

Global Carbon Fiber Market: Analysis By Volume, By Raw Material (Polyacrylonitrile-Based and Pitch-Based), By Tow Size (Small & Large), By Application (Composites & Non Composites), By Industry Vertical (Aerospace and Defense, Automotive, Wind Energy, Sporting Goods, Building and Construction, Marine, Textiles & Others), By Region, Size & Forecast with Impact Analysis of COVID-19 and Forecast up to 2028

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Abstracts

The global carbon fiber market in 2022 was valued at US\$3.95 billion and is expected to reach US\$6.70 billion by 2028, growing at a CAGR of 9.17%, during the forecast period of 2023-2028. Carbon fiber is a lightweight and exceptionally strong material composed of thin fibers primarily made of carbon atoms. It is produced through a multi-step process that involves the conversion of a precursor material, such as polyacrylonitrile (PAN) or pitch, into carbon fibers through high-temperature heating and stretching. The resulting material possesses remarkable strength-to-weight ratios, high stiffness, and resistance to corrosion, making it ideal for a wide range of applications.

In terms of volume, the global carbon fiber market is projected to reach 228.62 kilo tons in 2028. The global carbon fiber market has witnessed remarkable growth in terms of volume. Carbon fiber is primarily used in industries such as aerospace, automotive, wind energy, sports and leisure, and more. Its unique combination of strength, low weight, and corrosion resistance has made it an essential material in the production of high-performance components. With a global push toward fuel efficiency and reduced emissions, the automotive industry has increasingly turned to carbon fiber to create lightweight components. Another significant driver is the wind energy sector. Carbon

fiber is instrumental in creating the lightweight yet sturdy blades of wind turbines.

Market Segmentation Analysis:

By Raw Material: The report splits the global carbon fiber market into two different segments on the basis of raw material: Polyacrylonitrile-based and Pitch-based. The PAN-based carbon fiber segment dominated the global market in 2022. PAN-based carbon fiber materials are preferred for use in the aerospace industry owing to their high strength, low heat expansion, moisture absorption, lightweight, specific strength, ease of use, and thermal conductivity.

By Tow Size: The global carbon fiber market can be divided into two segments on the basis of tow size: Small Tow and Large Tow. In 2022, the significant portion of the market share was attributed to the small tow segment. Small tow fibers, which are characterized by rovings containing 24,000 filaments or less, find widespread application in the aerospace and defense sector owing to their impressive modulus and tensile strength.

By Application: The report divides the global carbon fiber market into two application: Composites and Non Composites. Composite Materials encompass a range of industries, including aerospace and automotive, where the imperative for lightweight materials to enhance fuel efficiency and reduce emissions fuels the demand for carbon fiber composites. Similarly, the wind energy sector relies on carbon fiber composites to create lightweight yet robust wind turbine blades, contributing to the expansion of renewable energy sources, which is expected to drive the segment's growth during the forecasted period.

By Industry Vertical: The global carbon fiber market by industry vertical can broadly be divided into eight segments namely, Aerospace and Defense, Automotive, Wind Energy, Sporting Goods, Building and Construction, Marine, Textiles and Others. Aerospace and Defense dominated the market in 2022. One of the primary drivers in this segment is the quest for lightweight materials to improve the fuel efficiency of aircraft. Carbon fiber's exceptional strength-to-weight ratio is instrumental in reducing the weight of aircraft, leading to decreased fuel consumption and lower emissions. In the defense sector, carbon fiber composites are increasingly used for lightweight armor and vehicle components.

By Region: According to this report, the global carbon fiber market can be divided into

four major regions: Asia Pacific (China, Japan, India, South Korea and Rest of Asia Pacific), Europe (Germany, UK, France, Italy, and Rest of Europe), North America (The US, Canada and Mexico), and Rest of the World. In 2022, the Europe region took the lead in the regional segment, contributing the highest share of revenue. The expansion of the aerospace and defense sector in Europe has been a driving force behind the carbon fiber industry's growth in recent years, a trend anticipated to continue in the forecast period. Europe and North America, home to aerospace giants like Airbus and Boeing, have significantly boosted regional carbon fiber demand. Germany occupied the dominant position within Europe. Germany is renowned for its automotive industry, including brands like BMW, Mercedes-Benz, and Volkswagen. These companies actively use carbon fiber to reduce vehicle weight and enhance performance. The country is home to leading aerospace companies like Airbus, which utilize carbon fiber materials extensively for aircraft construction.

Conversely, the Asia Pacific market is projected to experience rapid growth during the forecast period, mainly due to swift urbanization and increased government investments in infrastructure projects. The burgeoning use of construction composites in building projects, such as tunnels, bridges, and residential structures in India and China, will propel market expansion. Additionally, the presence of prominent construction firms in the Asia Pacific region presents substantial opportunities for product adoption in the construction sector.

Market Dynamics:

Growth Drivers: Increasing demand from the aerospace & aviation industry has emerged as a significant driving factor for the carbon fiber market. Aerospace & Aviation industry relies heavily on advanced materials that offer a unique combination of strength, durability, and lightweight properties, and carbon fiber perfectly fits these requirements. Carbon fiber's exceptional strength-to-weight ratio makes it an ideal choice for manufacturing aircraft components, such as wings, fuselage sections, and interior components. The aerospace sector is continually striving to reduce fuel consumption and emissions, and carbon fiber's lightweight properties contribute to achieving these goals. Further, the market is expected to increase due to increasing product usage in automotive industry, growing construction sector, increasing demand for consumer goods, etc.

Challenges: However, some challenges are impeding the growth of the market such as high production cost and presence of substitute. The manufacturing process of carbon fiber is notably expensive, significantly elevating the final product's price tag. This cost

factor serves as a major impediment to the broader adoption of carbon composites in diverse sectors. Presently, PAN-based carbon fibers, in particular, the non-aerospace grade variants, command an average price of approximately US\$21.5 per kilogram, with a conversion efficiency of just 50%. These elevated costs act as a formidable barrier for smaller, domestic manufacturers seeking entry into the market, thereby curbing overall market expansion.

Trends: A major trend gaining pace in carbon fiber growing use of green carbon fiber. The carbon fiber market is experiencing a notable shift driven by mounting concerns surrounding climate change and the imperative to curtail carbon emissions. This transformative trend is characterized by a burgeoning demand for sustainable materials, with a spotlight on green carbon fiber emerging as an environmentally-conscious solution. In response to the pressing need for sustainable materials, several pioneering companies have been introducing innovative green carbon fiber products. Mitsubishi Chemical Corporation, for instance, made a significant stride in 2020 by unveiling a cutting-edge green carbon fiber material produced from bio-based feedstocks. More trends in the market are believed to augment the growth of carbon fiber market during the forecasted period include increasing demand for carbon fibers from wind energy, growing use of carbon fiber for storing hydrogen fuel, growing usage of carbon fiber in 3D printing, use of carbon fiber in suspension bridges, etc.

Impact Analysis of COVID-19 and Way Forward:

The COVID-19 pandemic significantly impacted the carbon fiber market, causing disruptions in the supply chain, fluctuating demand, production slowdowns, and shifts in consumer behavior. Lockdowns, travel restrictions, and labor shortages disrupted supply chains, leading to delays, increased costs, and challenges for manufacturers. Reduced demand in sectors like aerospace, automotive, and construction, due to economic downturns and travel restrictions, also lowered carbon fiber product demand, resulting in decreased production and revenue.

As economies adapted to the new normal, the carbon fiber market demonstrated resilience. Investments in research and development continued, leading to innovative carbon fiber products and expanding its potential applications. In essence, the pandemic initially disrupted the carbon fiber market but ultimately accelerated its adoption in industries emphasizing sustainability and high performance. This shift in priorities is expected to create opportunities for carbon fiber applications in various sectors.

Competitive Landscape and Recent Developments:

The global carbon fiber market exhibits a consolidated structure characterized by fierce competition among industry leaders vying to expand their market presence. Prominent players in this market encompass renowned entities such as Toray Industries Inc., SGL Carbon, Mitsubishi Chemical Corporation, Hexcel Corporation, and Teijin Limited, alongside several other notable companies.

Key players of the carbon fiber market are:

SGL Carbon SE

DowAksa Advanced Composite Material Industries Ltd Co

Formosa Plastics Corp

Hexcel Corp

Hyosung Advanced Materials Corp

Kureha Corp

Mitsui Chemical Group Corp

Solvay SA

Teijin Ltd

Toray Industries Inc

Nippon Carbon Co., Ltd

Prominent players are adopting strategies such as expansion, mergers & acquisitions, and partnerships to strengthen their market presence in various regions. Companies in the industry continuously invest in research and development to improve their production processes, enhance product quality, and develop new applications. In February 2022, Teijin Limited disclosed the plans to collaborate with Fuji Design Co. Ltd, a Japanese company specializing in recycled carbon fibers. Their joint initiative aims to establish a venture focused on manufacturing, distributing, and marketing

carbon fiber reinforced plastic products.

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