INDUSTRIEVEREINIGUNG
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FEDERATION OF REINFORCED PLASTICS

The European Market for Fibre Reinforced Plastics / Composites in 2021

Market developments, trends, challenges and outlook

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The AVK, as the German professional association for fibre composite plastics/composites, represents the interests of producers and processors of reinforced plastics/composites on a national and a European level.

Its services include organisation of task forces, seminars and conferences as well as providing market relevant information (www.avk-tv.de).

The AVK is one of the four national pillars of the GKV – Gesamtverband Kunststoffverarbeitende Industrie and an international member of the European composites confederation EuCIA – the European Composites Industry Association.

The AVK is a foundation member of Composites Germany.

1 Notes on changes to the data basis

The AVK Market Report has been published for decades and is based on continuous data which has been drawn from systematic surveys since 1999. Changes in underlying conditions have now led to this data basis being expanded and adjusted in some segments in this issue of the market report.

Until the last issue, manufacturing volumes for the current financial year were surveyed in Q4 and volumes were estimated from the time of the survey through to the end of the year. This system has now been fundamentally changed. The Market Report 2021 now contains the actual figures for 2021, collected at the beginning of 2022. Due to the increasingly dynamic nature of the market, it is necessary to wait until the end of the year in order to obtain valid figures.

In addition, further essential materials have been added to the database. In addition to the previously collected data, NCF (non-crimp fabrics) and the corresponding production volumes of short fibre reinforced plastics were added to the total volume of fibre reinforced plastics/composites. Both material groups are a useful addition and helpful in gaining an even more accurate survey of European production quantities. Furthermore, the report now presents the market for thermoplastic composites in much greater detail.

As part of the reorganisation of the report, the two key market groups, thermosets and thermoplastics, are now considered separately in individual areas. This marks a change from previous years. Likewise, the analyses of the application areas and regional developments have been adjusted. The expansion and adaptation of the data basis result in an even more comprehensive picture both of the current markets and their development.

2 Summary and introduction

The composites market returns to pre-crisis levels

After a long period of growth from 2013 to 2018, the corona pandemic, which began in February 2020, as well as many other negative factors have severely impacted not only the economy as a whole, but the industrial sector and composites market in particular.

European composites production volumes declined by more than 15 % in the period 2018-2020. In 2021, this trend was clearly reversed. With growth of 18.3 %, the market almost returned to its pre-crisis level. The increase was thus significantly higher than overall economic growth in the EU, which the European Commission reported as being 5.3 % in 2021. Growth in industrial production in the EU, which the Kiel Institute for the World Economy (IfW) estimates at 4 % for 2021, was also significantly slower than in the composites industry.

The global market for composites also rose strongly, rising from 11.2 to 12.1 million tonnes last year – equivalent to a rate of 8 %. Overall, however, market momentum in Europe was higher than in the global market. Europe's share of the world market is around 25 %, similar to that of the USA. Asia now accounts for around 50 % of global production.

While the impact of the corona pandemic and its cuts/restrictions were the dominant factors in market activity worldwide for a long time, with Europe no exception, its effects in Europe are now moderating. The industrial sector faced many other challenges in 2021, but their impact on the composites industry vary widely. These include, e.g. the continuing weakness of automotive sales in Europe, the aviation industry, which has not yet regained its former strength, very high logistics costs and, most recently, energy costs, the lack of availability of raw materials and semi-finished products, and increasingly also political tensions, which are evident, for example, in the current war in Ukraine.

All these factors have led to a great deal of uncertainty in the markets and complicate the task of forecasting future developments. In addition, markets are becoming more dynamic. The very close international links in the composites industry can also mean that events outside the core markets have a significant impact on market activity.

Despite numerous obstacles, key application segments developed very positively in 2021. These primarily included the transport sector, but also other application areas from the sports and leisure segment. In the transport sector, especially in passenger car production, an unusual phenomenon is currently emerging: OEMs' profit margins are rising significantly despite low sales figures. The impact of this phenomenon on the composites market is analysed in greater detail in the section on thermoplastics. The second major application area, construction and infrastructure, was significantly less affected by cuts as a whole. However, this is usually the case for the construction sector, which reacts much more slowly to macroeconomic changes – and with fewer swings – than the transport sector. Strong overall figures from the transport sector have led to a significant increase in production volumes. This applies, in particular, to the commercial vehicles sector, the consistently good trends in the construction and infrastructure sectors, and the positive developments in certain specific applications, e.g. in sports and leisure.

In regional terms, Germany, Spain/Portugal, Italy and Eastern European countries continued to maintain their strong positions in the European context. Germany remains the country with the highest market volume, with a share of almost 20 % of the total market. These four regions together represent 2/3 of the European market volume.

Glass fibre reinforced systems still account for over 95 % of the overall market. By contrast, other material systems, such as CRP (carbon fibre reinforced plastics) or NRP (natural fibre reinforced plastics) remain specialities. However, they continue to develop positively in corresponding application segments.

Thermoplastic composites have been the prime beneficiaries of these developments, growing by more than 25 % over the past year. Thermoset materials grew by just over 10 %. Thermoplastics are highly dependent on the transport sector, which accounts for over 70 % of their applications. The key area for thermosets is construction, which is several percentage points stronger than the transport sector.

As in the regions, there are major differences in the growth trends for the various processes/materials in this consistently positive market. Above-average growth was seen in the thermoset sector for SMC/BMC, open processes and non-crimp fabrics. Among the thermoplastic material systems, growth in LFT materials and short fibre reinforced plastics was particularly strong.

3 Markets reviewed in this report

As already indicated in the introduction, the data collection methodology used for this market report has changed since the last report was published.

In its consideration of glass fibre reinforced (GRP) materials, the analysis presented here again includes all GRPs with a thermoset matrix. Added to these are the market figures for NCF (non-crimp fabrics). The analysis of the thermoplastics market continues to take account of glass mat reinforced thermoplastics (GMT), long fibre reinforced thermoplastics (LFT) and continuous fibre reinforced thermoplastics. However, European production volume for short fibre reinforced thermoplastics is now also included in the analysis. Production data for carbon fibre reinforced plastics (CRP) completes the overall picture. Natural fibre reinforced plastics (NRP) are again only discussed here in an aggregated form, as it was not possible to obtain valid current market figures for this segment.

On the application side, the figures are shown both for the two relevant material systems, thermoplastics and thermosets, and in an aggregated form. The GRP Market Report considers all thermoset materials in the relevant European countries for which production figures can be recorded and validated.

4 Overall development of the composites market

The volume of the global composites market totalled 12.1 million tonnes in 2021, according to the latest figures from the JEC (www.jeccomposites.com). This represents growth of approx. 8 % over 2020, when the volume was 11.2 million tonnes.

In comparison, European composites production volume increased by 18.3 % in 2021. The total European composites market thus comprises a volume of 2,962,000 tonnes (see Fig. 1). The market is growing very rapidly and, after just two years, is almost back to the pre-crisis level of 2018 when the market volume was 3,046,000 tonnes.

Overall, market momentum in Europe was significantly higher than in the global market. Europe's share of the world market is thus around 25 %, similar to that of the USA. Asia now accounts for around 50 % of global production.

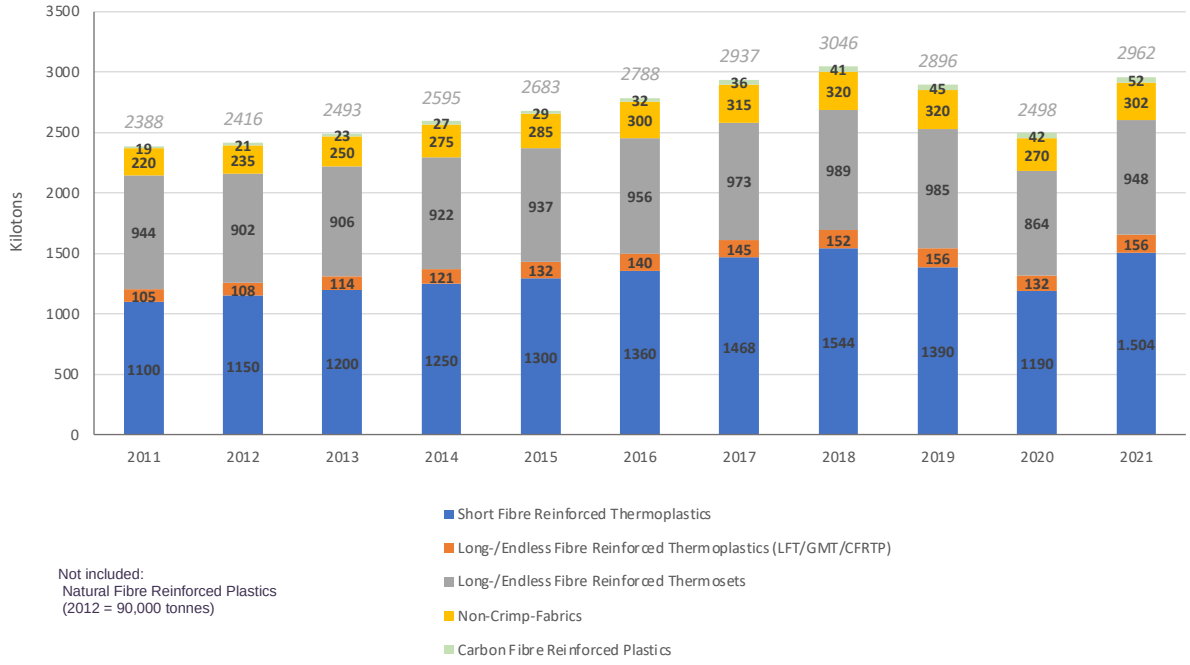

Fig. 1: Composites production volume in Europe since 2011 (in 000 t)

As in previous years, however, the trend within Europe is not uniform. The differences can be attributed to wide variations between the regional core markets, the high variability of the materials processed, the broad spectrum of manufacturing processes and widely differing areas of application. Thus, the growth trends vary from region to region, but above all with regard to the individual processes – although no region and only one procedure recorded declines this year. Only GMT (glass mat reinforced thermoplastics) declined slightly. The following sections present a detailed study of both the regional trends and developments for the respective processes/systems.

In terms of volume, the largest share of total composites production (50 %) is used in the transport sector (see Fig. 2). The next two largest sectors are construction and infrastructure and electro/electronics. CRP volumes are not included as they only account for around 1-2 % of the total market and thus have only a marginal influence on overall market share data.

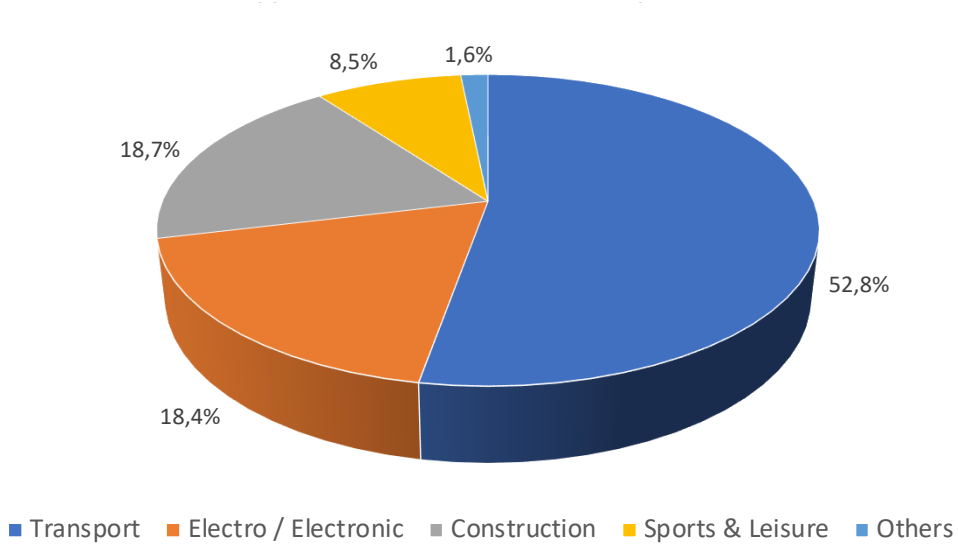

Fig. 2: Total composites market by application in 2021 (in %; excluding CRP)

The transport sector includes not only passenger car production, but also commercial vehicles, aviation, public transport, etc. The construction/infrastructure sector includes pipelines, containers, tanks, profiles, etc. The electro/electronics sector includes, e.g. switches, housings, telecommunications equipment or control cabinets.

Non-crimp fabrics (NCF) were also reported separately for the first time this year. These are glass fibre reinforced plastics manufactured with the help of scrims. This market segment has enjoyed above-average growth for the past ten years. Its two principal applications are in wind turbine blades and boat and ship building. Strong growth is forecast, especially for the wind energy sector, in the coming years.

4.1 Development of the thermoset composites market

In 2021, total production volume of thermoset composites (excluded CRP) was 1,250,000 tonnes. This class of materials thus accounted for 43 % of the total market in Europe. Despite significant absolute growth of 10.2 %, the market share of thermoset materials declined by 3.2 % compared to 2020 (see Fig. 3).

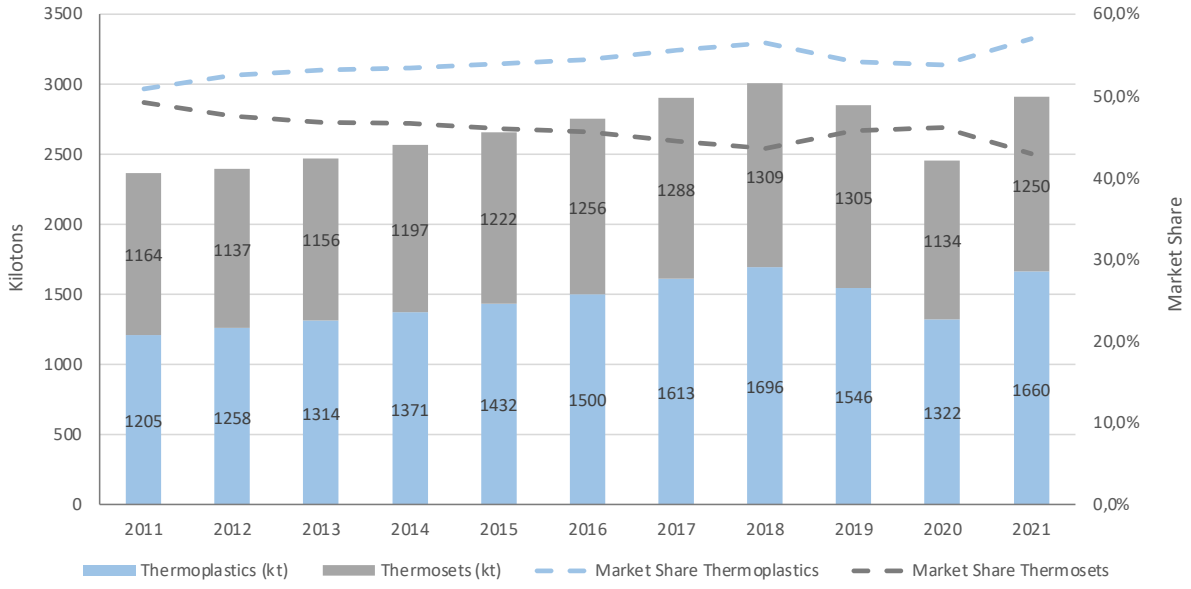

Fig. 3: The European composites market by material system (in % and 000 t; excluding CRP)

The two main application areas for thermoset composites remain the construction/ infrastructure and transport sectors (Fig. 4).

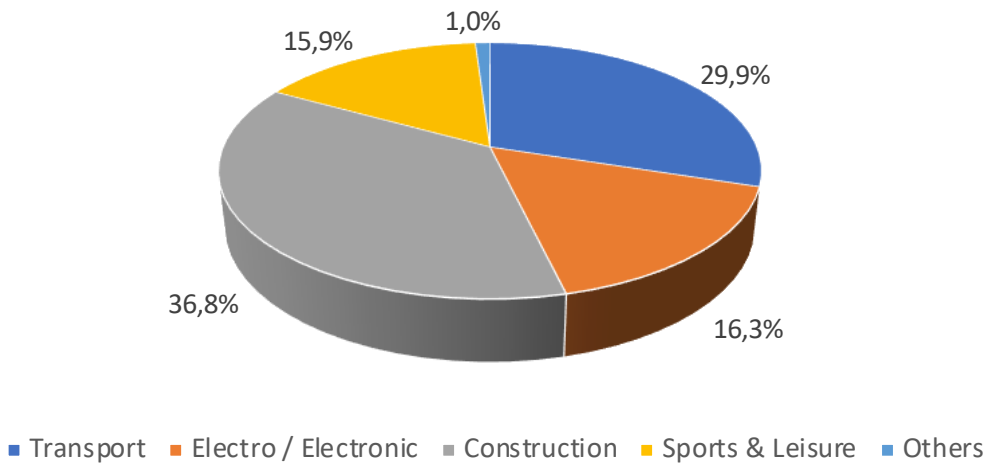

Fig. 4: Thermoset composites by application area in 2021 (in %, excluding CRP)

Until 2019, the transport sector was still the largest application segment for the GRP industry (the term used in this report to describe all long and continuous fibre reinforced thermoset and thermoplastic composites). Now, however, consumption of these materials is experiencing a clear and accelerating shift towards the construction and infrastructure sector. This trend is also emphasised by the fact that the materials are considered separately in this report. For many years now, the thermoplastics market has been dominated by applications in the transport sector, especially in passenger cars and commercial vehicles. Even in the past, it was clear that the focus of the market when short fibre reinforced plastics (= GRP industry) are excluded from the data was less transport-dominated. The following section provides an overview of thermoplastic materials.

4.2 Development of the thermoplastic composites market

The thermoplastic composites market in Europe accounted for a total volume of 1,660,000 tonnes in 2021 (source: AMAC). The market share of these systems in the total European market was thus 57 %. Compared with the previous year, the market grew by 25.6 % – a significantly higher rate than for thermoset materials.

The largest group of materials within the area of thermoplastic composites, but also in the overall market, are short fibre reinforced plastics. Here, the reinforcing fibres have a length of only a few millimetres. Consequently, the reinforcing effect differs greatly from that of long or continuous fibre systems. This is another reason why these materials have not been specifically considered in the composites market report until now. However, since they also use fibres for reinforcement, they have now been adopted into the present survey.

In terms of materials, this category is dominated by polyamide (PA), which accounts for more than 63 % of the matrix materials employed. Polypropylene (PP) forms the second largest group. Together, these two material systems account for over 81 % of volume in the sector. The picture is different in the area of LFT. Here, over 95 % of the material used is PP. So here, too, there are already clear differences.

In total, short fibre reinforced thermoplastics accounted for a volume of 1,504,000 tonnes. Compared to 2020, this sector grew by 26.4 %. It therefore has a 90 % market share of the thermoplastic composites segment and more than a 56 % share of the European composites market. LFT materials form the second largest group. Long fibre reinforced plastics accounted for a market volume of 119,000 tonnes in 2021, with year-on-year growth of 28 %. The markets for glass mat reinforced thermoplastics (GMT) and continuous fibre reinforced thermoplastics are significantly smaller with total volumes of 27,000 tonnes and 10,000 tonnes respectively.

The main area of application for thermoplastic composites is the transport sector, which accounts for more than 2/3 of the market (see Fig. 5).

Within this segment, the passenger car and commercial vehicle sectors dominate. Together with applications for electro/electronic applications, these sectors made up 90 % of the market in 2021. Overall, 2021 was the strongest year for this material group since the survey began in 2011. In the past ten years, this category has grown by almost 40 %, despite the obstacles discussed above.

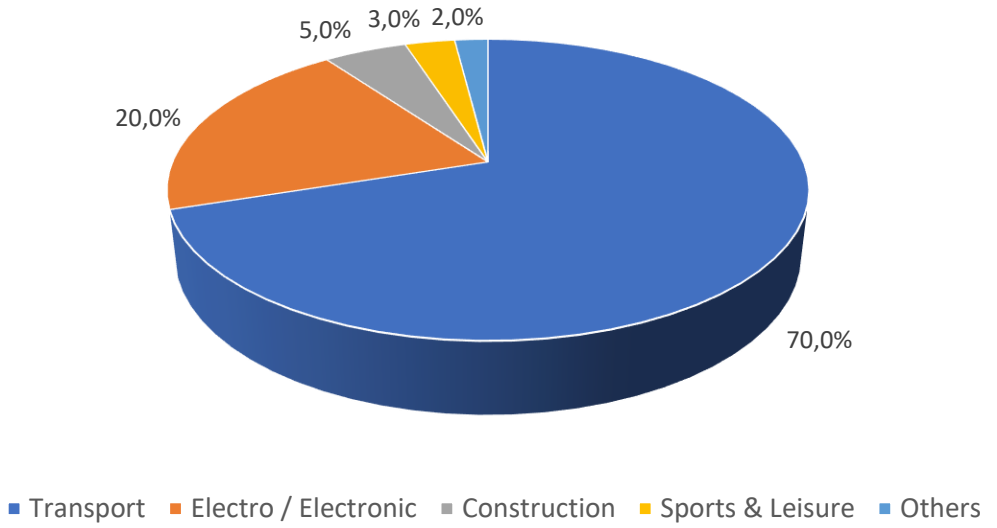

Fig. 5: Thermoplastic composites by application area in 2021 (in %)

In this context, the rapid growth within this market segment is remarkable. Various sources indicate that new passenger car registrations in 2021 are down 2.7 % year-on-year to 9.7 million units.

The main reason cited in many cases is the acute shortage of semiconductors, which had already led to a fall in new production in 2020 and continued in 2021. In many cases, production and thus sales of volume models were scaled back in favour of higher priced, high margin models. As a result, many OEMs enjoyed a boost in terms of profits despite their lower sales.

The picture is different in the commercial vehicles sector. According to the ACEA (European Automobile Manufacturers' Association), overall commercial vehicle registrations in the European Union increased by 9.6 % to 1,880,682 units in 2021, mainly due to the low level of production in H1 2020. Nevertheless, this figure still falls well below the 2.1 million units registered in 2019, the year before the pandemic.

The strong growth in the area of thermoplastic composites can therefore only be explained by corresponding catch-up effects in production and by an increased use of composites, especially in higher value models as well as commercial vehicles. It is also conceivable that composites are being used more widely as substitutes for existing materials.

When the two main material systems are compared, it is clear that the fluctuation range in the area of thermoplastic composites is much wider than for thermoset composites. This supports the finding that thermoset materials are more likely to be employed in markets that react to market fluctuations less dramatically and/or more in the medium term, e.g. the construction and infrastructure sectors, which are often more closely aligned with macroeconomic trends.

5 Trends in the development of processes/components

Table 1 shows the trends in the production volume of essential processes/parts for composites production over recent years. The names of the individual segments are not always entirely stringent or precise. However, in addition to these processes, there are many other production processes/technologies which can essentially be classified under one of the areas mentioned.

	2017	2018	2019	2020	2021
SMC (kt)	202	204	205	174	197
BMC (kt)	78	81	82	70	81
SMC/BMC (kt)	**280**	**285**	**287**	**244**	**278**
Hand lay-up	140	140	139	121	135
Spray-up	98	99	98	88	97
Open mold (kt)	**238**	**239**	**237**	**209**	**232**
RTM (kt)	**146**	**148**	**148**	**131**	**138**
Sheets	93	96	94	85	92
Pultrusion (kt)	53	55	56	50	56
Continuous processing (kt)	**146**	**151**	**150**	**135**	**148**
Filament winding	78	79	78	70	72
Centrifugal casting	67	69	68	60	65
Pipes and Tanks (kt)	**145**	**148**	**146**	**130**	**137**
Non-crimp fabrics (kt)	**315**	**320**	**320**	**270**	**302**
Others (kt)	**18**	**18**	**17**	**15**	**15**
Total Market Thermoset (kt)	**1,288**	**1,309**	**1,305**	**1,134**	**1,250**
GMT (kt)	**35**	**36**	**36**	**29**	**27**
LFT (kt)	**103**	**108**	**111**	**93**	**119**
CRTP (kt)	**7**	**8**	**9**	**10**	**10**
Short fibre (kt)	**1,468**	**1,544**	**1,390**	**1,190**	**1,504**
Total Market Thermoplastics (kt)	**1,613**	**1,696**	**1,546**	**1,322**	**1,660**
CRP – Carbon Fibre Reinforced Plastics	**36**	**41**	**45**	**42**	**52**
Total Composites Market (kt)	**2,937**	**3,046**	**2,896**	**2,498**	**2,962**

Table 1: Composites production volumes in Europe according to processes/components (kt = 000 t)

Fig. 6 shows the long-term trends for the various market segments. Short fibre reinforced plastics have been omitted from the analysis for two reasons. Firstly, this serves to provide a better overview; secondly, the differences between this material group and the GRP industry have already been mentioned above.

The material properties of short fibre reinforced materials differ, in some cases significantly, from those of long fibre reinforced and continuous fibre reinforced systems. The glass fibres used here generally have a length of less than 2 mm. Nevertheless, reinforced materials do have enhanced properties compared to their non-reinforced equivalents. Above all, they have a positive influence on the elastic modulus and stiffness of the materials. As the fibre length increases, the strength and impact resistance of the composite increase as well. Consequently, the materials are generally differentiated according to their basic, and sometimes significantly differing, mechanical properties. Data for CRP were also taken into account here.

According to the data, the largest single segment is NCF. This is followed by SMC/BMC materials, many of which are used in large series applications. The third largest segment is the so-called “open processes” which often have a strong emphasis on manual skills and craftsmanship. The other processes mentioned here are at a similar level in terms of production quantities.

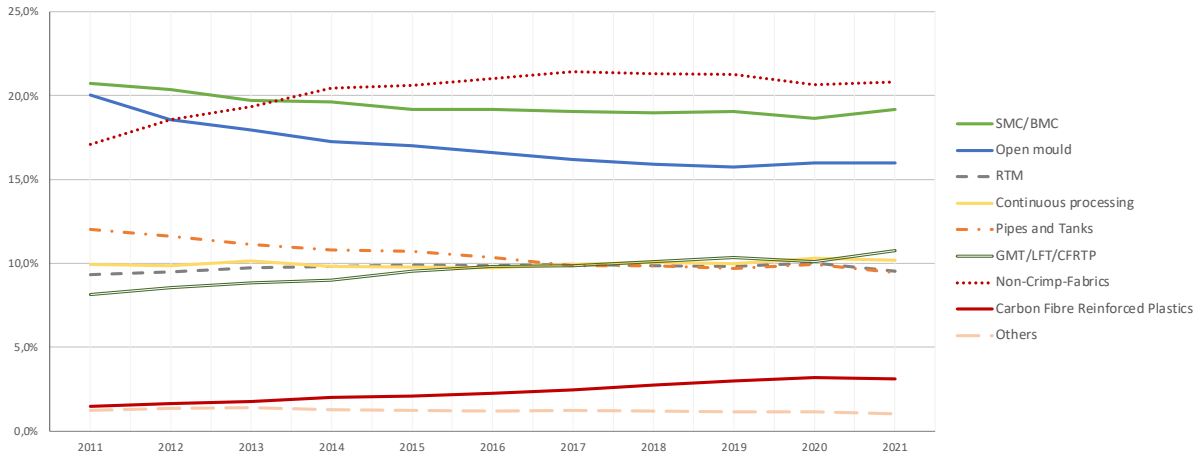

Fig. 6: Long-term trends market segments (share of total market)

Despite the unusual market conditions of the past few years, the general trend has stabilised. The only exception here is NCF, which was able to expand its market share at an above-average rate. The following section contains individual analyses of the various segments considered in this report:

5.1 NCF – Non-Crimp Fabrics

Over the past ten years, this market segment (included here for the first time) has grown by almost 40 %. While the market level in 2011 was still 220,000 tones, it will reach 302,000 tones in 2021.The main areas of application are the wind energy industry and boat and ship building. However, these materials also have a number of special applications in the areas of transport/public transport, sports and leisure, and construction and infrastructure.

The wind energy industry, in particular, is likely to be the key driver in this segment over the next few years. Every six months, the trade association Composites Germany (www.composites-germany.com) surveys its members on their qualitative assessment of the market. Their expectations regarding future growth drivers are clear. The participants in the most recent Composites Market Survey see the wind energy industry as a clear driver of future growth (see Fig. 7).

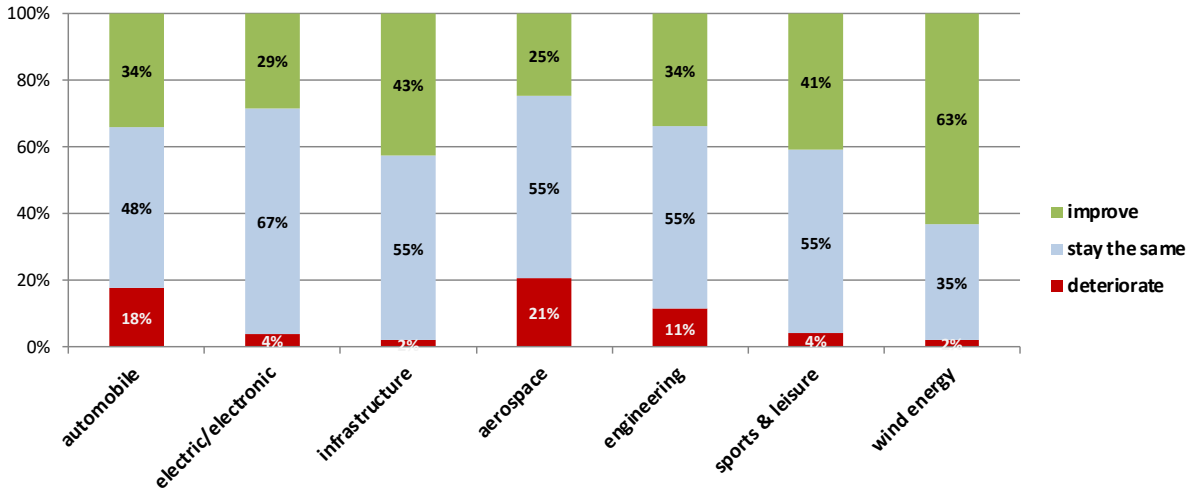

Fig. 7: Composites Germany – Composites Market Survey (H2 2021): Growth drivers for the composites industry

This assessment is supported by the trends of recent years and relevant government policies.

The average output of individual wind turbines has been growing continuously for many years, not least due to the ever greater size of the rotor blades. Just a few years ago, the average capacity of each onshore turbine was around 3 MW. Today, the turbines achieve an output of 5 MW and the trend is rising.

The largest rotor blades currently in use have a length of over 100 metres and weigh almost 60 tonnes. Modern turbines in the 4-5 MW power range have blade lengths of approx. 60 metres and weigh 15-20 tonnes. However, both the weight and the geometry of the blades differ, sometimes significantly, depending on the requirements of the particular site. The trend towards larger turbines requiring a greater volume of material suggests that the volume of composites employed in this sector will increase significantly.

But it is not only the size of the plants that is increasing. In 2000, approx. 9,000 onshore turbines were installed in Germany. By 2021, the number had risen to over 28,000 – boosting installed capacity from around 6,000 MW to more than 56,000 MW (source: BWE - German Wind Energy Association). When offshore plants at sea are also included, Germany had an installed capacity of approx. 64 GW last year. A further significant increase in these values is expected over the coming years, both in Germany and Europe (see Fig. 8).

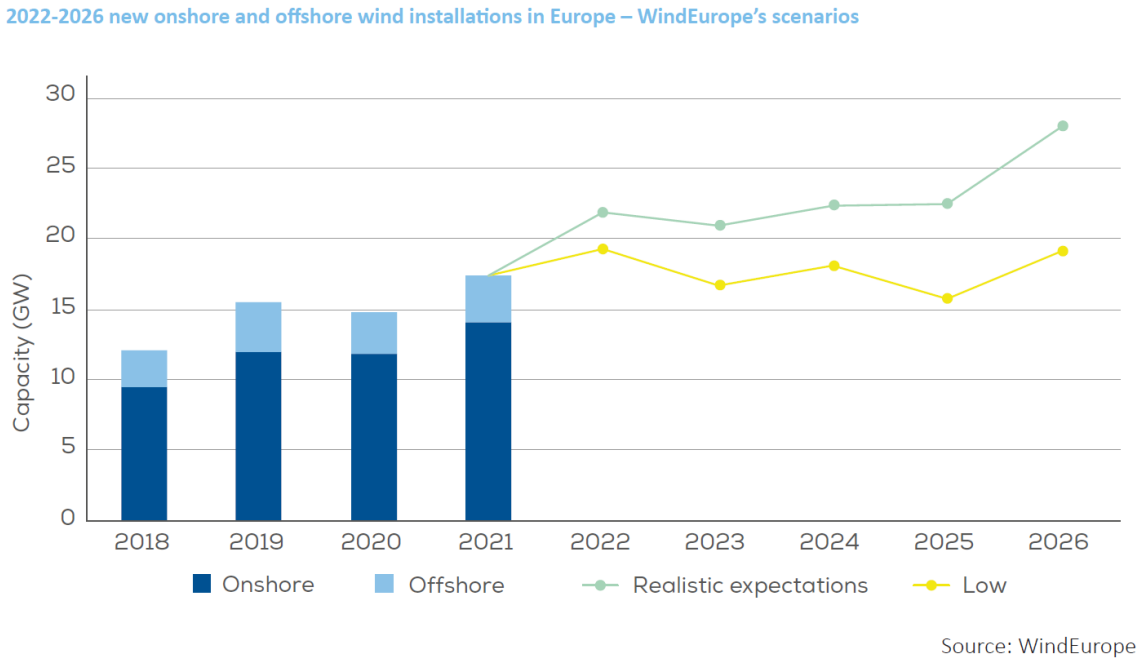

Fig. 8: Forecast expansion of wind energy (source: WindEurope (2022), Wind energy in Europe: 2021 Statistics and the outlook for 2022-2026)

As part of the “Green Deal”, the EU is aiming for renewable energies to account for approx. 40 % of total electricity production by 2030. To achieve this target, WindEurope assumes that around 32 GW of new capacity will have to be installed each year. The currently planned figure of around 18 GW/year is therefore far from sufficient. The wind energy industry, and with it production of NCFs, is therefore likely to be one of the future guarantors of growth in the composites market.

5.2 SMC/BMC

Production of SMC (sheet moulding compound) and BMC (bulk moulding compound) components is the second largest market segment of the GRP industry with a total volume of 278,000 tonnes. The semi-finished products/moulding materials are processed using pressing or injection moulding methods.

SMC/BMC are primarily used in (large scale) series production applications. Both materials have been well-established in the electro/electronics and transport sectors for many years. Together, these two application segments account for over 80 % of the market volume, with the transport segment making up 64 % of the total.

Typical applications include headlight systems, lamp housings, control cabinets, cases, and exterior components in the commercial vehicle and automotive sectors as well as public transport.

In 2021, the SMC/BMC segment grew by 13.9 %. Alongside thermoplastic systems, this market segment has thus seen the strongest growth.

Of the two market segments, SMC is significantly larger with a volume of 197,000 tonnes. However, its rate growth (13.2 %) was somewhat lower than that of BMC (15.7 %). The market volume here rose from 70,000 to 81,000 tonnes.

The SMC/BMC industry continues to work on a wide range of innovative products and product enhancements. The most important of these are high-performance SMC (carbon fibre reinforced SMC), continuous fibre reinforced SMC and natural fibre reinforced SMC.

On the one hand, these materials aim to boost the sustainability of the corresponding components. Above all, however, they seek to open up new application areas for this technology – especially in the field of highly stressed or structural components. The results of the first beacon projects have now been presented in several segments and it is time for these materials/material systems to prove their worth in series production processes. It remains to be seen whether the corresponding applications will become widely used in the long term.

5.3 Open processes

With total production of 232,000 tonnes, “open processes” – hand lay-up and spray-up – continue to be one of the largest segments in the European GRP market. In 2021, this market segment grew by 11 % overall. With an increase of 11.6 %, hand lay-up processes grew even more strongly than spray-up processes, which increased by 10.2 %, in line with the overall market.

This very positive development has, for now, reversed a general trend. For many years, the overall market share of open processes has been in a steady decline. In the wake of the corona pandemic, however, a few specific applications significantly increased demand.

For example, due to the lockdown and its associated travel restrictions, many places have seen a boom in home swimming pool construction.

Private households have therefore been extremely willing to invest in upgrading their homes/gardens. This is now also reflected in the above-average market trend. Nevertheless, it seems unlikely that the sector will regain its former levels (see Fig. 9).

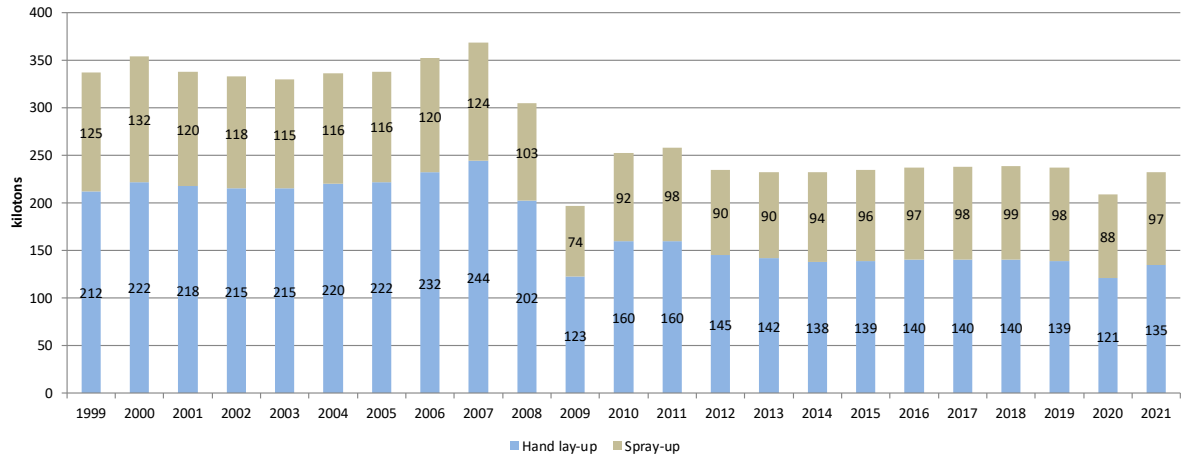

Fig. 9: Market development of "open processes" in Europe (in 000 t)

In general, open processes will still make an important contribution to the GRP production volume in the coming years. Indeed, they are often the method of choice – especially in the field of bespoke and custom-made products or small batch sizes – due to their low investment costs. Spray-up and hand lay-up – the original techniques for processing GRP – continue to perform very well in the production of large, highly complex components or products.

However, the enduring and increasingly strict statutory processing regulations, especially for unsaturated polyesters/styrene, and changes to the limit values for other raw materials are making production in Europe ever more costly and difficult.

As well as these stricter regulatory requirements, which sometimes mandate costly renovations/modifications to production facilities, the industry is also reporting that it is becoming more difficult to find suitable and well-trained employees – another challenge for manufacturers.

For several years, there has been a trend towards substituting open processes with closed production methods – primarily with RTM technology. This looks set to continue.

5.4 RTM

In this report, the RTM (resin transfer moulding) segment comprises all processes in which resin is infused/injected into a closed cavity. These include a variety of injection methods (HP-RTM, P-RTM, RTM-Light, etc.) as well as infusion processes. This segment does not include those RTM processes that use NCFs (described above).

An enormous range of RTM processes have been developed over the years. All use dry fibre/fibre semi-finished products. Once the mould has been lined with reinforcing materials (fibre products or, e.g. core materials), it is closed/sealed and the resin introduced into the cavity of the closed form either under pressure and/or vacuum. The resin flows around or through the fibres and any additional products/semi-finished products.

After a period in which RTM processes were unable to significantly increase their market share, slightly above-average growth of 11 % was also indicated here in 2021. The total volume in this processing segment rose to 138,000 tonnes. Despite this strong growth, this segment did not quite return to its pre-crisis level in 2021 (see Fig. 10).

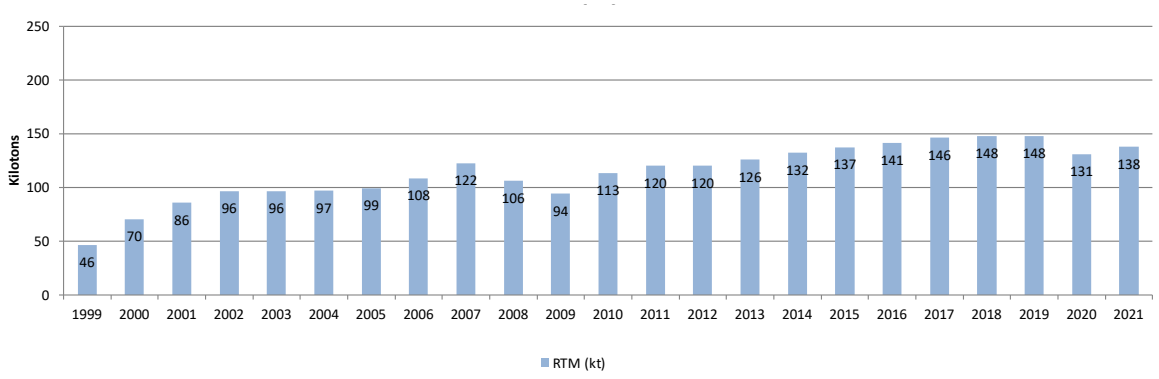

Fig. 10: Market development for RTM processes (in 000 t)

RTM technology encompasses a broad spectrum of production methods with many process variants. It can be used for manufacturing just a few units or larger series and for both small components and larger products. In addition, it is suitable for use with many different fibre and matrix systems. Typically, it also uses corresponding preforms.

As a result, it is used in a wide range of applications – from vehicle construction to public transport, boat and ship building, sports and leisure, and aerospace.

The specifics of the RTM process also make it ideal for manufacturing highly stressed components. RTM technology was considered by many to be the process of choice at the beginning of the 2010s, even for large-scale automotive production. Today, however, research is focusing on other processes. In large-scale series production, thermoplastic processes seem to be prevailing at the moment.

5.5 Continuous processes

The volume of GRP components produced using continuous processes (pultrusion and flat panel production) grew by 9.6 % in 2021 – slightly below the average rate of growth for the industry. Overall, the production level for pultrusion products increased by 12 % to a volume of 56,000 tonnes. Production of flat panels “only” grew by 8.6 % to a volume of 92,000 tonnes.

Panels have mostly been used in vehicles for many years, e.g. for truck side panels, caravan superstructures or the conversion of commercial vehicles. These are supplemented by applications in the facade sector. Like pool construction, the caravan industry benefited from the unusual market environment, especially in 2020. The market figures are particularly impressive when judged by the number of new registrations. The association Caravaning Industrie Verband e.V. (CIVD) reported that 2020 was the second best year in history in terms of new registrations of camper vans in Europe. From 2019 to 2020, new registrations increased by 20 %.

For 2021, the European Caravan Federation recorded growth in new registrations of over 13 %. Thus, 2021 is likely to be the strongest year to date in this segment in terms of absolute registration numbers.

Here, too, the reasons for the lower growth are likely to be stagnating supply chains and the semiconductor shortage. Demand still appears to be high.

Continuous profiles are produced using pultrusion. Like SMC/BMC technology and thermoplastic processes, pultrusion is widely considered to have an extremely promising future due to its process specifics. This is also shown by the aforementioned survey by Composites Germany and the Composites Index.

When questioned about their expectations for the development of specific processing methods, almost half of the participants said they see a positive trend for pultrusion processes (see Fig. 11).

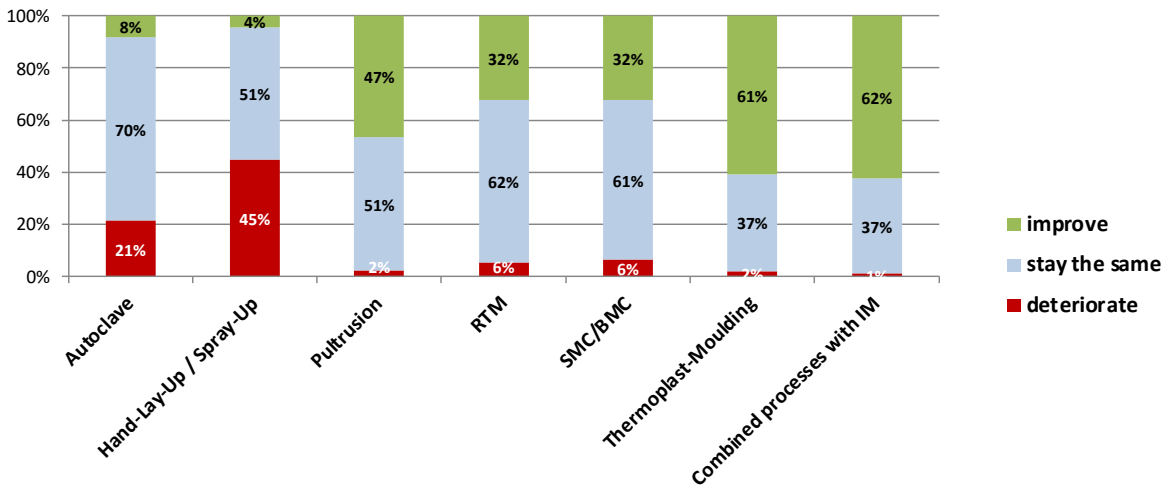

Fig. 11: Composites Germany – Composites Market Survey (H2 2021): Development of processing methods

Within the pultrusion industry, the construction and infrastructure sectors are considered the key markets of the future. Products for these areas include, for example, reinforcement systems for bridges and buildings, window-, stair- and ladder profiles, as well as antenna systems (keyword: 5G network). In the above sectors, other specific properties of the materials play a key role alongside their light weight.

For example, they must be transparent to radio waves, corrosion resistant, require little or no maintenance, permit load-specific designs and be electrical and thermal insulators.

In many cases, however, there is still a lack of corresponding general approvals and standards that would further promote their use. This lack of “security” increases the reluctance of many architects and decision makers to adopt these materials. Moreover, many decision makers still know too little about the advantageous properties that GRP offers compared to other building materials.

5.6 Pipes and tanks

The market segment for GRP pipes and tanks, manufactured using centrifugal or filament winding processes, grew by 5.4 % this year – well below the average for the market as a whole. Production volume in 2021 totalled 137,000 tonnes, with 72,000 tonnes from filament winding processes and 65,000 tonnes from centrifugal processes. Growth in filament winding processes (2.9 %) was significantly lower than in centrifugal processes (8.3 %).

GRP pipes and tanks are principally used in plant construction and public/private pipelines as well as by customers in the oil/gas and chemicals industries.

This segment is currently dominated by relatively few, large producers who have a comparatively high throughput of material – at least in terms of GRP industry operations.

GRP pipe/tank and plant construction is a typical area where GRP materials offer many advantages, e.g. the excellent resistance to aggressive media, such as salts, etc.

In addition, the use of GRP allows operators to significantly extend maintenance intervals and the service life of their equipment. Moreover, the load-bearing design is a tremendous advantage in many applications.

As well as requirements resulting from standards, the main obstacle to the adoption of GRP products is operators' and planners' ignorance about the materials and their properties.

There is still strong growth potential in the pipe sector, and especially in tank and plant construction, that could be tapped by further improving general awareness of the materials. There are also numerous research activities, especially in the field of filament winding technology. For example, this is currently being used to wind hydrogen tanks (using carbon fibre) that can withstand pressures of several 100 bar while remaining very light. Highly interesting potential fields of application are emerging here, e.g. in the automotive sector for the future, which do not yet hold a significant share of the market.

5.7 LFT/GMT/CFRTP

The following section examines short fibre reinforced plastics separately from the long and continuous fibre reinforced thermoplastics LFT/GMT/CFRTP. The latter group presents similar issues to long and continuous fibre reinforced thermoset materials in terms of their material properties, areas of application and, in some cases, processing requirements.

Materials that use short fibre reinforcement (<2 mm fibre length) differ from the LFT/GMT/CFRTP with regard to the influence of the fibres on the material properties and the (load-appropriate) design.

The following diagram provides an overview of the development of this market segment. In 2021, the market for GMT was the only market segment that did not grow at all and, indeed, declined by 6.9 %. Market volume declined from 29,000 to 27,000 tonnes.

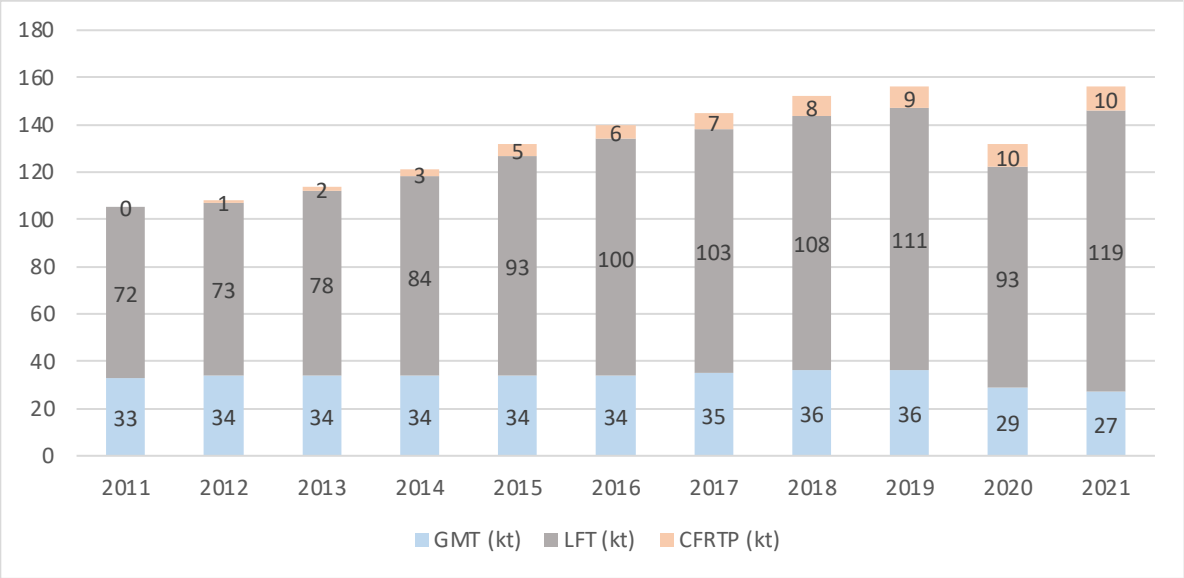

Fig. 12: Market development for LFT/GMT/ CFRTP (in 000 t)

LFTs grew by 28 % to a total volume of 119,000 tonnes. This made them the material group with the highest growth in 2021. Continuous fibre reinforced thermoplastics are still a niche product. The market volume here was steady at 10,000 tonnes.

This market segment is particularly dependent on the transport sector. Almost all of the production volume recorded here is likely to have been used in the transport sector.

Possible reasons for the strong growth in this segment have already been outlined in Section 4.2. Most probably, these are largely due to catch-up effects from the first two years of the corona pandemic, a significant increase in new registrations of commercial vehicles and corresponding material substitutions.

5.8 Short fibre reinforced thermoplastics

As already mentioned, there are some clear differences between the properties of short fibre reinforced materials and long or continuous fibre reinforced systems. However, these important materials are still composites – not least because they are plastics reinforced with fibres. The glass fibres used here generally have a length of less than 2 mm. Nevertheless, reinforced materials do have enhanced properties compared to their non-reinforced equivalents. Above all, they have a positive influence on the elastic modulus and stiffness of the materials. As the fibre length increases, the strength and impact resistance of the composite increase as well.

The European market for short fibre reinforced thermoplastic materials grew at a rate of 25.6 % in 2021. Production rose to 1,504,000 tonnes (source: AMAC), making this by far the largest single segment in the composites industry. However, despite the extraordinary growth, it did not quite return to pre-crisis levels in 2021 (see Fig. 13).

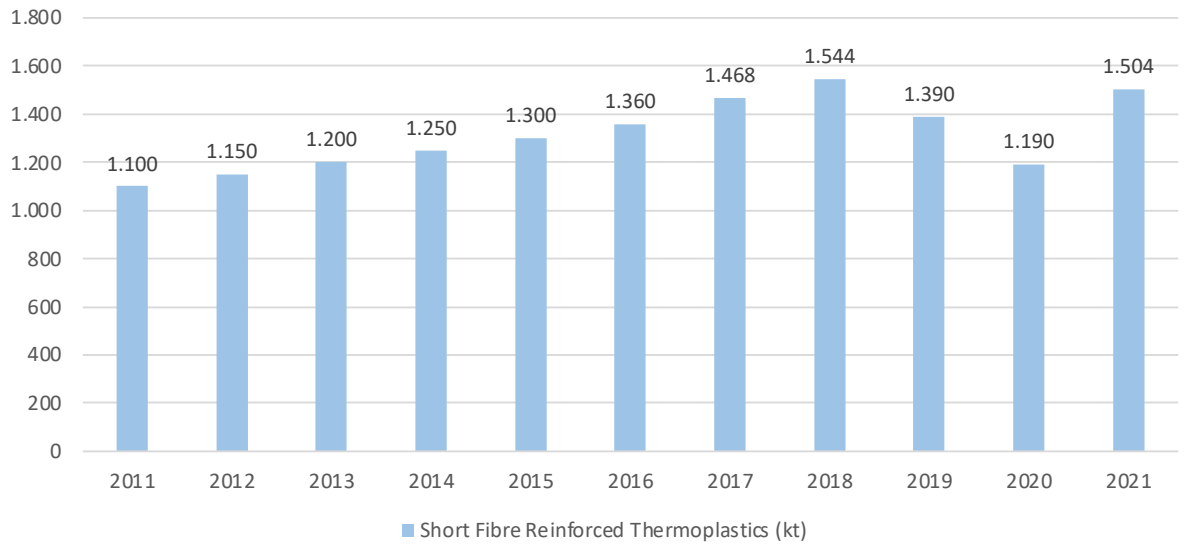

Fig. 13: Market development of short fibre reinforced thermoplastics (in 000 t)

In terms of materials, the market described here is dominated by polyamide (PA), which accounts for more than 60 % of the matrix materials employed. Polypropylene (PP) forms the second largest group. Together, these two material systems account for over 80 % of the resin systems used. The picture is different in the area of LFT described above. Here, 95 % of the material used is PP.

Applications for these products are primarily found in the automotive sector, with a 65 % share of the market volume, but there are also applications in the electro/electronics sector. Other, less significant, markets include the construction/infrastructure sector and the sports and leisure sector.

6 Regional market developments

The following section analyses regional market distribution within Europe. NCF, as a large product group, has now been added to the figures included in this report. This marks a change from previous issues and, for now, prevents it from taking a long-term view. Nevertheless, there are still clear parallels to the previous surveys. Although the absolute figures are now higher due to the change in the data basis, there have been no significant changes in the rankings of the importance of the respective markets.

The underlying data include all long and continuous fibre reinforced thermoset materials. Thermoplastics are not included in the regional analysis, as a regional breakdown for the volumes of these materials is currently not available.

The German thermoset market achieved a volume of 242,500 tonnes in 2021. As already discussed, Germany remains the largest market among the regions reviewed with a share of 19.4 % (Fig. 14).

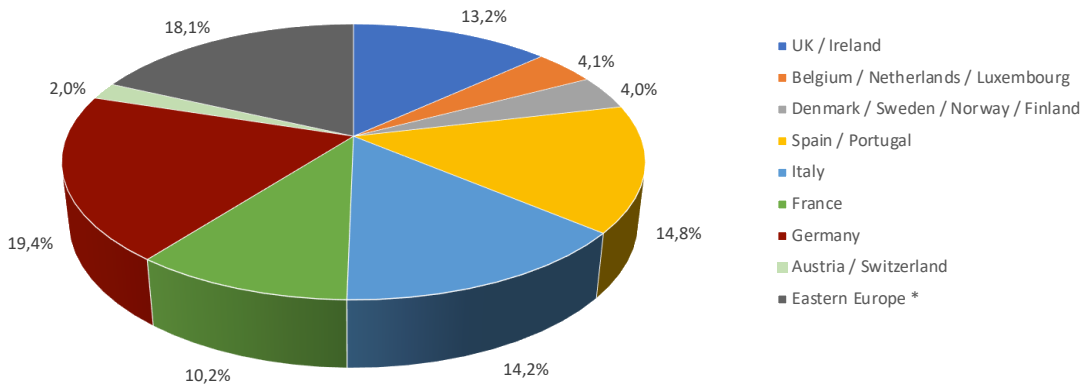

Fig. 14: Regional distribution of the European thermoset market

Eastern Europe is in second place with a market share of 18.1 % and a volume of 226,500 tonnes. This region includes the following countries: Poland, Czechia, Hungary, Romania, Serbia, Croatia, Macedonia, Latvia, Lithuania, Slovakia and Slovenia.

It is not always possible to allocate individual quantities/material flows with a 100 % level of separation, which is why these countries are combined here into a fairly large group. Spain/Portugal form the third largest group with a processing volume of 185,000 tonnes – a market share of 14.8 %. Italy ranks only just behind Spain/Portugal, with a market share of 14.2 % and a composites processing volume of 177,500 tonnes. These four regions together represent 2/3 of the European composites market.

The next largest processing region within Europe is UK/Ireland with a market share of 13.2 % and a volume of 165,000 tonnes. There is then a significant gap to France, which has a market share of 10.2 % and an associated production volume of 127,500 tonnes.

The remaining three, somewhat smaller processing regions, are led by the Benelux countries, which produced a volume of 51,250 tonnes or a share of 4.1 % in 2021.

The volume manufactured in the Northern European countries (Denmark, Sweden, Norway and Finland) was only slightly lower. This region produced a volume of 50,000

tonnes of composites, equivalent to a 4 % share of the overall European thermoset market. Austria/Switzerland accounted for the smallest share in percentage and thus also in volume terms. The two countries produced 25,000 tonnes of thermosets in 2021. This equated to a market share of 2 %.

As well as considering the market in pure volume terms, it is always important to remember that the composites industry – in almost all regions – focuses on widely differing areas. Consequently, the various countries/regions are often also affected quite differently by macroeconomic developments. A pan-European view can therefore only ever provide a rough indication of the underlying trends and developments. Different trends often emerge upon detailed analysis, depending on the specific core markets and primary applications within the countries. In Turkey, for example, pipe and tank systems have dominated the market in terms of volume for many years, with a share of almost 50 %. In Germany, on the other hand, they play a much less important role. Here, automotive applications and the electro/electronics industries are more dominant.

In Norway and Sweden, applications in the oil and gas industry dominate the market. It is therefore important to ensure that corresponding market analyses are precisely focused and take account of regional characteristics and developments. For example, just because one region is growing strongly or declining, it does not necessarily follow that this is true of the entire European market and vice versa. The mechanisms in play here are similar to those affecting general differences in industrial and economic developments in Europe.

This report has been presenting market figures for the Turkish composites market for several years. Due to the very small data basis, they will continue to be reported separately. For 2021, the Turkish trade association reported a total volume of 300,000 tonnes. After the 10 % decline in market volume to 225,000 tonnes in 2020, this would represent growth of over 33 % – making Turkey clearly the largest single market in Europe and confirming significantly above-average growth in 2021. As in previous years, it can be assumed that around half of the production volume will be used in the construction sector and for the manufacture of pipes and tanks. The automotive and transport sectors account for approx. 1/3 of the production volume. The third largest application area is the wind energy industry.

7 Other composite materials – CRP and NRP

In addition to the material groups discussed in detail so far, carbon fibre reinforced plastics (CRP) and natural fibre reinforced plastics (NRP) are the most important material groups in terms of volume.

CRP market volume grew very dynamically in 2021, increasing by more than 23 % compared to 2020 (source: Composites United). The global market volume increased to 147,500 tonnes, of which Europe accounted for approx. 1/3. The total volume in Europe increased to 52,000 tonnes.

No new information is currently available for NRP. According to an AVK survey conducted within the NRP sector in 2020, this special composites segment primarily uses thermoplastic materials, although thermoset materials are also used. Unfortunately, no current figures regarding the precise volumes being processed are available. However, it can be assumed that the market for these materials in Europe is at least 90,000 tonnes. The last survey of production volumes, for 2012, recorded a volume of 92,000 tonnes of NRP (source: nova-Institut GmbH).

The largest application area for these materials is the automotive sector, followed by the consumer goods industry. The fibres used are mainly flax, hemp, jute and kenaf. The dominant manufacturing processes are moulding/compression moulding. Injection and extrusion process are also used. The principal processors in terms of region are Germany, France and several Eastern European countries (Poland, Czechia and Slovenia).

Natural fibre reinforced plastics are mostly used because of their special material properties (low weight, low cost, sound insulation, good mechanical properties). But they can also help to reduce the environmental impact of a product. This area appears to be particularly rich in future market development opportunities.

8 Outlook

Opportunity is an inherent component of all change

It is currently extremely difficult to predict possible future economic development scenarios and thus the trends for the composites market in Europe, either as a whole or for a particular region. Indeed, it is virtually impossible to provide reliable estimates of production quantities for specific processes and/or applications in the medium or long term. Against the current background of global economic and political developments, any estimate of production volume beyond the short term inevitably becomes imprecise.

The impact of many of the key or decisive events and developments of recent years would have been unthinkable to almost every analyst until shortly before they occurred.

One such turning point was 11 March 2011. Although many people may not initially recall the date itself, they do remember the events that began that day. These were also to have a massive long-term impact on the composites industry. This was the day when Japan was shaken by the strongest earthquake ever measured in the country. It also destroyed the external power supply of the Fukushima nuclear power plant. As a result, by 18 March, meltdowns had occurred in three reactors. This directly led to a decision by the German federal cabinet, in a special session on 6 June 2011, to phase out nuclear power earlier than planned and decommission eight of the country's nuclear power plants by 2022 (source: WDR/Planet Wissen). Even though the process of phasing out nuclear energy had already begun, the speed and absolute nature of the decision was enormous. Of course, the energy transition did not begin on this date, but the decision inevitably resulted in a massive acceleration of the transition process and increased the urgency of developing or expanding new forms of energy. Wind energy plays a central role here, especially in Germany, but also in other European countries.

According to statistics from WindEurope (www.windeurope.org), the total installed capacity of wind turbines in Europe is currently 236 GW. In 2012, the figure was 109 GW. Capacity has therefore more than doubled in the past ten years. Germany is the leading country in Europe here, accounting for 27 % of the region's total installed capacity. Wind power makes up 23 % of the electricity mix in Germany. This proportion was higher in only five European countries (source: WindEurope) (see Fig. 15).

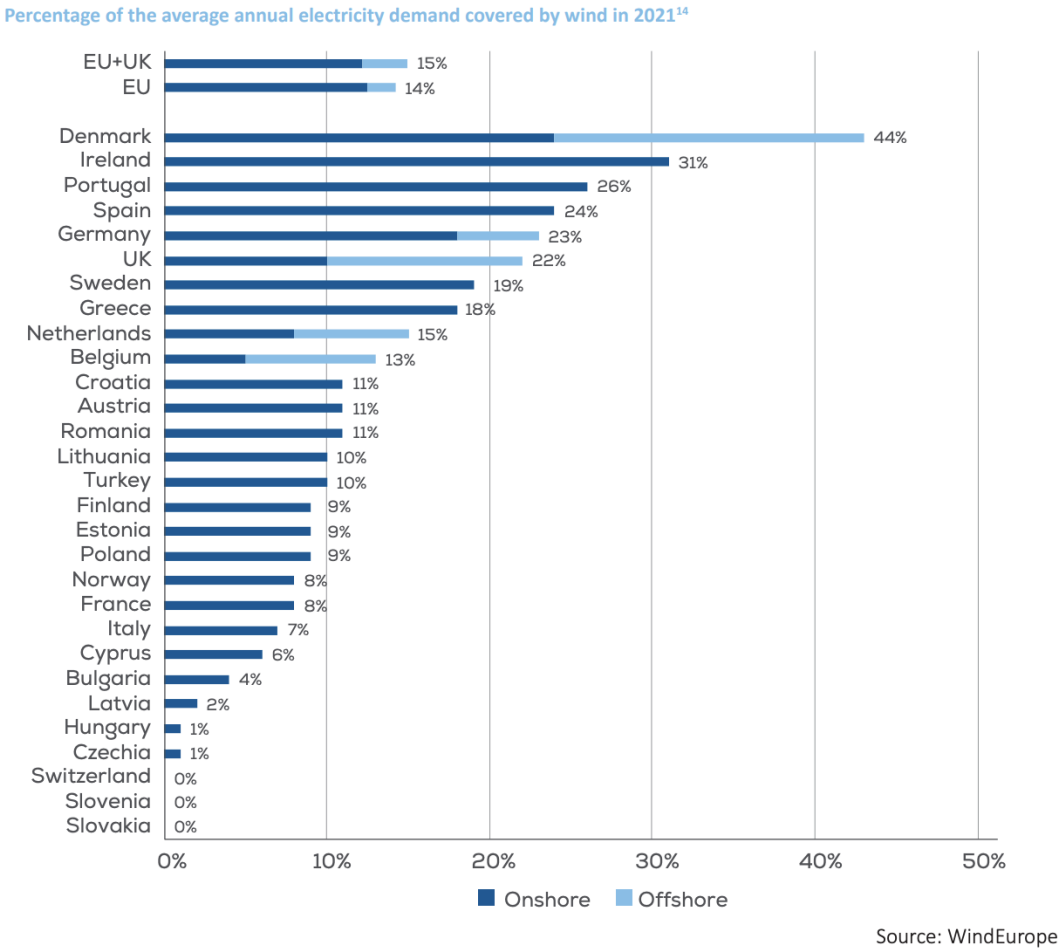

Fig. 15: Percentage of average annual electricity demand met by wind power in 2021

This is expected to increase considerably in Germany over the coming years as Germany has also decided to phase out coal-fired power generation by 2038 at the latest. Renewable energies will be essential to prevent the country from becoming massively dependent on foreign energy sources. The website of the Federal Ministry of Economics and Climate Protection states: “At present, wind energy is the driving force in expanding renewables. In 2020, onshore and offshore wind energy installations accounted for an installed capacity of 54.4 and 7.5 gigawatts respectively. (...) According to plans drafted by the Federal Government, offshore wind capacity will reach 20 GW by 2030. For onshore wind energy, installed capacity according to EEG 2021 will reach 71 GW by 2030.”

Germany is an unusual example and the impact here has been exceptional. Nevertheless, this serves as a good illustration of how unpredictable individual events can have a dramatic impact on overall economic activity, not just in the short term, and lead to profound and fundamental changes. This development is an extremely positive signal for the composites industry as the indicators are clearly pointing upwards.

The area of mobility is also closely linked to energy supplies. Prices for gasoline and diesel have risen enormously in recent months. There are many reasons for this. Firstly, the price of crude oil has risen sharply on the international markets. There is also the new CO_2 tax while VAT has been restored to the 2020 level. However, prices sky-rocketed with Russia's invasion of Ukraine on 24 February this year. Oil supplies no longer seemed secure. Tension in the region had been smouldering for many years and flared up with the annexation of Crimea in 2014. However, even experts did not expect an invasion of this scale. As well as the material damage, as of April there is talk of many thousands of dead and millions have been displaced. Again, this is a single event that is leading to multiple effects. On the one hand, it gives further momentum to the energy transition as a means of reducing dependencies on other countries/regions. This will not only be true for Germany, but for many countries. At the same time, it adds fuel to the debate about alternative drive concepts. For example, with gasoline prices hitting peaks of over EUR 2.30 per litre, switching to electric vehicles (EVs) appears even more attractive. This structural change, too, presents many opportunities for the composites industry. Numerous applications beyond existing components are already emerging. These offer a wide range of new possibilities, such as battery housings/covers for battery packs, where composites have many innate advantages. The expansion of charging infrastructure for EVs also opens up exciting new horizons for composites. Durability, low maintenance and weather resistance are key requirements in this area and composites seem likely to benefit here as well.

As a final example, consider 27 January 2020 – the day on which the novel corona virus began to spread through Asia, Europe and the world. On 11 March 2020, the WHO classified the spread of the disease as a pandemic. This was followed by the lockdown in Europe and Germany with dramatic consequences for the population, industry and the economy in general.

The impact of the virus was the most severe event since the economic and financial crisis of 2008/2009. Within the composites industry, the transport sector was particularly hard hit. The aviation industry collapsed almost completely. Fig. 16 shows the number of passengers carried in the European Union.

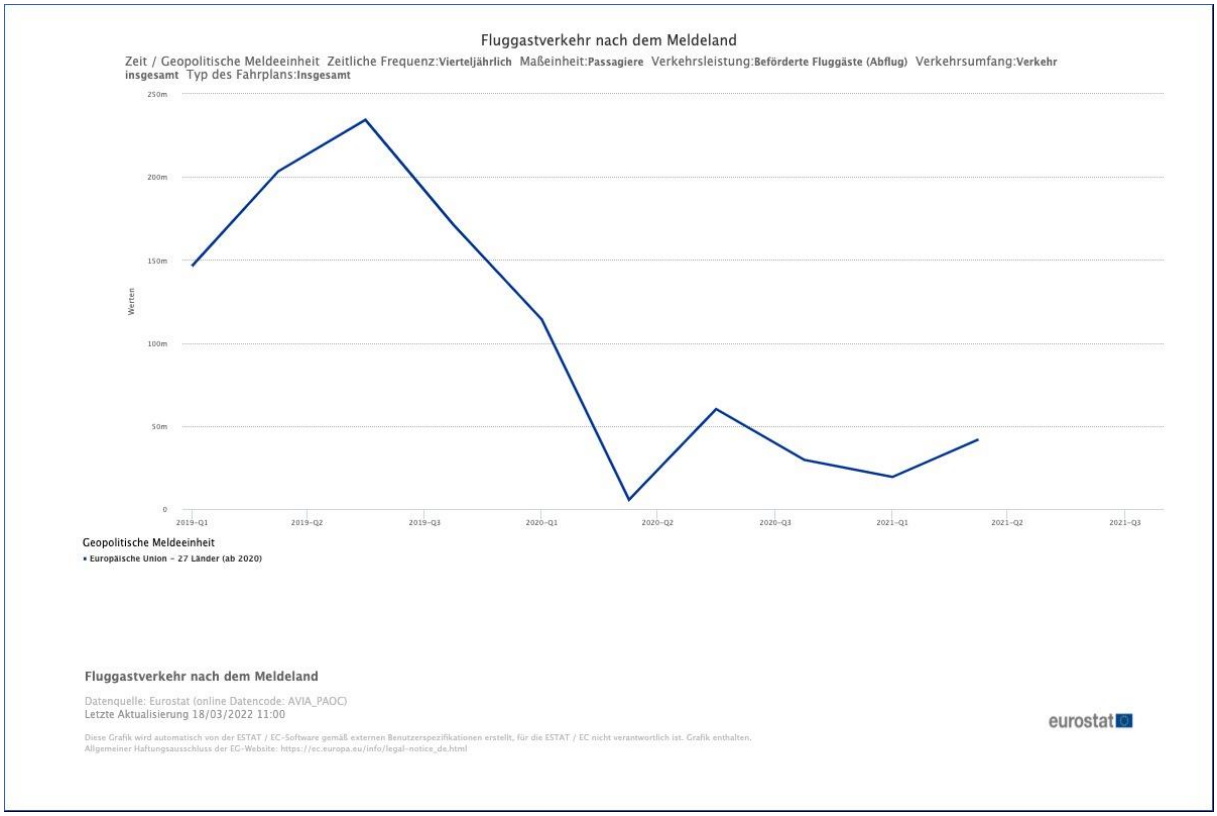

Fig. 16: Number of passengers carried in the European Union

Although a slight recovery is underway, the industry is still well below its pre-crisis levels. Investments in the aircraft fleet will therefore be delayed for now.

On the other hand, the picture was quite different for caravans and motorhomes. Above-average growth rates have been and continue to be achieved here. The trend toward individual vacations seems unlikely to abate in the next few years. So even during a global crisis there are always applications/industries that can buck the trend and grow while others suffer severe damage due to the same event.

Almost all industries are currently struggling with extremely high raw material and logistics prices. Here, too, specific events have exacerbated existing situations. International logistics chains had already been weakened by the corona pandemic when, on 23 March 2021, the Ever Given ran aground in the Suez Canal – blocking it for six days.

The resulting traffic jam of over 300 vessels halted the transportation of goods worth several billion euros (source: Wikipedia). Already fragile trade routes suffered yet more severe disruption. The effects are still being felt today. Prices for fibre optics, for example, rose by several hundred euros per tonne within a year. Ultimately, of course, this has an impact on margins and also on prices for potential customers. Companies can only ever remain competitive by achieving an optimal price/performance ratio.

Despite all the imponderables that have been briefly listed here, one thing is crystal clear: forecasting market trends is always subject to certain uncertainties. It is virtually impossible to predict long-term developments – there are simply too many unknown factors at play. What can be said with certainty, however, is that there are many fields of application for which composites – with their unique properties and outstanding capabilities – seem almost predestined.

Going forward, we expect positive developments, above all, in the wind energy and commercial vehicle sectors. But infrastructure applications also offer many opportunities and possibilities, such as in the aforementioned expansion of EV charging station infrastructure and the urgently needed construction and renovation of bridges. These areas are supplemented by the expansion of the 5G network, where experts see a high level of benefits for the use of composites.

The composites industry must be even more successful in promoting the advantages of the materials, not just their lightweight properties, to decision-makers. Corrosion resistance, design freedom, options for load-bearing construction, high strength and rigidity, durability, low maintenance – these are just some of the advantages that need to be more widely understood. The future holds many opportunities, some of which have yet to emerge as the developments of recent years have shown. Composites are materials of the future. The goal must be to ensure they are considered in all material selection processes.