Driving new ideas, developing innovative solutions and meeting the latest standards come down to one thing: making the right connections. Because there are no one-size-fit-all answers, DuPont works hand-in-hand with our customers to help them find optimal solutions to their specific needs. Among the biggest challenges facing many industries is how to reduce environmental impact while continuing to deliver quality products. A case in point is the automotive sector, with the focus on light weighting solutions that reduce carbon dioxide emissions without compromising performance.

The key to innovations lies in identifying the right mix of different technologies and expertise

Multi-Material Design Approach – No single material can help them achieve this goal – which is why holistic thinking and collaboration along the value chain is so important. It requires a multi-material design approach that supports material optimization by using the right material in the right place to achieve performance improvements, weight savings and cost reductions all at once.

In this regard, we see significant potential in the use of thermoplastic composites (TPC). They allow automakers to integrate lightweight materials selectively in specific areas of a vehicle. Vizilon® TPC is a growing family of thermoplastic composite solutions within the DuPont product portfolio. Our existing capabilities and enabling technologies, including predictive engineering, help us to continue to validate our Vizilon® TPC offering and develop tailored solutions by pooling expertise with partners in the value chain.

An example of a successful collaboration in this area is our work with EconCore N.V. on the development of thermoplastic composite based honeycomb sandwich panels. Combining EconCore’s ThermFex technology with DuPont’s Vizilon®, this partnership has given shape to ultra-light sandwich panels that directly meet the needs of customers in sectors such as automotive, construction, leisure and energy. The panels demonstrate that strength, stiffness and high rigidity can go hand in hand with lightweight and high-volume applications.

The key to innovations such as these lies in identifying the right mix of expertise, materials innovation, design, processing, and assembly techniques along the value chain. AS AN AZL-PREMIUM PARTNER, DuPont values the center’s unique platform for engagement with different sectors and experts working at the cutting-edge of research. This is why we co-located our research activities at AZL in 2016 with a view to matching market needs with commercially viable innovations. DuPont’s ongoing commitment to investing in innovation and future technologies is based on precisely these types of connections.

Learn more about DuPont’s partnerships and innovations at Pavilion 5A, stand E24 during JEC World 2017, 14-17 March or by visiting vizilon.dupont.com

Unique and Innovative Building Façade System

Construction company TGM collaborated with Indupol, Aliancys, BÜFA and Solico to create novel construction technologies and a great composite façade project example with a unique shape and design.

TGM is a Dutch construction company specialising in the installation of building façade systems. Over the years the company has been acting as subcontractor in multiple construction consortia in the Netherlands, completing a large number of office and residential buildings in the high end of the market.

Typically TGM is installing a complete façade solution onto the bare concrete building. This façade assembly includes structural components, insulation to heat and moisture, ingress protection, as well as elements that provide aesthetics. Unique Design – Architects have been asking TGM for help to create buildings with unique and distinctive looks. For that reason, a solution based on composites seemed logical, as that provides architects with high flexibility to create novel shapes and designs. In addition, it brings to the building owner the interesting benefits of long service life and minimal maintenance.

A novel composite façade solution was first developed for the construction of the new Eurojust office building in The Hague, Netherlands. This project required the delivery of over 700 façade panels of multiple widths and lengths (ranging from 3.5 to 10 m).

Changing Requirements – Right from the start TGM involved composites design company Solico, resin suppliers Aliancys and BÜFA, and component manufacturer Indupol to develop the composite system and a reliable process for large-scale production. After having gone through several design iterations, the companies developed a compact proprietary composite system that met all the requirements. As an illustration: a mock-up of the assembly successfully passed fire testing and a real-life and very harsh mechanical attack by experienced vandals.

Smooth Productions and Installation – The composite components were made by Indupol through a hand lay-up process in modular molds that were adjusted to the desired shape and dimensions, using resin from Aliancys and Büfa (delivered through Distributor Euroresins). After molding, the parts were treated with a topcoat in white color and transported to the job site for installation. With minimal use of scaffolding, the parts were lifted by a crane and attached onto the building.
**AXIA MATERIALS LAUNCHES PIXEL HAUS®**

**A NEW WAY OF HOUSE CONSTRUCTION WITH COMPOSITE PANEL**

Axia Materials, located in South Korea, entered into new business discussions in various countries including Americas, northern Europe and middle east countries.

Axix Materials, the development specialist and provider of composite material announced the launch of Pixel Haus®, the brand for house construction solution with composite panel. Axia Materials (www.litetex.com), located in South Korea, is one of the world’s leading thermoset composite material and solution provider, specialized in high strength and lightweight composites for weight reduction applications in automotive, aircraft, military & defense, electronics and construction industries. Based on the accumulated composite technologies and experience in supplying composites to US military construction project, the company recently completed the development of a new construction solution to build houses with composite sandwich panels and branded it as Pixel Haus®. Axia Materials is strengthening its global presence in construction industry along with various contract discussions for new business and investment opportunities in USA, Sweden, Norway, Denmark, Italy, UAE, Saudi Arabia and many other countries.

### The Pixel Haus® – easy assembly of Composite Panels

The Pixel Haus® uses Axia Materials’ unique continuous fibre reinforced thermoset composite, LiteTex®, and composite sandwich panel, LitePan®, which is made of LiteTex® with various insulating foam cores. The Pixel Haus® has innovative and differentiating points compared to existing construction method. The core material of Pixel Haus®, LitePan® is composite SIP (Structural Insulating Panel), which has structure, insulation, waterproof, and corrosion resistant functions simultaneously and the dimension of one panel is up to 2.7m x 1.2m. Owing to the lightweight and size, it is possible to complete construction by simple assembly of the panels in a short period. The actual constructions including interior and exterior finishes in Germany, USA, Sweden and Korea have been completed less than a week. Despite the short period, its structural and finishing performance showed as same as conventional construction method.

The insulation performance of Pixel Haus® is very high because thermal bridges are eliminated. In case of 110m² completed house, the heating cost was recorded under 12 Euros per month in winter season. And, when considering a SIP house, the fireproof is one of essential factors for safety. LitePan® got 1 hour of loadbearing fireproof certificates in USA, Sweden and Korea. Additionally, the Pixel Haus® is eco-friendly and green construction solution. LiteTex® has zero VOC (Volatile Organic Compounds) emission, and during the Pixel Haus® construction, there are less noise, dust, and dry process uses no water. Most of Pixel Haus® materials are fully recyclable, and the production of composites use only 15% of the energy that is used for production of fabricated steel.

Justin Jin, CEO of Axia Materials said, “The Pixel Haus® solution is the perfect fit for today’s highly demanding requirements for insulation, energy efficiency, eco-friendliness, sustainable, and cost and labor savings globally”, and he finally emphasized that “We are under in-depth discussion with several partners to build fully automated plants in strategic countries and strongly believe our solution will help many people to enjoy better quality of life with less budget and time investment.”

“Pixel Haus® is not only for high-end energy saving homes but also for affordable home solutions for emerging countries. This technology will enable the local people to build their own homes by themselves in DIY way as well.”

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**THE FUTURE OF BUILDING**

The growing use of Composites in Construction

The Paris based JEC Group, whose mission is to provide knowledge and networking opportunities for the composites industry worldwide, is publishing a new study of the use of composites in construction. The study looks at eighty-two examples of the use of composites across a very wide range of building applications around the world.

To do justice to these applications, a much wider definition of composites has to be used, one which encompasses a wider range of matrices than just polymers e.g. gypsum, cement or concrete and a broader range of reinforcements than just glass and carbon fibre e.g. natural fibres and steel fibres.

The first area which is looked at in detail is the use of composites in architectural projects, of which there have been a growing number in the last three years. Many of the world’s leading architect firms have discovered how composites can turn architectural designs into a reality which cannot be achieved with other materials. Light weight and freedom of form are the two key reasons for this choice of composites. In total twenty-one reasons have been identified as driving the growing uses of composites.

The second area examined is the use of composite systems in the construction of either the whole building or significant parts of buildings e.g. floor, walls and roofs. There are large existing applications as well as fast developing new ones such as pre-cast concrete walls reinforced with carbon fibre grid.

The third area covered is that of composite elements e.g. doors, window frames, modular shower rooms. Composite moulders have developed a wide range of solutions for the building industry.

Finally, the use of composites for the reinforcement and repair of buildings is examined. Additionally, a number of trends positively impacting the growth of composites are reviewed. Altogether the future for composites in building looks very positive.
AZL: How do you regard the relevance and development of lightweight for the automotive sector?

Lothar Gräbener: The global commitment to environmental protection of almost all major industrial nations has resulted in ambitious goals to reduce the CO2 emission of motor vehicles. OEMs are compelled to bring down their fleet consumption drastically in the period of 2020 to 2025 in order to avoid costly penalties.

Numerous initiatives and innovations have been launched in this respect. All OEMs are required to present hybrid and electric vehicles in the near future to meet the stringent emission targets. Regardless of the drive concept, it is mandatory to reduce the vehicle’s weight.

Less consumption of fuel or battery energy and less CO2 emission is the challenge. The rising environmental awareness of customers will have an impact on the market shares. Only clever and economical solutions with sufficient reach can be marketed successfully. Therefore the development of lightweight components for the automotive industry is of highest priority.

Which production processes will play a major role in the future serial production of lightweight components?

Currently a multi-material mix is being used in lightweight vehicle designs. Various materials for lightweight components are available: High strength steels (HSS), aluminium, fiber reinforced plastics and hybrid materials. The corresponding manufacturing processes have been established: The hot stamping process for HSS and aluminum, the hydroforming process for tubular structures and the HP RTM, wet molding and SMC processes for fiber reinforced plastics which can be combined to make hybrid structures.

Over the last years, the hot stamping technology has experienced tremendous growth. In the field of composites, the growth has been rather moderate. In the future, we see a high potential for hybrid parts as they combine various advantages.

How will the composites market develop over the next 3 years?

We confirm the findings of the actual composite market survey by the VDMA. According to the survey, all member companies have estimated the current business situation as generally positive. In the forecast for the major economic regions relating to the second half of 2017, the highest growth rate is expected in Asia for the first time. With a continued positive investment climate, the composite index shows a strong upward trend.

Among the main growth drivers, the automotive and aerospace sectors are those where the highest growth impact is being anticipated. CFRP (carbon fiber reinforced plastics) still is the growth driver no. 1. With the development of the new multi-functional composite press, the close collaboration with the leading European institutions and research institutes (AZL, NCC, USA (IACM)) and the Composite Alliance with the company FRIMO, Schuler has established the prerequisites to participate in the growing market.

Which developments do you monitor for the Asian and north American market?

The major incentives are coming from Asia, followed by Germany and the USA. The Institute for Advanced Composites Manufacturing Innovation (IACM) is a lighthouse project in the USA supported by the Department of Energy. Likewise, a Korean OEM relies on an innovative short-stroke press concept to develop composite parts for the Asian market. It is noticeable that various facilities are operating in the fields of research and process development in the Asian and North American markets, however, contrary to Germany, so far none of the applications has gone into serial production.

From your point of view, what is the major impact of shoulder to shoulder cooperation and Open Innovation?

We see an advantage in the collaboration with institutions, research institutes and specialized suppliers in the supply chain. Schuler has already entered into several cooperation projects. We are collaborating with the AZL in Aachen regarding the development of process technology for future applications. In 2017, the institute will start up an 18.000 KWh multi-functional composite press that will be used also in the research project iComposites 4.0, a public funded BMBF project together with e.g. Frimo, AZL, Siemens, Toho Tenax. The Composite Alliance set up with the company FRIMO enables Schuler to supply turnkey systems for composite manufacturing processes.
LIGTHWEIGHT CONSTRUCTION – ACTIVITIES OF THE GERMAN FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND ENERGY

In order to maintain Germany as a global leader in terms of resource efficiency, the Federal Ministry for Economic Affairs and Energy focuses on promoting innovative production technologies and innovative materials. We must seize the opportunities of lightweight construction and actively look for solutions to tackle challenges such as recycling concepts for composites or the high energy demand in the production of specific materials. Only holistic concepts can contribute to modernizing and strengthening a sustainable industrial basis.

The Federal Ministry for Economic Affairs and Energy promotes lightweight construction as an innovative technology by means of the following measures:

The lightweight construction atlas – The “lightweight construction atlas” (www.leichtbauatlas.de) is an interactive portal which illustrates the lightweight-construction-related skills in Germany—for all materials, technologies and sectors. Organisations can present their processes and activities on this website. The atlas helps in particular enterprises and research institutions to find local lightweight-construction solutions that meet their needs. For this purpose, a catalogue comprising around 250 criteria has been elaborated in close cooperation with business and academia for the targeted search for suppliers and partners. The atlas is designed for the users by a team of experts from the Federal Ministry for Economic Affairs and Energy. It aims to serve as a national and international hub for lightweight construction and to help German companies, especially SMEs, to present their processes and activities on this website. The atlas helps to identify available solutions and to consider the possibility to present and discuss recent technological trends, the work of the Federal Ministries, and the potential for challenges at national level and on foreign markets.

Lightweight construction office – In the coming months, the lightweight construction office will start its work on behalf of the Federal Ministry for Economic Affairs and Energy. It is to serve as a national and international hub for lightweight construction and to help German companies, especially SMEs, to seize the opportunities and challenges at national level and on foreign markets. The Lightweight construction forum – The “Lightweight construction forum” (www.leichtbauforum.de) is a platform to share knowledge and establish contacts. It provides the possibility to present and discuss recent technological trends, the work of the Federal Ministries, and the potential for challenges at national level and on foreign markets. It is designed to be used as a platform to present and discuss recent technological trends, the work of the Federal Ministries, and the potential for challenges at national level and on foreign markets. It is a tool to guarantee structural integrity, while reducing the amount of inspections, while an increasing number of structural events (e.g., impacts) damage progression to be considered. Hence, it is essential to detect damages during the critical stage, leading to high monitoring effort (e.g. performing regular inspections).

Structural Health Monitoring (SHM) is the automatic in-service monitoring of structural condition. It is a tool to guarantee structural integrity, while reducing the amount of inspections. Since there are various obstacles, successful SHM needs a holistic and interdisciplinary approach. It is not sufficient just to attach a sensor to a highly stressed region of the structure. Recorded data need to be transmitted, processed and evaluated. Therefore, the system needs an innovative power supply, e.g. achieved by energy harvesting. In addition, sensor application during the manufacturing process of the structure should be considered. For example, integration of the sensor within two different layers of composite materials is beneficial since it leads to a protected sensor. Deepened structural analyses provides data for optimizing sensor position with respect to sensor sensitivity.

In order to cover all of these aspects, the Institute of Structural Mechanics and Lightweight Design (SLA) founded an interdisciplinary consortium consisting of 14 research institutes of the RWTH Aachen University. A thin-walled drive shaft made out of glass fibre reinforced plastics (GFRP) is chosen as demonstration. Due to the low thickness to diameter ratio, torsional buckling limits the load carrying capabilities. An accidental event such as an impact may damage the material and thereby reduce the buckling load.

In order to detect impact damages, fibre optical sensors, produced by the Fraunhofer Institute for Machine Design (IME), are integrated during the braiding process at the Institute of Textile Technologies (ITA). Their positions and directions are optimised using numerical analyses (see Fig. 1) at the SLA with respect to sensor sensitivity. The impact damage (see Fig. 2) is introduced at the SLA with respect to sensor sensitivity. The impact damage (see Fig. 2) is introduced at the SLA with respect to sensor sensitivity. The impact damage (see Fig. 2) is introduced at the SLA with respect to sensor sensitivity. The impact damage (see Fig. 2) is introduced at the SLA with respect to sensor sensitivity. The impact damage (see Fig. 2) is introduced at the SLA with respect to sensor sensitivity.

The Institute of Structural Mechanics and Lightweight Design (SLA) initiated an interdisciplinary consortium for Structural Health Monitoring to achieve low system cost. The holistic approach is demonstrated for a thin-walled drive shaft. The results are going to be presented at an industry workshop in fall 2017.
The AVK (Federation of Reinforced Plastics e.V.) represents the interests of manufacturers and processors of reinforced and filled plastics, engineering thermosets as well as their raw materials suppliers on a national and European scale. Elmar Witten, Managing Director at AVK and Volker Mathes, in charge of Business Development at AVK, summarise latest trends of the CFRP and GFRP markets drawing on Composites market report 2016 and the results of the 8th Composites market survey of Composites Germany.

**AZL: Can you describe the development of the market for glass fiber reinforced plastics?**

Elmar Witten: The worldwide composites market reaches a level of about 9 million tons. Europe’s share of global composites production continues to decline – despite its absolute growth in total production over recent years. Processing of commodities (standard products), in particular, has clearly shifted towards Asia and America over this period. In short, GRP production in Europe continues to grow but will probably lag behind the global trend.

**How is the market allocation of the different Composites materials?**

The AVK together with their partners CC&V (Carbon Composites e.V.) and AMAC (Advanced Materials and Consultancy GmbH) collects data concerning the European Composites Market. The following figure refers to this data. The whole European market reaches a level of about 2,850 kt in 2016. This is a little less than 1/3 of the world production. The biggest single segment in this market is the Short Fiber Reinforced Thermoplastics. They have a share of more than 45% of the complete market. The next biggest group are the GRPs with a volume of 1.096 kt. The term GRP refers to all glass fibre reinforced plastics with a thermoset matrix as well as glass mat reinforced thermoplastics (GMT). The Teflon® market reaches a level of 350 kt and last but not least CRP had a production volume in Europe of 35 kt. Besides there are other materials like Natural Fiber Reinforced Composites or ceramic composites for example. The GRP market is the market-segment we mention when we typically talk about the GRP-Market.

**How is the European GRP-market developing?**

Volker Mathes: In 2016, the volume of glass fibre reinforced plastics (GRP) manufactured in the European countries has grown by 2.5%. The market growth continues at the same rate as in 2015. The total production reaches a volume of 1.096 million tons.

**Which are the growing sectors in Europe in the composites business?**

Elmar Witten: It may not be overseen that GRP products are very often already well established in different markets. This includes single part production as well as serial production in many different application fields. The production volume is many times higher as the GRP production volume (35 kt Europe 2015) for example. The largest buyers of GRP components are to be found in the transport and construction sectors. These each consume around one-third of total production and play a major role in national economies. The long-term trend for GRP production therefore tends to follow the growth of the economy as a whole. Nevertheless, no rapid expansion of production (similar to that seen in the CRP segment) is to be expected in the near future. This is partly due to the very considerable level of existing production and also the fact that fluctuations in one industry are usually “smoothed out” by other applications. Especially the thermoplastic production technologies as well as the RTM-Technology have gained special interest and an increase in production volume.

**What are the upcoming trends?**

Volker Mathes: As the results of the 8th Composites market survey – published by Composites Germany – show the general business situation is largely seen as positive in the composites market. When asked to assess the general business situation in three regions – Germany, Europe and worldwide – the respondents came to highly positive conclusions. For example, 84% of respondents see the current worldwide business situation as positive. Beyond 29% said they were expecting demand to continue to improve in Europe, whereas in other regions the value has now risen to 49%. By contrast, the proportion of those expecting a negative development has stagnated at 5%. As a conclusion the survey shows that the respondents are quite optimistic for the coming months. The market is therefore likely to continue in its dynamic development – all the more so as half of all respondents believe that their businesses will become more active on the market, while only 2% are anticipating a decline.

**Especially the thermoplastic production technologies as well as the RTM-Technology have gained special interest and an increase in production volume.**

Elmar Witten
Managing Director | AVK e.V. and AVK TV-GmbH
Elmar.Witten@avk-tv.de
Huntsman's VITROX® resin technology has proved central to Project R.A.C.E and the development of KTM’s new license plate holder. Suitable for HP-RTM processing, this innovative polyurethane-based matrix material has unique snap cure capabilities – meaning manufacturers can carefully control the resin curing process and achieve a full cure within minutes. Hubert Reithberger, Product Manager for Advanced Composite Resins at Huntsman, said: “Project R.A.C.E is an excellent platform where high-speed polyurethane matrix materials such as VITROX® resins can demonstrate their full performance. Self-releasing systems with outstanding mechanical properties, combined with optimized curing times, are the key to mass-producing products with a short cycle time. Project R.A.C.E and the application of KTM Technologies’ CAVUS technology is a prime example of how highly specialized partners can come together to create a step change in the production of fiber composite hollow parts.”

The aviation industry is one of the branches with the highest growth rates during the last years. Lightweight design and the use of lightweight materials such as carbon fiber reinforced plastics are important key aspects for meeting the rising need for fuel-efficient civil aircraft in the future. For the cost-efficient and lead-time-related production of aircraft structures or components the development of innovative manufacturing technologies is necessary. In this context the combination of pre-impregnated continuous fiber reinforcements and sheet molding compounds reinforced by long fibers in a one-shot compression process is really promising. By using this hybrid material and this process technology functional and light-weight composite components can be realized in a cost-saving way and with short lead times. The direct implementation of metal components such as inserts, sleeves and plates promises further functional integration. Polymat Composites has invested many efforts in research and development for new class of thermoset reinforced materials to react to the increasing aircraft market requests. In particular it has been launched a new range of SMC for aircraft industries in its German plant in Miethen (near Frankfurt) such as HUP 27. The SMC described by HUP 27 is developed for the fire containment requirements for cargo areas and fulfills the FAR requirements according FAR 25 App. F Part I - V and the AITM 3.005. And HUP 63. The SMC described by HUP 63 is developed for the fire containment requirements for cabin and interiors and fulfills the FAR requirements according FAR 25 App. F Part I - V and the AITM 3.005. Both SMC can be co-molded with carbon fiber reinforcement (fabrics or unidirectional) impregnated with the same thermostetting resins in order to give the same continuity on the organic phase.
CONTINUOUS PRODUCTION PROCESSES OF TOMORROW

Berndorf Band Group: Highly precise steel belt systems from Austria

All over the world, the high quality steel belts and process systems of Berndorf Band Group are considered to be a technological standard. The latest development is a modular double belt press which allows for a continuous and particularly efficient production of most different flat-sheet products in the composite area. Within the scope of feasibility tests, customers can directly convince themselves of the advantages of this press type in the Research & Development Center in Berndorf.

Steel belt systems: A versatile production technology—No matter if laminate manufacturers, testing centers of the automotive industry or producers of chemical products—they all rely on individual steel belt solutions of Berndorf Band Group. "We support everything from the identification of suitable process parameters to the implementation of customized systems and their maintenance. Extensive service as well as research and development are an important part of our customer-oriented corporate philosophy", explains Gernot Binder, president of Berndorf Band Engineering GmbH. On the basis of this philosophy, a new system has now been developed, especially for the plastics industry. It allows for an even more efficient production of flat-sheet products such as thermoplastic composite materials.

More output with high flexibility: Continuous instead of static pressing—In many cases, static processes with cycle presses are used exchange of the modules without belt removal. In this connection, you can combine calender, roller, roller carpet and slitting modules which can reach process temperatures of up to 400 degrees Celsius. Roller carpet modules generate pressures of up to 2 MPa and slitting modules of up to 0.2 MPa. Roller modules generate a line pressure of up to 15 kN/m and calendar modules of up to 60 kN/m. Due to the hydraulic generation of the compressive forces in the modules, the press can be operated in an isostratic and isochoric manner. In order to be able to adjust pressures even better to the needs of thermoplastic composite materials, Berndorf Band Group strives for an intensive exchange with material manufacturers and producers.

Test procedure in Berndorf: New steel belt press and competent consultation—In the Research & Development Center in Berndorf, Austria, customers can already convince themselves of the modular double belt press during the material and product development. Due to the flexible arrangement of the modules, individual production processes can be realized and checked for their effectiveness. In the area of thermoplastic composite materials, some flat-sheet products could already be produced in continuous form, e.g. CFRP (with PEEK, PA6, PP and PE), GFRP (with PA6, PP & PE) as well as organic sheets.

The successful pilot productions at Van Wees have led to the sales of the first thermoplastic UD tape production machines and the decision to close the chain for composite tailored blanks production with a new machine and equipment and machining of high-strength steels for lightweight applications mainly for the automotive industry are running. Shear cutting of composite structures on a press is scheduled.

From 2014 onwards, Van Wees has noticed a continuous growing demand for the production of thermoplastic resin based UD tapes. In its Research and Technology Center (R&TC) the UD tapes can be made on three different machines. The width is 600 mm maximum and these rolls can be slit in-house to smaller width. The UD600 TPR is used on daily basis and several tons of UD tapes are already made for interested parties. These tapes are used for evaluation of the customers resins and fibers. By running the machine for longer periods, the customer can experience the equipment capabilities, develop its products and the operators will be trained for a smooth startup when the machine is installed.

The Van Wees R&TC machine is currently equipped with a double belt calender with steel cooling belts. This addition has increased the tape quality due to better control of the process variables. It also opens new possibilities for making thicker tapes, multi-materials and other lamination processes.

The R&TC will be expanded with a new UD placement machine. For making tailored blanks, a multi-angle ply cutting machine and welding equipment are present. The plies from this machine are manual welded according to the ply book configuration. The panels can be made with these laminates on a press of 800 x 500 mm. Van Wees has built two Crossmich machines, one in 2012 and one in 2014 for its R&TC. The first one was a large Multi-axial UD machine, working width 1.800 mm and the latter version was a robot based unit. Both machines were not according to the performance and operational wishes and therefore a new design is made. Using the experience from the "old" versions, a new generation machine is configured in which all knowhow is bundled. This high automation machine will be operational after the summer of 2017.

Van Wees always welcomes ideas for testing on its equipment and recently performed new trials with flax fiber based UD tapes. Having worked 2 – 3 years on this product from 2010 onwards, but without success in the market, it is good to notice that also this material is gaining interest again.

AZL CONFERENCE AT JEC WORLD 2017: PRODUCTION TECHNOLOGY FOR MULTI-MATERIAL LIGHTWEIGHT COMPONENTS

PRODUCTION OF COMPOSITE BLANKS

AZL JOINT PARTNER PROJECT: 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 just started to progress on the developed double-belt press system with the aim to build an industry-scaled machine according to the pursued concepts. Your AZL Contact for further assistance: Albert Wendt, albert.wendt@azl.rwth-aachen.de.

AZL JOINT PARTNER PROJECT ULTRA-FAST MANUFACTURING OF TAILED COMPOSITE BLANKS

To increase resource-efficiency in the production of continuous fiber reinforced plastics, the manufacturing of scrap-optimized blanks with defined fiber alignment ("tailed composite blanks") on basis of unidirectional semi-finished products (thermoplastic tapes, tow-pregs or dry-fibres) 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. The project was initialized at the Annual Partner Meeting 2015 and aims to realize a novel machine solution for the high-volume production of tailored composite blanks. Your AZL Contact: Thomas Weiler, thomas.weiler@azl.rwth-aachen.de.

MAJOR EQUIPMENT EXPANSION AT VAN WEES UD AND CROSSPLY TECHNOLOGY

Fig. 1: Multi-axial UD8000 machine

Fig. 2: Double belt calender in operation
DEVELOPMENT OF A FULLY AUTOMATED ADHESIVE BONDING PROCESS

Consideration of large-scale manufacturing processes – with the use of Laser irradiation as pre-treatment method for FRP

The increasing application of material mixture results in a growing importance of the adhesive bonding technology as the most promising joining technique for multi-material joints. Until now, the use of adhesive bonding for multi-material joints is, however, connected with high process and expenditure. Despite the successful implementation in individual applications, the methods have not yet been sufficiently developed for large-scale manufacturing. One of the most important challenges is the provision of robust surface pre-treatment methods in order to ensure efficient and durable adhesive bonding of joints. Furthermore, methods have to be developed which make it possible to achieve the handling stability of the joined components within a very short time. The development and introduction of this methods into the adhesive bonding process remains challenging under the boundary conditions of large-scale manufacturing.

Fig. 1: Laboratory size adhesive bonding process chain

At the Welding and Joining Institute (ISF) at RWTH Aachen University, a process chain in laboratory size was developed and built (see figure 1). In this process chain components of FRP and metal are adhesively bonded fully automatically. The process chain includes a 6-axis industrial robot, a vacuum gripper system, a CO2-CW laser system for the pre-treatment of (fiber-reinforced) plastics, an adhesive dosing unit for processing 1K or 2K adhesive cartridges, a joining device and an induction system for accelerated curing of the adhesive joint. Alternatively, an atmospheric pressure plasma system can be used for pre-treatment instead of the laser system. With this existing opportunity, bonding and related joining processes between various materials can be tested for feasibility studies. Additionally, it is possible to gain detailed information about the process in terms of e.g. process time, reproducibility, practicality and economical.

Feel free to contact us, if you are interested in the development of modern adhesive bonding process chains, related processes as thermal direct joining, hybrid joints of FRP and pin structurised metal, repair concepts for FRP or smart structural health monitoring (SHM) systems (see figure 2).

KIRA VAN DER STRAETEN AND FRANK SCHNEIDER | FRAUNHOFER INSTITUTE FOR LASER TECHNOLOGY ILT

AZL WORKGROUP: HYBRID THERMOPLASTIC COMPOSITES

Production processes combining continuous and short or long fiber reinforcements allow an high design flexibility as well as good mechanical properties at the same time. Thus, overmolding of FRP parts is a popular process to functionalize thermoplastic semi-finished products and local reinforcement by AFP increases significantly the performance of plastic components. Within the AZL workgroup “Hybrid Thermoplastic Composites” faces technological challenges such as thermal management, thermofoming, handling and fixation, trust in technology and cost-efficient design.

Next Workgroup Meeting: October 10th, 2017

www.lightweight-production.com
State of the art – Lightweight structures are used not only for weight reduction and, thus, for the implementation of legal requirements such as lower CO2 emissions in the automotive sector, but also for the integration of functional elements. In view of the above-mentioned requirements, injection molding of thermoplastics is highly suitable. Injection molding allows a high level of design freedom, short cycle times and the implementation of continuous fiber structures. The FiberForm technology largely depends on the automation concept, the heating concept and the size of the injection unit (Figure 2). Due to different process-varying components, the effect which the individual cost factors have on component prices changes.

Manufacturing Concepts – Based on the challenges, KraussMaffei has developed three concepts for three different organic sheet sizes (Figure 2). The concepts are developed based on low cycle times, minimal installation space, flexibility and low component costs.

Characteristic of all FiberForm concepts is the positioning of an infrared heating station above the fixed clamping plate. Thanks to this heating concept, very short transfer moves are possible to insert the heated organic sheet into the molding tool. This results in very short transfer times of the organic sheet into the tool and therefore facilitates high series production of components. The infrared technology is used as a heating principle. Depending on the thickness of the semi-finished product, heating takes place on one side or both sides. The dimensions of the infrared heating area depend on the size of the organo sheet and the corresponding injection molding machine, but can also be customized. Two decoupled robot units are defined as automation kinematics. As a result, heating of the organic sheet and removal of the finished part can be decoupled from one another in terms of time, which leads to a further reduction in the cycle times. Due to the different component sizes, the robot kinematics differ in terms of their freedom of movement and their load capacities.

This allows for a production of UD tapes with a tape width of 25 to 75 mm, a tape thickness of 0.1 to 0.3 mm, at a production speed of 0.6-10 m / min. The processing of glass fibers (> 2,400 test) and carbon fibers (> 24K) as well as polypropylene or polyamide matrix is possible. This allows for a production of UD tapes with specific properties. Together with the forming of thermoplastic composites in the Double-Diaphragm-Forming process or the back-molding of such structures, a continuous process analysis can be done at IKV.

Due to the increasing individualization in production, variant production gets increasingly important. Hence, the Institute for Plastics Processing at the RWTH Aachen (IKV) presented a production cell for the production of individualised composite parts at the K2016 show together with an industrial consortium (Fig. 1).

K 2016 PRODUCTION CELL NOW AT IKV

With new tape plant

Felix Haschke and Christian Beste | IKV at RWTH Aachen University
felix.haschke@ikv.rwth-aachen.de | christian.best@ikv.rwth-aachen.de

IKV has a new extrusion-based production facility for the production of UD tapes with an online quality assurance system. The plant technology was developed with the partners Bayer GmbH Maschinenfabrik, Pistorius GmbH, F.A. Kümpers GmbH & Co. KG and KUKA Industries GmbH in the publicly funded BMBF project LightFlex. Current research activities in this area focus on the interactions between measurable quality data and the profitability of the process. The built-up tape line allows for the production of UD tapes with a tape width of 25 to 75 mm, a tape thickness of 0.1 to 0.3 mm, at a production speed of 0.6-10 m / min. The processing of glass fibers (> 2,400 test) and carbon fibers (> 24K) as well as polypropylene or polyamide matrix is possible. This allows for a production of UD tapes with specific properties. Together with the forming of thermoplastic composites in the Double-Diaphragm-Forming process or the back-molding of such structures, a continuous process analysis can be done at IKV.
INTERNATIONAL COOPERATION ON INNOVATIVE WINDING TECHNIQUE

The installation of the innovative and economic production technology "MFW-48" is making progress in January 2017

Henning Janssen and Thomas Storms | Fraunhofer Institute for Production Technology IPT

Next Workgroup Meeting:

May 30th, 2017

Research projects for local heating and machining of high-strength steels for lightweight applications mainly for the automotive industry are running. Cutting of composite structures on a press is scheduled. The use of high-strength steels is known as a key factor to enable cost-efficient lightweight design. With its improved properties, these steels guarantee customized functionality and simultaneously a reduction of mass. As a matter of fact, the advantages in the application turn into difficulties during the machining process. The high strength causes noticeable applications. Especially, the production of lightweight pressure vessels will be taken into consideration. In automotive industry, these vessels can be used to store hydrogen and thus make an important contribution towards implementing the turnaround in energy policy and CO2 reduction. ITA expresses their gratitude to the partner Murata Machinery Ltd. for the good collaboration and the intensive efforts on site at ITA in Aachen.

The Fraunhofer IPT extended its machinery with a 200 ton servopress in 2016.

The growing demand on the low carbon dioxide emitting vehicles within the automotive and transportation sector, promotes and encourages the usage of fuels like CNG or hydrogen. The composite vessel technology allows tank systems with high working pressures combined with low structural weight. The well known technology was hindered so far by the high material and production costs. AFPT faced the challenge to develop an innovative production technology that meets the requirements of an industrial scale vessel manufacturing. The technology is based on a thermoplastic prepreg material, which is heated by laser energy and consolidated by a compression roller. The so called in-situ consolidation allows the curing of the laminate during the winding process. So no post-processing in an autoclave or hot press is necessary. The laser is a very energy efficient heat source that can be well controlled, especially at high winding speeds. The process also contains less health risks, because it avoids open resin systems and the process happens fully automated in a safety enclosure.

The new winding head was consequently designed to face the requirements of the high speed vessel winding. Most important goals have been the reliability and the productivity of the system. By optimizing the head and its handling system the maximum winding speed has been increased from 20 m/min up to 90 m/min. To withstand these velocities the tape guiding system has been completely redesigned. Also the tape tension system has been adapted to higher tape tensions, which also increases the consolidation and laminate quality.

MACHINING OF HIGH STRENGTH STEELS AND SHEAR CUTTING OF COMPOSITES

The Fraunhofer IPT extended its machinery with a 200 ton servopress in 2016.

Henning Janssen and Thomas Storms | Fraunhofer Institute for Production Technology IPT

Next Workgroup Meeting:

May 30th, 2017

Using local heating of the high-strength sheet metal. With several years of research in local laser heating of high-strength steels, Fraunhofer IPT built up experiences and competencies in developing corresponding systems and processes for the integration of this novel approach in existing sheet metal working processes. The local laser heating softens the material temporarily and enables production processes like shear cutting and bending with clear cut surfaces of up to 100% and high degrees of deformation. Based on the experiences with laser radiation for metal working processes. The local laser heating softens the material temporarily and enables production processes like shear cutting and bending with clear cut surfaces of up to 100% and high degrees of deformation.

Based on the experiences with laser radiation for the heating of complex geometries, different techniques like inductive or conductive heating are currently developed at the IPT. Depending on the process parameters also local hardening is possible.

Load optimized properties of individual parts can be achieved in order to further reduce component weight.

With the commissioning of a Schuler servopress with a maximum force of 2000 kN in 2016, Fraunhofer IPT has the opportunity to operate under industrial conditions. As an application oriented research organization, Fraunhofer IPT offers research activities and the development of integrated heating systems and processes under an industrial point of view. In order to exploit further lightweight potential, the IPT is going to extend the bandwidth of analyzed materials on the servopress. Examples are Aluminum as well as composite structures and sandwich materials. The use of the test as a press bench for shear cutting of composite materials is possible. That includes the cutting of outer contour as well as shear cutting within the part.

Also in the upcoming years, Fraunhofer IPT is your partner for any material- and process-based research in the field of lightweight design. At a seminar on the 4th of May, 2017, a detailed overview about industrial machining of high-strength steels and research activities in this field is going to be presented at the Fraunhofer IPT in Aachen.

For more information please visit our website at:

WWW.LIGHTWEIGHT-PRODUCTION.COM

Seminar see Page 9

PRESSURE VESSELS & AUTOMOTIVE PARTS

LASER-ASSISTED WINDING OF HIGH SPEED VESSELS

High speed winding of thermoplastic high pressure vessels

Anne Böttner | AFPT

AFPT developed a high speed winding head for large scale composite vessel manufacturing.

The Fraunhofer IPT extended its machinery with a 200 ton servopress in 2016.

The growing demand on the low carbon dioxide emitting vehicles within the automotive and transportation sector, promotes and encourages the usage of fuels like CNG or hydrogen. The composite vessel technology allows tank systems with high working pressures combined with low structural weight. The well known technology was hindered so far by the high material and production costs. AFPT faced the challenge to develop an innovative production technology that meets the requirements of an industrial scale vessel manufacturing. The technology is based on a thermoplastic prepreg material, which is heated by laser energy and consolidated by a compression roller. The so called in-situ consolidation allows the curing of the laminate during the winding process. So no post-processing in an autoclave or hot press is necessary. The laser is a very energy efficient heat source that can be well controlled, especially at high winding speeds. The process also contains less health risks, because it avoids open resin systems and the process happens fully automated in a safety enclosure.

The new winding head was consequently designed to face the requirements of the high speed vessel winding. Most important goals have been the reliability and the productivity of the system. By optimizing the head and its handling system the maximum winding speed has been increased from 20 m/min up to 90 m/min. To withstand these velocities the tape guiding system has been completely redesigned. Also the tape tension system has been adapted to higher tape tensions, which also increases the consolidation and laminate quality.

AFPT winding head for vessel manufacturing
The quality assurance during composite life cycle is essential for a successful and economic application. The WZL offers the Fiber Measurement Sensor (FMS), designed for inline applications and also develops individual software solutions for automated defect detection.

The industrialization of the production of composites is still impede by insufficient quality assurance methods. To increase the production speed and decrease scrap quota automation and an automatic adaption of the behavior of the quality assurance system to dynamic production conditions is essential.

Therefore, at the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, a new method was developed, which enables the measurement of the geometry (macro form) and the local fiber orientation (micro form) by data fusion algorithms. Defects in the textile structure and preforms are now fully automated detectable and classifiable. The system is available as a robot-based or as a multi camera set-up.

For the inspection of composites parts in field use thermography and ultrasonic systems are common sensor systems. The optical lock-in thermography is an active heat flow analysis, which is well suited for the inspection of carbon fiber reinforced plastics (CFRP). Large areas are covered in a single inspection step with contact-free infrared excitation and high-resolution infrared sensors. Ultrasonic testing is characterized by high flexibility and cost efficiency which are important factors for the realization of a quality assurance method for CFRP.

The Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University develops solutions for the automated defect detection of manufacturing errors or damage due to delamination, fiber breakage and matrix cracks. In addition, (adhesive) bonding points and wall thicknesses can be investigated nondestructively.

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Aachen – A balanced conduct of cost, quality and efficiency during every stage of the process, product and tool development surely guarantees coping with the daily challenges encountered within the market. Moldex3D is dedicated to assist part designers and mold makers to develop and produce higher quality products in form, fit and function at lower costs and reduced times-to-market. The recent release of Moldex3D already surprised the users with its numerous developments but far more novelties and ground-breaking enhancements are to be expected in Moldex3D R15 of all of which can dramatically improve the speed, robustness and reliability of simulation and thus allow enterprises to get the most out of virtual simulation for injection molding and create core competences and add a substantial amount of value to their products.

Completely New Platform – Studio – One path-breaking development to look forward to is the new Moldex3D Platform – Studio. The necessity to use two applications to perform a simulation is a feature of the past. Simulations and pre-post operations can now be completed in one application. A ribbon style user interface is guaranteed and high-performance rendering promises smooth and fast operations. Another great advantage is the extremely reduced file size. Furthermore, multi-run comparisons are supported as well as hot-key operations.

Designer BLM 3.0 goes to an entire new level – The new version of Moldex3D R15 will take the Boundary Layer Mesh (BLM) generator to a completely new level. BLM 3.0 will not only allow using fewer meshing elements which dramatically reduces the meshing time whilst keeping up the maximum wall thickness resolution but will also enable extraordinary possibilities in terms of advanced meshing and flexibility. Furthermore, the capabilities and options of non-meshing technology have been extended, optimized and intensively modified. More components such as cooling channels, heating rod, mold insert, and mold base are supported. This makes the solid mold base mesh preparation job a lot easier and cuts down meshing hours significantly and temperature results show a smooth outcome. BLM 3.0 thus revolutionizes your simulation to a whole new, highest possible level of efficiency and performance.

Fig. 2: The new Moldex3D Boundary Layer Mesh (BLM) generator 3.0 allows extraordinary possibilities in terms of advanced meshing and its flexibility. The non-meshing technology has been intensively modified.

Fig. 1: With the new Moldex3D Platform – Studio Simulations and pre-post operations can now be completed in one application and multi-run comparisons are supported.

Hexcel’s new fast curing film adhesive for the high-volume processing of metal/CFRP hybrid structures.

Hexcel’s automotive technologies promotions include a suspension knuckle made by St. Juan Industries in which the aluminum structure is stiffened with HexPly® M77 prepreg stacks, resulting in a 26% increase in stiffness compared to the aluminium-only knuckle, without any increase in part volume. The prepreg stacks are bonded to the aluminum with Redux® 677, Hexcel’s new fast curing film adhesive for the high volume processing of metal/CFRP hybrid structures.

Hexcel will also display a composite door demonstrator manufactured for Jaguar Land Rover using HiMax™ carbon fiber multiaxial fabrics. Hexcel created a non-crimped fabric with the optimum balance between drape, stability and permeability, using an automotive-grade standard modulakus, high tow count carbon fiber.

PolySprey™ Pultruded Carbon Profiles are new technology from Hexcel for pre-cured, thick-ply carbon fiber elements, offering an economical way of structurally reinforcing wind turbine blades. Carbon fiber tows are impregnated with a thermoset resin and shaped and cured in a continuous pultrusion process, resulting in perfect fiber alignment and a smooth surface. Pultrusion is a cost-effective solution for achieving standardized geometries in high volume production. Hexcel’s displays at JEC include a 2 meter diameter carbon laminate coil made from PolySprey® carbon fiber pultrusion for the structural reinforcement of a wind turbine blade.

As a leading manufacturer of carbon fiber and composite materials Hexcel is promoting a number of composite innovations for aerospace, wind energy, automotive and recreation industries at JEC World 2017.

Aerospace promotions include advances in HiTape® carbon fiber reinforcements for the automated lay-up of preforms for aircraft structures that are manufactured out of autoclave by resin infusion.

Aeropace displays include an Airbus A320 neo fan cowl for the LEAP 1A engine made with Hexcel’s carbon fiber, structural prepreg, dry fabric and RTMs resin. Also a Main Landing Gear door by Daher for Gulfstream made from Hexcel’s HexWeb® Engineered Core and demonstrating Hexcel’s expertise in potting, splicing, forming & NC machining of honeycomb.

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AZL CONNECTING RESEARCH AND INDUSTRY FOR LIGHTWEIGHT PRODUCTION

RWTH Aachen University is one of the worldwide leading universities in the field of production technology. The Aachen Center for integrative Lightweight Production (AZL) of RWTH Aachen consolidates the lightweight expertise of eight partner institutes with 750 scientists on the RWTH Aachen Campus. The AZL builds an international partner network between these institutes and more than 80 international companies involved in lightweight production. For this, AZL consists of two separate entities: The AZL of RWTH Aachen University addresses the transformation of lightweight design in mass production with basic research and development of lightweight products, materials, production processes and systems with access to the latest full-scale machines and automation systems. As a service provider partnering with companies in the field of lightweight production technology, AZL Aachen GmbH provides industrial services in the areas of engineering, consultancy and project management, networking and business development. Together as AZL, we are the one-stop shop for lightweight production technology and offer holistic and cross-industry solutions.

OFFICES FOR AZL PARTNERS IN NEW PRODUCTION ENGINEERING CLUSTER

Lightweight experts working shoulder to shoulder at the RWTH Aachen Campus

With co-working spaces and exclusive offices in the new Production Engineering Cluster, AZL is bringing together its industrial and research partners within the heart of Europe’s largest landscape for production technology. By working shoulder to shoulder, AZL Partner Companies keep their finger on the pulse of new technologies and are in direct contact to experienced industrial and scientific lightweight players. Besides having an inspiring presence to bring their employees and their customers, companies can connect their R&D to the high-tech environment and make use of the nearly unlimited equipment and hardware of RWTH Aachen. The Packages include fully equipped co-working spaces for AZL Business Partners and one exclusive office room with complete infrastructure for two employees for each AZL Partner. Meeting rooms as well as a communication zone are available. More information see www.azl-aachen-gmbh.de.

UPCOMING AZL MEETINGS

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<td>AZL OPEN DAY Light in Aachen 2017</td>
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<td>May 30-31</td>
<td>PIPES &amp; VESSELS</td>
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<tr>
<td>June 21-22</td>
<td>AZL ANNUAL PARTNER MEETING 2017 Discuss the activities of the last 12 months and define future topics and projects with us!</td>
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<td>September 14-15</td>
<td>B2B NETWORKING EVENT AT IAA FRANKFURT Keynote Presentations</td>
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Find more details on » azl-aachen-gmbh.de or the >> AZL Partner Section

AZL @ JEC WORLD

At JEC World 2017, the AZL Partner Institutes present their latest research at the special exhibition zone “Composites in Action”. On March 15th, JEC Group and AZL organize a conference on “Production Technology for Multi-Material Lightweight Components” and guided tours to booths of AZL Partner Companies. Since 2015, AZL and JEC Group cooperate with the aim of jointly promoting developments and insights regarding integrative lightweight production technology. AZL @ JEC World 2017: Hall 6 | C79

Your Direct Contact for Inquiries

Marina Biller
Executive Assistant – Marketing
marina.biller@azl-aachen-gmbh.de
+49 241 8904 - 380