the prestigious Innovation Award of the industry association AVK in the category "Research and Science" for "Photonics-enabled



Fig.2: OPTO-Light project demonstrator as part of a series geometry of the BMW i3

process chain for manufacturing functionally integrated thermosetting/thermoplastic hybrid components for automobile construction".

In interdisciplinary cooperation with BMW AG, KraussMaffei Technologies GmbH, ARGES GmbH, Precitec GmbH & Co. KG, Sensortherm GmbH and Zeiss Optotechnik GmbH, the Aachen Center for Integrative Lightweight Production (AZL) was strongly involved in this development as the process and system integrator. "AZL has extensive expertise in developing combination technologies in regard to material sciences and production technology. For this research project this is extremely valuable, particularly the know-how in the area of reaction- and laser system technology" emphasized Martin Würtele, who is head of technology development at KraussMaffei Technologies GmbH and project coordinator.

On February 6th 2018, the developed technologies of the research project were presented thoroughly during a public final meeting in the technical laboratory of AZL in Aachen.



Fig.1: OPTO-Light final meeting in February 2018

Richard Schares | Aachen Center for Integrative Lightweight Production (AZL) of RWTH Aachen University | Research Assistant | richard.schares@azl.rwth-aachen.de

## AZL WORKGROUP: HYBRID THERMOPLASTIC COMPOSITES



Next Workgroup Meetings:  
March 20th, 2018 & September 26th, 2018



Thermoplastic composites become increasingly popular in cost-driven industries due to short cycle times, robust production technologies and recycling opportunities. Production processes combining continuous and short or long fiber reinforcements allow a high design flexibility as well as good mechanical properties at the same time. The Workgroup works on the consolidation of the high-potential overmolding technology of thermoplastic FRP inlays for series production with partners of industry and RWTH Aachen University since 2013. The Workgroup so far has initiated 5 Joint Partner Projects.

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## FROM CONSULTANCY TO DEVELOPMENT OF SPECIAL-PURPOSE MACHINERY

The Fraunhofer Institute for Production Technology IPT will be presenting its extensive range of products and services, spanning consulting, process design and optimization through to the development of special-purpose machinery, exemplified by winding operations conducted on pressure vessels at JEC World 2018, the Leading International Composites Show.

With its lightweight production technology business unit, the Fraunhofer IPT helps companies to manufacture lightweight products efficiently on a large scale, making them affordable to end customers. These bundled knowledge and competencies allow the Institute in Aachen to serve a diverse range of sectors of industry including automotive engineering, aerospace, energy and medical technology as well as the consumer goods industry.

"Our special strength in this business area lies in our decades of experience in manufacturing processes, production methods, metrological systems, sensor integration and process monitoring as well as in technology and quality management. Our extensive expertise in processing and machining fiber reinforced plastics and metals enables us to offer clients our professional advice on virtually any issue arising at any point on the lightweight

production technology process chain", declared Stephan Schröder, the new Business Unit Manager. Part of his remit is to select exactly the right contact partner from the pool of experts available and to provide multi-disciplinary advice.

### 30 years of experience in developing special-purpose machinery

In order to keep this wide range of processes as economically efficient and robust as possible, the Fraunhofer IPT has already developed, set up and optimized a number of special-purpose machines and provided in-company training prior to commissioning in numerous research projects and collaborative ventures with industry. In the meantime, the Institute has notched up 30 years of experience in constructing special-purpose machinery for placement and winding systems.

### Providing a clear insight into lightweight production technology: Quality assurance via smart glasses

The Institute also offers support to the users of production machinery: Customized smart devices such as smart glasses or tablets can enable staff to access directly the information they require while the manufacturing process is in progress. At the JEC in Paris, visitors to the fair will be able to experience these advantages at first hand: The Fraunhofer IPT will be presenting the use of smart glasses in lightweight production environments exemplified by fiber-reinforced pressure tanks. Visitors are invited to try out the new terminals with the corresponding software live at the Fraunhofer IPT booth (Hall 5A, C55) and to access information such as process speeds or data relating to the materials used.



**Stephan Schröder** | Fraunhofer Institute for Production Technology IPT | Head of the business unit "Lightweight production technology" | leichtbau@ipt.fraunhofer.de

## DEA288 – THE CURE FOR YOUR PROCESS

A unique sensor for a robust and efficient automated mid- and high-volume production of composite components.

Highly automated manufacturing processes play a key role for the aspired large-scale production of composite parts in the automotive and aviation industry. Therefore the call of the composite industry for a precise and robust characterization of the critical and invisible in-mold cure behavior of a resin is steadily increasing. So far, available sensors are struggling to meet the demands of a robust, highly automated series produc-

the requirements of the industry regarding temperature, pressure and scratch resistivity combined with attractive costs and low installation space. This new sensor technology reveals the material behavior in reactive FRP processes, processes with high in-mold pressures (RTM, PCM, SMC) and much more important into composite processes with electrically conductive carbon fibers. While having a look inside the mold



Fig.2: DEA-measurement system and sensor.

cess management based on the curing behavior aiming the compensation of deviations in semi-finished products and the reduction of cycle times and scrap. Through communication with the process control system, the new sensor technology controlled the process in such a way that an optimal adhesion of dissimilar materials in a cascaded process could be achieved. Come and see the new in-mold sensor technology at the JEC show in Paris, hall 5 booth N67.



**Alexander Chaloupka**  
NETZSCH-Gerätebau GmbH  
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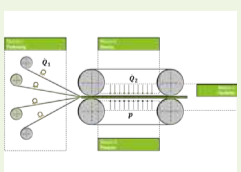


Fig.1: In-mold sensor for carbon composites.

tion of composites, not to mention the in-process identification of properties that are relevant for a component's quality. NETZSCH Analyzing & Testing developed a new sensor for that has a unique ceramic construction and meets

the sensor can provide information about the resin viscosity, gel-points and the degree of cure. During the run-time of the AVK awarded project OPTO-Light it was proven that this new sensors create a benefit for intelligent self-adapting pro-

## AZL FOLLOW-UP PROJECT "NEW DESIGNS FOR DOUBLE-BELT PRESSES"



The project aims at improving the energy efficiency and product geometry flexibility in production of composite sheets with double-belt presses. In the first phase of the project, the AZL, together with seven partner companies, developed a prototype for proof-of-principle of a novel cost and energy-efficient double-belt press system for the continuous production of composite sheets. The follow-up project aims at enhancing the developed double-belt

press system with the aim to build an industry-scaled machine according to the pursued concepts. Participating Companies: DuPont, Faurecia, Kraussmaffe, Siempelkamp and Toyota.

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## LAYER-FOR-LAYER PRECISION PLUS HIGH PERFORMANCE

The first processes for manufacturing of thermoplastic composite components with organic sheets have reached the series production stage. Further developments are now focused on solutions for thermoplastic tapes reinforced with glass and carbon fibers. ENGEL – the injection molding machine maker and systems supplier – also gathered the necessary experience in the production of robot components. The ENGEL e-pic robots are fitted with a lightweight carbon rotational axis.

A major challenge was the reduction of the robot arm's weight, thereby improving its performance data even more. To make this possible, ENGEL developed a pick-and-place procedure for tape processing. Due to the carbon fibre materials used and the innovative manufacturing technique, a 37 % weight reduction of the robot's rotational axis was achieved. In this way, the robot's agility increases significantly, and the motions require less energy.



Fig.2: The e-pic robots are fitted with a lightweight carbon rotational axis.

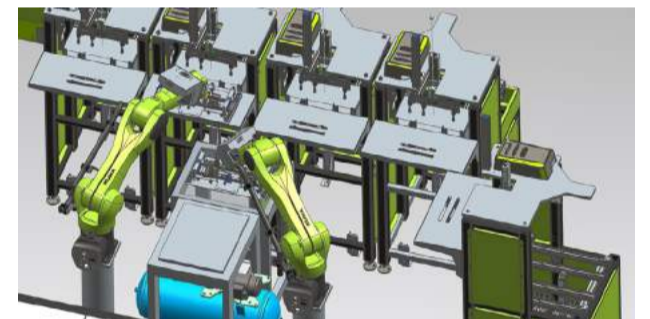


Fig.1: The newly developed tape laying cell includes two fast robots as well as magazines for separating the pre-cut tape.

For the rotational axis, four different tape cutouts are required. Each half shell consists of 32 individual and unidirectionally reinforced tapes. To obtain the required high dynamics during the laying operation, a fast articulated robot is used. The removal of the tapes from the magazines is done independently of the actual laying operation, so that the robot's laying speed is not reduced by slow removal movements.

Layup quality depends mainly on the accuracy of the positioning of the tapes. If tapes overlap, severe fiber shifting occurs during consolidation, i.e. the fibers slip sideways in order to compensate for local deviations in the tape layup thickness. If the tapes are laid with a gap, linear areas without fibers are created during consolidation, resulting in reduced stiffness and strength. Different to thermoset tape layups, the gaps between the tapes are frequently not closed completely during consolidation, because the viscosity of the thermoplastic matrix is several decades higher than e.g. with epoxy resin. Therefore, it is essential that the tapes are

laid precisely even at high laying speeds. Often, laying accuracies with gap widths of max. 1.0 mm are demanded, sometimes even below 0.5 mm. High laying accuracy of each individual tape is achieved with the help of a fast and high-resolution optical measuring system.

Tape laying using the pick-and-place approach is flexible in application and is not limited to specific tape widths. Furthermore, layups consisting of different materials can be made quite easily. Another aim is to produce the layup in parallel to the injection molder's cycle time. The technology enables production of a layup that matches precisely to the final component's geometry. Therefore, subsequent processing steps such as consolidation, heating in the IR oven, plus forming and functionalization in the injection mold can be carried out immediately without any intermediate or additional trimming step.

**Dr. Norbert Müller** | ENGEL Austria | Head of the Centre for Lightweight Composite Technologies  
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## MAHR METERING SYSTEMS ACQUIRES UNIPRE

With the acquisition of UNIPRE GmbH, Mahr Metering Systems GmbH is expanding its activities in the market of mixing and dispensing machines.

Mahr Metering Systems GmbH, an international company whose portfolio includes gear pumps and mixing and dispensing machines, has acquired UNIPRE GmbH, based in Werl (North Rhine-Westphalia/Germany).

Since 1974, UNIPRE has been established on the market as an innovative quality supplier of dispensing and mixing systems for processing liquid plastics, specialized in the construction of tailor-made machines and systems. "The sales intentions of Theo Hunold, the Managing Partner of UNIPRE GmbH, offered us the ideal opportunity to put the business unit of dispensing and mixing technology on a broader basis and to strengthen it", says the managing director of Mahr Metering Systems, Dr. Reiner Karl, explaining the investment. He also emphasizes: "The product range of both companies complement each other perfectly."



The company in Werl will be managed under the name Mahr Unipre GmbH. "With Mahr, we have found an investor who will continue UNIPRE's many years of expertise in the field of mixing technology and continue to drive technology development", says Hunold. The location in Werl is thus preserved and the merger creates new jobs.

In the future, Mahr Metering Systems in Göttingen will concentrate on the growing business with gear metering pumps. At the new location in Werl, the machine business of Mahr Metering Systems and UNIPRE will be merged and expanded.

**Dr. Reiner Karl** | Mahr Metering Systems | Managing Director | reiner.karl@mahr.de

## THE JAPANESE THERMOPLASTIC COMPOSITES MANUFACTURER MARUHACHI GOES EUROPE



The Japan-based MaruHachi Group is a well-established, family-owned firm with over 80 years of experience and a strong history in automotive and medical textiles. MaruHachi has now been active in the composites business for more than 10 years, before entering the European market, starting in 2017. With its products and offerings, MaruHachi aims to particularly serve applications in the field of sports and leisure, consumer goods, electronics and electricity, building and infrastructure as well as transportation like aviation, the automotive and train sector.

The specialty manufacturer of small-size tailor-made thermoplastic composite components in form of tapes and organo-sheets develops high-quality products using various polymer types, ranging from PP, PU, PE, TPU, PA6 and other specialty PAs, PPS, PEI, PES, LCP to high

temperature PEEK and the traditional fiber systems of glass, carbon and aramids.

Especially MaruHachi's products like tapes, sheets, near-net shaped preforms and prepregs represent an interesting category of material systems and semi-finished products with higher performance, tailored and optimized for any new applications. MaruHachi's focus and competences lie here in the offering of various integrated functionalities, extremely thin layers and complex shapes.

Joint developments together with its customers and make to order are MaruHachi's strength. MaruHachi figures as a one-stop shop for OEM's, Tier 1s and Tier 2s (compression and injection molders) with its offering of flexible style prototyping processes and its continuous and discontinuous manufacturing. System and

machinery are also developed in-house.

With its products, MaruHachi aims to contribute to significant weight reductions of the final product, thus improve energy efficiency while offering a cost-efficient and high-quality solution. In Europe, MaruHachi cooperates with Dr. Michael Effing who advises and supports the company strategically with its company AMAC GmbH. During 2018, Dr. Toshihide Sugahara will preside over the Japanese Sampe and in this role, he will be happy to connect with those ones of the AZL partner network who are interested in a closer and direct contact with Japanese firms.

MaruHachi is attending the JEC WORLD 2018 as a Sponsor and will exhibit within the AZL area.

**Dr. Toshihide Sugahara** | MaruHachi Group | CEO | toshi@maruhachi.co.jp

## ARRK WILL BECOME SUBSIDIARY OF MITSUI CHEMICALS

Mitsui Chemicals and ARRK have announced, that globally active ARRK Cooperation will become a consolidated subsidiary of the Mitsui Chemicals Group

Materials from the Mitsui Chemicals Group are widely used in such fields as electronics and information technology, automotive, housing and construction, packaging industries, healthcare and agriculture. The company's products include specialty chemicals, functional polymeric materials, polyurethane, basic chemicals, petrochemicals and films and sheets. Along with PP compound operations (PRIME POLYPRO™), the Group supplies a wide range of products such as TAFMER™, MILASTOMER™, Mitsui EPT™, ADMER™, ARLEN™ and APEL™, which are ideally suited to any functions concerning the diverse needs of customers. Regarding the composite business, the Mitsui Chemicals Group provides and continuously develops LFT compounds (MOSTRON™) already for many years. As announced in the previous AZL NewsLIGHT #10, recent composite developments are focusing on UD-Tapes based on carbon fiber and polypropylene matrix (CF/PP - UD-Tapes).

ARRK operates as a business group that provides development support for new products in the industrial goods sector. With activities ranging from producing design models for initial development to providing support for low-volume manufacturing of products and product molds, the company's primary business model is to support the product development of its customers. ARRK provides products and services across five corners of the globe: Japan, North America, China, the ASEAN region and Europe. The ARRK Group in Europe includes several subsidiaries like P+Z Engineering GmbH, Shapers, LCO Protomoule, SPG Pre-Series Tooling & Prototyping B.V. and the ARRK Europe Limited.



Fig.: Exemplary products made of CF/PP - UD-Tapes

The purchase of shares is intended to help both Mitsui Chemicals and ARRK in further expanding their business foundations. In addition, both companies will mutually put each other's technologies to use for achieving continued growth in the global market. ARRK will be able to apply the materials expertise of Mitsui Chemicals, utilizing its diverse lineup of products and materials technologies in carrying out design, prototyping and analytical activities. Meanwhile, Mitsui Chemicals aims to work with the strengths of ARRK to broaden the range of business domains for its own products and services, strengthen its ability to market and offer solutions to various industries, especially in the mobility domain.

Meet us for exchange and discussions at:  
JEC World 2018: Hall 6 | Booth H52



**Christos Karatzias** | Mitsui Chemicals Europe GmbH | Business Development Engineer Composites | christos.karatzias@mcie.de

## REVIEW OF AZL COMPOSITE EVENT IN POLAND | OCTOBER 2017



*Today the local composite companies in Poland have a lot of interesting and even inspiring ideas to offer. It's definitely a different world than just 5 years ago - and hopefully a chance for our high performance materials, too.*

**Dr. Andrzej Wolak** | Evonik | Senior Business Manager for Central & Eastern Europe and Nordic



In order to connect with Polish composite companies and to gather market information for AZL Business and Premium Partners, AZL organized a joint trip to Krakow in the context of the Polish composite show KOMPOZYT-EXPO. Besides introductions of the Special Economic

Zone in Krakow including numbers on the Polish industry landscape and a joint visit of the show and a networking dinner, the AZL Partners and Polish participants visited the company New Era Materials, producing composite sheets made of a thermoset resin powder.



# PRODUCTION AND SALES GROW TOGETHER – A RESULT OF DIGITALIZATION

GRP works with an increasing number of industrial companies that place production planning in the hands of sales.

In order to produce more precisely and efficiently, production companies are increasingly taking advantage of the opportunity to have production planning controlled directly by sales. Where in the past it was almost possible to speak of a competitive

situation between production and sales, today's digital aids make it possible to achieve a much closer interaction between the individual company divisions.

An MES like that of GRP gives our customers the possibility to manage the entire process to control various different departments like Human Resources, Sales, Maintenance, Production, QM and Administration with one digital platform.

While many stand-alone solutions are at risk of losing track of things and the different strands of data, GRP, with its experience of almost four decades of MES business, provides a path that only needs to be adapted to the individual needs of the customer.

This kind of digitalization and data collection often leads to the first defined stage of a Smart Factory.

GRP has therefore decided to focus its development on the interaction of the individual modules and web technology. This gives our customers more precise results and greater flexibility through intuitive usability and easier physical structure.

The step to migrate the system to web technology has probably been the most important step in the recent past. This opens up unexpected possibilities for the customer to access from everywhere, as long as in-house IT allows it. This means for example, that sales can receive an access to the current production output in real time and provides its customers with more precise delivery information.

The new existing market developments prove year after year that MES's path is not over yet and can be meaningfully integrated into the GRP system. We also receive a lot of input from our customers, whose demands and wishes are fulfilled and implemented together with us, helping us to continuously grow and get better. GRP has and will consider this reciprocity as most important.



**Yannik Wirtz** | GRP | Project Engineer | [yannik.wirtz@grp.de](mailto:yannik.wirtz@grp.de)



## EQUIPMENT FOR RESEARCH PROJECTS

### SCHULER PRESS SYSTEM AT AZL

At the AZL machinery hall in the Production Engineering Cluster at the RWTH Aachen Campus, AZL's Composite Press System with a table size of 1.8 m x 2.8 m and a tonnage of 1.800 tons is already used in research projects such as iComposite 4.0. The Schuler press system is available for joint research projects and bilateral industrial research and projects. For details please contact Mr. Sebastian Stender: [sebastian.stender@azl.rwth-aachen.de](mailto:sebastian.stender@azl.rwth-aachen.de)



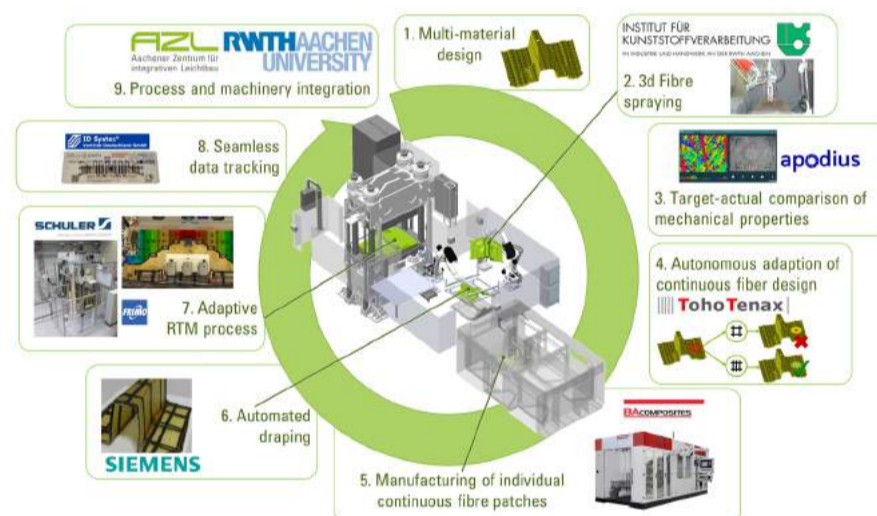
The production system of the BMBF funded research project "iComposite 4.0" (Framework Concept "Research for Tomorrow's Production;" funding ref. no. 02P14A045) is currently being set up at AZL's facilities at Campus Melaten, Aachen.

Aim of the "iComposite 4.0" project is the introduction of predictive control mechanisms into a production system formed by additive preforming technologies, advanced Quality Assurance and an adaptive HP-RTM-Process – turning the production system itself into a material a process expert. For Data tractability, RFID labels will be included in every individual part.

By scrap reduction via additive preforming and extinction of production rejects by predictive control, part cost savings of at least 50% compared to a state of the art RTM process chain is targeted. The technological maturity will be demonstrated manufacturing an automotive floor pan.

Besides AZL, fellow RWTH institute IKV, Apodius GmbH, BA Composites GmbH, Frimo Sontra GmbH, ID-Systec Vertrieb Deutschland GmbH, Schuler Pressen GmbH and Siemens AG have joined this sophisticated research project. Additional support comes from Dow Automotive Systems, Dr. -Ing. K. Busch GmbH,

## "iCOMPOSITE 4.0" PRODUCTION SYSTEM IS CURRENTLY BEING SET UP AT AZL FACILITIES



Kuka Roboter GmbH and LAP GmbH Laser Applikationen.

The next opportunity for the public to catch a glimpse of the "iComposite 4.0" production system will be IKV's 29th International Colloquium Plastic Technology on Feb, 28th till March, 1st and AZL's Open Day on April, 19th 2018 at the AZL facilities in the Production Engineering Cluster.

This research and development project is funded by the German Federal Ministry of Education

and Research (BMBF) within the Framework Concept "Research for Tomorrow's Production" (funding ref. no. 02P14A045) and managed by the Project Management Agency Karlsruhe (PTKA). The author is responsible for the contents of this publication.

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### SAVE THE DATE: AZL OPEN DAY ON APRIL 19<sup>TH</sup>

Join the AZL Open Day to experience Lightweight Production Technologies on the RWTH Aachen Campus – From carbonisation to quality metrology



On April 19th, we invite you to visit the machinery halls of the 9 Partner Institutes of the AZL. Located in a walking distance on the RWTH Aachen Campus, 750 researchers and 1,100 students work on about 100 lightweight and composite research projects covering the entire value chain. During the guided tours, the AZL Open Day provides you with extensive insights into this broad range of expertise and equipment as well as with networking opportunities with the industrial participants.

Register at: [lightweight-production.com](http://lightweight-production.com)



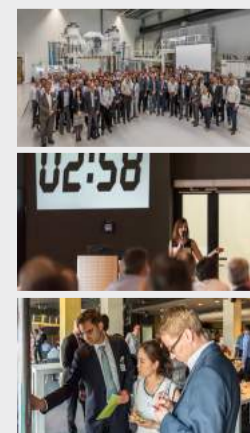
### SAVE THE DATE: ANNUAL PARTNER MEETING 2018 ON JUNE 27<sup>TH</sup> AND 28<sup>TH</sup>

AZL Partners will define topics and strategy during Annual Partner Meeting 2018

Each year, the AZL Partner Companies meet in Aachen in order to define the activities of the upcoming year and to network with about 150 participating representatives of the AZL Partner Network. The AZL partner companies and institutes present their technologies in speed dating presentations, review running and past joint AZL activities and vote for new activities.

AZL Partners can register at the AZL Partner Section:

>> [login.azl-aachen-gmbh.de/dates](http://login.azl-aachen-gmbh.de/dates)



## ENERGY STORAGE SYSTEMS

## HEXCEL TO SHOWCASE INDUSTRIAL INNOVATIONS AT JEC WORLD 2018

Hexcel's Industrial Business will present an exciting portfolio of composite innovations at JEC World 2018 taking place in Paris on March 6-8. Hexcel will promote market specific developments for automotive, marine, wind energy and other industrial sectors at Stand J41 in Pavilion 5A.

**Automotive** Hexcel's prepreg system for the manufacture of leaf springs used in van, truck and SUV suspension offers clear advantages: weight savings of up to 70%, higher corrosion resistance, improved ride comfort. Compared with other solutions, Hexcel's system offers a 50% cure time reduction and 15% higher mechanical performance.

Hexcel has introduced new simulation technology for the development of HiMax™ non-crimp fabrics, minimising the need for trial programmes. A finished component plus the 2D flat fabric reinforcement will be on display.

Hexcel will showcase its new Polyspeed® glass laminates that have been integrated into a wooden truck trailer floor by Havco®. Havco's product, Fusion Floors, reduce fuel consumption, increase floor load rating and extend trailer operating life.

**Marine** Hexcel has a range of products aimed at racing yacht and luxury boat builders. Recently expanded, the portfolio includes class and DNV GL-approved prepreps, woven reinforcements and multi-axials for hull and deck structures, masts and appendages.

Hexcel's HiMax™ DPA (Dot Print Adhesive) reinforcements come pre-tacked for ease of lay up in preparation for infusion. Providing an optimal level of tack, they eliminate the use of spray adhesive, and are unrolled and applied to the mould or core layer before resin is added. Advantages include better resin flow, lower risk of contamination, and reduction in weight.

**Wind Energy** Pre-cured Polyspeed® pultrusion laminate technology offers an economical way of reinforcing large-scale composite structures which require resistance to corrosion, durability, shear strength, and weight management. The laminates are manufactured as continuous cross-section profiles, with a polyurethane matrix and unidirectional carbon fiber reinforcement. The result is perfect fiber alignment and consistently high mechanical properties: excellent stiffness-weight ratio, high fracture toughness, and great shear strength. The profiles are transportable and easily stored, with an example on display at the show.

Hexcel will also showcase its updated surface finishing prepreps for turbine blades and components – a tough, durable and ready-to-paint surfacing solution, removing the need for an in-mould gel-coat, saving production time, and reducing costs.



**Rachel Owen** | HEXCEL | Director Marketing Communications | rachel.owen@hexcel.com

» *We see a booming energy storage systems market for the next several years and an increase in our company's turnover coming from this market. This is why we strategically invest in it and look for strong partners that choose to grow with us. The AZL study is designed to help us identify and connect with the right partners.*

**Peter Adriaansen** | Imerys Graphite & Carbon  
Business Director Carbon Black |  
peter.adriaansen@imerys.com



## INTERNATIONAL CONSORTIUM STARTS STUDY ON TECHNOLOGICAL ANALYSIS OF ENERGY STORAGE SYSTEMS

In cooperation with 19 participating companies, the RWTH Aachen University and CONBILITY® GmbH, AZL Aachen GmbH has launched an international market and technology study on Energy Storage Systems. The study is still open to join.

With a kick-off on January 30, 2018, AZL Aachen GmbH, in cooperation with 19 participating companies as well as RWTH Aachen University and CONBILITY® GmbH, has launched an international market and technology study. Over the next 8 months, the team of experts will work out a detailed insight into the technologies of the diverse energy storage systems. Together with the consortium, the technology experts will analyze established and

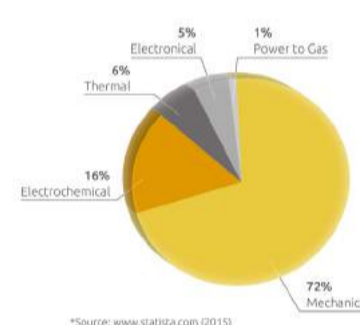
emerging storage systems, in particular with regard to the materials used and the production technologies for the production of key components. The study results are especially relevant for suppliers of materials, processing technologies and machinery and equipment.

Thomas Wegman, Marketing Manager of Aliancys, comments: "As the market will grow significantly in the next few years, we see many applications and parts where we can use our resin systems. Composites score highly in both stationary and mobile storage systems due to their durability, chemical resistance and lightweight potential. We want to learn more about the market and where we can develop new applications for composites. Tackling this in the study together with other companies and their specific interests and insights is a good opportunity for us." Companies wishing to evaluate the potential of their products and production technologies as well as their know-how in the field of energy storage systems are invited to participate in the study.

Market Volume in Germany\*



Distribution of Global Market Volume\*



\*Source: www.statista.com (2015)

Fig.3: Market Prognosis of Energy Storage Systems

The kick-off meeting on January 30, 2018 opened the first phase of the study, which focuses on detailed market segmentation, including the identification of market requirements and potentials as well as existing and future technologies and their respective readiness levels. In addition to energy storage in the transport sector, the study will examine storage systems and technologies in other market segments. These include thermal, electrochemical, mechanical and electrical storage systems. At the kick-off meeting, participants were given a first market overview including

exemplary market segments and possible storage technologies. The study structure was presented on the basis of the two example technologies and applications of lithium-ion batteries in the automotive sector and power-to-gas technologies. In a workshop, the participating companies raised unanswered questions and provided initial impulses for focusing the study analyses by voting on relevant market segments.

**Still open to join | Your Contact:**

Philipp Fröhlig | philipp.froehlig@azl-aachen-gmbh.de



Fig.1: Consortium of the Kick-Off Meeting



Fig.2: Kick-Off Meeting Voting

## GLASS-FIBER COMPOSITES WITH EXTREME WEATHERING RESISTANCE

Covestro develops polyurethane resins for cost-efficient production using pultrusion technology

*Covestro is developing polyurethane resin matrix systems for fiber-reinforced plastics with extreme weathering resistance. These can be processed in a simple and cost-efficient way using pultrusion technology, and show excellent mechanical properties as well as good fire resistance properties.*

By developing processes and products for manufacturing weather-resistant lightweight materials, Covestro offers excellent solutions for fiber-reinforced plastics, which can become fully protected from a variety of environmental influences. Desmocomp® is a new aliphatic polyurethane resin designed specifically for exterior applications.

Thanks to its excellent weathering and UV resistance, the polyurethane resin matrix material protects composites from environmental influences such as sunlight and furthermore gives them very

good resistance against chemicals or a salty environment. The pultruded material doesn't show changes after more than 15,000 hours exposure in UVA and UVB radiation tests (according to DIN EN ISO 16474/3) or after more than 20,000 hours in a salt spray test. UV stabilizers and protective coatings are no longer required.

Besides this, pultruded parts based on Desmocomp® show anti-graffiti properties and good fire resistance. A single burning item test (SBI, in accordance with EN 13823) revealed that the composites fulfill flammability class B and is characterized by smoke generation class s1 and droplet formation class d0.

The one-component system can be easily processed using pultrusion technology. It enables very economical manufacturing of pultruded composites, since it offers a direct drop-in solution for estab-

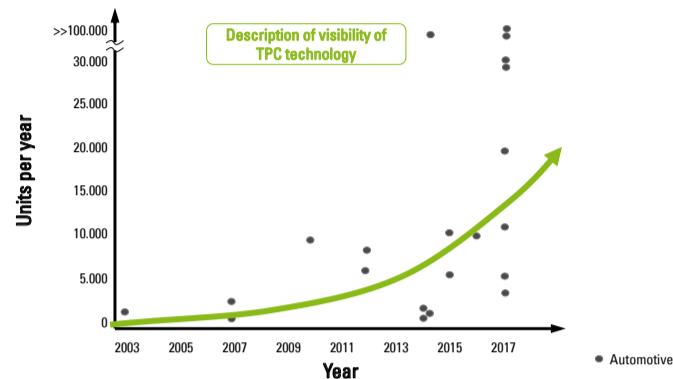
lished production processes – for the first time, a polyurethane system can be processed even in an open resin bath impregnation mode with standard equipment.

The resin is characterized by a long pot life of up to 8 hours at room temperature. After efficiently wetting the fibers, the resin cures rapidly, leading to a durable and mechanically stable yet lightweight composite. This combination of properties opens up a wide range of potential applications, as an alternative to conventional materials such as metal and wood.

**Dr. Stamo Mentizi** | Covestro Deutschland AG  
Marketing Manager | stamo.mentizi@covestro.com | **Dr. Paul Heinz** | Covestro Deutschland AG  
Senior Project Manager Fiber-Reinforced Polymers | paul.heinz@covestro.com

## AZL SMART FACTS FOR YOUR MARKET INTELLIGENCE

As part of the Market Intelligence program of the Business Partnership, the AZL provides various analyses of composite business cases, market reports, conferences as well as smart facts on composite technologies. The entire analyses are available at the AZL Partner Section for AZL Business and Premium Partners.



### HISTORICAL ANALYSIS OF THERMOPLASTIC COMPOSITE APPLICATIONS IN HIGH-VOLUME MARKETS

© AZL of RWTH Aachen. Year regarding press releases or SOP, units regarding public production data.

» **The production of composite components, includes typically material costs of 75 % to 85 % of the total part costs.**

Number derived from the AZL analysis of composite business cases in 2017.

### AZL COMPOSITE BUSINESS CASES

In regular web conferences, AZL analyses composite components providing market numbers and smart facts, process chains as well as process cost structures and cost drivers:

- |                          |                         |
|--------------------------|-------------------------|
| #1: Automotive Bonnet    | #6: Riser               |
| #2: Automotive Tailgate  | #7: Aircraft Trolley    |
| #3: Pressure Vessel      | #8: Leaf Spring         |
| #4: Automotive Underbody | #9: Door Module Carrier |
| #5: Wind Turbine Blades  |                         |



Next Web Conference on Business Cases: June 2018

88

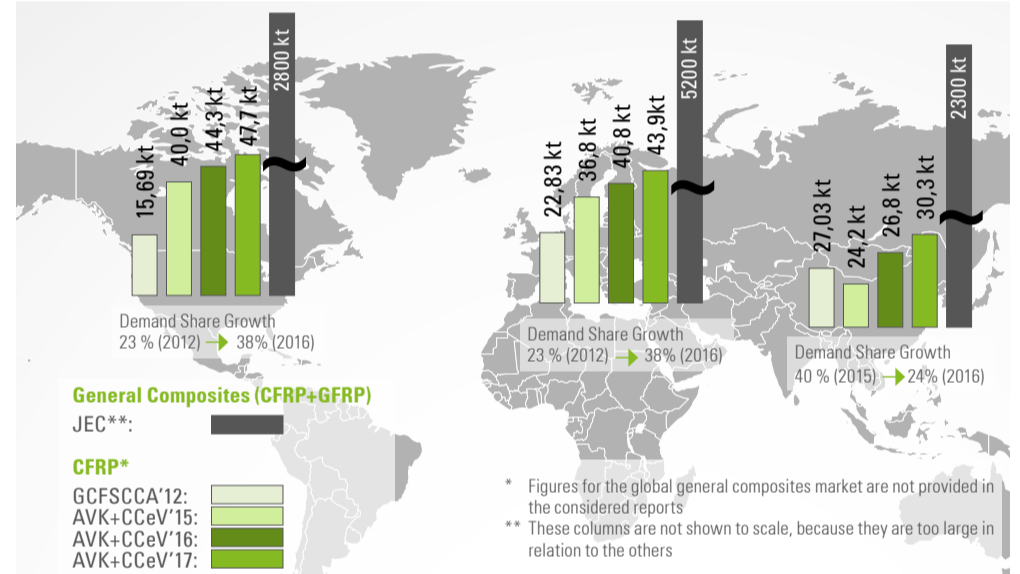
From **88 conferences** which took place in 2017 having composite-based lightweight as the main topic,

**17** of these conferences exclusively addressed composites in automotive applications and

**2** in buildings and infrastructure applications.

### NUMBER DERIVED FROM THE AZL CONFERENCE OVERVIEW

The information given includes organizational key facts on each event, the addressed material groups and markets, the type of presentations given, the organizer's profile as well as additional activities such as exhibitions, conference dinner or matchmaking programs.



### AZL MARKET REPORT ANALYSIS

AZL analyses available market information, reports and numbers combining these to trend analyses and smart facts. This information will be provided in brief summaries throughout the year. © AZL Aachen GmbH.

## AZL MEETINGS IN 2018

**January 25**

### COMPOSITES IN BUILDINGS & INFRASTRUCTURE

Initial Workgroup Meeting

**January 30**

### ENERGY STORAGE SYSTEMS

Kick-Off Meeting of Joint Market & Technology Study

**February 7**

### HIGH-SPEED RTM MATRICES

Workgroup Meeting

**February 22**

### HIGH-PERFORMANCE SMC STUDY

Report Meeting

**March 20**

### HYBRID THERMOPLASTIC COMPOSITES

Workgroup Meeting of Joint Market & Technology Study

**April 19**

### AZL OPEN DAY

Guided Tours to 9 AZL research labs

» [Registration at lightweight-production.com](http://Registration at lightweight-production.com)

**June**

### COMPOSITE BUSINESS CASES

Web Conference

**June 6**

### HIGH-PERFORMANCE SMC

Workgroup Meeting

**June 7**

### PIPES & VESSELS

Workgroup Meeting

**June 27 - 28**

### AZL ANNUAL PARTNER MEETING 2018

Discuss the activities of the last 12 months and define future topics and projects with us!

**September 4**

### COMPOSITES IN BUILDINGS & INFRASTRUCTURE

Workgroup Meeting

**September 26**

### HYBRID THERMOPLASTIC COMPOSITES

Workgroup Meeting

**October**

### JOINT BUSINESS DEVELOPMENT TRIP TO USA

B2B Meetings at CAMX, US Networking Event

» [See Page 6](#)

**October 11**

### PIPES & VESSELS

Workgroup Meeting

**November**

### COMPOSITE BUSINESS CASES

Web Conference

**November 13**

### HIGH-SPEED RTM MATRICES

Workgroup Meeting

**November 14**

### HIGH-PERFORMANCE SMC

Workgroup Meeting

**January 2019**

### EXECUTIVE NETWORKING EVENT @BAU







Find more details on

» [lightweight-production.com](http://lightweight-production.com)

or the **AZL Partner Section**

# ACCESS TO LIGHTWEIGHT EXPERTISE AND EQUIPMENT @ THE RWTH AACHEN CAMPUS

In a walking distance of 1000 meters, the RWTH Aachen Campus comprises research along the entire value chain for composite-based lightweight production. AZL Aachen GmbH offers one-stop-shop solutions bringing together the numerous resources in equipment and know-how of its nine Partner Institutes. AZL provides services reaching from individual and exclusive projects over open innovation in joint projects and workgroups, business development and networking in its AZL Partnership to community offices offering access to RWTH Aachen University.



Process Chains for Hybrid Composite Materials

Fiber & Textile Technology

Material Development and Processing Technologies

Production Technologies


Laser Technology

Bonding Technology

Lightweight Design

Machine Tools and Measurement Technologies

Automotive Science and Engineering



The AZL and its Partner Institutes are located at the RWTH Aachen Campus © Campus GmbH/ Steindl

- 9 institutes dealing with composite-based lightweight topics
- +750 scientists
- 1,100 student workers
- more than 100 public funded lightweight projects in parallel

## THE AZL PARTNERSHIP: COLLABORATION BETWEEN INDUSTRY AND SCIENCE FOR LIGHTWEIGHT PRODUCTION

With the AZL Partnership, AZL enables the close cooperation between the lightweight industry and the research institutes of RWTH Aachen Campus. The AZL Partner Network consists of more than 80 industrial partners representing the entire lightweight production value chain from the raw material producer, over molders, manufacturing equipment suppliers, Tier 1 and Tier 2 to OEMs, from SMEs to large multinational corporations, from Germany to Mexico, China or Japan, from 21 different countries in total.



- Joint Business Development
- Cost Sharing in R&D
- Open Innovation & Networking
- High-Potential Graduates
- On-Campus Community Offices

### THE AZL PARTNER NETWORK: MORE THAN 80 COMPANIES FROM 21 COUNTRIES



### AZL DEVELOPMENT & CONSULTANCY SERVICES

Besides the AZL Partnership, AZL offers individual industrial projects for exclusive development and consultancy involving the relevant lightweight expertise and equipment of its Partner Institutes.

Studies & Benchmarks


Technology Advisory

R&D Projects

**WE OFFER YOU**

- Involvement of the relevant experts from RWTH Aachen University
- Efficient project management and contracts from a single point of contact
- Uncomplicated access to the equipment at RWTH Aachen University
- Identification of suitable industry partners who could co-finance your project

### YOUR ON-CAMPUS COMMUNITY OFFICE



Through direct access to the RWTH infrastructure, you can expand your company with the expertise of numerous scientists and industry experts as well as machine halls with comprehensive and up-to-date equipment. At the campus you will be part of a network that not only consists of companies at the AZL, but also includes numerous member companies of other clusters and networks. In this hub, you identify trends and future employees at an early stage and present your company in an innovative context. In addition, publicly funded projects offer financing opportunities to pursue long-term projects.

**YOUR DIRECT AZL CONTACT:** Marina Biller | Head of Partner Networking Services  
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