

Carbon Fiber Market Assessment, By Raw Material [Polyacrylonitrile, Petroleum Pitch, Rayon], By Tow Size [Small Tow, Large Tow], By Application [Composite Materials, Textiles, Microelectrodes, Catalysis], By End-user Industry [Aerospace and Defense, Construction, Alternative Energy, Automotive, Sport Goods, Others], By Region, Opportunities and Forecast, 2018-2032F

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Report description:

Global carbon fiber market is expected to grow at a CAGR of 8.06% during the forecast period 2025-2032, growing from USD 6.12 billion in 2024 to USD 11.37 billion in 2032. The carbon fiber market is poised for significant growth, driven by growing demand for lightweight materials across a variety of industries, dominated by aerospace and defense, automotive, and renewable energy. With firms seeking ways of fuel efficiency and reduced emissions, the high strength-to-weight ratio of carbon fiber makes it a natural choice for use in electric vehicles and aircrafts. The sustainability wave is also boosting use of carbon fiber in building and infrastructure construction, where carbon fiber's corrosion resistance and strength enable it to be utilized in structures with increased lifespan. Furthermore, expansion in the wind energy sector is also fueling the carbon fiber demand prominently, as the use of carbon fiber in turbine blades makes them light weight. Higher performance characteristics of carbon fiber products is also propelling the growth of the market.

Additionally, pressure vessels are equipment found in different markets including oil and gas, chemical processing, power generation, pharmaceuticals, aerospace, and food and beverage. Pressure vessels engage, move, and process gases and fluids at high pressure and temperature. The pressure vessels are designed to be safe to operate despite being exposed to extreme internal pressures from their contents. The demand for lightweight and high-strength pressure vessels is fueling the adoption of carbon fiber in pressure vessel manufacturing.

For instance, in July 2023, Toray Composite Materials America, Inc. reported its expansion plans to increase its capacities at its carbon fiber production plant based in South Carolina, the United States, following an increasing order from clean energy solution

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demands. This will help add another 3,000 metric tons a year to carbon fiber production starting from 2025. Further increased supply of carbon fiber would be utilized in compressed natural gas and hydrogen tanks, in addition to the pressure vessels that are used in all forms of storage and transportation.

Rising Demand for Carbon Fiber in the Aerospace and Defense Industry

The unique combination of properties of carbon fiber, such as their high strength-to-weight ratio, corrosion resistance and durability, makes it ideal for their use in bodies of aircraft, structural components, along with advanced types of weaponry. In the aviation sector, carbon fiber has the benefit of being lightweight, hence making the fuel consumption lower. It, therefore, means reduced costs of operations and emissions. Aerospace applies carbon fiber to structural components to enhance performance and safety. Carbon fiber armor for lightweight defense and ballistic protection with advanced armament enhances mobility and survivability in the defense sector. Carbon fiber demand is increasingly driven by an investment in next-generation aircraft and space exploration. The industry's development of advanced aircraft, satellites, and spacecraft demands carbon fibers that are necessary for long-term missions and extreme environmental conditions to achieve the structural integrity and lightness required.

For instance, in order to meet the growing demand for next-generation composite subassemblies and components in the aerospace and military industries in India and throughout the world, Kineco Ltd. acquired a 49% additional ownership stake in its subsidiary, Kineco Kaman Composites India Private Ltd, from Kaman Aerospace Group Inc. in October 2024. The business is well-known for creating intricate composite parts and subassemblies used in space, aerospace, and defense applications.

Increasing Carbon Fiber Applications in Wind Energy Generation

The rapidly growing field of wind power is heavily driving demand for carbon fiber, led by the need for extended, lighter, and more robust wind turbine blades. Carbon fiber allows the creation of longer blades due to its inherent stiffness and strength, which helps increase the swept area and generate more energy from the same amount of wind. Compared to standard fiber blades, the carbon fiber-made blades promise to deliver significant weight reductions, thereby reducing loading on turbines and allowing the installation of larger rotor sizes for increased energy capture. Additionally, carbon fiber's excellent fatigue resistance also increases blade life, saving on maintenance and lost time, which is specifically critical in adverse offshore installations. The potential for cost reductions through innovative carbon fiber designs and the growing deployment of offshore wind farms are further amplifying the increasing demand for carbon fiber. Consequently, carbon fiber is becoming an indispensable material in the technological advancement of wind energy.

For instance, in May 2024, Toray Industries Inc. and Toray Advanced Materials Korea Inc. (TAK) have signed an investment memorandum of understanding to expand their production of high-performance carbon fiber, aramid fiber, and eco-friendly materials in South Korea to grow through cooperation with companies in the carbon fiber composite materials industries, including aerospace, high-pressure vessels, and wind power generation. The company plans to invest in carbon fiber unit 3 at Gumi Plant 4 with an annual expansion capacity of 3,300 tons, aiming to operate by the second half of 2025. The expansion will secure a production capacity of 8,000 tons per year.

Composite Materials Segment Dominates the Global Carbon Fiber Market

The demand for carbon fiber is increasing for composite material applications due to the unique combination of lightweight, high strength, and durability advantages offered by carbon fiber. Carbon fibers are highly used in composite materials for manufacturing lighter, more aerodynamic vehicles and aircraft. The lighter and more aerodynamic vehicles and aircraft help in improving the fuel efficiency of engines, which drives the demand for composite materials in the market. Moreover, several other industries, such as wind energy and construction, are driving the demand for lightweight materials with high strength. Carbon fiber composite materials enable the production of longer, lighter, and more efficient turbine blades, thereby increasing energy output and lowering maintenance costs, thereby driving the demand for carbon fiber in composite materials production in the market. Furthermore, the upcoming technological development in carbon fiber reinforced thermoplastics and the production process of composite materials are accelerating the production of composite materials in the market.

Asia-Pacific Dominates the Global Carbon Fiber Market

Asia-Pacific is the leading in the global carbon fiber market, led by the huge expansion of the wind energy market, where the very specific properties of carbon fiber make it very useful in the manufacturing of durable, efficient wind turbine blades. Additionally,

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expansion in the automotive sector, particularly the surge of demand for electric cars, is propelling the Asia-Pacific carbon fiber market growth, as carbon fiber solutions for lightweighting are integral to improving vehicle efficiency and performance. Moreover, the rapid pace of urbanization and significant government investments in infrastructure development projects in countries such as China and India are altering market dynamics. Carbon fiber is being increasingly used in composite materials for constructing tunnels, bridges, and buildings. Additionally, the demand from the aerospace and defense sectors, along with the booming sporting goods sector, further anchors the Asia-Pacific as the hub of demand and innovation in carbon fiber. Furthermore, prepregs, fabrics, multiaxial and carbon fiber composites, technical textile expansion, and government support in countries such as India are also supporting demand for carbon fiber.

For instance, in May 2024, Jindal Advanced Materials Private Limited (JAM) partnered with Italian chemical fiber manufacturer MAE S.p.A. to invest USD 320 million in India's first carbon fiber facility. The facility will offer a range of intermediates, including prepregs, fabrics, multiaxial, and carbon fiber composites, catering to diverse industrial needs. JAM aims to penetrate industrial markets and offer lightweight carbon fiber solutions. The capacity expansion is projected to reach 10,000 MT by 2027. The facility is expected to be operational within 30 months and cover the entire value chain from polyacrylonitrile precursor to carbon fiber intermediates.

Impact of U.S. Tariffs on Global Carbon Fiber Market

□□The rise in the United States tariff on imports of carbon fiber is expected to raise costs for carbon fiber products manufacturers which leading to higher prices for end-users, thereby impacting the overall profitability of the industry.

□□Supply chain disruptions and compliance hurdles are expected to cause delays and reduced material choices, impacting the production of carbon fiber products in the current situation.

□□The imposition of higher tariffs elevates costs and generates uncertainty within the market, consequently suppressing innovation and delaying product adoption, which negatively affects overall market growth.

Key Players Landscape and Outlook

The carbon fiber market is highly concentrated, with a small number of firms exploiting vertically integrated operations and technical competencies. Such companies stay ahead in terms of competition because they have spent significant amounts of money on R&D. Their manufacturing processes are technologically sophisticated. There are high barriers to entry, and the product has complex production, significant capital outlays, and high-quality standards. The prominent players are emphasizing cost-effective and sustainable carbon fiber manufacturing processes, including recycling technologies and bio-based precursor materials. Strategic alliances and tie-ups, especially with aerospace and automotive companies, are important for the growth of the market. Strategic mergers and acquisitions to expand product offerings and geographical presence have been evident in the industry. Other organizations are forward integrating, wherein organizations buy out carbon composite producers to enhance their position in the value chain. Product launches, agreements, business expansions, collaborations, and developing technologies are projected to increase competition in the fast-paced market.

For instance, in July 2023, Toray Industries, Inc. decided to increase the production of regular tow carbon fiber production capacity at two facilities. Capital investments added a line to the Spartanburg plant in South Carolina, USA of Toray Composite Materials America, Inc. and the Gumi plant in Gyeongsangbuk-do, Korea of Toray Advanced Materials Korea Inc. The investments increased the Toray Group's annual capacity by over 20% to 35,000 metric tons in 2025, which will further increase the company's production capacity.

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