LUCINTEL INSIGHT
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CARBON FIBER: THE MATERIAL OF FUTURE

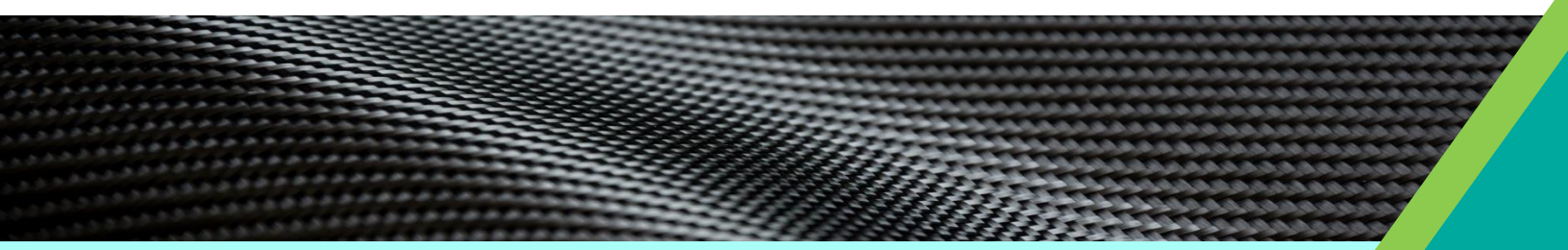
Carbon fiber has come a long way over the years and have impacted almost every field of industry from aerospace, sporting goods automotive, construction, to wind energy. The key advantages of carbon fiber compared to other fibers (glass fiber and aramid fiber) are high tensile strength, high stiffness, low density, and a high chemical resistance which led to increase

penetration in various sectors. Between 2010 and 2019 the carbon fiber industry experienced an uninterrupted growth. During this time, the demand of carbon fiber industry grew from 82.3 million pounds in 2010 to over 192 million pounds ($2.6 Billion) in 2019.

Then in 2020, coronavirus (covid-19) pandemic hit and it was a disruptive time for the world and carbon fiber industry was no exception. The overall carbon fiber industry declined by 9.7% in 2020. Aerospace and automotive were the major markets which affected more due to COVID 19 in 2020. At the beginning of 2021, the carbon fiber industry performed well and showed positive sign. However, by the end of 2021, the overall carbon fiber demand grew only by 4.4% due to supply chain issues and lower demand from aerospace and automotive industries. Increasing wind MW installation and growing demand of premium sports equipment were the major driving factors for carbon fiber industry in 2021.

Aerospace, which is one of the major end use industries of carbon fiber was affected severely in 2020 and 2021. Carbon fiber based composite parts are used heavily in aircrafts such as A350 and B787, for which production dropped by ~45% in 2020. Before pandemic, A350 and B787 were built at a rate of 12 and 14 per month respectively. However, due to travel ban and other COVID related crisis, production of these aircrafts dropped to two and three per month in 2021. As a result, the carbon fibers demand for the aerospace declined by 33% in 2021 after huge drop of 46% in 2020.

Automotive industry did not perform well in 2021 due to shortage of chips. Global automotive production grew only at 0.5% in 2021 compared to 2020. In 2022, the automotive production is expected to see double digit growth of 10.5%, which will bring good growth for CFRP parts in automotive. Carbon fiber reinforced plastics (CFRP) parts are used in a variety of exterior and interior parts in high performance and luxury vehicles.



Wind energy industry performed pretty well in 2020 and 2021 despite COVID 19 pandemic and the demand for carbon fiber reinforced plastics for the wind energy grew by double digits in 2020 and 2021. The continuous increasing blade length for both off shore and onshore market drives the demand of carbon fiber based composites due to high stiffness requirement in blades.

Various manufacturing processes are used to manufacture carbon fiber parts for thousands of applications in various industries. Aerospace, sporting goods, marine and wind energy predominantly uses prepreg layup process. Pultrusion process is used by wind blade manufacturers to produce spar caps. Prepreg layup and pultrusion processes together contributed approximately 64% followed by RTM process with 17%. RTM process is used in automotive and aerospace industry.

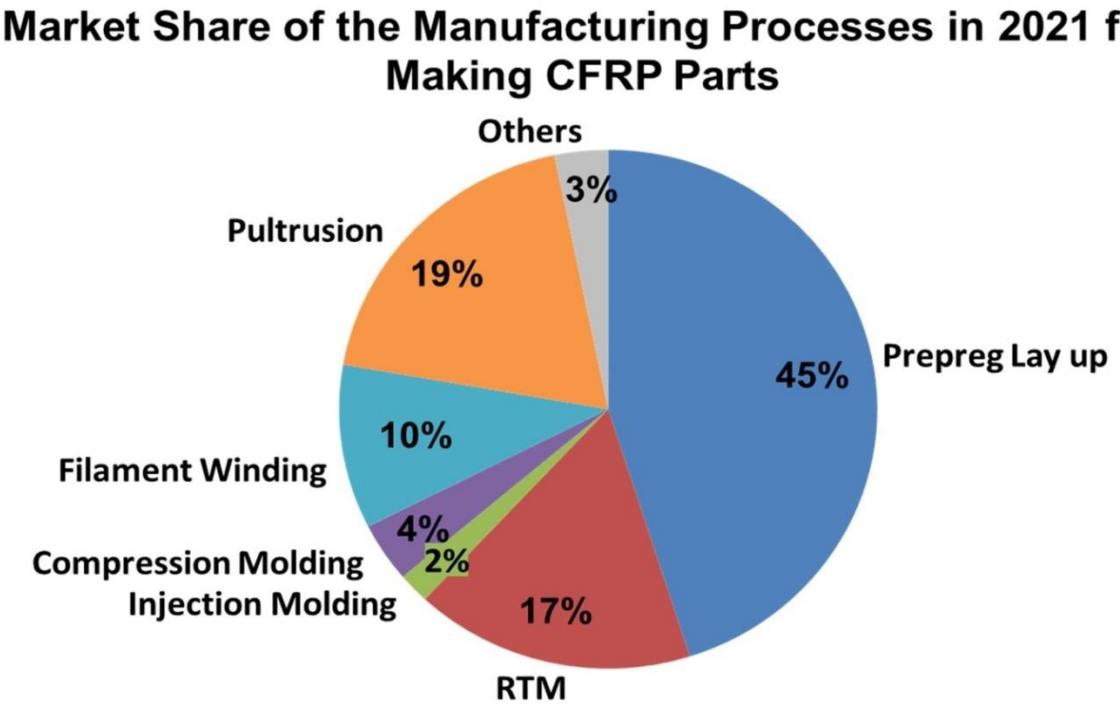


Figure 1: Market Share of the Manufacturing Processes in 2021 for Making CFRP Parts

Lucintel forecasts that the demand for global carbon fiber in 2022 will increase by about 2.6% due to slow recovery in aerospace market and slower growth in wind market in 2022. However, there are plenty of new opportunities emerging, which will increase demand for carbon fiber applications to a greater height. Lucintel sees immense opportunities for carbon fiber in three areas such as air taxis, hydrogen storage, and fuel cell. These technologies and applications are at nascent stage but it has huge potential for growth in future.

1. Urban Air Mobility (UAM) / Air Taxis

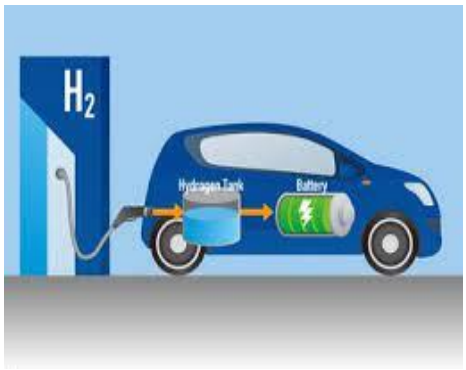
Increasing urban populations will lead to road congestion and demands for competitive mode of transport which can reduce the traffic issues and save the journey time. Air taxis (electric vertical takeoff and landing (eVTOL)) are one of the future modes of transport, which will reduce the travel time at a competitive cost. Carbon fiber based parts are used in air taxis to make structural and interior components.

2. Pressure Vessels for Hydrogen Storage

Increasing emphasis on decarburization of transporting modes is driving demand for hydrogen based fuels. Hydrogen storage tanks are used in transportation (car, trucks, rail, aerospace, etc.), distribution (mobile pipeline), and hydrogen refueling stations. Pressure vessels (Type IV) for hydrogen storage are gaining use in the automotive and aerospace industries. Carbon fiber composites are the ideal material for making Type IV and Type V pressure vessels. High cost of carbon fiber is a challenge in these applications, especially when demand for hydrogen tanks would grow rapidly.

3.Fuel Cell

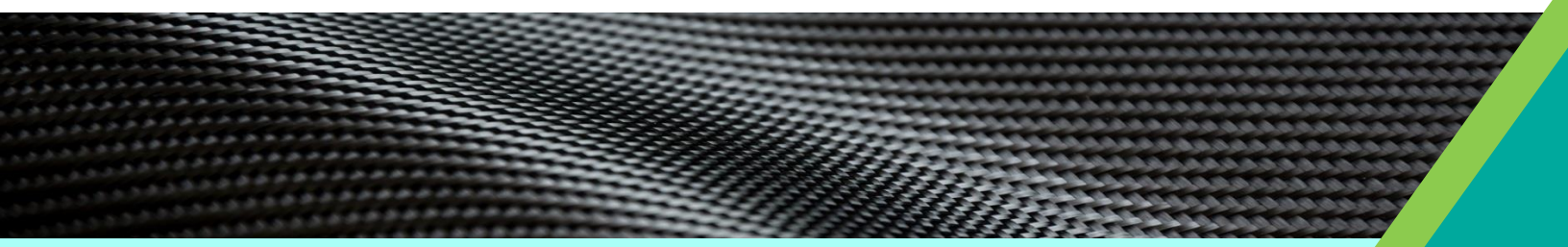
Increasing demand for portable devices and increasing interest in hydrogen fuel cell vehicles in developing countries are driving fuel cell demand. Carbon fiber composites are used in key components of fuel cell stack. Major components such as bi-polar plates and gas diffusion layers are being made using carbon fiber composites which not only reduce the system weight and part counts but also increase mechanical strength, and corrosion resistance.



Strategic Considerations for Key Players in the Carbon Fiber Market

Carbon fiber has found its way in many industries and applications from aerospace to construction. Any part which moves is a good target for carbon fiber composites to drive fuel efficiency and other performance benefits due to high strength and stiffness characteristics of carbon fiber. Emerging carbon fiber applications in robots, drone (UAV), 3D printing, air taxis, fuel cell, hydrogen tanks and many others will drive the growth of carbon fiber in future.

The carbon fiber industry is dynamic and ever-changing. Successful industry players are necessarily masters of innovation, change, and adaptation. To retain this status, they need to be attentive to current trends. We believe there will be promising opportunities carbon fiber in the automotive, aerospace, and sporting goods end use industries. As per Lucintel's latest market research report (Source: https://www.lucintel.com/carbon-fiber-market.aspx), the carbon fiber market is expected to grow with a CAGR of approx. 5.5% between 2021 and 2026. This market is primarily driven by the growing demand for high performance and lightweight composite materials and increasing performance requirements in the end use industries.



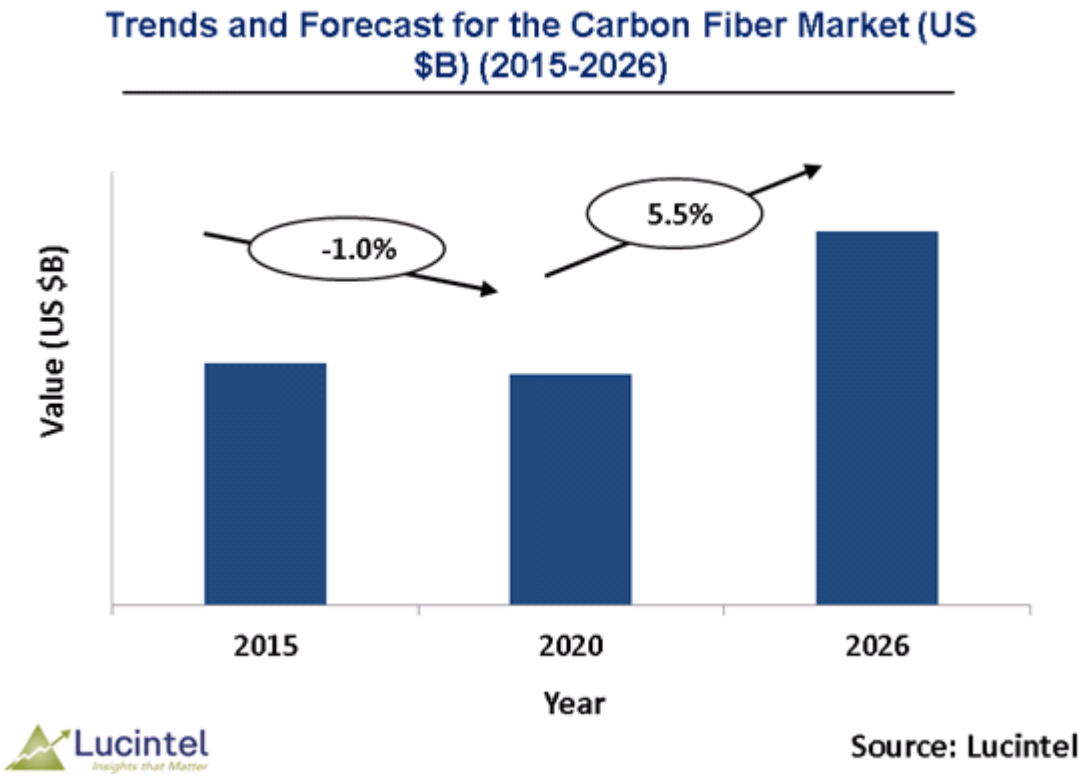
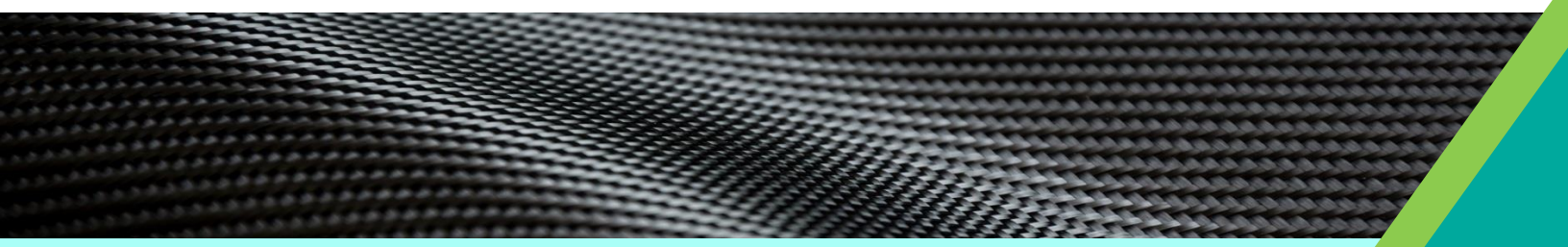


Figure 2: Trends and Forecast for the Carbon Fiber Market

Whether you are new to the carbon fiber market or an experienced player, it is important to understand the trends that impact the development process, as these trends as listed above will lead players to create long-term strategy formulation that will allow them to remain competitive and successful in the long run. For example, to capture growth, some of the strategic considerations for players in the carbon fiber market are as follows:

- Players of the carbon fiber market can increase their capabilities to use alternative precursors to reduce the manufacturing costs.
- Players can focus on pan based precursors, which are expected to lead future trends.
- Research and development activities for development of low-cost carbon fiber for various end use industries

Note: In order to gain better understanding, and learn more about the scope, benefits, and companies researched, as well as other details in the carbon fiber market report from Lucintel, click on https://www.lucintel.com/carbon-fiber-market.aspx. This comprehensive report provides you in-depth analysis on market trends and forecast, segment analysis, regional analysis, competitive benchmarking, and company profiling of key players. In addition, we also offer strategic growth consulting to meet your customized needs. We have worked with many PE firms and corporate customers in the process of their market entry and M & A initiatives.



Lucintel - At a Glance

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- Management comprised of PhDs, MBAs, and subject matter experts. Head quarter in Dallas, USA.

Conducted 500+ consulting projects across industries for 3M, Audi, Dupont, Carlyle, GE, etc.

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Industries Served

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