Mass Production of Lightweight Composite Parts
“Lightweight production technology has tremendous potentials for high-wage countries but requires an interdisciplinary approach along the value chain to establish the mass production of lightweight components, especially regarding multi-material systems. The new „Aachen Center for Integrative Lightweight Production – AZL“ combines both material science and production technology in order to generate new efficient process chains for the mass production of lightweight components.”

Prof. Dr.-Ing. Ernst Schmachtenberg,
Rector RWTH Aachen University

“Integrative production technology enables interdisciplinary research work especially for the realization of mass production of lightweight components which is a great potential for high-wage countries. Within the AZL we combine our competences in machine tools, automation and system development with the competences in material science and process technology especially regarding fiber-reinforced plastics and multi-material systems.”

Prof. Dr.-Ing. Christian Brecher,
Professor for Machine Tools at the Laboratory for Machine Tools and Production Engineering (WZL)
Director of the Department for Production Machines at the Fraunhofer Institute for Production Technology IPT

“Fiber-reinforced plastics (FRP) play a vital role in lightweight applications due to their outstanding weight specific properties. In contrast to conventional metallic lightweight materials, the anisotropic material behaviour of FRP and the complex production technologies require an integrative collaboration of very specialized research disciplines. Since more than 25 years, different institutes of RWTH Aachen University providing competences along the entire process chain contribute to the industrialisation of FRP in joint research projects. The new AZL now offers the optimum platform to interlink the specific technologies developed at the institutes within innovative full-scale process chains.”

Prof. Dr.-Ing. Christian Hopmann,
Head of the Institute of Plastics Processing (IKV)
Chairholder „Plastics Processing“ at the Faculty of Mechanical Engineering at RWTH Aachen University

“Fiber-reinforced plastics allow, due to their high weight specific strength, the design of components with outstanding properties for lightweight construction. The existing challenges of a material-specific integration of these components into complex structures and the maximum utilization of the lightweight potential of FRP are making joining to a key technology for the successful use of FRP in mass production. The AZL, with its combined competences, is working on the development and the optimal integration of joining technologies in the production chain of FRP components and multi-material systems.”

Prof. Dr.-Ing. Uwe Reisgen
Head of the Welding and Joining Institute of the RWTH Aachen (ISF)
RWTH Aachen University is the European Center for Production Technology

**RWTH Aachen University**
- Founded in 1870
- 130 programs of study
- 260 research institutes
- 4,500 scientists
- 40,400 students
- 15 special research fields
- 2 clusters of excellence
  - “Integrative Production Technology for High-Wage Countries”
  - “Tailor-Made Fuels from Biomass”

**New RWTH Campus and Cluster of Excellence “Integrative Production Technology for High-Wage Countries”**
- RWTH Campus: 2 areas with 800,000 m²
- Emphasis on production technology
- Already signed collaborations:
  - 120 international and national companies,
  - 30 research institutions

The AZL is designed as the Integrative Solution Provider for the established Composite Network at RWTH Aachen University

**All Competences Available at One Campus**

**Industrial Partners**
- Material supplier
- Moulder
- Manufacturing equipment supplier
- Tier 1/2
- OEM

- All required competences along the entire value chain are present at the new campus
- Integrative and interdisciplinary approach along the process chain
- Institutes have 25 years experience in collaborative research projects concerning composite production technology
- 750 scientists working on production technologies, lightweight materials and lightweight applications
Mission of AZL: Development of Breakthrough Technologies for the European Composite Industry

State of the Art
- Large aircraft structures
- Large complex structures in wind energy
- Automotive structures for small and medium-sized series
- Cycle times still too long
- Limited process capability and quality assurance
- Limited reproducibility
- High costs

Goals & Challenges
- Mass production
- Short cycle times
- High quality
- Reproducibility
- Cost efficiency
- Multi-material manufacturing

 AZL Development Center
- Office building
- Machinery hall
- Staffing:
  - Scientists
  - Technicians
  - Designers
- Founded in 2012

Services:
Full-Scale Production Equipment for
- Thermoplastic systems
- Thermoset systems
- Multi-material systems

Composite Academy
- Education for industrial staff:
  - Technicians, lab workers, engineers, managers
- Seminars
- Sales and Marketing Excellence

Consultancy Services
- Market studies
- Technology transfer
- Benchmarking
- Innovation management

Composites have a tremendous potential but they require an integrative and interdisciplinary approach along the entire value chain

Source: Architekturbüro Henn, Capricorn Development
Integrative Approach of AZL

Production
- Special purpose machinery development
- Fiber production, preforming, plastics processing, machining, functionalisation, quality metrology, automation
- Full-scale production equipment for composites and composite-based multi-material systems

Materials
- Reinforcement fibers
- Semi-finished products
- Thermoplastics and thermosets
- Hybrid material systems
- Testing

Application
- Part development
- Part testing
- Assembling/Recycling
- Failure analysis

Our Partners

+=6 anonymous partners
Continuous Process Chains for Mass Production of Composite and Multi-Material Lightweight Components

**Automotive and Transportation**
The switch to new lightweight materials, such as fiber-reinforced plastics, is the target of many manufacturers. Components are supporting structures up to moving components. Thus the industry is working intensively on the producibility of lighter vehicles. The AZL offers its partners the opportunity to carry out research projects whose focus concentrates on lightweight production technology along the entire process chain.

**Aerospace**
The aviation industry has always shown a great demand for high-strength materials and lightweight constructions. Beside the increased use of carbon fiber-reinforced plastics, novel combinations of materials can continue to reduce weight and to increase strength and corrosion resistance at the same time. A simplification of the assembly can be achieved through integrative construction, as well.

**Energy Engineering**
In power engineering, lightweight structures improve the efficiency of the energy-generating machinery and enables new designs such as long wing types in wind turbines. Required material properties are high dynamic load capacity, chemical resistance and longer service life. By integrating expertise of different engineering fields at the AZL, new manufacturing processes and process chains for an economical manufacturing can occur.

**Oil & Gas / Process Engineering**
Due to increasing drilling depths and extremely high pressures in conveyor lines enormous masses have to be transported. Therefore requirements often overlap with the characteristics of lightweight materials. Chemical resistance and high weight-specific strength are the main features. By the superior performance of lightweight materials the intended exploitation of deep oil reserves is possible.

**Machinery and Plant Engineering**
This industry sector is on improving dynamic properties and performance. Thus, reducing inertia, higher stiffness and better damping coefficient are the keywords. Many scientific works are about producing cost-efficiently and lightweight machine parts. Due to the close collaboration with institutes like the Laboratory for Machine Tools (WZL) and the Fraunhofer Institute for Production Technology IPT, the AZL has access to experts.

**Consumer, Sports, Leisure**
For this industry, lightweight materials are used for various applications with different requirements. This resulted in a variety of lightweight manufacturing processes in the past, which should become more economical and ecological. The main reason for the use of lightweight materials in this industry, however, is always the weight-specific strength in addition to the high design freedom.

**Building and Construction Industry**
Structures, ceilings, transportable shelters, partition walls and sound insulation profiles are just a small sample for the different use of resistant lightweight materials in this industry. High load capacity and low weight at the same time are the main reasons for the attractiveness. Additional features such as good noise insulation, recyclability and resistance to rotting increase the possibilities further more.
The competencies of the associated institutes at RWTH Aachen University perfectly complement each covering the whole value chain of lightweight components. This results in an unique setup of the AZL. As lightweighting is an important driver of our business, we appreciate the AZL very much offering one-stop solutions for lightweighting related research assignments.

Hartwig Meier, Head of Global Product and Application Development, High Performance Materials, LANXESS

Ashland Performance Materials, a leader in composite resins and adhesives, is looking forward to the cooperation with AZL in exploring new markets and application segments, which we are not serving today. The option to have our composite products enter mass production in automotive applications, will be a key success factor of this project.

Stefan Osterwind, Business Director Europe, Ashland Performance Materials

Lightweight materials play a key role for Siemens. We are developing automation solutions for fiber composites process technologies and therefore, the cooperation with the AZL brings us a unique entry, both from the market side as well as from the technology side.

Mike Fokken, Industry Sector Drive Technologies Division Motion Control Systems, Siemens AG

Johnson Controls is a global leader in automotive seating, overhead systems, door and instrument panels, and interior electronics is putting a lot of emphasis on lightweight designs and the improvement of the carbon footprint. Therefore, we are glad to find all the competences in one campus at the University of RWTH Aachen. We expect to develop new material systems and thus, the joined competences of the 8 institutes on the Campus are really useful for us - from raw materials over design of tools to production technology and even car-crash testing, all this in close proximity to our European headquarters in Burscheid near Cologne.

Hans van Gent, Automotive Electronics & Interiors, Johnson Controls

Laserline acknowledges the outstanding importance of lightweight construction for the future development of the European economy and its competitiveness. Lightweight constructions will open a lot of new opportunities for innovative companies. The AZL-project allows us to work closely in a network with competent partners at a very early stage of technology development as well as to validate the potential of new technologies and to derive new markets.

Christoph Ullmann, CEO, Laserline

Lürssen Shipyard is a world-renowned luxury yacht builder. Lürssen is using extensively high performance metal alloys and aluminum, but is as well following the success of composites in marine applications like high-speed yachting. To gain additional expertise and capabilities in these fields, we are happy to have the AZL as our cooperation partner to analyze and develop new applications in lightweight design.

Michael Gross, Project Manager, Lürssen Shipyard

The founding of the AZL and the possibility to expand the cooperation between AFPT, AZL and its partners is crucial for AFPT to get scientific and practical feedback in our thermoplastic tape placement development programs. This enables AFPT to offer optimized solutions to our customers and raise our customer satisfaction.

Coert Kok, Managing Director, AFPT

Through our collaboration with AZL we hope to further understand and optimize composite solutions with consideration of all core aspects including resin, fiber, precursors, textile production, composite part design and production. This understanding will help us transfer the benefit of composites from niche applications to mass-production vehicles. The AZL network of industrial partners is also extremely attractive to us for solving shared technical and business challenges efficiently. The formal education opportunities offered by AZL will empower Toyota engineers with a thorough understanding of these materials and processes such that we can offer a passionate driving experience to our customers while satisfying their expectations for cost, quality, reliability and environmental performance.

Dr. Andrew Willett, Manager Advanced Production Processes and Measuring, Toyota
Our Services, Your Benefits

- Expertise along the entire value chain, from preforming, handling and consolidation to the application
- Full-scale production equipment for machine-, process- and part development
- Direct person to contact and project coordination from one single source
- Intense networking within an international consortium to develop new technologies and to derive new markets
- Direct access to highly qualified junior employees for your business