

JEC COMPOSITES

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SPECIAL ISSUE

COMPOSITES
SUSTAINABILITY
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In partnership with





European Composites Industry Association.



**EuCIA is the unified voice of
the European composites industry.**

**We support the sustainable growth of the composites sector and promote the
development of a flourishing business environment.**

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Sustainability – a key topic in Germany's composites market

The German composites industry is a leading player in the European market. The country's composites associations are focusing on the opportunities that arise from an increased need for sustainability, engaging in activities to strengthen the Germany industry's position.

With a volume of about 2.7 million tons and a share of 22% of the world production in 2022, Europe is a significant part of the global composites market. Germany was the largest market within Europe representing 19.5% of the whole European production volume. Like the economy as a whole, the composites industry has faced and continues to face many challenges. Negative influences in both the economic and political spheres are impacting the entire value chain. However, a wide range of opportunities and very high future potential are also emerging.

Of central importance for the industry and many of its associated application segments, irrespective of the current challenges, is the sustainability of the materials used. On the one hand, only rapid and committed, conscious action will enable future generations to live in safety and prosperity. The basis for this is an intact ecological and social system and responsible use of the natural resources available to us. On the other hand, political framework conditions, such as the Green Deal, are currently leading to greatly increased need to act, which is particularly important for a strong economic and industrial location such as Germany.

With the European Green Deal, the 27 EU member states want to become climate-neutral by 2050. As a first step, greenhouse gas emissions are to be reduced by at least 55% by 2030 compared with 1990 levels. German policymakers are currently pushing very hard to meet these targets. Direct pressure to act arises for all companies along the value and supply chains, but especially for medium-sized and large companies, as the new Corporate Sustainability Reporting Directive (CSRD) shows. This involves reporting on sustainability in companies according to clearly defined standards. In the future, reporting of non-financial indicators will also include corporate CO₂ emissions. Their reporting must be mandatory in the management report and in accordance with clearly defined EU standards. The recently published draft of the European Commission's Directive on end-of-life vehicles also highlights the increasing pressure in individual sectors of the economy.

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In the future, no positive material decision will be made that does not take sustainability into account, that is able to prove the corresponding key figures, and also delivers corresponding added value.

Challenge and opportunity

The need to deal with the topic of sustainability has undoubtedly increased in recent years. However, this should not be seen as a burden. Rather, it is a necessity in order to increase or maintain the prosperity of all in the future. Sustainability should be seen as an opportunity for composites. Due to their exceptional properties, composites are already making an important contribution in many industrial sectors, especially regarding sustainability. For example, composites have very good corrosion and weathering resistance. In addition, they have excellent chemical and biological resistance. This often enables a very long, often



Aspects of the European Green Deal.

(Source: <https://euinasean.eu/eu-green-deal/>)

almost maintenance-free service life (>30 years). In addition, the materials have a high lightweight potential. These properties/advantages do not only save costs, but also reduce, for example, the corresponding CO₂ footprint during the use phase.

Many branches of industry, above all the transport and construction infrastructure sectors, have recognised these potentials. The aim here is to expand the existing possibilities and open up new fields of application.

The umbrella organisation Composites Germany bundles the interests of the German composites industry. It is the voice of the composites industry, combining interests and creating synergy along the complete value creation chain. Working with its members, the aim of Composites Germany is to strengthen the German composites industry and research activities, determine joint positions and safeguard overarching interests. The members of Composites Germany, AVK - Federation of Reinforced Plastics and Composites United, are the two leading organisations of the German composites industry. As associated partner, the VDMA working group Hybrid Lightweight Technologies, supports the goals of Composites Germany and joins forces to advance the future topics of high-performance composites and automated production technologies in, and for, Germany.

One strong focus is to support and promote the constant sustainable development of energy- and resource-efficient processes and products.

Sustainability has been incorporated into the vision of Composites Germany for many years. One strong focus is to support and promote the constant sustainable development of energy- and resource-efficient processes and products, in order to use the extraordinary innovation potential of composites and their significant contribution to climate protection, leading not only the traditional but also the top-class performance applications to their final breakthrough.



Sustainability is a core topic in nearly every composites industry segment.

The high importance of the topic of sustainability for the composites industry is also reflected in numerous activities within the member associations AVK and Composites United.

Activities in the AVK

AVK recognised the need for action many years ago. As early as March 2009, a new working group on sustainability was founded under the umbrella of the AVK. The activities in this area have been continued over the past years. For several years now, "highlighting sustainability of materials and applications" has been one of the five central points of the AVK mission.

Currently, many of the AVK expert working groups deal with the topic of sustainability, either product- and/or application-specific, but also across the network. For example, there is a working group on the topic of Recycling of Composites. After a preparation and development phase of 1.5 years, the AVK Composites Recycling Study was presented in January of this year. This more than 230-page document was prepared by the IKK - Institute for Plastics and Recycling Technology of the Leibniz University of Hanover. It analyses the composites market and possible recycling quantities, explains and evaluates existing and future recycling possibilities, and lists research projects and market players, with a special focus on Germany and Europe.

The Sustainability working group is currently working on a brochure on the subject of Sustainability of Composites – Current Situation and Future Scenarios. This is intended primarily as an information brochure for stakeholders from politics, but also for other interested parties, and as a basis for communication with customers.



AVK's Composites Recycling Study.

(English version available in 2024.)

I. Conception & Raw Materials

All activities are carried out in close cooperation with other associations/political bodies. AVK is an active member of the Working Group Sustainability of EuCIA (European Composites Industry Association). There is a regular exchange with partner associations in the German plastics industry via the GKV - German Association of the Plastics Converters. Due to the short service life of many products, companies in the plastic packaging and consumer goods sectors in particular are currently under much greater pressure to take short-term measures to protect the environment than the composites industry.

In addition, there is close exchange with political decision-makers, for example with the UBA - German Environment Agency or the Federal Ministry for Economic Affairs and Climate Action. AVK is in close exchange with both organisations, especially on the topics of recycling, sustainability and lightweight construction potential for the future. In addition, AVK plays an active and leading role in the relevant committees and acts in an advisory capacity.

In order to strengthen further developments in this important area and drive innovations, AVK also actively participates in research projects. Since 2021, AVK has been an active partner in the FIBREGY project. FIBREGY stands for 'Development, engineering, production and life cycle management of improved FIBRE-based material solutions for the structure and functional components of large offshore wind enerGY and tidal power platforms.' The overall objective of the FIBREGY project is to enable the extensive use of FRP materials in the structure of the next generation of large Offshore Wind and Tidal Stream (OWTS) platforms by overcoming the above-mentioned challenges.

Since 2022 AVK has also been involved in the RECREATE project. RECREATE is the abbreviation for 'Recycling technologies for circular reuse and remanufacturing of fibre-reinforced composite materials'. The main ambition of the RECREATE project is to develop a set of innovative technologies aimed at exploiting the circularity potential of end-of-life (EoL) complex composite waste (mainly carbon fibre reinforced composites and glass fibre reinforced as a feedstock for profitable reuse of parts and materials in the manufacturing industry).

In addition, we use our network on a daily basis to refer partners, answer inquiries, provide technical information and bring the topic of sustainability into the focus of industry and research in our other numerous working groups.

Activities in Composites United

For more than 15 years, Composites United e.V. (CU) has been working intensively with its members on the topic of sustainability for high performance composite materials. Since early on, it was clear to CU and its members that recycling of composite materials is crucial, so a large emphasis was put on this subject since the foundation of the association in 2004. Consequently, in the CU environment in Stade near Hamburg, the pyrolysis technology for recycling of carbon fibre reinforced composites was developed and industrialised more than 10 years ago, which is still the main recycling technology for this material class.

Together with the topic of digitalisation, sustainability is the most important aspect affecting almost all materials and technologies related to composites materials.

Today, almost all activities in the 45+ working groups of CU are related to the topic of sustainability. Together with the topic of digitalisation, sustainability is the most important aspect affecting almost all materials and technologies related to composites materials. Nevertheless, two groups exist within CU where the activities are centralised. The CU-Strategy Circle Sustainability deals with strategic aspects of sustainability. A wide range of topics from technology to regulation is discussed by a selected group of experts on a regular basis. For instance, the Strategy Circle defined circular economy (short- to mid-term) and renewable raw materials for composites (mid- to long-term) as the most important sustainability topics for CU and its members and the group made the decision to develop CU publications regarding sustainability (see below). The second group is the working group sustainability. It was recently renamed to broaden its focus to all sustainability topics related to composites and it is now supported by more than 15 experts from the CU network covering all relevant sustainability aspects. The working group sustainability deals with operational topics, focusing on, for example, developing ideas for new required standards or initiating R&E projects for advancing technologies. Furthermore, the group supports the CU conference events on sustainability, on average two per year.

CU has developed and published several publications. The position paper Climate Neutrality through Innovative Lightweight Design highlights the important benefits of fibre-based lightweight design for achieving climate neutrality in a prosperity-keeping manner

which is required for the acceptance of society. In the framework of the CU Knowledge series, several fact-based information papers describing the current state of the art for relevant topics were developed and are available to CU members. Here, the papers Recycling and Recovery of CFRP, as well as Exposure and Effects of Carbon Fiber and CFRP Dusts, exist, focusing on ecological as well as social sustainability respectively.

In the past 10+ years, CU has supported more than 15 projects related to sustainability of composites. Early projects like MAI Recycling or MAI RecyTape focused on the development and application of recycling technologies for carbon fibre composites and the re-application of the recycled materials. In the recent past, this focus has shifted to a more holistic view in order to fill the existing gaps towards a circular economy. Therefore, for instance the project HiPeR aimed at increasing the performance of recycled materials to increase their attractiveness for reuse; and the project MAI Ökocap evaluates the value and CO₂ footprint of recycled composite materials from a holistic point of view to reduce reservations towards and increase the interest in recycled materials for end users. Summaries for all projects can be found here: <https://composites-united.com/en/research/projects/>

The project HiPeR aimed at increasing the performance of recycled materials to increase their attractiveness for reuse, and the project MAI Ökocap evaluates the value and CO₂ footprint of recycled composite materials from a holistic point of view.

Starting in 2024, upcoming CU projects focusing on sustainability are, for instance, the EU DigiPass project to develop a concept for a digital product pass for composites, or the project ResC4EU to support the development of resilient supply chains for Europe (economic sustainability).

Lastly, CU is well connected within the German and European political landscape and in close contact to other relevant associations. In Germany, CU provides a spokesperson for the lightweight design initiative of the Federal Ministry for Economic Affairs and Climate Action (BMWK) promoting sustainable lightweight design solutions both in Germany and Europe. Also, there is a close contact to the UBA - German Environment Agency. For instance, CU was partner in a recent UBA project to develop standards for rebuilding and recycling for blades of wind turbines. A close cooperation exists with the AVK regarding sustainability topics. AVK and CU are main drivers of Composites Germany and in this regard members of EuCIA, with a close collaboration up to the European levels as described above.

EPTA – pultruded parts are a sustainable solution

The activities of the European Pultrusion Technology Association (EPTA) are closely linked to the work of AVK. EPTA was created in 1989 by the leading pultruders in Europe with the mission to support the growth of the composite profiles industry by maximising external communication efforts and having an actively contributing membership. Since 2006, the association has existed under the umbrella of the AVK.

Pultrusion is one of the longest established technologies for manufacturing profiles made from fibre reinforced plastics. The aim of the association was, and remains, to reinforce the position of this process technology and promote the members' common interests. Today, EPTA has over 40 members throughout Europe and provides a strong network for pultruders sharing know-how and marketing ideas they have developed jointly.

Some of the latest core activities in EPTA also relate to sustainability. Sustainability was a core topic during the EPTA's World Pultrusion Conference in 2022 and will be in 2024. The advantages of the use of pultruded profiles in the construction sector are analysed in the latest EPTA Industry Briefing, 'Pultruded composites contribute to a more sustainable future for construction.' Another industry briefing from 2021 describes the use of 'Pultruded composites in energy efficient buildings.' The new EPTA brochure also focusses in some points on the sustainable use of pultruded composites products.

A core topic

These numerous activities clearly demonstrate that sustainability is not only of great importance to the industry as a whole, but also has a very specific impact on specific sub-segments. Sustainability is not just becoming a core topic for the composites industry, but it is already and has been for many years!

Composites Germany: www.composites-germany.org

AVK: www.avk-tv.de

Composites United: www.composites-united.com

EPTA: www.pultruders.com

Glossary

3D printing: A form of additive manufacturing which lays down layer upon layer of polymer and reinforcing fibre through a moving nozzle head according to a computer aided design (CAD) file.

Aramid fibre: Para-aramid fibre has a unique combination of high strength, high modulus, toughness and thermal stability.

Autoclave curing: Commonly used in the production of composite aerospace components. The component is placed inside a vacuum-sealed autoclave and subjected to pressurised conditions during the heated curing cycle.

Bio-based: Bio-based materials are manufactured, in part or in whole, using renewable biological resources, most often plants.

Biopolymers: Natural polymers derived from renewable plant or animal resources.

BMC (bulk moulding compound): A mix of thermoset resin and chopped fibres, usually glass fibres, which can be injection or compression moulded to produce a part.

Carbon fibre: A reinforcement fibre produced by the high temperature oxidation of a polyacrylonitrile precursor and sold as a tow (continuous fibre), fabric, and chopped strand.

CFRP/CFRTP: Carbon fibre reinforced plastics/carbon fibre reinforced thermoplastics.

Circular economy: An economic model with the goal of producing goods and services in a sustainable way by limiting consumption and wasted resources (raw materials, water, energy) and waste generation.

Fibre reinforced composite materials (composites): High performance, long lasting, engineered materials consisting of a combination of polymer (thermoset and/or thermoplastic) and reinforcing fibres (glass, carbon, aramid, natural).

Compound: A mixture of resin or polymer with reinforcing fibres and possibly filler.

Compression moulding: A process where a press, using metal male and female moulds, compresses and moulds SMC or BMC into composite parts.

Core materials: Used to create stiff and yet lightweight composites parts, usually in the form of a sandwich structure. Typical core materials are balsa, thermoplastic foams and honeycombs.

Curing: When using thermosets in composite manufacture, the resin must be fully cured in the mould for the part to have the desired properties. Curing involves chemical reactions transforming reactive monomers into a 3D stable polymer matrix.

Eco-design: Takes into account environmental aspects throughout the life cycle, starting with the design phase of a product (or service), in order to improve the environmental performance and ensure that the service rendered is equivalent or superior.

Environmental Product Declaration (EPD): A document that quantifiably demonstrates the environmental impacts of a product.

FRP: Fibre reinforced polymer – a generic description of a composite.

Glass fibre: A reinforcement fibre, usually of a specific glass formulation, drawn from a melting furnace and sold as roving, chopped strands, and other formats.

GFRP/GFRTP: Glass fibre reinforced plastics/Glass fibre reinforced thermoplastics

Hand lay-up (contact moulding): A manual process for creating composites.

Infusion: Infusion is the transfer to and impregnation of reinforcement fibres in a mould by a resin. It is often used in combination with a vacuum applied to assist the movement of the resin.

Life cycle assessment (LCA): An evaluation method that allows the potential environmental impacts of a product (a good or service) to be quantified. It may also be used to evaluate a process over the course of its entire life cycle, i.e., from extraction of the raw materials composing it, up to processing at end-of-life.

Natural fibre: A reinforcement fibre of vegetable origin such as flax, hemp, kenaf, and others.

Polymer: A molecule with a high molecular mass, which is composed of a repetitive chain of simple molecules called monomers, which may or may not be identical.

Prepreg: Reinforcement fibres that have been pre-impregnated with a thermoplastic or thermoset resin but are not yet cured.

Pultrusion: A continuous process producing a profile of constant cross-section.

RTM (resin transfer moulding): A process using a closed mould where reinforcement had been laid prior to the mould being closed and resin being pumped into the mould (often with vacuum assistance – then called VARTM).

SMC (sheet moulding compound): Produced on a manufacturing line where glass fibres are chopped and distributed randomly across the width of a moving film which has thermoset resin deposited on it. Further resin is added on top together with a further layer of film and the whole is in-line compacted.

Sustainable development: A way to meet current needs without compromising the ability of future generations to meet theirs, based on three pillars: economic efficiency, social fairness, and use that supports preservation of the environment.

Thermoplastic: A family of polymers which melt upon being heated. The most common ones used in composites are polyamide (PA), polypropylene (PP), PET, PEEK, PPS and others.

Thermoset: A family of polymers which chemically and irreversibly cure to produce rigid polymer masses. The most common ones used in composites are unsaturated polyester resin, epoxy and polyurethane.

Contributing Associations

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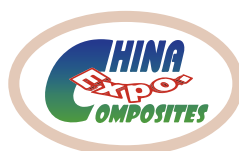
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