



TECH 2023S3: Carbon Fibers

Carbon Fibers is one in a series of reports published as part of NexantECA's 2023 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Carbon fiber is a lightweight and high strength material that can withstand high loads without deformation. Its characteristics are stable over long time periods, even under severe conditions, and also include good fatigue and corrosion resistance, good electrical and thermal conductivity, chemical inertness and electromagnetic interference shielding capacity as well as low thermal expansion coefficient, making it a high-value product.

This TECH report provides an updated overview of the technological and economic aspects of carbon fiber. The following issues are addressed in this report:

- What are the major production technologies for carbon fiber and how do they differ? Is the technology available and who are the key technology owners and licensors?
- Who are the top producers of carbon fiber? What are the strategic and business considerations associated with entering the carbon fiber market?
- What are the key factors that impact overall economics for producing carbon fiber across different geographic regions?
- How are carbon fibers recycled? Who are the key recyclers on the market?
- What is the carbon intensity (scope 1 and 2) of carbon fiber processes and how does it compare across different geographic regions?
- What are the production routes of carbon nanotubes? Who are the top producers and how do their end-use applications differ from that of carbon fibers?

Commercial Technologies

Carbon fiber properties depend principally on the precursor used, and the process conditions employed. Three precursors are commercially employed: polyacrylonitrile (PAN), which accounts for over 98 percent of the global market; pitch, accounting for less than two percent; and rayon for around 0.1 percent of the global capacity.

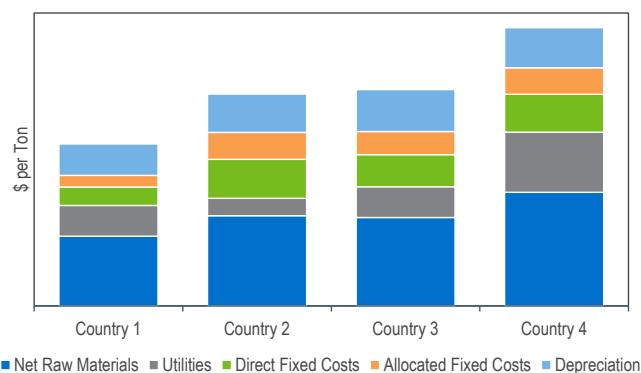
Developing Technologies

The R&D work being carried out aims to lower the precursor cost, whether by finding new precursors such as lignin, by manufacturing PAN from bio-based acrylonitrile, or by manufacturing pitch from coal.

Process Economics

Detailed cost of production estimates for the PAN and pitch-based carbon fibers are presented for USGC, Western Europe, Japan and China, reflecting the location of existing carbon fiber capacities.

PAN-Based Carbon Fiber Regional Cash Cost of Production



Commercial Overview

Global carbon fiber capacity was 253 000 tons in 2023. Carbon fiber applications are generally divided into three major segments:

- Industrial (wind turbine blades, ground transportation, pressure vessels, civil engineering, oil and gas, medical, and other industrial applications)
- Consumer (sports & leisure, and other consumer goods)
- Aerospace and military (civilian aviation, military, and space)

A complete global capacity list by producer and region (North America, Western Europe, Asia Pacific and Rest of the World) is provided in this TECH report.



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The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging technologies of interest to the energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- Process Technology:
- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

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- Cost of production tables in spreadsheet format
- Consultation time with the project team

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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