



The European Market for Fibre-Reinforced Plastics and Composites 2022

Market developments,
trends, challenges and outlook

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AVK, the professional German association for fibre-reinforced plastics and composites, represents the interests of manufacturers and processors both in Germany and at the European level.

Its range of services includes expert working groups, seminars and conferences as well as the provision of market-specific information (www.avk-tv.de).

In Germany, AVK is one of four support organisations of GKV, the General Association of the Plastics Processing Industry. Within Europe, it is a member of the European umbrella association for composites, EuCIA (European Composites Industry Association).

AVK is a founding member of Composites Germany.

1 Notes on the underlying data

The AVK Market Report, which has been a well established publication for many decades now, has been expanded and adjusted in its underlying data material since the 2021 report. This was in response to changes in the parameters of several segments.

Until the 2021 issue, the production quantities for the ongoing financial year were surveyed in the 4th quarter, and the volumes were then forecast from the survey period until the end of the year. This methodology was fundamentally revised in the last issue. As before, the 2022 Market Report now also includes the actual figures for the previous year, 2022, which were collected in early 2023 and which can only be determined with sufficient certainty after the end of the year under review. This is partly due to the increasing dynamics that can be observed in the market.

As in 2021, unlike in the previous years, the two central market segments, thermosets and thermoplastics, have been analysed separately in a number of areas. Likewise, we have proceeded differently in analysing the various areas of application and regional developments. By expanding and modifying the underlying data, we have obtained an even more comprehensive picture of current markets and their developments.

2 Summary introduction

Macro-economic developments are dampening the mood in the composites market

Like all industries, the composite industry has been affected by strong negative forces in recent years. Even before the Covid pandemic, which started in early 2020, some key challenges had emerged, such as structural changes in the transport sector. The economic climate was affected by steadily declining numbers of new car registrations in core markets, also impacting composite processors.

Like many sectors of the economy, the industry was hit particularly hard during the pandemic. Direct influences such as shutdowns, production closures and a negative consumer climate were further aggravated by a severe shortage of semiconductors, supply chain problems and specific effects such as the closure of the Suez Canal following the Ever Given accident. The war in Ukraine and sharp price increases for raw materials, energy and logistics subsequently had a highly negative impact on the economic climate, especially in 2022.

All these factors resulted in a 20% slump in European production volumes in 2019/2020. However, thanks to excellent market developments in 2021, they almost reached their previous level again. 2022 displayed a further decline in European production volumes, totalling 6% across all materials.

The world market for composites, on the other hand, showed an increase from 12.1 million tonnes to 12.7 million tonnes last year, amounting to around 5% growth. Market dynamics were thus significantly lower in Europe than globally. In total, Europe's share of the world market was about 22%.

Overall, we could observe an acceleration of market dynamics, albeit in the face of many imponderables. The extremely strong international integration of the composites industry also meant that events outside its core markets had a significant impact on market developments at times.

Developments continued to be dynamic throughout 2022. Whereas the first three quarters were still relatively stable for raw material producers, they eventually stopped being able to sell their products on a full scale, particularly during the fourth

quarter. Manufacturers primarily depleted their stocks, and the ensuing slump in demand was accompanied by a sharp increase in warehousing on the part of raw material manufacturers. Production volumes thus developed more robustly over the year as a whole compared, while many raw material manufacturers saw massive changes in their sales situation and were impacted extremely negatively, particularly during the last quarter of 2022.

The central application segments continued to develop differently in 2022, with a noticeable decline in all market segments. The most important application segment remained the transport sector, followed by the electrical and electronics sector and applications in construction and infrastructure. Thermoplastics displayed a high level of dependence on the transport sector, which accounted for 67% of all applications. The strongest sector for thermosets, on the other hand, was construction, with several percentage points above the transport sector.

Where regions were concerned, the countries that continued to maintain strong positions within Europe were Germany, Spain and Portugal, Italy and the Eastern European countries. Germany was still the country with the highest market volume, a share of nearly 20% of the market as a whole. Taken together, the four above-mentioned regions represented two thirds of the European market volume.

Glass fibre-reinforced systems still accounted for a share of more than 95% of the total market. Other materials, e.g. CRP (carbon fibre-reinforced plastics) and NRP (natural fibre-reinforced plastics), on the other hand, continued as specialities, although they still developed positively in the relevant application segments.

In all, the 4.5% decline in thermoplastic composites was still lower than in thermoset materials, where the decline was 9%. On the material side, the most positive development could be observed in CRP (carbon fibre-reinforced plastics). Unlike all other segments, it grew by around 10%, although it only formed a very small part of the total composites volume. The only other segment that also experienced growth was continuous fibre-reinforced thermoplastics, albeit – in absolute terms – only on a very small scale. The most moderate decline in glass fibre-reinforced plastics within a generally declining market could be observed in short glass fibre-reinforced thermoplastics and in SMC and BMC materials.

3 The market under review

When considering glass fibre-reinforced (GRP) materials, the present analysis again includes all GRPs with a thermoset matrix. As before, NCFs (non-crimp fabrics) are reported separately. The thermoplastics market covers glass mat-reinforced thermoplastics (GMT), long fibre-reinforced thermoplastics (LFT) and continuous fibre-reinforced thermoplastics (CFRTP). One area that has been added since the last Market Report is an overview of the European production volume of short fibre-reinforced thermoplastics. Our overall review also includes the production volume of carbon fibre-reinforced plastics (CRP).

On the application side, we will show the figures both separately, for the two relevant material systems, thermoplastics and thermosets, and together, as consolidated figures. Regionally, our overview of the GRP market covers all thermoset materials in the relevant European countries where production volumes can be recorded with sufficient certainty.

4 Overall development of the composite market

According to the latest figures from the JEC (www.jeccomposites.com), the volume of the global composites market in 2022 totalled 12.7 million tonnes. Compared with 2021, when the volume was 12.1 million tonnes, this was an increase of around 5%.

By comparison, European composites production in 2022 declined by 6.1%. The overall European composites market thus went down from 2,962 kt in 2021 to 2,781 kilotons (kt) (see Fig. 1).

Europe's share of the world market was therefore around 22%. America's market share was on a similar scale. Asia's global market share, on the other hand, was as high as 50%.

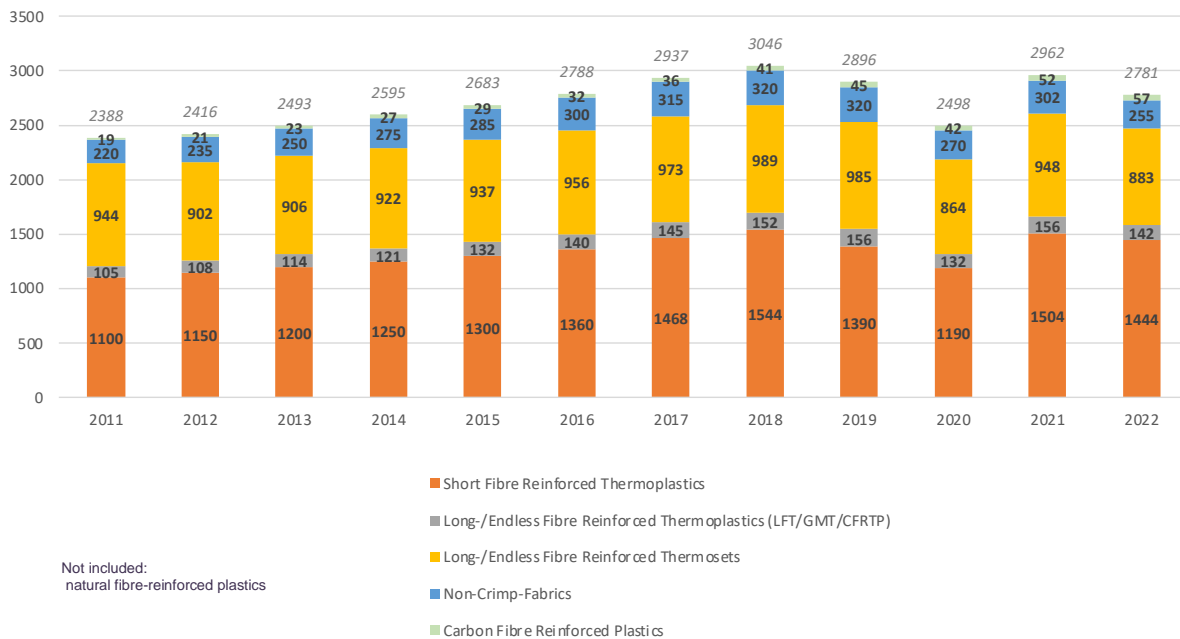


Figure 1: Composites production volume in Europe since 2011 (in kt)

As in previous years, however, developments within Europe were not homogeneous. The differences were due to highly diverse regional core markets, substantial variability of processed materials, a broad spectrum of different manufacturing processes and widely differing areas of application.

Accordingly, we can see different developments both regionally and, above all, with regard to different processes – although, in 2022, a decline was reported for all regions and for nearly all processes. The only materials that saw growth were CFRTP and CRP. A detailed examination of both regional developments and the development of different processes and systems will be presented in the next chapters.

In terms of volume, the largest part of all composites production flowed into the transport sector, which continued to account for more than 50% of the market volume (see Fig. 2). The next two largest sectors were construction and infrastructure, on the one hand, and electrical and electronics, on the other. One area that is not covered here is CRP which, with a share of around 1-2% of the total market, only had a minor impact on this distribution.

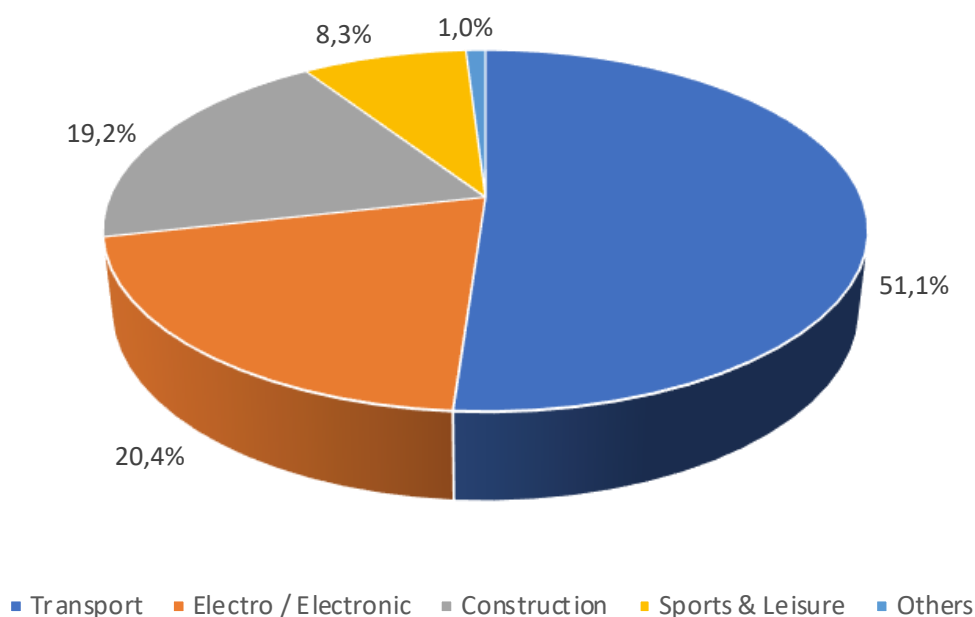


Figure 2: Total composites market by applications in 2022 (in %, excluding CRP)

Transport includes the production of cars as well as commercial vehicles, aviation, public transport, etc. Construction and infrastructure covers, for example, pipelines, containers, tanks, structural sections, etc. The electrical and electronics sector, for instance, includes switches, housings, telecommunications equipment and control cabinets.

4.1 Market development for thermoset composites

The overall manufacturing volume of thermoset composites (excluding CRP) was 1,138 kilotons in 2022, compared with 1,250 kilotons in the previous year. Consequently, the share of this material group was 41.8% of the entire European market. Unlike thermoplastic systems, 2022 followed the same pattern as the previous year (2021) by displaying a slight 1.2% downturn in the market share compared with the year before (see Fig. 3).

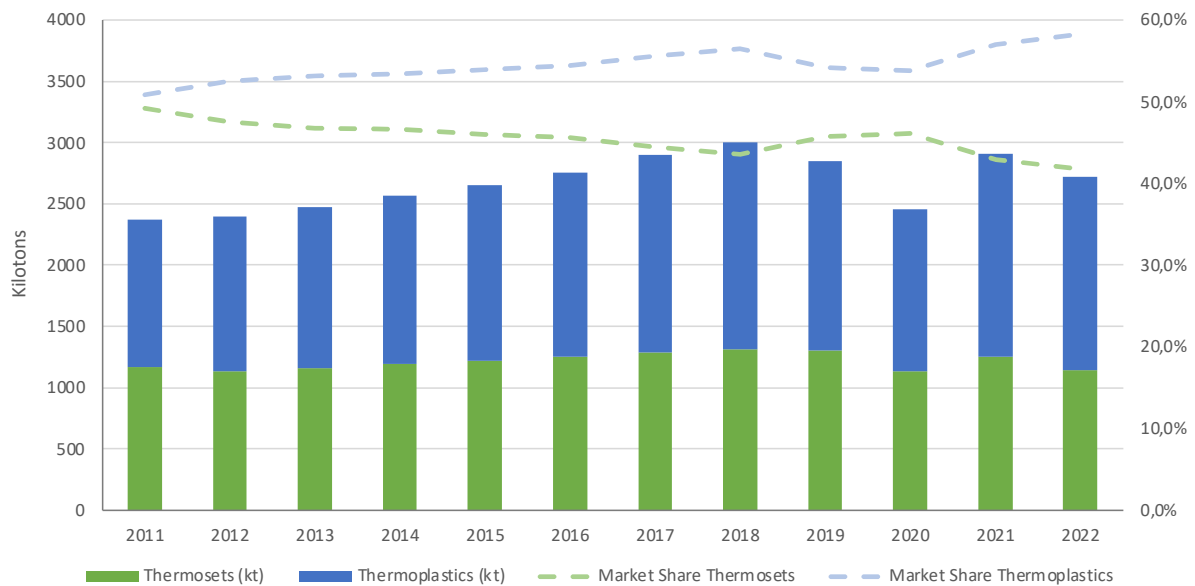


Figure 3: European composites market by material systems (in % and kilotons, excluding CRP)

The two main areas of application for thermoset composites continued to be construction and infrastructure, on the one hand, and transport, on the other (see Fig. 4).

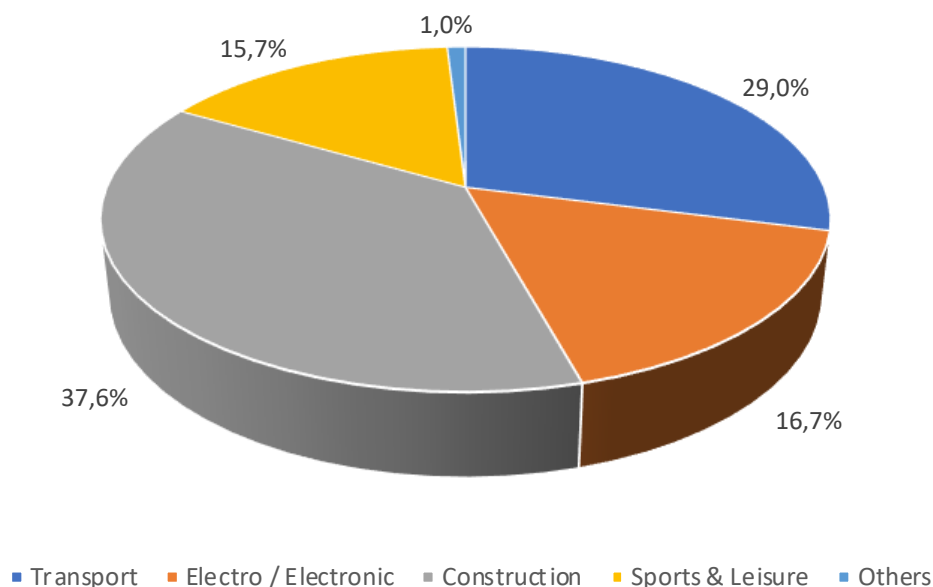


Figure 4: Thermoset composites by areas of application in 2022 (in %, excluding CRP)

Whereas, until 2019, the transport sector had still been the largest application segment for the GRP industry (hereinafter this term will be used for all long and continuous fibre-reinforced thermoset and thermoplastic composites), there was a clearly

increasing shift towards the construction and infrastructure sector in the year under review. This trend continued in 2022. By contrast, the thermoplastics market had been dominated for many years by applications in the transport sector, especially for cars and commercial vehicles. The following chapter provides an overview of thermoplastic materials.

4.2 Market development for thermoplastic composites

The European thermoplastic composites market had a total volume of 1,586 kilotons in 2022, compared with 1,660 kilotons in the previous year (source: AMAC). Nevertheless, the decline was smaller than for thermoset systems. The share of these systems in the overall European market rose from 57% in 2021 to 58.2% in 2022.

The largest material group within thermoplastic composites and also in the market as a whole was short fibre-reinforced plastics, where the reinforcing fibre has a length of only a few millimetres.

Here, the reinforcing effect is very different from long or continuous fibre systems – another reason why such materials are often disregarded in the composites sector. On the material side, this material group is dominated by polyamide (PA). However, a different picture emerges in LFT where much longer fibres are used, primarily polypropylene (PP). So here, too, there are already some obvious differences.

Overall, short fibre-reinforced thermoplastics accounted for a volume of 1,444 kt. Compared with 2021, this was a 4% decline. The market share within the thermoplastic composites segment was therefore around 90%. Its share of the European composite market was over 50%. The second largest group was LFT materials. In 2022, long fibre-reinforced plastics accounted for a market volume of 105 kt, but faced a sharp decline of 11.8%. The markets are significantly smaller for glass mat-reinforced thermoplastics (GMT), with a total volume of 25 kt, and for continuous fibre-reinforced thermoplastics, with a volume of 12 kt.

The main area of application for thermoplastic composites was the transport sector, which accounted for over two thirds of the market (see Fig. 5).

This segment was dominated by cars and commercial vehicles. Together with applications in the electrical and electronics sector, the 2022 market share was 90%. Since the beginning of the survey in 2011 and despite the many challenges, the overall market segment grew by more than 30%.

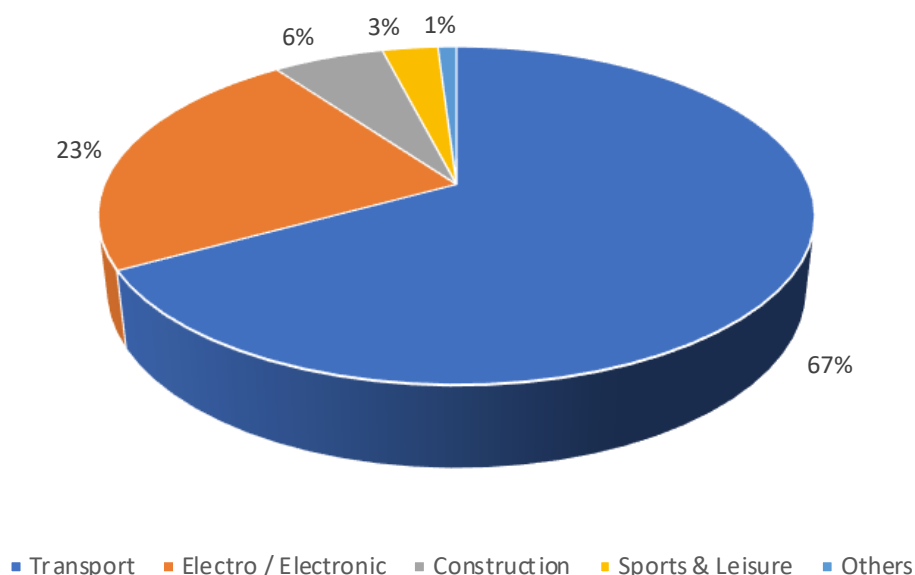


Figure 5: Thermoplastic composites by areas of application in 2022 (in %)

What is striking in this context is the strong increase within this market segment despite a sharp decline in car registrations.

According to ACEA (European Automobile Manufacturers' Association), the car market in the European Union contracted by 4.6% in 2022, mainly due to the impact of component shortages in the first half of the year. Although the market recovered between August and December 2022, the cumulative volume was 9.3 million units, the lowest since 1993 when 9.2 million units were registered.¹ In many cases, production and thus sales of volume models were cut back in favour of high-margin models with higher prices. As a result, many OEMs achieved good profits while their sales were quite low.

¹ <https://www.acea.auto/pc-registrations/passenger-car-registrations-4-6-in-2022-12-8-in-december/>

A similar picture emerged for commercial vehicles in 2022. Whereas commercial vehicle registrations had still risen by 9.6% in 2021, figures in 2022 then dropped quite significantly, according to the ACEA.

“Overall, the EU commercial vehicle market contracted by 14.6% to 1.6 million units in 2022, with volumes falling below those of the 2020 pandemic year (1.7 million units). This was primarily due to ongoing supply chain issues hampering vehicle availability throughout the year.”²

The strong increase in thermoplastic composites over the past few years and their relatively small decline in 2022 can therefore only be explained by an increased use of composites in this segment. In addition to making changes to designs and converting components and component groups, another option is to substitute more existing materials with composites.

What matters in this context is to distinguish the core markets according to thermosetting and thermoplastic material systems. By serving the construction and infrastructure sector, thermosetting materials enter a segment that is often highly oriented towards macro-economic developments and which reacts less sharply to market changes and/or reacts to them more in the medium term. The transport sector, on the other hand, often clearly reacts to macro-economic developments more in the short term.

² <https://www.acea.auto/cv-registrations/commercial-vehicle-registrations-14-6-in-2022-5-1-in-december/>

5 Development tendencies of processes/parts

Table 1 shows the quantitative development of main processes/parts for the production of composites in the past years. Individual segments cannot always be defined and distinguished very consistently or clearly. In addition to the above-mentioned processes, there are numerous other production processes and technologies, which can, however, generally be assigned to one of the above-mentioned areas.

	2018	2019	2020	2021	2022
SMC (kt)	204	205	174	197	190
BMC (kt)	81	82	70	81	78
SMC and BMC (kt)	285	287	244	278	268
Hand lay-up	140	139	121	135	120
Spray-up	99	98	88	97	85
Open mould (kt)	239	237	209	232	205
RTM (kt)	148	148	131	138	130
Sheets	96	94	85	92	84
Pultrusion (kt)	55	56	50	56	52
Continuous processing (kt)	151	150	135	148	136
Filament winding	79	78	70	72	68
Centrifugal casting	69	68	60	65	62
Pipes and tanks (kt)	148	146	130	137	130
Non-crimp fabrics (kt)	320	320	270	302	255
Others (kt)	18	17	15	15	14
Total thermoset market (kt)	1309	1305	1134	1250	1138
GMT (kt)	36	36	29	27	25
LFT (kt)	108	111	93	119	105
CFRTP (kt)	8	9	10	10	12
Short fibre (kt)	1544	1390	1190	1504	1444
Total thermoplastics market (kt)	1696	1546	1322	1660	1586
CFRP – carbon fibre-reinforced plastics	41	45	42	52	57
Total composites market (kt)	3046	2896	2498	2962	2781

Table 1: Composites production volumes in Europe by processes/parts (kt = kilotons)

Figure 6 illustrates long-term developments in the various market segments. Our analysis, however, does not cover short fibre-reinforced plastics. This is partly to provide a better overview, but also because the differences between this material group and the GRP industry were already highlighted above.

The material properties of short fibre-reinforced materials sometimes differ significantly from long and continuous fibre-reinforced systems. The glass fibres within the material are usually less than 2 mm in length. Yet they do increase the level of properties compared with non-reinforced materials. One benefit, in particular, is a positive impact on the elastic modulus or stiffness of the materials. Moreover, the longer the fibres, the greater their firmness and impact resistance. Generally speaking, materials are distinguished with regard to their basic and, in some cases, clearly different mechanical properties. The CRP figures are also included here.

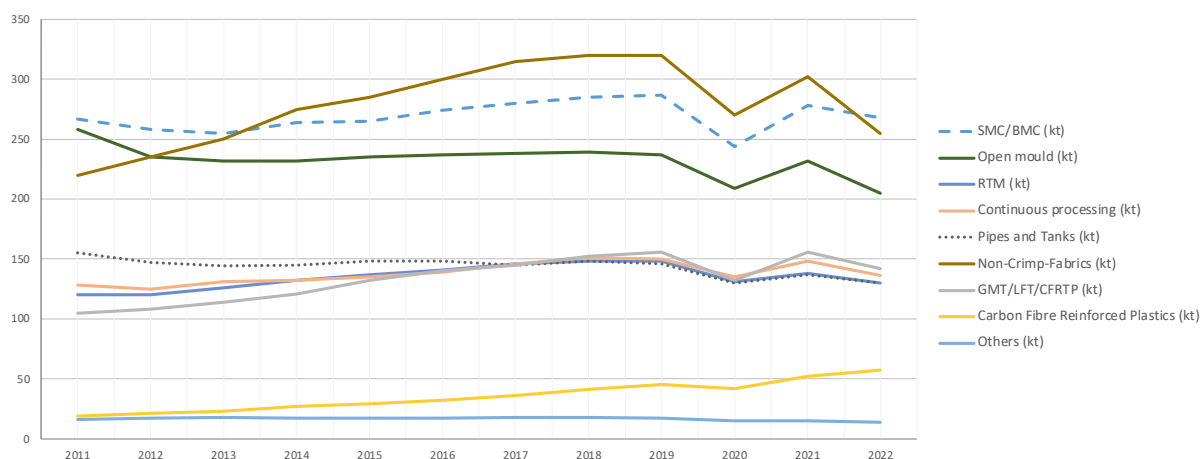


Figure 6: Long-term developments of market segments (share of total market)

The largest single segment since 2014 has been non-crimp fabrics (NCF). 2022, however, was the first time that SMC and BMC materials were the largest material group, many of which were used in large series applications. The third place was occupied by open mould processes, which are often applied in highly manual contexts. In terms of volume, the other processes that were mentioned here were on a very similar level. In particular, we can see above-average growth in CRP – at a lower absolute level – especially in the year under review.

We are now going to present individual assessments of the segments covered here.

5.1 SMC and BMC

The production of SMC (sheet moulding compound) and BMC (bulk moulding compound) components is the largest market segment in the thermoset GRP industry, with a processing volume of 268,000 tonnes. The semifinished products and moulding compounds are processed using press-moulding and injection-moulding processes.

SMC and BMC are mainly used in the field of (large-scale) series production. Both materials have been successfully established in electrical and electronics and in the transport sector for many years. Together, these two application segments account for an estimated 90% of the market volume, with transport accounting for over 60% of the total.

Typical applications are headlight systems, lamp housings, control cabinets, casings and exterior components in commercial vehicles, cars and public transport vehicles.

The decline in the SMC and BMC segment was 3.6% in 2022, while the total market decline in thermosets was 9%. Like thermoplastic systems, this market segment therefore suffered relatively little under the economic downturn in the year under review.

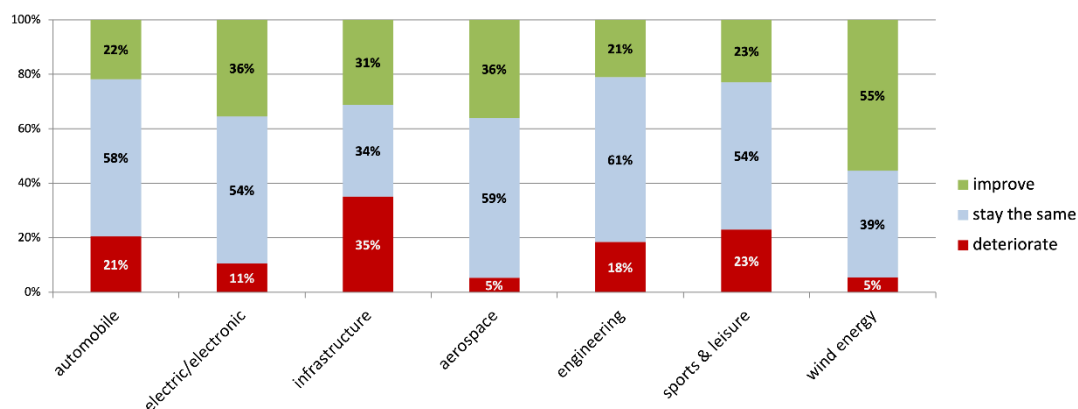
SMC was clearly the bigger of the two market segments with a volume of 190 kilotons (kt). The BMC market volume stood at a total of 78 kt. Both sectors reported declines of a similar magnitude, down 3.6% and 3.7% respectively.

For several years now, the SMC and BMC industry has been working on numerous innovative products and product developments. They include, in particular high-performance SMCs (carbon fibre-reinforced SMCs) as well as continuous fibre-reinforced SMCs and natural fibre-reinforced SMCs. Above all, SMC and BMC have major opportunities as a result of strong growth in e-mobility, for example in battery housings and covers and in the charging infrastructure. As well as their excellent general material properties, it is of great benefit that they are already associated with existing large-scale series production in the automotive industry.

5.2 NCF – non-crimp fabrics

Over the last few years, this segment experienced above-average growth. Whereas, in 2011, the market level was still 220 kilotons, it reached 302 kilotons in 2021. In 2022, the market contracted sharply by 15.6%, down to a volume of 255 kt. NCFs are therefore most strongly affected by the downturns that occurred in 2022. The main areas of application were the wind industry and boat and ship building. They were supplemented by various applications in private and public transport, in sports and leisure and in construction and infrastructure.

Generally, despite the current weakness of NCF, we can assume a highly positive development of this market in the future. The main driver will be wind energy. The trade association Composites Germany (www.composites-germany.com) takes member surveys at six-month intervals, asking respondents to provide qualitative assessments of the market. Their expectations on future growth drivers were unequivocal. Respondents in the past Composites Market Survey saw the wind industry as a clear driver for future developments (see Fig. 7).



Source: Composites Germany – Market Survey 2/2022

Figure 7: Composites Germany – Composites Market Survey (2nd half of 2022): Growth drivers of the composites industry

This assessment was underpinned above all by political measures: The German government, for instance, has set itself the aim of doubling electricity from renewable energies by 2030.

Wind power plays a major role in this process. Its recent Wind-on-Land Act, which entered into force on 1 February 2023, is intended to speed up the expansion of Germany's wind energy by a significant margin.³

On the other hand, there are now no longer any manufacturers of rotor blades in Germany.

These self-imposed targets are very high, but implementation of the necessary measures is still lagging behind – quite severely in some cases. “In order to achieve the climate protection targets, the expansion of renewable energies and power grids will need to speed up significantly. By 2030, at least 80% of gross electricity consumption will have to be covered by renewable energies. In 2022, it was 46.2%. So their share will have to almost double within less than ten years. Wind and solar energy will have to expand three times faster than before – on water, on land and on rooftops.”⁴

The massive decline in a market that should in fact be growing significantly as a result of political decisions – growth which would also fuel the composites industry – can be attributed to the current situation, as explained by the lobby group WindEurope. Set against this background, there are several reasons that may slow down growth or even cause a decline in the European wind industry:

Achieving the set goals of Europe's energy policy therefore requires massive investments in new and existing industrial production capacities and in the entire supply chain, ranging from installation vessels, cranes and ports to research, innovation, grids and skilled labour. Yet the wind power supply chain does not have the money to invest on the necessary scale. Europe's five wind turbine manufacturers are still operating at a loss.

The more ambitious targets for renewable energies are not yet reflected in orders for wind turbines: The EU is building wind farms only half as fast as would be necessary

³ <https://www.bundesregierung.de/breg-de/themen/klimaschutz/wind-an-land-gesetz-2052764>

⁴ <https://www.bundesregierung.de/breg-de/themen/klimaschutz/energiewende-beschleunigen-2040310>

to achieve the REPowerEU targets. The main problem continues to be bottlenecks caused by red tape, and 80 gigawatts of wind projects are currently stuck in approval procedures. In addition, the turbines themselves have become more expensive due to rising raw material prices – added costs that cannot be absorbed for the time being.

Poorly conceived tendering seems to be another stumbling block. Government tenders for new wind farms are almost exclusively focused on prices, a development that has caused a race to the bottom. Some countries even allow negative bids, where developers have to pay for the right to build wind farms. Chinese manufacturers, for example, are now starting to undercut European manufacturers on costs and are gaining contracts in Europe.

2022 was also marked by major insecurities about revenues from renewable energies. Government intervention in electricity markets in 2022 had an erosive impact on investor confidence while also affecting the flow of revenues for wind energy projects. Investments in wind energy declined last year, with almost no final investment decisions for offshore wind farms. Compared with 2021, new wind turbine orders decreased by 47%.⁵

The wind industry – and with it, NCFs – will need to make appreciable gains if it wants to achieve the self-imposed goals. In fact, they are the ones that can offer future growth guarantees to the European composites market. However, this will only be true for as long as markets can be served from Europe and secure supply chains can be installed.

5.3 Open mould processes

Open mould processes – i.e. hand lay-up and fibre spray-up – remained one of the largest segments in the GRP market in Europe, with a production volume of 205 kilo-

⁵ <https://windeurope.org/newsroom/news/europe-must-boost-the-competitiveness-of-its-wind-supply-chain/>

tons. In 2022, however, this market segment also declined significantly, by 11.6% in all.

Over many years, the proportion of open mould processes in the total market steadily declined. During the Covid pandemic, however, there were certain special applications that caused a significant demand. Due to lockdown and the resulting travel restrictions, pool construction, for example, developed highly positively in many instances, and numerous private households were correspondingly eager to invest. However, this exceptionally positive effect seemed to be losing momentum in the year under review, and the general trend continued whereby open mould processes steadily lost market shares. Whereas, in 2011, the market share of open mould processes was still 20%, it dropped to 15.3% in the year under review. In absolute terms, the production volume declined from 258 kt to 205 kt within the same period.

Generally, open mould processes are still set to make a substantial contribution to the GRP production volume over the coming years. Due to their low investment costs, such processes are particularly in demand for made-to-order or piece production and small batch sizes. Also, when it comes to manufacturing large components and products with a high degree of complexity, fibre spray-up and hand lay-up are still considered to be highly suited as the most original forms of GRP processing.

However, production in Europe is getting more and more difficult and costly due to the ongoing and still increasing intensification of legal restrictions on the processing of unsaturated polyesters and styrene, in particular, and also due to new limits on other basic materials. In addition to stricter legal parameters, which sometimes require costly redevelopments and conversions of production facilities, the industry reported that it was finding it increasingly difficult to recruit suitable, well-trained workers during the year under review. This issue complicated production even further.

5.4 RTM

The RTM segment (resin transfer moulding) in this report covers all processes where resin is either infused or injected into an enclosed cavity. As well as a variety of injection methods (HP RTM, P RTM, RTM Light, etc.), it also includes infusion methods. However, it does not include RTM processes that involve the above-mentioned NCFs.

In recent years, we have seen the development of many different variations of RTM processes. What they all have in common is the use of dry or semifinished fibres. The coated moulding tool is then either sealed or enclosed. (Apart from suitable fibre products, it is also possible to use, for instance, core materials.) The resin flows through the cavity in the enclosed mould, aided by pressure or a vacuum or both. This involves permeating and/or flowing around the fibres and the relevant additional finished or semifinished products.

After a period when RTM processes continued to develop steadily, this was another area where European production volumes dropped, with a 5.8% reduction, down to a total of 130 kt. Overall, despite increases in absolute terms, the market share has noticeably remained almost the same over the past few years (see Fig. 8).

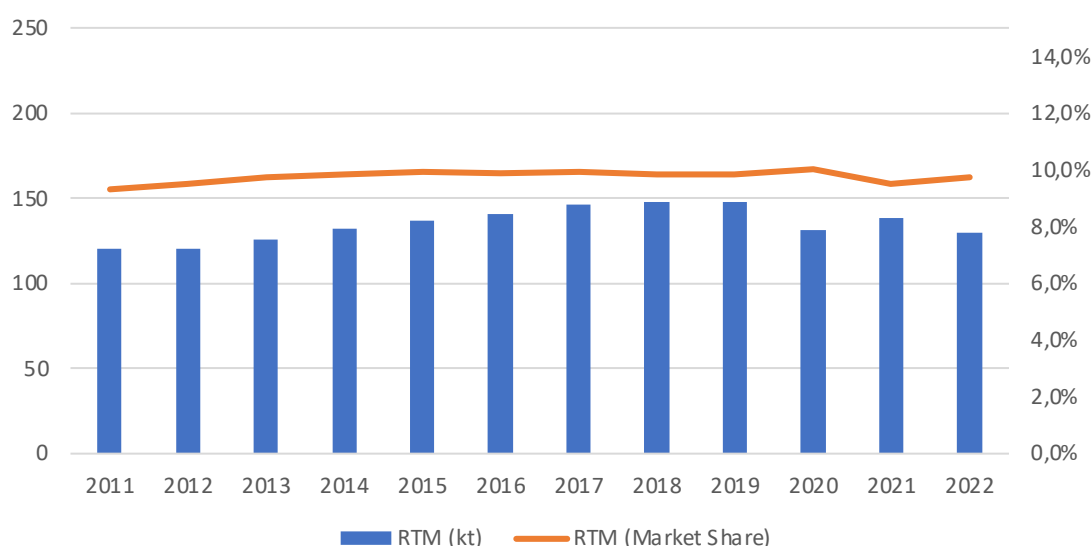


Figure 8: Market developments of RTM processes (in kt)

The production spectrum of this technology is very broad, and there are numerous different processing options. It is possible to produce any number of items, ranging from small batches to fairly large series, and it is also possible to produce different component sizes, ranging from small to large. Furthermore, there is the option of using a variety of different fibre and matrix systems. Typically, suitable preforms are also used.

The areas of application are therefore correspondingly broad, comprising vehicle construction, public transport, boat and ship building, sports and leisure as well as aviation.

Due to the process specifics, RTM is also ideally suited for the production of high-stress components. After RTM technology was often considered the process of choice in the early 2010s – even in large-scale automotive production – today’s research is currently focusing on different processes. In large-scale manufacturing, preference is currently given to thermoplastic processes, in particular.

5.5 Continuous processes

2022 saw an 8.1% downturn in the production volume of GRP components using continuous processes (i.e. pultrusion and the production of flat panels). In total, the production volume of pultrusion declined by 7.1%, down to a volume of 52 kt. In the case of flat panels, the decline was 8.7%, down to a volume of 84 kt.

For many years, panels have been made primarily for vehicles, e.g. for truck side panels, for caravan bodies and in the conversion of commercial vehicles. It also has its applications in façade construction. Like pool construction, the caravan industry has also benefited from an exceptional market environment since the Covid pandemic. The ECF (European Caravan Federation) comments: “Caravanning is all the rage across Europe, and the high demand for leisure vehicles is leading to nicely filled order books in this industry. The European market for new leisure vehicles, however, recorded a 16.1% downturn compared with the industry record of 2021. An overall total of 218,301 newly registered motorhomes and caravans was the third best figure in history.

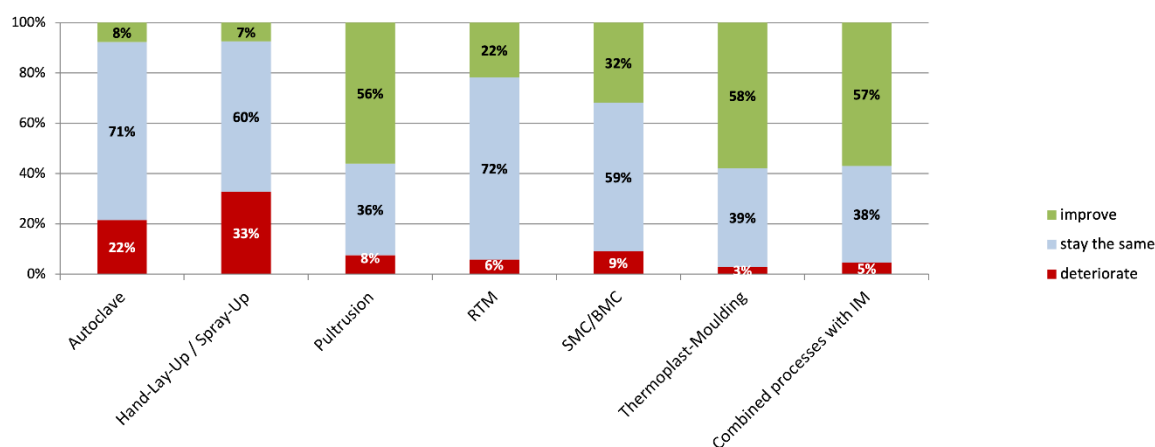
The main reasons (...) were supply chain bottlenecks and Covid-related staff shortages at European manufacturers. As a result, the demand for vehicles clearly exceeded the available supply in Europe.”⁶

⁶ <https://www.civd.de/news/insgesamt-ueber-218-000-neue-reisemobile-und-caravans-in-europa-zugelassen/>

Another market that proved to be difficult in 2022 was the commercial vehicle market. According to the ACEA, “(...) the EU commercial vehicle market contracted by 14.6% to 1.6 million units in 2022, with volumes falling below those of the 2020 pandemic year (1.7 million units). This was primarily due to ongoing supply chain issues hampering vehicle availability throughout the year.” The overall performance of the region was not helped by the four main markets which all recorded declines in double-digit percentages: France (-17.7%), Spain (-16.7%), Germany (-11.0%) and Italy (-10.5%).⁷

Continuous sections are made with the help of pultrusion. Like SMC/BMC and thermoplastic technologies, pultrusion is often considered to be extremely promising because of its specific process characteristics. This was also reflected in the above-mentioned survey by Composites Germany and the Composites Index.

When asked to rate the developments of specific processing methods, over half of all respondents said they expected pultrusion processes to do well (see Fig. 9).



Source: Composites Germany - Composites Market Survey 2/2022 - 100% missing data resulting from rounding inaccuracies

Figure 9: Composites Germany – Composites Market Survey (2nd half of 2022): Developments of the processing methods

⁷ <https://www.acea.auto/cv-registrations/commercial-vehicle-registrations-14-6-in-2022-5-1-in-december/>

For some years now, the market that has been seen as a major market with plenty of hope for pultrusion is construction and infrastructure. Here, important areas are, for instance, reinforcement systems in bridge construction and civil engineering, sections for windows, staircases and ladders as well as antennas (with a view to 5G, in particular). In these areas, the crucial features are lightweight construction and a range of further specific material properties. For instance, they allow the transmission of radio waves, they are resistant to corrosion and largely maintenance-free, they permit a design that can withstand or distribute loads and stresses, and they prevent the flow of electricity and heat transfer.

Quite often however, there is still a lack of suitable general permits and regulations or standards that might encourage their use. This insecurity is still making many architects and decision-makers reluctant to use such materials. Furthermore, many decision-makers still know too little about the positive qualities of GRP compared with other building materials.

5.6 Pipes and tanks

The market segment of GRP pipes and tanks, manufactured in centrifugal casting and filament winding processes, declined by 5.1% in the year under review. The 2022 production volume totalled 130 kilotons (kt), with 68 kt filament winding and 62 kt centrifugal casting.

The main areas of application for GRP pipes and tanks were plant construction, public and private pipeline construction and the oil, gas and chemical industries as users.

This segment is currently dominated by a rather small number of large-scale manufacturers whose operational throughput of their material volumes is relatively big for the GRP industry.

GRP pipe/tank and plant construction is a typical area where GRP materials offer numerous benefits, e.g. their excellent resistance to aggressive media such as salting.

In addition, GRPs permit a considerable extension of maintenance intervals and service times. Also, in many areas of application, the load-specific structure presents an enormous advantage.

Both in the pipe sector and especially in tank and plant construction, there is still plenty of room for growth that can be exploited, for example, by further improving the general perception of the materials. Furthermore, there are numerous research activities, especially in filament winding technology. At the moment, for instance, filament winding is applied to hydrogen tanks, using carbon fibres. This method ensures that a tank can withstand a pressure of several 100 bars while at the same time being very lightweight. This shows that there are also highly attractive potential areas of application elsewhere, e.g. in automotive engineering, although they do not yet represent a significant market share today.

5.7 LFT, GMT and CFRTP

In the following overview, we will look at short fibre-reinforced plastics separately from long and continuous fibre-reinforced thermoplastics (LFT, GMT and CFRTP). The latter group poses similar issues in terms of material properties, areas of application and, to some extent, processing as the issues of long and continuous fibre-reinforced thermosets.

Materials with short fibre reinforcements (less than 2 mm of fibre length) differ from LFTs, GMTs and CFRTPs in their impact on material properties and (load-specific) structures.

The following illustration provides an overview of the development of this market segment.

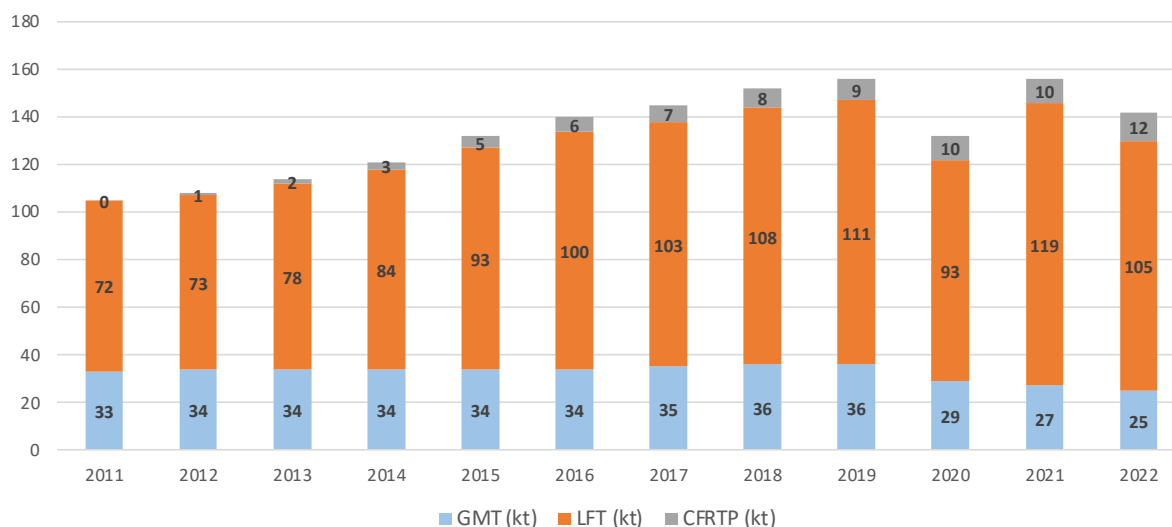


Figure 10: Market developments of LFT, GMT and CFRTP (in kt)

In 2022, LFT (long fibre-reinforced thermoplastics) lost a total of 11.8% reaching a production volume of 105,000 tonnes. CFRTPs (continuous fibre-reinforced thermoplastics) continued to be a niche product, but was the only segment in the general overview that showed any growth. In all, the market rose from 10 kt to 12 kt. This was due to several major stand-alone projects for OEMs in the automotive sector.

This market segment, in particular, was very much dependent on the transport sector. Nearly the entire volume recorded here was probably went into the transport sector. From the industry’s perspective, the increase in CFRTP was therefore all the more encouraging, considering its very difficult market environment (see also the chapter on thermoplastic materials).

5.8 Short fibre-reinforced thermoplastics

Although – as mentioned earlier – short fibre-reinforced materials have some very different material properties compared with long and continuous fibre-reinforced systems, this important group of materials still counts as composites. One reason, in particular, is that it is a fibre-reinforced plastic.

The glass fibres within the material are usually less than 2 mm in length. Yet they significantly increase the number of properties compared with non-reinforced materials. One benefit, in particular, is a positive impact on the elastic modulus or stiffness

of the materials. Moreover, the longer the fibres, the greater their firmness and impact resistance.

The European market for thermoplastic short fibre-reinforced materials declined by 4% in 2022, while the production level dropped to 1,444 kilotons (source: AMAC).

Nevertheless, short glass fibre-reinforced thermoplastics continued to be by far the largest single segment in the composites industry. Despite a very strong year in 2021, production levels dropped back to pre-Covid again (see Fig. 11).

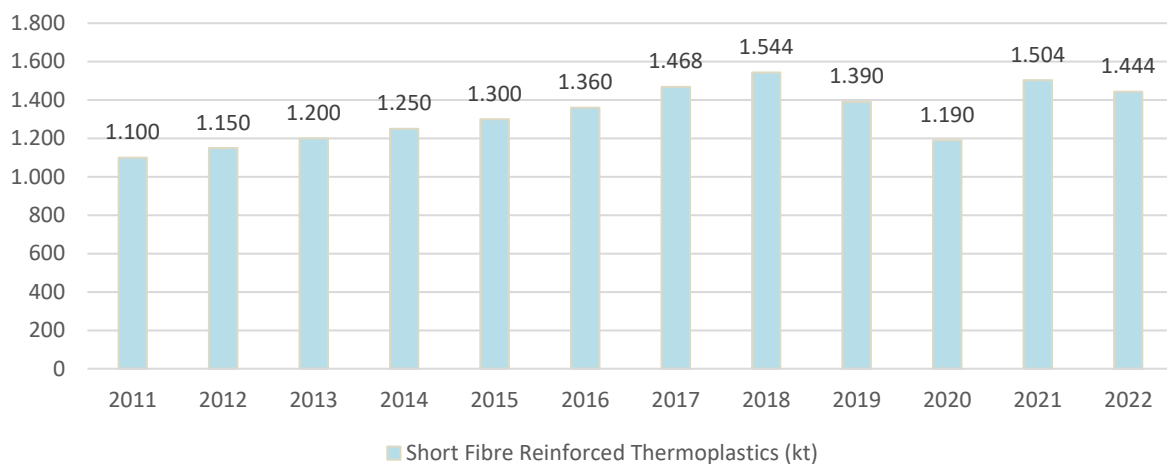


Figure 11: Market development of short fibre reinforced plastics (in kt)

In terms of materials, the market described here was dominated by polyamide (PA), while the second largest group was polypropylene (PP). Together, the two material systems accounted for over 80% of the resin systems in use. A different picture emerges in the above-mentioned area of LFT where the proportion of PP was 95%.

Applications could be found primarily in the automotive sector, but also in the electrical and electronics sector. LFT plays a lesser role in construction, infrastructure or sports and leisure.

Overall, as highlighted above, this significant decline was most likely a result of ongoing issues in the private and commercial vehicle sectors. The lowest registration figures in Europe for 30 years were of course bound to lead to a decline in the volume of composites, with their high dependence on this segment.

6 Regional market developments

Below, we are going to provide an analysis of the regional market distribution in Europe: Unlike in previous years, we added NCFs to the figures as a major product group, so that any analysis over a long period of time is only possible to a limited extent. Nevertheless, there are some clear parallels with the preceding surveys. Even though the absolute figures are now higher, due to a larger number of underlying data, there have been no significant changes in the rankings of the different markets.

The underlying data covers all long and continuous fibre-reinforced thermoset materials. Thermoplastics are not included in the regional analysis, as there is currently no regional breakdown of these quantities of materials.

The percentage distribution by regional core areas has hardly changed at all between 2021 and 2022. The German thermoset market reached a volume of 222 kt in 2022. As in previous surveys, Germany was the largest market within the regions covered in the period under review, representing 19.5% (see Fig. 12).

Second place was taken by the Eastern European countries with a market share of 18.8% and a volume of 214 kt. This region comprises the following countries: Poland, Czech Republic, Hungary, Romania, Serbia, Croatia, Macedonia, Latvia, Lithuania, Slovakia and Slovenia.

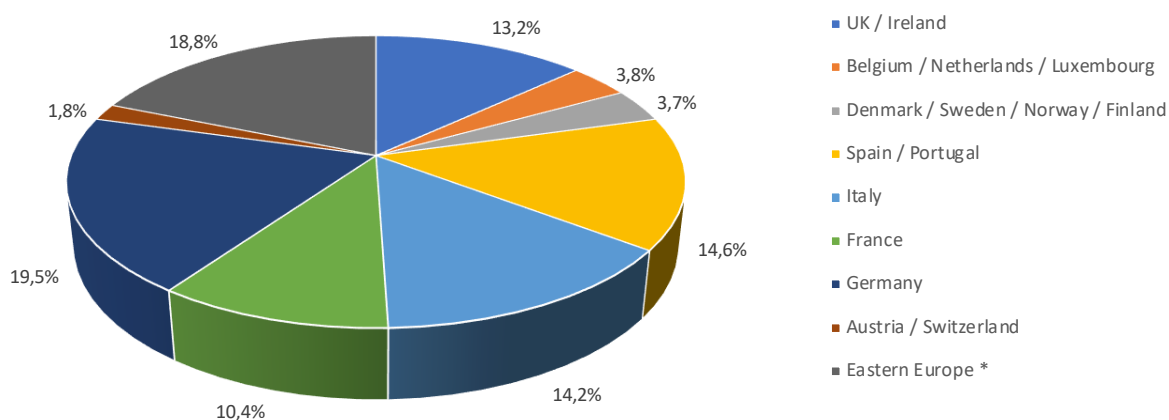


Figure 12: Regional distribution of the European thermoset market

The reason why these countries have been combined into such a large group is that the individual volumes and material flows cannot always be assigned to a specific country very consistently or clearly. Spain and Portugal formed the third largest group, with a processing volume of 166 kt and a market share of 14.6%. Italy followed closely behind Spain and Portugal, with a market share of 14.2% and a composites processing volume of 162 kt. Taken together, the four regions represented two thirds of the European composites market.

The second biggest processing region within Europe was the UK and Ireland with a market share of 13.2% and a volume of 150 kt. France was a long way behind, with a market share of 10.4% and a production volume of 118 kt.

The remaining three, rather small processing regions, were led by the Benelux countries, where the 2022 production volume was 43 kt and the overall share in Europe was 3.8%. The volume in the Nordic countries (Denmark, Sweden, Norway and Finland) was only marginally smaller, with 42 kt of composites and a 3.7% share of the general European thermosetting market. The lowest percentage and thus also the smallest volume was produced in Austria and Switzerland, where the thermoset total in 2022 was 21 kt and the overall market share amounted to 1.8%.

In addition to this purely volume-based perspective, it must always be borne in mind that nearly all regions had very different areas of emphasis in their composites industries. As a result, each country or region was often affected by macro-economic developments in a completely different way. A pan-European view can therefore only ever provide a rough indication of the development and can only give us an idea of basic, general developments. When we take a detailed look at each country with its specific core markets and primary applications, we can often see that their developments differ substantially. 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 only play a subordinate role, and the dominant areas are automotive applications and the electrical and electronics industries. In Scandinavia, on the other hand, Norway and Sweden are dominated by applications in the oil and gas industries.

For a number of years, we have presented the figures of the Turkish composites market at this point. As the underlying data material is not very large, we will continue to show these figures separately here. The Turkish trade association reported a total volume of 330 kt for 2022 and thus a 10% increase compared with the 2021 market volume of 300 kt. This would make Turkey by far the largest single market in Europe, with significant above-average growth. As in previous years, it can be assumed that about half of the production volume is used in the construction sector and in the production of pipes and tanks. The automotive and transport sector accounts for about one third of the production volume. The third biggest area of application is the wind industry.

7 Other composite materials: CRP and NFRP

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

The CRP market volume developed highly dynamically in 2022, achieving 9.6% growth compared with 2021. The overall volume in Europe rose to 57,000 tonnes.

No new information is currently available for NRP. According to an AVK survey conducted in this particular composite segment in 2020, this market is dominated by the use of thermoplastics, although thermosets also play a role. Unfortunately, there is no current data on the exact processing volume.

The largest area of application is the automotive sector, followed by the consumer goods industry. The most frequent materials that are processed are flax, hemp, jute and kenaf. On the processing side, manufacturing is dominated by compression moulding, alongside injection moulding and extrusion. Where regions are concerned, the dominant producers are Germany, France and several Eastern European countries (Poland, Czech Republic and Slovenia).

Natural fibre-reinforced plastics are mostly used because of their special material properties (low weight, low cost, sound insulation and good mechanical properties).

However, they can also help towards a positive impact on the lifecycle assessment of a product. In this area, in particular, we can see numerous opportunities for future market developments.

8 Outlook

The future is looking bright for composites.

How will the composites market develop in the medium and long term? This has always been a difficult question, and quantitative forecasts have been and still are associated with enormous uncertainty. Over the last few years, markets have been changing at an increasingly rapid pace.

The two central areas of application for composites are construction and infrastructure, on the one hand, and transport, on the other. Both areas also have a major impact on the wider economy, which – due to the interdependencies mentioned above – often develops in parallel. This wider economy has been and is still being shaken by several severe crises. In particular, it has been weakened by the Covid pandemic and other negative factors such as the war in Ukraine – factors which are continuing to cause major potential insecurities. The Institute of the German Economy (IW) summarises the development as follows:

“The German economy has been in crisis mode for almost three years. Had it not been for the pandemic and the war, the overall added value in Germany would have been €420 billion higher between 2020 and 2022. (...) First, consumer spending was prevented by lockdowns, then the world’s supply chains began to falter, and for some months now households and companies have been forced to contend with horrendous energy prices. In the meantime, high economic costs have piled up in Germany. (...) In 2020 alone – the first year of the crisis – losses amounted to €175 billion. The first lockdown saw the closure of the retail trade as well as restaurants and cafés, while the German economy was weighed down heavily by major uncertainties, as a vaccine was still a long way off. In 2021, households, companies and industry as a whole were hit by global supply bottlenecks, resulting in losses of €125 billion. As the vaccination campaign progressed, the first quarter of 2022 saw an economic recov-

ery, but this soon came to an abrupt halt with Russia's attack on Ukraine. High energy prices and ongoing supply chain disruptions caused a loss of purchasing power and lower consumer confidence among Germans.

In total, the cost of the pandemic and the war in 2022 is likely to have been €120 billion.”⁸

The manufacturing sector, which includes the production of composite components, has traditionally been more important in Germany than in the other large economies of the EU. In 2021, Germany's manufacturing sector generated 20.2% of the total gross value added. Among the 27 countries of the EU as a whole, this figure was 16.6%,⁹ and we can see that Germany's economy was particularly dependent on industry. Looking at these indicators, it should be a legitimate question to ask whether German industry can still be saved.

We cannot currently provide any reliable quantitative forecast of the development of production volumes in composites within the various regions and manufacturing sectors. Below, however, we will look at some key economic factors that should provide some insight into developments and potential forecasts for the future.

One key indicator for assessing the situation from a manufacturer's perspective is the Producer Price Index, which measures the price changes of commercial products (...) manufactured and sold within a given country. It illustrates the magnitude of price increases in recent years (see Fig. 13).

⁸ <https://www.iwkoeln.de/presse/pressemitteilungen/michael-groemling-krieg-und-pandemie-kosten-420-milliarden-euro.html#:~:text=Hohe%20Energiepreise%20und%20die%20weiterhin,voraussichtlich%20auf%20120%20Milliarden%20Euro.>

⁹ <https://www.destatis.de/Europa/DE/Thema/Industrie-Handel-Dienstleistung-Industrie.html#:~:text=Im%20EU%20%2DDurchschnitt%20entfielen%20rund,Daten%20in%20der%20Eurostat%20Datenbank.>

Erzeugerpreise

Index der Erzeugerpreise gewerblicher Produkte, Inlandsabsatz, Originalwerte, 2015=100

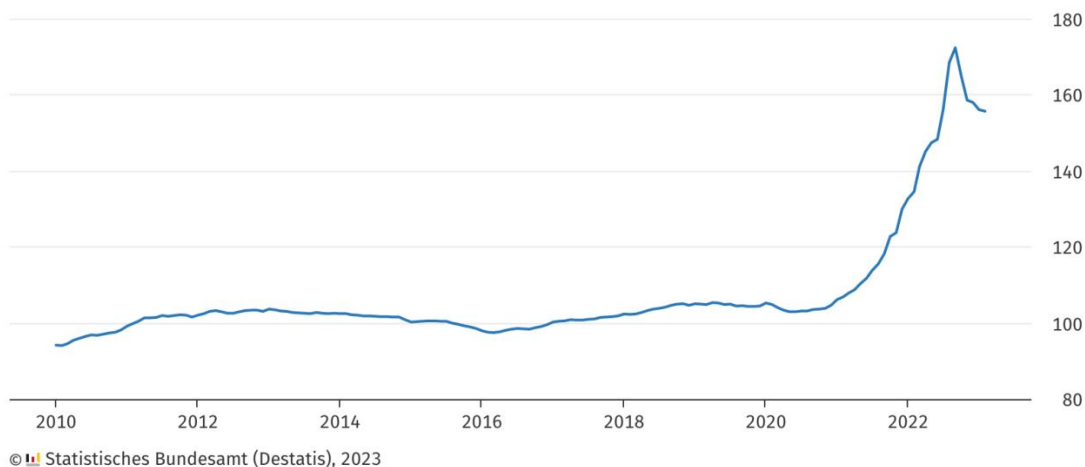


Figure 13: Producer price index of industrial products (source: Destatis)

A detailed analysis of contributing factors shows that the main driver of the enormous increase has been, above all, a substantial rise in energy prices (see Fig. 14).

Erzeugerpreisindizes gewerblicher Produkte

2015 = 100

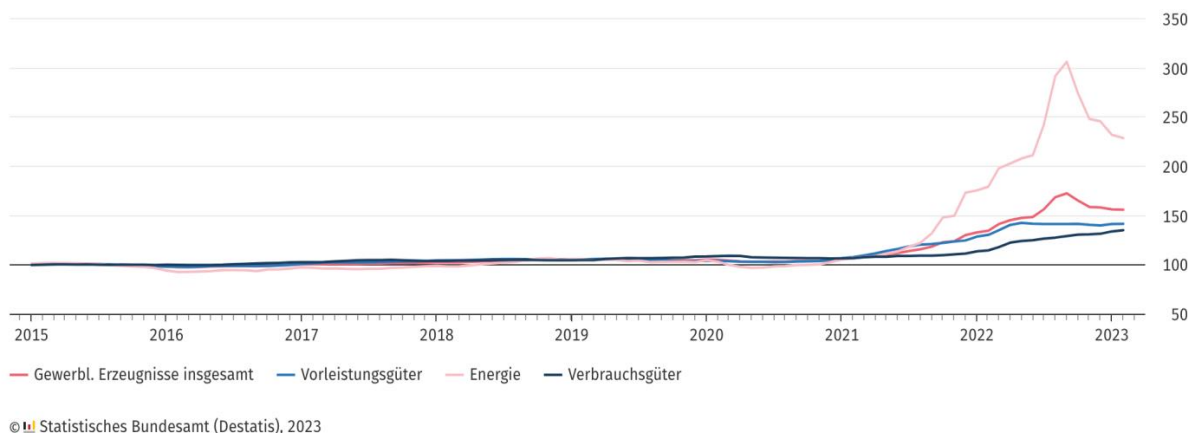


Figure 14: Producer price index of industrial products – details (source: Destatis)

The massive rise in the cost of production in the most important European national economies seems to have stopped for the time being, and the relevant indicators are currently beginning to come down.

However, the resulting price reductions – measured in terms of short-term purchase values on the stock exchanges – might still be significantly lower. Between July and September 2022, the price of spot market electricity more than doubled on the power

exchange. On the day-ahead market, prices peaked at nearly 59 eurocents per kWh. Since then, they have fallen sharply again and after a low point at the beginning of the year (10 eurocents per kWh), they are currently at around 14 eurocents per kWh. At present, however, these decreases are not yet being passed on to industrial or private customers, on the grounds that purchase prices are partly subject to extreme fluctuations. This is an area where the future still holds plenty of potential for price drops.

In addition to manufacturing costs, another extremely important element in the highly internationalised composites market is the cost of logistics. Here, too, some of the costs have fallen sharply. After increasing almost tenfold during 2021, container freight rates have now returned to pre-crisis levels (see Fig. 15).

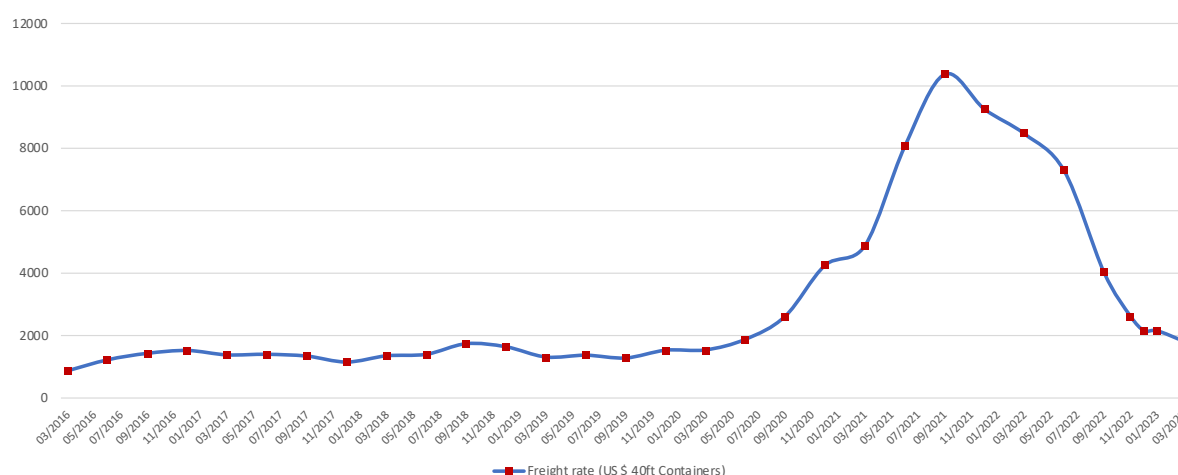


Figure 15: World container index (assessed by Drewry) – own presentation

This is partly caused by overcapacities of shipping companies, which mainly accrued during the Covid pandemic and as a result of high prices, and partly also to a slow-down in the global economy which, in turn, is having a negative impact on the industry. However, the cost of road transport is currently still very high due to numerous factors, such as a shortage of drivers and high fuel prices.

Despite the latent danger of a global recession, the above indicators currently suggest that markets are calming down. For example, the GfK Consumer Climate Index, which measures the level of income and consumer confidence for the next 12

months, has edged up a little in recent months, after its historic low in October 2022 (-42.8 points), so that it is now at -30.5 points.

For the composites industry, the two most important purchasers are the transport sector and the infrastructure and construction sector. Taken together, these two areas account for more than 70% of the market volume. However, developments in these core markets were very different.

We already mentioned the sharp drop in new car and commercial vehicle registrations in 2022, resulting in the lowest value for 30 years. Nevertheless, OEM profits were high, and many German manufacturers, in particular, succeeded in making record profits. This is where we can see OEMs moving away from volume models and opting for more profitable mid-range and premium segments. The rather low production figures do of course mean that the composite segment, too, is under pressure. It remains to be hoped that the high profits will provide enough of an impetus and motivation for the impending structural changes aiming at new drive concepts and that they will support this important market segment, so that it becomes fit for the future – also in the face of international competition.

The construction sector, as the second largest application segment, proved to be largely robust during the crisis, although there has been a slight decline in construction activity in recent months (see Fig. 16).

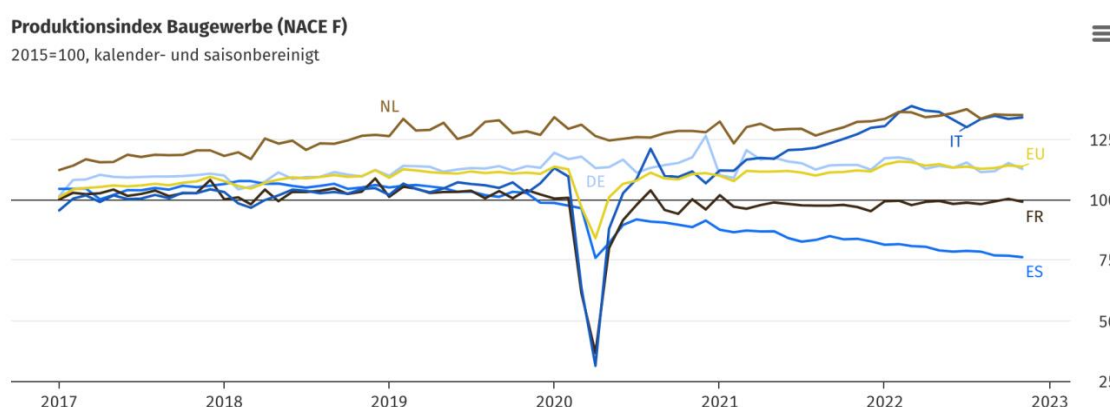


Figure 146: Construction industry production index (source: Federal Statistical Office, Destatis) 2023

As planning and implementation processes are often long-term, the construction and infrastructure sector generally reacts far more slowly to macro-economic develop-

ments than many segments in the transport sector, which is why fluctuations tend to be medium-term in nature.

Another reason for optimism is the employment situation, which also has a significant impact on private consumer spendings. In early 2023, the average unemployment rate in the EU was lower than it had been for many years (see Fig. 17). However, it should not be overlooked that, especially during the Covid pandemic, this level could only be maintained through state intervention, for example in the form of a short-time work allowance. Another widespread issue is youth unemployment, which is currently at 15% in the 27 EU member states. This is clearly an area where significantly more countermeasures are needed.

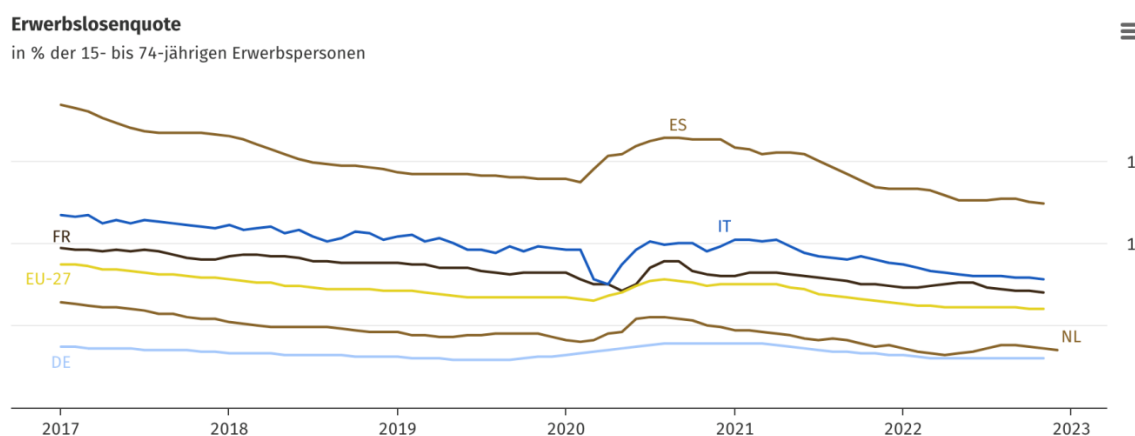
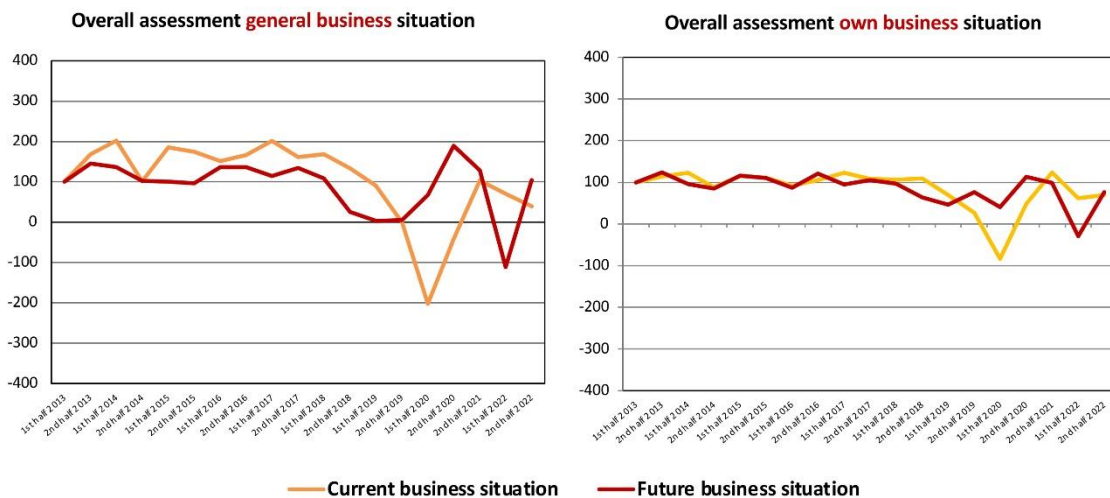


Figure 17: Unemployment rate in the EU (source: Federal Statistical Office, Destatis) 2023

Despite the challenges mentioned above, composites are set up for success in the future. There is much to suggest that the fundamentally positive developments of the last few years will continue. In the medium term, structural changes in the transport sector will open up numerous opportunities for composites to gain a new foothold in new applications. Major opportunities can also be seen in construction and infrastructure, an area where composites offer enormous hope due to their unique level of properties that predestine them for long-term use. The main assets of these materials in terms of application are clearly their durability, their almost maintenance-free use, their potential for use in lightweight construction and their frequently positive impact on sustainability.

This is also the view of the composites industry itself. To compile the Composites Index at six-month intervals, Composites Germany takes a survey among all member companies of the umbrella organisations of Composites Germany (AVK, Composites United and the associate partner VDMA), asking each of them to provide a qualitative assessment of the market. Whereas companies are currently taking a critical view of today's economic situation, their expectations for the future are clearly becoming more positive.



Note: The Composites Index 1st half 2021 could not be generated due to a data breach! – index: 1.half 2013= 100

Figure 18: Composites development index 02/2022 (source: Composites Germany)