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# Global Carbon Fiber Market 2017 Industry Research Report

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The Digital Transformation of Logistics  
Carbon Fibers and Their Composite Materials  
Carbon Fiber  
Carbon Fiber Manufacturing Facility Siting and  
Policy Considerations: International Comparison  
Carbon Fibers  
Recent Developments in the Field of Carbon  
Fibers  
Carbon Fibres and Their Composites  
Carbon Fibers  
The Carbon Fibre Industry  
Carbon Fibre from Lignin  
Recent Developments in the Field of Carbon  
Fibers  
Carbon Fibre  
Fibers and Composites  
Carbon Fibers  
Carbon Fibers  
Carbon and High Performance Fibres Directory  
and Databook  
Industrial Carbon and Graphite Materials  
Carbon-Carbon Materials and Composites

Carbon Fiber Composites

Carbon Composites

Beleuchtung derjenigen Gründe, aus welchen die Erb-Lehen-Folge des chur- und fürstlichen Hauses Pfalz in denen Herzogthümern Ober- und Nieder-Bayern bezweifelt werden will

Carbon Fibers

Carbon Fibers and Their Composite Materials

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Automotive Carbon Fiber Composites

Direct Natural Gas Conversion to Value-Added Chemicals

Carbon Fibre from Lignin

Carbon Fibers Filaments and Composites

Carbon Fibers and Their Composites

Multifunctionality of Polymer Composites

Update on Carbon Fibre

Carbon Fibers, Third Edition,

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## **PAOLA JORDAN**

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### **The Digital Transformation of Logistics**

SAE International  
Carbon fibres are lightweight, chemically stable materials with high mechanical strength, and have state-of-the-art applications in aerospace, marine, construction and automotive sectors. The demand for carbon fibre-based components is expected to grow dramatically with expanding opportunities for lightweight metals and composites. Although this field has achieved a high level of maturity, nanoscale

developments in carbon fibres have seen dramatic improvements in the functions of conventional biomaterials and composites. This book reveals several new developments in the field to enhance characteristics of carbon fibres and their composites, novel applications for tissue engineering, biological scaffoldings and implants, recycling and reuse of end-of-life CFRP and manufacturing waste and other issues of concern in the field of carbon fibres.

*Carbon Fibers and  
Their Composite  
Materials* CRC Press  
Approx.964 pages  
Approx.964 pages  
*Carbon Fiber* CarTech  
Inc  
The market for

aerospace composites is projected to reach \$42.97 billion by 2022, up from \$26.87 billion in 2017, at a CAGR of 9.85% from 2017 to 2022. Clearly, the use of aerospace composites in commercial aircraft has gained momentum during the past few decades, but there is still much room for growth and much more to learn.

Lightweighting is generally considered to be the main driver for the increased and pervasive use of composites. However, beyond the contribution toward fuel efficiencies, composites also offer increased resistance against corrosion and part count reduction. Those corrosion characteristics, as well as fatigue properties,

lead to lower maintenance costs over aircraft and components manufactured using traditional materials. Commercial aircraft are complex, sophisticated engineering marvels. And while introducing composites into new programs has added many benefits, it has also added complexity. This book aims to help manage and mitigate that complexity. To reduce the learning curve, the book opens with a refresher of key criteria involved with the forming of aerospace components, and then moves on to take a provocative look at the real-world practicality of manufacturing composite parts to rigid, at times untestable,

specifications. The book then segues into suggesting a few “rules of design” for manufacturing CFRP components to minimize or avoid common production problems, and then into more specific manufacturing tools and processes that could enable larger and more complex component geometries, while retaining specific material properties and maintaining part functionality. Ultimately, readers will be enlightened to the potentials of aerospace composites, and empowered to include them at the beginning of any aerospace development program, from the smallest component to entire airframes.

*Carbon Fiber*

*Manufacturing Facility Siting and Policy Considerations: International Comparison* MDPI

Carbon Fibers presents an up-to-date review of the progress pertaining to the formation of carbon fibers from rayon, acrylic, and pitch precursors. The book emphasizes the preparation, characterization, and properties of commercial materials. It also considers the compressive properties of carbon fibers, the lack of correlation between surface characterization and fiber-matrix interactions, and the discrepancy between surface composition as determined by XPS and the reaction of surface groups with chemical reagents. Other topics discussed include:

Carbon Fibers William Andrew

This useful guide provides a practical approach to making carbon fibers and their composites. The book begins with a brief history of the development of carbon fiber, defining the terminology for all forms of solid carbon and the properties for elemental carbon and its allotropic forms. Various precursors for carbon fibers, corresponding surface treatments and sizes for various types of carbon fiber available on the world market are presented. The book gives an excellent overview of the chemical and physical properties of carbon fibers and their composites. Common test and analysis methods for verifying

these properties are also presented. In several chapters, typical processing processes for carbon fibers with dry and also impregnated semi-finished products in application areas such as aerospace, wind industry and automotive up to the construction industry are presented. The advantages and disadvantages of various manufacturing processes are shown based on application examples. Considerations regarding carbon fiber recycling and sustainability (environmental footprint) as well as new developments in the field of carbon fiber production should support the reader in the selection and understanding of

material, process and design in order to be able to implement them successfully.

*Recent Developments in the Field of Carbon Fibers* Butterworth-Heinemann

Carbon Fiber, Second Edition, brings together available information on the production, properties, application and future of carbon fibers. This book will be of interest to those involved in the investigation of carbon fiber, carbon fiber manufacturing, and users. In addition, the recycling of carbon fiber reinforced polymers and the manufacturing of composites from recycled carbon fiber reinforced polymers are discussed. The book offers in-depth coverage on the production of carbon

fiber and the global carbon fiber market, demand and major growth drivers. Carbon structures from biowaste, waste lignin and novel processes to obtain high purity lignin are presented, along with future directions. Provides thorough and in-depth coverage of carbon fiber production

Presents the global carbon fiber market, demand and major growth drivers Covers carbon structures from biowaste and waste lignin Discusses novel process to obtain high purity lignin Includes discussions of future directions for the carbon fiber industry

**Carbon Fibres and Their Composites**  
CRC Press

This book brings together a diverse compilation of inter-

disciplinary chapters on fundamental aspects of carbon fiber composite materials and multi-functional composite structures: including synthesis, characterization, and evaluation from the nano-structure to structure meters in length. The content and focus of contributions under the umbrella of structural integrity of composite materials embraces topics at the forefront of composite materials science and technology, the disciplines of mechanics, and development of a new predictive design methodology of the safe operation of engineering structures from cradle to grave. Multi-authored papers on multi-scale modelling of problems

in material design and predicting the safe performance of engineering structure illustrate the interdisciplinary nature of the subject. The book examines topics such as Stochastic micro-mechanics theory and application for advanced composite systems Construction of the evaluation process for structural integrity of material and structure Nano- and meso-mechanics modelling of structure evolution during the accumulation of damage Statistical meso-mechanics of composite materials Hierarchical analysis including "age-aware," high-fidelity simulation and virtual mechanical testing of composite structures right up to the point of failure. The volume is ideal for



scientists, engineers, and students interested in carbon fiber composite materials, and other composite material systems.

**Carbon Fibers**

Springer Science & Business Media  
The digital transformation is in full swing and fundamentally changes how we live, work, and communicate with each other. From retail to finance, many industries see an inflow of new technologies, disruption through innovative platform business models, and employees struggling to cope with the significant shifts occurring. This Fourth Industrial Revolution is predicted to also transform Logistics and Supply Chain Management, with

delivery systems becoming automated, smart networks created everywhere, and data being collected and analyzed universally. The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution provides a holistic overview of this vital subject clouded by buzz, hype, and misinformation. The book is divided into three themed-sections: Technologies such as self-driving cars or virtual reality are not only electrifying science fiction lovers anymore, but are also increasingly presented as cure-all remedies to supply chain challenges. In The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial

Revolution, the authors peel back the layers of excitement that have grown around new technologies such as the Internet of Things (IoT), 3D printing, Robotic Process Automation (RPA), Blockchain or Cloud computing, and show use cases that give a glimpse about the fascinating future we can expect. Platforms that allow businesses to centrally acquire and manage their logistics services disrupt an industry that has been relationship-based for centuries. The authors discuss smart contracts, which are one of the most exciting applications of Blockchain, Software as a Service (SaaS) offerings for freight procurement, where numerous data sources can be integrated and

decision-making processes automated, and marine terminal operating systems as an integral node for shipments. In *The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution*, insights are shared into the cold chain industry where companies respond to increasing quality demands, and how European governments are innovatively responding to challenges of cross-border eCommerce. People are a vital element of the digital transformation and must be on board to drive change. In *The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution* explains how executives can

create sustainable impact and how competencies can be managed in the digital age - especially for sales executives who require urgent upskilling to remain relevant. Best practices are shared for organizational culture change, drawing on studies among senior leaders from the US, Singapore, Thailand, and Australia, and for managing strategic alliances with logistics service providers to offset risks and create cross-functional, cross-company transparency. The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution provides realistic insights, a ready-to-use knowledge base, and a working vocabulary about current activities

and emerging trends of the Logistics industry. Intended readers are supply chain professionals working for manufacturing, trading, and freight forwarding companies as well as students and all interested parties.

**The Carbon Fibre Industry** John Wiley & Sons

The proper choice of technology is a complex decision, particularly for developing countries, as it depends not only on local needs and conditions but also, importantly, on the national political context and, increasingly, on the international environment. This technological choice carries with it the genetic code of the nation's future development. Many

developing countries which lack the needed infrastructure do not have real options; others with a reservoir of scientific and engineering skills and explicit SIT strategies, can indeed choose between alternatives. Turning to the technologies themselves, these cover a wide spectrum: traditional technologies that are low-cost, low-energy and often better suited to meet basic needs; more sophisticated technologies which are highly knowledge-intensive and require large capital outlays for research, product design and manufacturing; and still others which depend upon a blending of modern technology with traditional methods to

create products and processes more suited to local needs. Even within the group of advanced technologies, there is considerable differentiation, and those at the lower end of the product cycle are clearly within reach by the newly industrializing countries.

### **Carbon Fibre from**

### **Lignin** Springer

Carbon fiber is an oft-referenced material that serves as a means to remove mass from large transport infrastructure. Carbon fiber composites, typically plastics reinforced with the carbon fibers, are key materials in the 21st century and have already had a significant impact on reducing CO2 emissions. Though, as with any composite

material, the interface where each component meets, in this case the fiber and plastic, is critical to the overall performance. This text summarizes recent efforts to manipulate and optimize the interfacial interaction between these dissimilar materials to improve overall performance.

Recent Developments in the Field of Carbon Fibers CRC Press

The major areas of carbon-carbon materials and composites are described in this comprehensive volume. It presents data and technology on the materials and structures developed for the production of carbon-carbon materials and composites. The text is composed of papers by

13 noted authors in their areas of expertise relating to the processes and production of these material systems and structures. The subject matter in the book is arranged to lead the reader through materials processing, fabrication, structural analysis, and applications of typical carbon-carbon products. The information provided includes: fiber technology, matrix material, design of composite structures, manufacturing techniques, engineering mechanics, protective coatings, and structural applications using carbon-carbon materials and composites. Carbon Fibre John Wiley & Sons

Carbon fiber is an oft-referenced material that serves as a means to remove mass from large transport infrastructure. Carbon fiber composites, typically plastics reinforced with the carbon fibers, are key materials in the 21st century and have already had a significant impact on reducing CO2 emissions. Though, as with any composite material, the interface where each component meets, in this case the fiber and plastic, is critical to the overall performance.

**Fibers and Composites** William Andrew Carbon Composites: Composites with Carbon Fibers, Nanofibers, and Nanotubes, Second Edition, provides the

reader with information on a wide range of carbon fiber composites, including polymer-matrix, metal-matrix, carbon-matrix, ceramic-matrix and cement-matrix composites. In contrast to other books on composites, this work emphasizes materials rather than mechanics. This emphasis reflects the key role of materials science and engineering in the development of composite materials. The applications focus of the book covers both the developing range of structural applications for carbon fiber composites, including military and civil aircraft, automobiles and construction, and non-structural applications, including electromagnetic

shielding, sensing/monitoring, vibration damping, energy storage, energy generation, and deicing. In addition to these new application areas, new material in this updated edition includes coverage of cement-matrix composites, carbon nanofibers, carbon matrix precursors, fiber surface treatment, nanocarbons, and hierarchical composites. An ideal source of information for senior undergraduate students, graduate students, and professionals working with composite materials and carbon fibers, this book can be used both as a reference book and as a textbook. Introduces the entire spectrum of carbon fiber

composites, including polymer-matrix, metal-matrix, carbon-matrix, ceramic-matrix and cement-matrix composites  
Systematically sets out the processing, properties, and applications of each type of material  
Emphasizes processing as the foundation of understanding, manufacturing, and designing with composite materials  
Carbon Fibers Elsevier  
Provides an account of the manufacturing processes for PAN, pitch and carbonized viscose rayon carbon fibres. This book includes a section on carbon fiber testing and characterization, followed by a section on textile conversion of carbon fibers and techniques for mixing carbon fiber and

composite substrates.

### **Carbon Fibers**

Springer Science &  
Business Media

This book presents detailed information on the production and properties of carbon fibers derived from lignin precursors.

Focusing on future directions in the carbon fiber industry, it also introduces a novel process for obtaining high-purity lignin, a key aspect in the manufacture of high-quality carbon fiber.

Carbon fiber is currently the most preferred lightweight manufacturing material and is rapidly becoming the material of choice for manufacturers around the world. Although more than 80% of commercial carbon fiber is estimated to use PAN

(polyacrylonitrile) as a precursor, carbon fiber manufactured from PAN is expensive and therefore its

application is limited to high-performance structural materials.

Lignin is the second most abundant biopolymer in nature after cellulose and offers a carbon-rich, renewable resource. As a byproduct of the pulp and paper industry and the production of cellulosic ethanol, lignin is also available at low cost, making it an economically attractive alternative to PAN for the production of carbon fibers, as highlighted in this book. The information presented will be of interest to all those involved in the investigation of carbon fiber materials, carbon fiber manufacturers



and carbon fiber users. Carbon and High Performance Fibres Directory and Databook BoD - Books on Demand  
The updated and expanded second edition of this book explores the physical and mechanical properties of carbon fibers and their composites, their manufacture and processing, and their current and emerging applications. Over 10 chapters, the book describes manufacturing methods, surface treatment, composite interfaces, and microstructure-property relationships with underlying fundamental physical and mechanical principles. It discusses the application of carbon materials in

delivering improved performance across a diverse range of fields including sports, wind energy, oil and gas, infrastructure, defence, and the aerospace, automotive and semiconductor industries. This new edition introduces chapters related to the manufacturing of carbon/carbon composites (C/C composites), antioxidation characteristics of C/C composites, and their applications. Furthermore, it addresses the effect of graphene and carbon nanotubes on the physical and chemical properties of carbon fibers. A final chapter looks at the emerging and future prospects for carbon fiber technology. Industrial Carbon and

Graphite Materials

Springer-Verlag

"Third Edition offers the latest information on the structural, surface, mechanical, electronic, thermal, and magnetic properties of carbon fibers as well as their manufacture and industrial applications from many of the world's most distinguished specialists in the field."

**Carbon-Carbon Materials and Composites** CRC Press

Carbon fibres are lightweight, chemically stable materials with high mechanical strength, and have state-of-the-art applications in aerospace, marine, construction and automotive sectors. The demand for carbon

fibre-based components is expected to grow dramatically with expanding opportunities for lightweight metals and composites. Although this field has achieved a high level of maturity, nanoscale developments in carbon fibres have seen dramatic improvements in the functions of conventional biomaterials and composites. This book reveals several new developments in the field to enhance characteristics of carbon fibres and their composites, novel applications for tissue engineering, biological scaffoldings and implants, recycling and reuse of end-of-life CFRP and manufacturing waste

and other issues of concern in the field of carbon fibres.

**Carbon Fiber Composites** Lulu.com

Carbon fiber is increasingly used in a wide variety of applications due largely to its superior material properties such as high strength-to-weight ratio. The current global carbon fiber manufacturing industry is predominately located in China, Europe, Japan, and the United States. The carbon fiber market is expected to expand significantly through 2024 and to require additional manufacturing capacity to meet demand. Carbon fiber manufacturing facilities can offer significant economic development and employment

opportunities as exemplified by the \$1 billion investment and 500 jobs expected at a new Toray plant in Moore, South Carolina. Though the market is expected to expand, it is unclear where new manufacturing facilities will locate to meet demand. This uncertainty stems from the lack of research evaluating how different nations with significant carbon fiber manufacturing capacity compare as it relates to certain manufacturing facility siting factors such as costs of labor and energy as well as policy directed at supporting carbon fiber development, domestic deployment, and exports. This report fills these gaps by evaluating the top carbon fiber

manufacturing countries, including China, European Union countries, Japan, Mexico, South Korea, Taiwan, and the United States. The report documents how the United States compares to these countries based on a range of manufacturing siting considerations and existing policies related to carbon fiber. It concludes with a discussion of various policy options the United States could adopt to both (1) increase the competitiveness of the United States as it relates to attracting new carbon fiber manufacturing and (2) foster broader end-use markets for deployment.

*Carbon Composites*  
Springer Nature  
The development of

new materials that are technically and economically viable is no small endeavor. The risks, costs, and time involved in research are usually so high that only governments or private consortia can bear them. And so it has been with the trajectory of carbon fiber reinforced composites, which are capable of providing the lightweighting needed for fuel efficiency, and the mechanical strength required for safety. After a long development cycle, this material is now being widely used by the military, in commercial aircraft, and in the automotive industry. Automotive Carbon Fiber Composites: From Evolution to Implementation,

written by Dr. Jackie Rehkopf, senior researcher at Plasan Carbon Composites, gives a high-level summary on carbon reinforced fiber composites specific to the automotive industry in today's market and its vision for the next 5 to 10 years. It begins with a comprehensive and easy-to-read overview of how composites started to be investigated as a possible alternative to metals, mostly driven by military demands, going on to cover: Fiber and resin types for automotive applications Composite constructions Manufacturing processes Machining and joining Reclaiming and recycling of these materials, among other topics. The title

approaches the future with the realistic optimism of those who work with the challenges of creating new solutions to problems that will stay with us for some time to come: the need to conserve energy and make transportation ever more affordable without the loss of safety. Carbon fiber reinforced composites have demonstrated real value in positively addressing these issues. Automotive Carbon Fiber Composites: From Evolution to Implementation is an excellent guide for those involved in technical material strategy and research, as well as those who need to understand the basics of this subject to support better business decisions.

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