

MARKET REPORT 2023

THE GLOBAL MARKET FOR CARBON FIBERS AND CARBON COMPOSITES

Market Developments, Trends,
Forecasts and Challenges

– freely accessible short version –



SHORT
VERSION

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**Contents of the extended version:
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About Composites United e. V.:

Composites United e. V. (CU) is one of the world's largest networks for fiber-based, multi-material lightweight composites. Around 350 members have joined forces to form this powerful industry and research association in order to jointly develop the lightweight construction solutions of the future. Several regional clusters and specialist networks support the association's activities throughout the DACH region, as well as international representative offices in Japan, South Korea, China and India.

The CU was created with effect from January 1, 2019 from the merger of the two existing associations Carbon Composites e. V. and CFK Valley e. V. The CU is based in Berlin, and the association is also represented at locations in Augsburg and Stade, as well as by local representatives at numerous other locations. Further information on the activities of the CU can be found at: www.composites-united.com.

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Ceramic Composites network in 2019. Since then, he has also co-authored this market report.

Important Note: Published short report version

Composites United e. V. expressly points out that this version of the Composites Market Report 2023 is a published shortened version. It can be quoted without restrictions.

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1 General information

Now in its fourteenth edition, the Composites United e. V. (CU) market report - The global market for carbon fibers and carbon composites - has been published annually since 2010 as an overview of current market developments in the field of carbon fibers (CF) and carbon composites (CC).

For this report, information and data were provided by members of the CU or collected by CU employees as well as checked and supplemented with the help of external market data.

The CU expressly points out that the information shown here can never provide a complete overview of the actual market conditions due to the complex and dynamic market development with individually differing data sources. The aim of the CU is to provide an overview of current trends and overarching development directions based on the sources provided. All information is non-binding and without guarantee, so that no claims can be made against the CU, e.g. for use in a commercial sense.

It should also be noted that for direct comparisons with previous versions of the report or external market reports, the framework conditions and any assumptions that apply in the individual case must be considered. In the interests of the best possible comparability, the CU attempts to achieve a uniform and consistent presentation in its publications based on the available data. Although new content is constantly being added, the structure is kept as consistent as possible for this purpose.

The sometimes very dynamic developments in combination with economic and political measures that are difficult to predict in the short term make reliable forecasts even more difficult. This applies to the forecasts shown for specific areas.

Overall, the global CF market environment proved to be very resilient in this reporting year and, following the corresponding distortions of previous reporting years, is once again showing significant growth potential. However, the individual effects of individual framework conditions are extremely complex and are consolidated in this report in an overarching manner.

In this respect, it must be pointed out that the figures, diagrams, and data shown can only represent a possible scenario of further developments. The exact nature of the underlying influencing factors must be continuously monitored. However, it is of course a clear concern of the CU to achieve the most robust information possible based on the given data. We will be happy to assist you with the optimal evaluation, use and interpretation of the data shown, as well as individual factors, at

market.report@composites-united.com

In the interests of better comparability with other market reports and to ensure that the data shown is easier to understand, the two most common growth rates and their calculation are listed below:

Averaged Annual Growth Rate (AAGR) = Arithmetic Mean Return (AMR) = Arithmetic mean of n annual growth rates (AGR):

$$AAGR(t_1, t_n) = \frac{AGR(t_1) + AGR(t_2) + \dots + AGR(t_n)}{n} = \frac{1}{n} \sum_{i=1}^n AGR(t_i)$$

Compound Annual Growth Rate (CAGR) = annual growth rate between n years, assuming constant growth in percentage terms:

$$CAGR(t_1, t_n) = \left(\frac{A(t_n)}{A(t_1)} \right)^{\frac{1}{n}} - 1 \quad \leftrightarrow \quad A(t_n) = A(t_1)(1 + CAGR)^n$$

2 Carbon fiber: Global market overview

2.1 Carbon fiber demand worldwide

In this reporting year 2023, a global average demand for carbon fibers of around 117,500 tons was calculated. For an observation horizon since 2010, this corresponds to an average annual growth rate of +10.26% (CAGR 2010-2023). For a shorter development period over the past five years, this results in a growth rate of +8.68% (CAGR 2019-2023).

In the reporting period, the upturn observed in recent years is continuing, meaning that the current demand figure is close to the upper limit of the estimate range of the forecast in the previous market report (see Figure 1). Various crisis effects continue to have an impact at present, such as the distortion of global trade networks because of political conflicts, supply bottlenecks in the high-tech sector and dynamic fluctuations in the energy market. These have the potential to trigger significant distortions in the CF market environment, even in the short term. Due to the high concentration of CF manufacturers' production facilities at relatively few locations, they are generally exposed to changes in local conditions. At present, however, the trend remains positive. This is also having a supportive effect on the longer-term CAGR growth rates, which have now stabilized at a high level again following the developments around 2020. The predominant assessment is therefore that it is not just catch-up effects because of the past crisis situations, but increasingly real market growth that is responsible for the sustained positive development. However, it should be explicitly pointed out that this is a summary view. Individual developments are possible regarding individual fiber qualities or product groups.

About the prediction of future development, there are various framework conditions that cause a range of fluctuation. Two different scenarios are considered in relation to the further forecast to increase the quality of the forecast and limit the individual scattering variables:

- **Scenario 1** is based on an estimate of demand based on available production volumes. This means that, in simplified terms, it is assumed that all requested fibers can also be produced and, conversely, that all produced fibers are also purchased on the market. In this respect, the expansion situation of the CF manufacturers' production capacity is indirectly reflected here. From the authors' point of view, this assumption is quite suitable for estimating an expected "lower production limit", even if not all requests and offers can always be met. Expansion measures in the CF market environment are long-term and capital-intensive projects, meaning that it is only possible to react to real market demand with a noticeable delay, or that this demand is even assumed in advance. On the other hand, these extended investment periods result in improved traceability and data collection.
- **Scenario 2** is based on continued market development with a constant annual growth rate (CAGR 2010-2023) compared to the base year (2023). Using the shorter observation horizon along CAGR 2019-2023 would result in a slightly lower development in the area highlighted in color (see Figure 1).

Of course, numerous other alternative scenarios are conceivable. However, the selected variants already show prospects that are open to wide interpretation. However, it should be noted that short-term setbacks or upswings in market development are certainly possible because of external stimuli, for example. However, these are not predictable. Therefore, they cannot be reliably presented as part of the above scenarios. Due to the high market concentration of the CF environment, even a change in a single market player

or location can have a significant impact, both positive and negative. In this respect, the two development forecasts shown are by no means to be understood as upper and lower limit lines, but rather represent two independent variants of numerous possible curves, which, however, illustrate quite different assumptions.

In summary, it can therefore be stated that the trend shown in Figure 1 is subject to numerous influencing factors. The determination method chosen here is based on the evaluation of existing production capacities and the associated utilization rates. Compared to direct market demand, this provides a more comprehensive data basis. However, this results in an important assumption that is only intended to outline a possible market situation and should therefore be considered in the assessment. The scenarios used forecast continued positive development. For a more holistic assessment, however, please refer to the explanations in the following chapters, which focus on the expansion capacities of CF manufacturers and the development of product portfolios. These two framework conditions can be regarded as key parameters for the interpretation of investment behavior and for the assessment of any bottlenecks in specific product qualities.

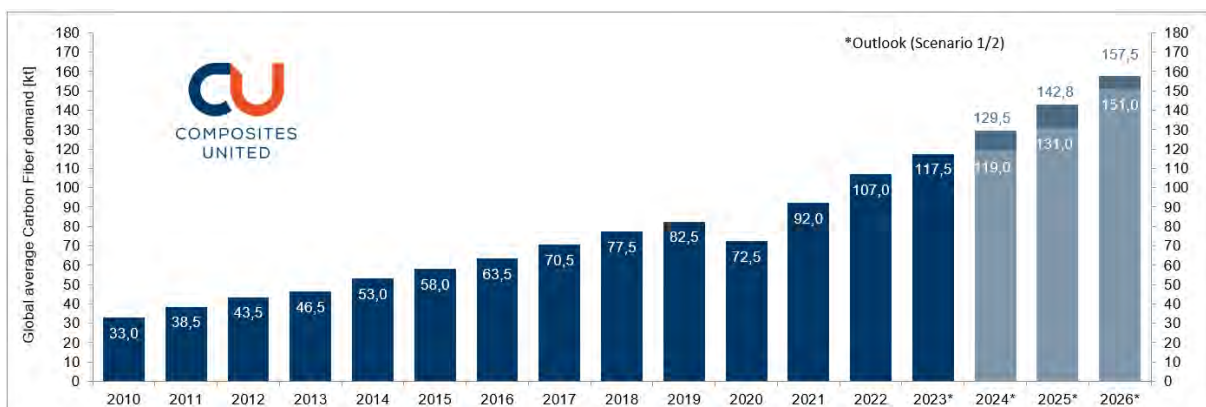


Figure 1: Development of the global average CF demand volume from 2010 to 2026
(*estimates; 03/2024)

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