Composites Market Report 2019

- The global CF- und CC-Market 2019 -

Market developments,
Trends, outlook and
challenges

- published short version –

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1 General introduction

With its actual tenth edition, the annual composites market report – The global CF- and CC-Market 2019 - is published since 2010 by the Carbon Composites e.V. providing an overview of current market developments in the area of carbon fibers (CF) and carbon composites (CC).

With 280 members (as of 09/2019), CCeV represents a substantial number of companies, research institutions and other organisations in the CF- and CC- market, with a focus on Germany, Austria and Switzerland.

Shown data was provided by CCeV members or collected by the CCeV as well as verified and complemented with the help of external partners, such as Lucintel, Acmite Industry Experts, Visiongain, and Grand View Research.

About the CCeV

Carbon Composites e.V. is a network of companies and research institutes that covers the entire value chain of high-performance fiber composites. CCeV links research and industry in Germany, Austria and Switzerland and regards itself as a competence network to promote the application of fiber-reinforced composites. CCeVs activities are focused on the product group “Marketable Composite structures”.

CCeV expressly points out that the information presented here can never provide a complete overview due to the complex and dynamic market development with individually different data sources. However, it is CCeV's aim to provide the most detailed possible impression of current market conditions by collecting its own data and by reviewing and supplementing this data in cooperation with CCeV members and external market data.

2 Explanation of terms

In order to enable a better comparability with other market reports and to assure a higher plausibility of the shown information, the two most common growth rates and their calculations are used as shown below:

- **Averaged Annual Growth Rate (AAGR)** = Arithmetic Mean Return (AMR) = Arithmetic average from n annual growth rates (AGR):

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

- **Compound Annual Growth Rate (CAGR)** = annual growth rate over n years assuming a proportionally constant growth:

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

In this report, growth rates are calculated exclusively on the basis of CAGR, since it better replicated the exponential growth prospects occurring under constant market growth rates.

3 The global CF- and CC-Market (Published short version)

The present version represents the published abridged version of the market report. For further information on the extended long version as well as detailed technical information on the various chapters and illustrations, please contact CCeV at

https://www.carbon-composites.eu/en/industry-sectors/general/cfk-market-analysis/

3.1 Global CF production capacity by manufacturer

Figure 1 shows the theoretical annual production capacity (name plate capacity) of the world's leading carbon fiber manufacturers, which at today's level is approximately 150.9 kt/a. Compared to the previous year, new production capacity of approx. 1.6 kt/a was built. This corresponds to a growth of approx. 1.1 %. In addition to the expansion programs already implemented, further expansion measures were announced for the coming years. These are further subdivided into short-term growth (until 2021) and medium- and long-term growth (later than 2022) in Figure 1. On this basis, a further increase of approx. 14.6 kt/a (+9.7 %) over current capacity can be expected for the short-term horizon. An additional 44.1 kt/a (+29.2 % compared to 2019) has already been announced in the medium to long term. It should be noted here that for this assessment, as in Figure 1, the very large announcements of the manufacturers Kangde and Zhongfu-Shenying are only taken into account up to their first stage of expansion. The exact scope of these measures is explained in more detail below. Overall, therefore, the investments made in plant capacity have weakened over the horizon covered by this market report compared with recent years (2017: +4.3%; 2018: +9.4%). The various reasons are examined in more detail in the following chapters and basically include both the tense overall economic situation and natural fluctuations between investment cycles. However, the short-term expansion measures as well as the new ambitious medium- and long-term expansion plans already indicate optimistic expectations of the overall market for the coming years with regard to such investments.

From the comparison with a demand quantity of approx. 84.5 kt (estimation for 2019), a theoretical utilization rate of approx. 56.0 % can be determined. However, it should be noted that the theoretical capacities used do not take into account any restrictions that occur in reality, such as batch changes, rejects and unexpected downtimes.

Over the past reporting years, this theoretical indicator has risen further (2016: 46.5%, 2017: 51.6%, 2018: 51.9%). The continuously strong investment measures of recent years, as well as the expansions announced in the meantime, also in the short term, allow us to generally assume significantly higher utilization rates in real terms. Of course, this also reflects the continuing confidence of CF producers in the future prospects of further growth in the fiber composite market. Such very extensive investment and expansion measures must be initiated at an early stage in order to effectively take advantage of and secure long-term opportunities to secure shares in the concentrated market environment.

For the following individual considerations, it should be noted that the tonnage breakdown shown does not distinguish between the different fiber product groups (e.g. small tow/heavy tow). In the case of carbon fibers in particular, there is a significant correlation between the fiber product group, throughput and the resulting price structure. Even though most manufacturers now offer a wide range of horizontally diversified product groups, they usually still have individual focal points in their portfolios. Therefore, no direct conclusions can be drawn from the shown breakdowns by tonnage with regard to a market distribution by turnover.

In the year under review, the world market leader Toray made an effort to further underpin its leadership position. To this end, the capacity for regular-tow products (up to 24K) in the USA was increased by a further 2 kt/a. This means that the Group now has a total capacity of approx. 49.5 kt/a, which corresponds to around 32.8% of global production capacity. Toray has thus been able to steadily expand its position since 2016 (approx. 31.2%). In addition, the Zoltek plants in Nyergesújfalu (Hungary) and Jalisco (Mexico) for the large-tow products (50K) there are to be expanded to a total of 25 kt/a within 2020, which corresponds to an additional increase of 4.6 kt/a and an announced total capacity of 54.1 kt/a respectively. Toray is now equally well represented in both product groups and reaches customers across all application areas.

CF-producers SGL Carbon and Mitsubishi Chemical Carbon Fiber and Composites (MCCFC) rank second and third by a wide spacing. Since both manufacturers have completed major expansion programs in recent years, no further announcements regarding new production capacities are currently announced. Both companies are currently focusing on expanding their vertical and horizontal value chains. The acquisitions and investments made in recent years will be integrated into the existing company

structures and integrated into the product portfolios and associated research and development activities.

A change in these podium positions can be expected in the near future, as the companies directly following Teijin and Hexcel are already implementing the necessary expansion measures. Teijin is in the midst of the construction phase for a new site in Greenwood (South Carolina, USA) valued at approx. 600 million US$, which corresponds to an additional capacity of approx. 6 kt/a from a todays point of view. South Carolina is increasingly turning out to be an interesting investment target for CF producers, with the result that Toray (Spartanburg) and Solvay (Greenville) have only opened corresponding local sites in recent years, ahead of Teijin.

Hexcel is also already planning further strategic investments on the way to achieving its stated goal of a total capacity of 15 kt/a by 2020. Following the example of the new plant in Roussillon, the focus here is primarily on the development and expansion of co-location plants, i.e. sites that have their own PAN precursor production for internal further processing to CF. The next such measure is a capacity increase for PAN and CF in Decatur (Alabama, USA) with a qualification target until 2020.

The manufacturer Formosa Plastics was generally very cautious with announcements over the past reporting periods and no capacity expansions are currently known for 2019 either. At the end of 2018, however, it was announced that a new joint venture with a focus on the offshore market in Taiwan had been founded against the background of a large-volume framework agreement in the wind energy sector. Formosa Plastics thus follows the predominant strategy of most CF producers to vertically integrate their value chain. The unique position as a local manufacturer now makes a potential capacity increase within the next few years interesting.

Solvay again underlines its strategic focus on CF high-performance products, especially for the aerospace industry. In the meantime, the group of companies has demonstrated extremely extensive internal process know-how and is bundling its activities in vertical technology projects. There are currently no known increases in capacity in the CF area.

The Chinese manufacturer Zhongfu-Shenying, which is a subsidiary of China Composite Group Ltd. (CCG) ultimately belongs to the state-owned China National Building Material Group Corporation (CNBM). After increasing capacity from 4 kt/a to 6 kt/a

(+50%) in 2018, Zhongfu-Shenying is currently the largest CF producer in China. A very large new site has now been announced within the Ganhe Industrial Park in Xining (capital of Qinghai province, China) and the ground-breaking ceremony has already been celebrated. With a planned investment of approx. 5 billion CNY (approx. 700 million US$), 10 kt/a of new CF production capacity, as well as the associated PAN precursor capacities, are to be created in the near future by 2022. In the medium term, an expansion to a total of 20 kt/a CF, as well as associated PAN precursor capacities at the same location is already planned. In comparison to other investments with a similar cost framework, especially since associated PAN lines are also to be created, the announced capacity appears somewhat ambitious, but successful implementation for sure means a new location of significant size.

The also Chinese manufacturer Jiangsu Hengshen Co. Ltd. had only completed a comparatively large expansion last year and has not announced any additional expansion plans so far. At present, the strategic activities are primarily aimed at the aviation industry, including the COMAC programme and the ongoing prepreg certification with Bombardier/Airbus.

The long-standing long-term investment announcement by DowAksa was reaffirmed in the reporting period. After new plants in the USA and Russia had originally been planned, DowAksa announced its inclusion in a "project-based incentive system" offered by the Turkish government by mid-2018. With the help of an investment of approx. US$ 545 million, a total capacity of 13.4 kt/a is to be created at the Yalova site (Turkey) by 2023.

Also for the South Korean manufacturer Hyosung, a long-term successive expansion at the production site Jeonju (province Jeollabuk-do, South Korea) is now beginning, whereby the necessary area is already largely developed. After the exact volume had been unclear for some time, an investment of approx. 1 trillion KRW (approx. US$ 828 million) was announced in order to gradually build up a total of 24 kt/a by 2028. The first associated CF line is already under construction and is scheduled to go into operation in 2020. A major driving force behind this investment is the increasing demand for CF tank containers for hydrogen or natural gas (CNG), with Hyosung playing a leading supplier role. In addition, the partnership with Saudi Aramco, announced in mid-2019, will provide further impetus for new sales markets as well as the aforementioned possibility of additional CF lines in Saudi Arabia.

The Chinese market participant Kangde Group also attracted a great deal of attention. On the basis of an enormous announcement about an investment volume of approx. 50 billion CNY (approx. 7.3 billion US$) at a single CF production site in Rongcheng (Shandong province, China), an enormous area has already been developed. As part of the first expansion stage, two CF lines and numerous infrastructure buildings are currently in parallel construction. In the medium term, the very ambitious target of 66 kt/a has been defined. This would correspond to approx. 44% of today's global plant capacity at a single location and would significantly exceed the current position of the world market leader Toray. Since the announcement of this high target in September 2017, a timeline for completion by 2023 has been mentioned. Initially, the activities also indicated such a very rapid build-up. Since the end of 2018, however, these prospects have been increasingly overshadowed by financial irregularities at the parent company in first instance, as well as initial financing problems and legal disputes, which have now reached a comprehensive scale. The focus of these issues is not on the lightweight construction segment, but on the much larger parent company, which is primarily active in the areas of optical films, laminating films and industrial packaging solutions. This has already led to a change in the management of the parent company. Against the background of these irregularities, the timeline and probably also the total volume of the planned expansion in Rongcheng has become increasingly unrealistic, which is why only the first expansion stage is currently listed for Fig. 1. However, since the overall situation of the Group is currently unclear and difficult to assess, it is important to wait for further developments.

“Other" fiber manufacturers accounted for approx. 12.5 kt/a in the reporting period. This includes many smaller Asian manufacturers such as Kureha Corp., Osaka Gas Chemicals Co. Ltd., Bluestar Fibres Co. Ltd. (a subsidiary of ChemChina) and Sinofibers Technology. In addition, the Russian manufacturer UMATEX (ROSATOM State Corporation; formerly Alabuga-Fibre LLC and Argon LLC; approx. 1.7 kt/a) and the Indian CF producer Reliance Industries (formerly Kemrock Industries and Exports Ltd.; approx. 2.5 kt/a) are included. Especially in the case of UMATEX and Reliance Industries, the support of the influential parent companies and the local unique selling propositions offer very interesting potential for the future.

In summary, this results in a very strong market concentration with a pronounced dominance of a few large manufacturers who were able to further strengthen their position in the past reporting period:

- Top 10: approx. 134,2 kt/a; 88,9% of overall capacity (2018: 88,6%)
- Top 5: approx. 103,9 kt/a; 68,9% of overall capacity (2018: 68,3%)
- Top 3: approx. 78,8 kt/a; ca. 52,2% of overall capacity (2018: 51,4%)

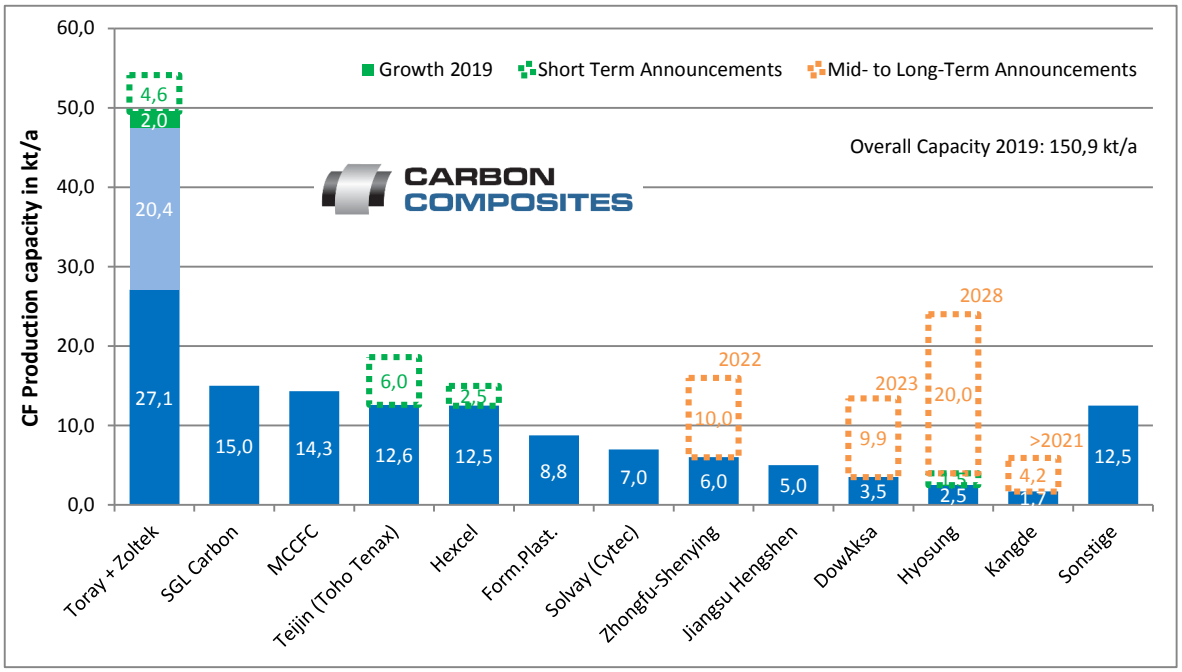

Figure 1: Theoretical, annual CF-production capacity by manufacturer (09/2019).

3.2 Development of the global CFRP-Demand and CFRP-Overall turnover

The CFRP material-class is by far the largest segment within the CC market and will continue to be the relevant growth driver for the industry in the coming years. A global CFRP-Demand of 128.5 kt was determined for 2018. In relation to the previous year, growth of approx. 12.7 % was achieved, with expectations being slightly exceeded. The average annual growth rate (CAGR 2010-2018) is thus 12.24 %. For the year 2019, a global demand for CFRP is currently estimated at approx. 141.5 kt (+10.1%).

Total global CFRP sales in 2018 amount to approx. US$ 16.31 billion, which corresponds to growth of approx. 10.7% and is slightly below the expectations of the previous year's report. This results in a CAGR (2013-2018) of 11.69%. For 2019, a total global CFRP turnover of approx. US$ 17.88 billion (+9.64 %) is currently estimated.

The fundamental development of the CFRP segment is currently still relatively analogous to the CF market, so that after a quite successful year 2018, the initial effects of the tense global economic situation will become visible for the current reporting horizon. Compared to other industry segments, however, the current market environment for CFRP continues to be relatively stable. It remains to be seen how the various framework conditions of the dynamic market environment will impact. The Participation of a large number of different players of all sizes may play an important here, featured by a CFRP market which is significantly less concentrated than the CF market.

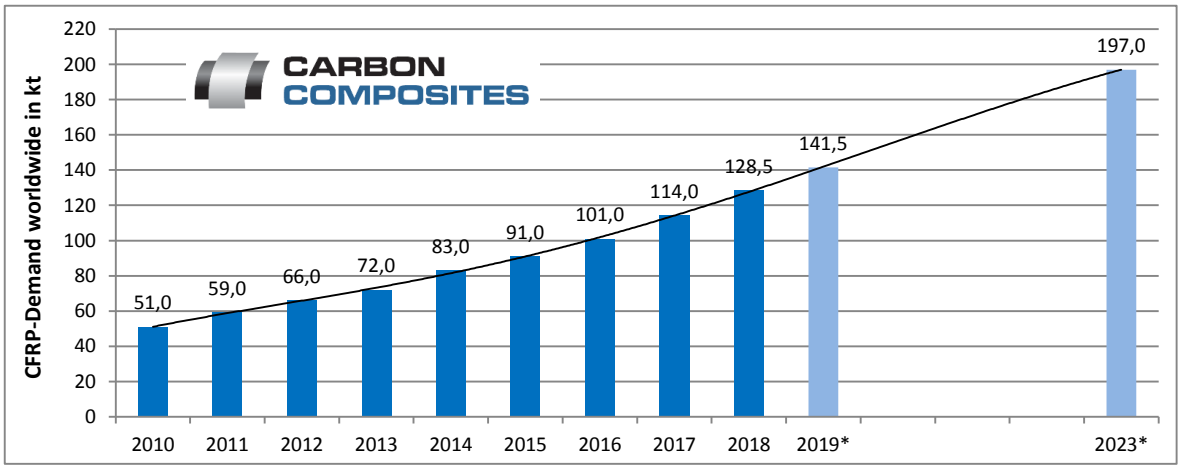

Figure 2: Development of the global CFRP-Demand from 2010 to 2023 (*Estimations; 09/2019).