

The Global Market for Carbon Nanomaterials 2020: Carbon Nanotubes, Graphene, Fullerenes, Carbon and Graphene Quantum Dots and Nanodiamonds

<https://marketpublishers.com/r/G6BF3E1ED797EN.html>

Date: May 2024

Pages: 0

Price: US\$ 1,850.00 (Single User License)

ID: G6BF3E1ED797EN

Abstracts

Carbon based-nanomaterials include fullerenes, carbon nanotubes (CNTs), graphene and its derivatives, graphene oxide, nanodiamonds, and carbon-based quantum dots (CQDs). Due to their unique structural dimensions and excellent mechanical, electrical, thermal, optical and chemical properties, carbon nanomaterials have gained great interest in a wide range of industrial market.

Carbon nanotubes (CNTs) and graphene are the strongest, lightest and most conductive fibres known to man, with a performance-per-weight greater than any other material. In direct competition in a number of markets, they are complementary in others.

Once the most promising of all nanomaterials, MWCNTs face stiff competition in conductive applications from graphene and other 2D materials and in mechanically enhanced composites from nanocellulose. Several major producers have closed their MWCNT capacities, but applications continue to come to market and LG Chem has established a large-scale production facility. Super-aligned CNT arrays, films and yarns have found applications in consumer electronics, batteries, polymer composites, aerospace, sensors, heaters, filters and biomedicine.

Large-scale industrial production of single-walled carbon nanotubes (SWCNTs) has been initiated, promising new market opportunities in transparent conductive films, conductive materials, transistors, sensors and memory devices. Again, a number of producers have ceased production, but those left are finding increased demand for their materials. SCWNTs are regarded as one of the most promising candidates to utilized as building blocks in next generation electronics.

Two-dimensional(2D) materials are currently one of the most active areas of nanomaterials research, and offer a huge opportunity for both fundamental studies and practical applications, including superfast, low-power, flexible and wearable electronics, sensors, photonics and electrochemical energy storage devices that will have an immense impact on our society.

Graphene is a ground-breaking two-dimensional (2D) material that possesses extraordinary electrical and mechanical properties that promise a new generation of innovative devices. New methods of scalable synthesis of high-quality graphene, clean delamination transfer and device integration have resulted in the commercialization of state-of-the-art electronics such as graphene touchscreens in smartphones and flexible RF devices on plastics.

Nanodiamonds (NDs) are relatively easy and inexpensive to produce, and have moved towards large-scale commercialization due to their excellent mechanical, thermal properties and chemical stability.

Other carbon nanomaterials of interest include fullerenes and more recently, carbon and graphene quantum dots.

This report on the carbon nanotubes, graphene and 2D materials and nanodiamonds market is by far the most comprehensive and authoritative report produced.

Report contents include:

Carbon nanotubes, fullerene, nanodiamond and graphene products.

Assessment of carbon nanomaterials market including production volumes, competitive landscape, commercial prospects, applications, demand by market and region, commercialization timelines, prices and producer profiles.

Unique assessment tools for the carbon nanomaterials market, end user applications, economic impact, addressable markets and market challenges to provide the complete picture of where the real opportunities in carbon nanomaterials are.

Company profiles of carbon nanotubes, graphene, 2D materials, fullerenes, carbon quantum dots and nanodiamonds producers and product developers,

including products, target markets and contact details

Market assessment of other 2D materials.

Assessment of carbon nanomaterials by market including applications, key benefits, market megatrends, market drivers for, technology drawbacks, competing materials, potential consumption of to 2030 and main players.

In depth-assessment of carbon nanomaterials producer and distributor pricing in 2020.

Global market for carbon nanomaterials in tons, by sector, historical and forecast to 2030.

Full list of technology collaborations, strategic partnerships, and M&As in the global carbon nanomaterials market.

In-depth profiles of carbon nanomaterials producers including products, production capacities, manufacturing methods, collaborations, licensing, customers and target markets.

Detailed forecasts for key growth areas, opportunities and demand.

Contents

1 EXECUTIVE SUMMARY

1.1 GRAPHENE

1.1.1 Why graphene?

1.1.1.1 Exceptional properties

1.1.1.2 Commercial opportunities

1.1.1.3 Collaboration key?

1.1.2 The market in 2019

1.1.3 Future global market outlook

1.1.4 Graphene producers and production capacities

1.1.5 Global graphene demand, 2018-2030, tons

1.1.6 Graphene market by region

1.1.6.1 Asia-Pacific

1.1.6.2 North America

1.1.6.3 Europe

1.1.7 Graphene products

1.1.8 Graphene investments

1.1.9 Industrial collaborations and licence agreements

1.1.10 Graphene market challenges

1.2 CARBON NANOTUBES

1.2.1 Exceptional properties

1.2.2 Products and applications

1.2.3 MWCNTs

1.2.3.1 Applications

1.2.3.2 Producers

1.2.3.3 Production

1.2.3.4 Market demand, tons

1.2.4 SWCNTs

1.2.4.1 Applications

1.2.4.2 Production

1.2.4.3 Market demand, tons

1.2.5 Carbon nanotubes market challenges

1.3 NANODIAMONDS

2 OVERVIEW OF GRAPHENE

2.1 History

2.2 Types of graphene

2.3 Properties

2.4 Graphene Quantum Dots

2.4.1 Synthesis

2.4.2 Applications

2.4.2.1 Optoelectronics, electronics and photonics

2.4.2.2 Energy

2.4.2.3 Biomedicine and healthcare

2.4.2.4 Other

2.4.3 Pricing

2.4.4 Producers

3 OVERVIEW OF CARBON NANOTUBES

3.1 Properties

3.2 Multi-walled nanotubes (MWCNT)

3.2.1 Properties

3.2.2 Applications

3.3 Single-wall carbon nanotubes (SWCNT)

3.3.1 Properties

3.3.2 Applications

3.3.3 Comparison between MWCNTs and SWCNTs

3.3.4 Double-walled carbon nanotubes (DWNTs)

3.3.4.1 Properties

3.3.4.2 Applications

3.3.5 Few-walled carbon nanotubes (FWNTs)

3.3.5.1 Properties

3.3.5.2 Applications

3.4 Carbon Nanohorns (CNHs)

3.4.1 Properties

3.4.2 Applications

3.5 Carbon Onions

3.5.1 Properties

3.5.2 Applications

3.6 Boron Nitride nanotubes (BNNTs)

3.6.1 Properties

3.6.2 Applications

4 OVERVIEW OF FULLERENES

4.1 Properties

4.2 Applications

5 OVERVIEW OF NANODIAMONDS

5.1 Production methods

5.1.1 Fluorescent nanodiamonds (FNDs)

5.2 Applications

6 GRAPHENE PRODUCTION

7 CARBON NANOTUBE PRODUCTION

8 GRAPHENE PATENTS AND PUBLICATIONS

9 CARBON NANOTUBES PATENTS

10 GRAPHENE PRODUCTION

10.1 Commercial production capacities

10.2 Graphene oxide and reduced Graphene Oxide production capacities

10.2.1 By producer

10.2.2 By region

10.3 Graphene nanoplatelets production capacities

10.3.1 By producer

10.3.2 Production capacity by region

10.4 CVD graphene film

10.4.1 By producer

10.5 Graphene production issues and challenges

10.5.1 Oversupply

10.5.2 Quality

10.5.3 Large-volume markets

10.5.4 Commoditisation

10.5.5 Industrial end-user perspective

11 CARBON NANOMATERIALS PRICING

11.1 Graphene pricing

- 11.1.1 Pristine graphene flakes pricing/CVD graphene
- 11.1.2 Few-Layer graphene pricing
- 11.1.3 Graphene nanoplatelets pricing
- 11.1.4 Graphene oxide (GO) and reduced Graphene Oxide (rGO) pricing
- 11.1.5 Graphene quantum dots pricing
- 11.1.6 Multilayer graphene (MLG) pricing
- 11.1.7 Graphene ink
- 11.2 Carbon nanotubes pricing
- 11.3 Nanodiamonds pricing
- 11.4 Fullerenes pricing

12 CARBON NANOMATERIALS IN 3D PRINTING

- 12.1 Market overview
- 12.2 Applications
- 12.3 Market assessment
- 12.4 Global market in tons, historical and forecast to 2030
- 12.5 Product developers

13 CARBON NANOMATERIALS IN ADHESIVES

- 13.1 Market overview
- 13.2 Applications
- 13.3 Market prospects
- 13.4 Market assessment
- 13.5 Global market in tons, historical and forecast to 2030
- 13.6 Product developers

14 CARBON NANOMATERIALS IN AEROSPACE

- 14.1 Market overview
- 14.2 Applications
- 14.3 Market prospects
- 14.4 Market assessment
- 14.5 Global market in tons, historical and forecast to 2030
- 14.6 Product developers

15 CARBON NANOMATERIALS IN AUTOMOTIVE

- 15.1 Market overview
- 15.2 Applications
- 15.3 Market prospects
- 15.4 Market assessment
- 15.5 Global market in tons, historical and forecast to 2030
- 15.6 Product developers

16 CARBON NANOMATERIALS IN BATTERIES

- 16.1 Market overview
- 16.2 Applications
- 16.3 Market prospects
- 16.4 Market assessment
- 16.5 Global market in tons, historical and forecast to 2030
- 16.6 Product developers

17 CARBON NANOMATERIALS IN COMPOSITES

- 17.1 Market overview
- 17.2 Fiber-based polymer composite parts
 - 17.2.1 Market prospects
 - 17.2.2 Applications
 - 17.2.3 Market assessment
- 17.3 Metal-matrix composites
 - 17.3.1 Market assessment
- 17.4 Global market in tons, historical and forecast to 2030
- 17.5 Product developers

18 CARBON NANOMATERIALS IN CONDUCTIVE INKS

- 18.1 Market overview
- 18.2 Applications
- 18.3 Market prospects
- 18.4 Market assessment
- 18.5 Global market in tons, historical and forecast to 2030
- 18.6 Product developers

19 CARBON NANOMATERIALS IN CONSTRUCTION

- 19.1 Market overview
- 19.2 Market prospects
- 19.3 Market assessment
 - 19.3.1 Cement
 - 19.3.2 Asphalt bitumen
- 19.4 Global market in tons, historical and forecast to 2030
- 19.5 Product developers

20 CARBON NANOMATERIALS IN ELECTRONICS

20.1 WEARABLE ELECTRONICS AND DISPLAYS

- 20.1.1 Market overview
- 20.1.2 Market prospects
- 20.1.3 Applications
- 20.1.4 Market assessment
- 20.1.5 Global market, historical and forecast to 2030
- 20.1.6 Product developers

20.2 CARBON NANOMATERIALS IN TRANSISTORS AND INTEGRATED CIRCUITS

- 20.2.1 Market overview
- 20.2.2 Applications
- 20.2.3 Market prospects
- 20.2.4 Market assessment
- 20.2.5 Global market, historical and forecast to 2030
- 20.2.6 Product developers

20.3 CARBON NANOMATERIALS IN MEMORY DEVICES

- 20.3.1 Market overview
- 20.3.2 Market prospects
- 20.3.3 Market assessment
- 20.3.4 Global market in tons, historical and forecast to 2030
- 20.3.5 Product developers

21 CARBON NANOMATERIALS IN FILTRATION

- 21.1 Market overview
- 21.2 Applications
- 21.3 Market prospects
- 21.4 Market assessment
- 21.5 Global market in tons, historical and forecast to 2030
- 21.6 Product developers

22 CARBON NANOMATERIALS IN FUEL CELLS

- 22.1 Market overview
- 22.2 Applications
- 22.3 Market prospects
- 22.4 Market assessment
- 22.5 Global market in tons, historical and forecast to 2030
- 22.6 Product developers

23 CARBON NANOMATERIALS IN LIFE SCIENCES AND MEDICINE

- 23.1 Market overview
- 23.2 Applications
- 23.3 Market prospects
 - 23.3.1 Drug delivery
 - 23.3.2 Imaging and diagnostics
 - 23.3.3 Implants
 - 23.3.4 Medical biosensors
 - 23.3.5 Woundcare
- 23.4 Market assessment
- 23.5 Global market in tons, historical and forecast to 2030
- 23.6 Product developers

24 CARBON NANOMATERIALS IN LIGHTING

- 24.1 Market overview
- 24.2 Applications
- 24.3 Market prospects
- 24.4 Market assessment
- 24.5 Global market in tons, historical and forecast to 2030
- 24.6 Product developers

25 CARBON NANOMATERIALS IN LUBRICANTS

- 25.1 Market overview
- 25.2 Applications
- 25.3 Market prospects
- 25.4 Market assessment

25.5 Global market in tons, historical and forecast to 2030

25.6 Product developers

26 CARBON NANOMATERIALS IN OIL AND GAS

26.1 Market overview

26.2 Applications

26.3 Market prospects

26.4 Market assessment

26.5 Global market in tons, historical and forecast to 2030

26.6 Product developers

27 CARBON NANOMATERIALS IN PAINTS AND COATINGS

27.1 Market overview

27.2 Applications

27.3 Market prospects

27.4 Market assessment

27.5 Global market in tons, historical and forecast to 2030

27.6 Product developers

28 CARBON NANOMATERIALS IN PHOTONICS

28.1 Market overview

28.2 Applications

28.3 Market prospects

28.4 Market assessment

28.5 Global market in tons, historical and forecast to 2030

28.6 Product developers

29 CARBON NANOMATERIALS IN PHOTOVOLTAICS

29.1 Market overview

29.2 Applications

29.3 Market prospects

29.4 Market assessment

29.5 Global market in tons, historical and forecast to 2030

29.6 Product developers

30 CARBON NANOMATERIALS IN RUBBER AND TIRES

- 30.1 Market overview
- 30.2 Applications
- 30.3 Market prospects
- 30.4 Market assessment
- 30.5 Global market in tons, historical and forecast to 2030
- 30.6 Product developers

31 CARBON NANOMATERIALS IN SENSORS

- 31.1 Market overview
- 31.2 Applications
- 31.3 Market prospects
- 31.4 Market assessment
- 31.5 Global market in tons, historical and forecast to 2030
- 31.6 Product developers

32 CARBON NANOMATERIALS IN SMART TEXTILES AND APPAREL

- 32.1 Market overview
- 32.2 Applications
- 32.3 Market prospects
- 32.4 Market assessment
- 32.5 Global market in tons, historical and forecast to 2030
- 32.6 Product developers

33 CARBON NANOMATERIALS IN SUPERCAPACITORS

- 33.1 Market overview
- 33.2 Applications
- 33.3 Market prospects
- 33.4 Market assessment
- 33.5 Global market in tons, historical and forecast to 2030
- 33.6 Product developers

34 OTHER MARKETS

34.1 ELECTRONIC POLISHING MATERIALS

- 34.1.1 Market prospects
- 34.1.2 Market overview
- 34.1.3 Market assessment
- 34.2 COSMETICS
 - 34.2.1 Market prospects
 - 34.2.2 Market overview
 - 34.2.3 Market assessment
- 34.3 CABLING
 - 34.3.1 Market assessment
- 34.4 THERMAL INTERFACE MATERIALS
 - 34.4.1 Market assessment
- 34.5 ANTI-STATIC PLASTIC PARTS
 - 34.5.1 Market assessment

35 GRAPHENE COMPANY PROFILES (236 COMPANY PROFILES)

36 MULTI-WALLED CARBON NANOTUBES COMPANY PROFILES (93 COMPANY PROFILES)

37 SINGLE-WALLED CARBON NANOTUBES COMPANY PROFILES (12 COMPANY PROFILES)

38 NANODIAMONDS COMPANY PROFILES (26 COMPANY PROFILES)

39 FULLERENES COMPANY PROFILES (40 COMPANY PROFILES)

40 OTHER 2-D MATERIALS

- 40.1 BOROPHENE
 - 40.1.1 Properties
 - 40.1.2 Applications
- 40.2 PHOSPHORENE
 - 40.2.1 Properties
 - 40.2.2 Applications
- 40.3 GRAPHITIC CARBON NITRIDE (g-C₃N₄)
 - 40.3.1 Properties
 - 40.3.4 Applications
- 40.4 GERMANENE
 - 40.4.1 Properties

- 40.4.2 Applications
- 40.5 GRAPHDIYNE
 - 40.5.1 Properties
 - 40.5.2 Applications
- 40.6 GRAPHANE
 - 40.6.1 Properties
 - 40.6.2 Applications
- 40.7 HEXAGONAL BORON-NITRIDE
 - 40.7.1 Properties
 - 40.7.2 Applications
- 40.8 MOLYBDENUM DISULFIDE (MoS_2)
 - 40.8.1 Properties
 - 40.8.2 Applications
- 40.9 RHENIUM DISULFIDE (ReS_2) AND DISELENIDE (ReSe_2)
 - 40.9.1 Properties
 - 40.9.2 Applications
- 40.10 SILICENE
 - 40.10.1 Properties
 - 40.10.2 Applications
- 40.11 STANENE/TINENE
 - 40.11.1 Properties
 - 40.11.2 Applications
- 40.12 TUNGSTEN DISELENIDE
 - 40.12.1 Properties
 - 40.12.2 Applications
- 40.13 ANTIMONENE
 - 40.13.1 Properties
 - 40.13.2 Applications
- 40.14 DIAMENE
 - 40.14.1 Properties
 - 40.14.2 Applications
- 40.15 INDIUM SELENIDE
 - 40.15.1 Properties
 - 40.15.2 Applications
- 40.16 COMPARATIVE ANALYSIS OF GRAPHENE AND OTHER 2D MATERIALS

41 RESEARCH METHODOLOGY

42 REFERENCES

Tables

TABLES

Table 1. Main graphene producers by country, annual production capacities, types and main markets they sell into 2020

Table 2. Demand for graphene (tons), 2018-2030

Table 3. Main graphene producers in North America

Table 4. Main graphene producers in Europe

Table 5: Consumer products incorporating graphene

Table 6: Graphene investments and financial agreements

Table 7. Graphene industrial collaborations, licence agreements and target markets

Table 8. Graphene market challenges

Table 9. Market summary for carbon nanotubes-Selling grade particle diameter, usage, advantages, average price/ton, high volume applications, low volume applications and novel applications

Table 10. Typical properties of SWCNT and MWCNT

Table 11: Properties of CNTs and comparable materials

Table 12. Key MWCNT producers

Table 13. Annual production capacity of the key MWCNT producers in 2018

Table 14. MWCNT market demand forecast (tons), 2018-2030

Table 15. Comparative properties of MWCNT and SWCNT

Table 16. Annual production capacity of the key SWCNT producers in 2018

Table 17. SWCNT market demand forecast (tons), 2018-2030. *

Table 18: Properties of graphene, properties of competing materials, applications thereof

Table 19. Comparison of graphene QDs and semiconductor QDs

Table 20. Graphene quantum dot producers

Table 21: Properties of carbon nanotubes

Table 22: Markets, benefits and applications of Single-Walled Carbon Nanotubes

Table 23: Comparison between single-walled carbon nanotubes and multi-walled carbon nanotubes

Table 24. Comparative properties of BNNTs and CNTs

Table 25: Markets, benefits and applications of fullerenes

Table 26. Summary of types of NDS and production methods-advantages and disadvantages

Table 27: Markets, benefits and applications of nanodiamonds

Table 28. Assessment of graphene production methods

Table 29: SWCNT synthesis methods

Table 30: Accumulated number of patent publications for graphene, 2004-2018
Table 31: Location of SWCNT patent filings 2008-2018
Table 32: Main SWCNT patent assignees
Table 33: Demand for graphene (tons), 2018-2030
Table 34: Graphene oxide production capacity by producer, 2010-2019
Table 35: Graphene oxide production capacity in tons by region, 2010-2019
Table 36: Graphene nanoplatelets capacity in tons by producer, 2010-2018
Table 37: Graphene nanoplatelets capacity in tons by region, 2010-2019
Table 38: CVD graphene film capacity by producer, 2010-2018/ 000s m2
Table 39: Types of graphene and typical prices
Table 40: Pristine graphene flakes pricing by producer
Table 41: Few-layer graphene pricing by producer
Table 42: Graphene nanoplatelets pricing by producer
Table 43: Graphene oxide and reduced graphene oxide pricing, by producer
Table 44: Graphene quantum dots pricing by producer
Table 45: Multi-layer graphene pricing by producer
Table 46: Graphene ink pricing by producer
Table 47: Carbon nanotubes pricing (MWCNTS, SWCNT etc.) by producer
Table 48: Nanodiamonds pricing by producer/distributor
Table 49: Fullerenes pricing by producer
Table 50: Market overview for carbon nanomaterials in 3D printing
Table 51: Applications of carbon nanomaterials in 3D printing
Table 52: Market and applications for carbon nanomaterials in 3D printing
Table 53: Demand for carbon nanomaterials in 3-D printing (tons), 2018-2030
Table 54: Product developers in carbon nanomaterials in 3D printing
Table 55: Market overview for carbon nanomaterials in adhesives
Table 56: Applications of carbon nanomaterials in adhesives
Table 57: Scorecard for carbon nanomaterials in adhesives
Table 58: Market and applications for carbon nanomaterials in adhesives
Table 59: Demand for carbon nanomaterials in adhesives (tons), 2018-2030
Table 60: Product developers in carbon nanomaterials for adhesives
Table 61: Market overview for carbon nanomaterials in aerospace
Table 62: Applications of carbon nanomaterials in aerospace
Table 63: Scorecard for carbon nanomaterials in aerospace
Table 64: Market and applications for carbon nanomaterials in aerospace
Table 65: Demand for carbon nanomaterials in aerospace (tons), 2018-2030
Table 66: Product developers in carbon nanomaterials for aerospace
Table 67: Market overview for carbon nanomaterials in automotive
Table 68: Applications of carbon nanomaterials in automotive

Table 69. Scorecard for carbon nanomaterials in automotive

Table 70. Market and applications for carbon nanomaterials in automotive

Table 71: Demand for carbon nanomaterials in automotive (tons), 2018-2030

Table 72: Product developers in carbon nanomaterials in the automotive market

Table 73. Market overview for carbon nanomaterials in batteries

Table 74. Applications of carbon nanomaterials in batteries

Table 75. Scorecard for carbon nanomaterials in batteries

Table 76. Market and applications for carbon nanomaterials in batteries

Table 77: Estimated demand for carbon nanomaterials in batteries (tons), 2018-2030

Table 78: Product developers in carbon nanomaterials for batteries

Table 79. Market overview for carbon nanomaterials in composites

Table 80. Scorecard for carbon nanomaterials in fiber-based polymer composite parts

Table 81. Applications of carbon nanomaterials in fiber-based polymer composite parts

Table 82. Market and applications for carbon nanomaterials in fiber-based composite parts

Table 83. Market and applications for carbon nanomaterials in metal matrix composites

Table 84. Global market for carbon nanomaterials in composites 2018-2030, tons

Table 85: Product developers in carbon nanomaterials composites

Table 86. Market overview for carbon nanomaterials in conductive inks

Table 87. Applications of carbon nanomaterials in conductive ink

Table 88. Scorecard for carbon nanomaterials in conductive inks

Table 89. Market and applications for carbon nanomaterials in conductive inks

Table 90. Comparative properties of conductive inks

Table 91: Demand for graphene in conductive ink (tons), 2018-2027

Table 92: Product developers in carbon nanomaterials for conductive inks

Table 93. Market overview for carbon nanomaterials in construction

Table 94. Scorecard for carbon nanomaterials in construction

Table 95. Carbon nanomaterials for cement

Table 96. Carbon nanomaterials for asphalt bitumen

Table 97: Demand for carbon nanomaterials in construction (tons), 2018-2030

Table 98: Carbon nanomaterials product developers in construction

Table 99. Market overview for carbon nanomaterials in wearable electronics and displays

Table 100. Scorecard for carbon nanomaterials in wearable electronics and displays

Table 101. Applications of carbon nanomaterials in wearable electronics and displays

Table 102. Market and applications for carbon nanomaterials in wearable electronics and displays

Table 103: Comparison of ITO replacements

Table 104: Demand for carbon nanomaterials in wearable electronics and displays,

2018-2030

Table 105: Product developers in carbon nanomaterials for electronics

Table 106. Market overview for carbon nanomaterials in transistors and integrated circuits

Table 107. Applications of carbon nanomaterials in transistors and integrated circuits

Table 108. Scorecard for carbon nanomaterials in transistors and integrated circuits

Table 109. Market and applications for carbon nanomaterials in transistors and integrated circuits

Table 110: Demand for carbon nanomaterials in transistors and integrated circuits, 2018-2030

Table 111: Product developers in carbon nanomaterials transistors and integrated circuits

Table 112. Market overview for carbon nanomaterials in memory devices

Table 113. Scorecard for carbon nanomaterials in memory devices

Table 114. Market and applications for carbon nanomaterials in memory devices

Table 115: Demand for carbon nanomaterials in memory devices, 2018-2030

Table 116: Product developers in carbon nanomaterials for memory devices

Table 117: Comparison of CNT membranes with other membrane technologies

Table 118. Market overview for carbon nanomaterials in filtration

Table 119. Applications of carbon nanomaterials in filtration

Table 120. Scorecard for carbon nanomaterials in filtration

Table 121. Market and applications for carbon nanomaterials in filtration

Table 122: Demand for carbon nanomaterials in filtration (tons), 2018-2030

Table 123: Carbon nanomaterials companies in filtration

Table 124. Electrical conductivity of different catalyst supports compared to carbon nanotubes

Table 125. Market overview for carbon nanomaterials in fuel cells

Table 126. Applications of carbon nanomaterials in fuel cells

Table 127. Scorecard for carbon nanomaterials in fuel cells

Table 128. Market and applications for carbon nanomaterials in fuel cells

Table 129: Demand for carbon nanomaterials in fuel cells (tons), 2018-2030

Table 130: Product developers in carbon nanomaterials for fuel cells

Table 131. Market overview for carbon nanomaterials in life sciences and medicine

Table 132. Applications of carbon nanomaterials in life sciences and biomedicine

Table 133. Scorecard for carbon nanomaterials in drug delivery

Table 134. Scorecard for carbon nanomaterials in imaging and diagnostics

Table 135. Scorecard for carbon nanomaterials in medical implants

Table 136. Scorecard for carbon nanomaterials in medical biosensors

Table 137. Scorecard for carbon nanomaterials in woundcare

Table 138. Market and applications for carbon nanomaterials in life sciences and medicine

Table 139: Demand for carbon nanomaterials in life sciences and medical (tons), 2018-2030

Table 140: Product developers in carbon nanomaterials for life sciences and biomedicine

Table 141. Market overview for carbon nanomaterials in lighting

Table 142. Applications of carbon nanomaterials in lighting

Table 143. Scorecard for carbon nanomaterials in lighting

Table 144. Market and applications for carbon nanomaterials in lighting

Table 145: Demand for carbon nanomaterials in lighting, 2018-2030

Table 146: Product developers in carbon nanomaterials for lighting

Table 147. Market overview for carbon nanomaterials in lubricants

Table 148. Nanomaterial lubricant products

Table 149. Applications of carbon nanomaterials in lubricants

Table 150. Scorecard for carbon nanomaterials in lubricants

Table 151. Market and applications for carbon nanomaterials in lubricants

Table 152: Demand for carbon nanomaterials in lubricants (tons), 2018-2030

Table 153: Product developers in carbon nanomaterials for lubricants

Table 154. Market overview for carbon nanomaterials in oil and gas

Table 155. Applications of carbon nanomaterials in oil and gas

Table 156. Scorecard for carbon nanomaterials in oil and gas

Table 157. Market and applications for carbon nanomaterials in oil and gas

Table 158: Demand for carbon nanomaterials in oil and gas (tons), 2018-2030

Table 159: Product developers in carbon nanomaterials for oil and gas

Table 160. Markets for nanocoatings

Table 161. Market overview for carbon nanomaterials in paints and coatings

Table 162. Applications of carbon nanomaterials in paints and coatings

Table 163. Scorecard for carbon nanomaterials in paints and coatings

Table 164. Market and applications for carbon nanomaterials in paints and coatings

Table 165: Demand for carbon nanomaterials in paints and coatings (tons), 2018-2030

Table 166: Product developers in carbon nanomaterials for paints and coatings

Table 167. Market overview for carbon nanomaterials in photonics

Table 168. Applications of carbon nanomaterials in photonics

Table 169. Scorecard for carbon nanomaterials in photonics

Table 170. Market and applications for carbon nanomaterials in photonics

Table 171: Demand for carbon nanomaterials in photonics, 2018-2030

Table 172: Product developers in carbon nanomaterials in photonics

Table 173. Market overview for carbon nanomaterials in photovoltaics

Table 174. Applications of carbon nanomaterials in photovoltaics
Table 175. Scorecard for carbon nanomaterials in photovoltaics
Table 176. Market and applications for carbon nanomaterials in photovoltaics
Table 177: Demand for carbon nanomaterials in photovoltaics (tons), 2018-2030
Table 178: Product developers in carbon nanomaterials for solar
Table 179. Market overview for carbon nanomaterials in rubber and tires
Table 180. Applications of carbon nanomaterials in rubber and tires
Table 181. Scorecard for carbon nanomaterials in rubber and tires
Table 182. Market and applications for carbon nanomaterials in rubber and tires
Table 183: Demand for carbon nanomaterials in rubber and tires (tons), 2018-2030
Table 184: Product developers in carbon nanomaterials in rubber and tires
Table 185. Market overview for carbon nanomaterials in sensors
Table 186. Applications of carbon nanomaterials in sensors
Table 187. Scorecard for carbon nanomaterials in sensors
Table 188. Market and applications for carbon nanomaterials in sensors
Table 189: Demand for carbon nanomaterials in sensors (tons), 2018-2030
Table 190: Product developers in carbon nanomaterials for sensors
Table 191: Desirable functional properties for the textiles industry afforded by the use of nanomaterials
Table 192. Market overview for carbon nanomaterials in smart textiles and apparel
Table 193. Applications of carbon nanomaterials in smart textiles and apparel
Table 194. Scorecard for carbon nanomaterials in smart textiles and apparel
Table 195. Market and applications for carbon nanomaterials in smart textiles and apparel
Table 196: Demand for carbon nanomaterials in textiles (tons), 2018-2030
Table 197: Carbon nanomaterials product developers in smart textiles and apparel
Table 198. Market overview for carbon nanomaterials in supercapacitors
Table 199. Applications of carbon nanomaterials in supercapacitors
Table 200. Scorecard for carbon nanomaterials in supercapacitors
Table 201: Comparative properties of graphene supercapacitors and lithium-ion batteries
Table 202. Market and applications for carbon nanomaterials in supercapacitors
Table 203: Demand for carbon nanomaterials in supercapacitors (tons), 2018-2030
Table 204: Product developers in carbon nanomaterials for supercapacitors
Table 205. Carbon nanomaterials scorecard for nanodiamonds in electronic polishing materials
Table 206: Market overview for carbon nanomaterials in polishing materials
Table 207. Market and applications for carbon nanomaterials in polishing materials
Table 208. Nanomaterials scorecard for carbon nanomaterials in cosmetics

Table 209: Market overview for carbon nanomaterials in cosmetics
Table 210. Market and applications for carbon nanomaterials in cosmetics
Table 211. Market and applications for carbon nanomaterials in cabling
Table 212. Market and applications for carbon nanomaterials in cabling
Table 213. Market and applications for carbon nanomaterials in anti-static plastic parts
Table 214. Sensor surface
Table 215. Ex-graphene producers and product developers
Table 216: CNT producers and companies they supply/licence to
Table 217. Properties of carbon nanotube paper
Table 218. Ex-producers of SWCNTs
Table 219. SWCNTs distributors
Table 220. Ex-producers of nanodiamonds
Table 221: 2D materials types
Table 222: Electronic and mechanical properties of monolayer phosphorene, graphene and MoS ₂
Table 223: Comparative analysis of graphene and other 2-D nanomaterials
Table 224: Categorization of nanomaterials

Figures

FIGURES

Figure 1. Demand for graphene, by market, 2019

Figure 2. Demand for graphene, by market, 2030

Figure 3. Demand for graphene, 2018-2030, tons

Figure 4. Global graphene demand by market, 2018-2030 (tons). Low estimate

Figure 5. Global graphene demand by market, 2018-2030 (tons). Medium estimate

Figure 6. Global graphene demand by market, 2018-2030 (tons). High estimate

Figure 7: Demand for graphene in China, by market, 2019

Figure 8: Demand for graphene in Asia-Pacific, by market, 2019

Figure 9. Main graphene producers in Asia-Pacific

Figure 10: Demand for graphene in North America, by market, 2019

Figure 11: Demand for graphene in Europe, by market, 2018

Figure 12. Demand for MWCNT by application in 2019

Figure 13. SWCNT production capacity by producer in 2018 (tons)

Figure 14. Calculated SWCNT sales volume by producer in 2018 (kg)

Figure 15. The structure of eight different allotropes of the carbon element

Figure 16: Graphene layer structure schematic

Figure 17: Illustrative procedure of the Scotch-tape based micromechanical cleavage of HOPG

Figure 18: Graphite and graphene

Figure 19: Graphene and its descendants: top right: graphene; top left: graphite = stacked graphene; bottom right: nanotube=rolled graphene; bottom left: fullerene=wrapped graphene.

Figure 20: Green-fluorescing graphene quantum dots

Figure 21. Schematic of (a) CQDs and (c) GQDs. HRTEM images of (b) C-dots and (d) GQDs showing combination of zigzag and armchair edges (positions marked as 1–4)

Figure 22. Graphene quantum dots

Figure 23: Schematic of single-walled carbon nanotube

Figure 24: TIM sheet developed by Zeon Corporation

Figure 25: Double-walled carbon nanotube bundle cross-section micrograph and model

Figure 26. TEM image of FWNTs

Figure 27: Schematic representation of carbon nanohorns

Figure 28: TEM image of carbon onion

Figure 29: Schematic of Boron Nitride nanotubes (BNNTs). Alternating B and N atoms are shown in blue and red

Figure 30: Fullerene schematic

Figure 31. Fabrication methods of graphene

Figure 32. TEM micrographs of: A) HR-CNFs; B) GANF® HR-CNF, it can be observed its high graphitic structure; C) Unraveled ribbon from the HR-CNF; D) Detail of the ribbon; E) Scheme of the structure of the HR-CNFs; F) Large single graphene oxide sheets derived from GANF

Figure 33: (a) Graphene powder production line in The Sixth Element Materials Technology Co. Ltd. (b) Graphene film production line of Wuxi Graphene Films Co. Ltd

Figure 34. Schematic illustration of the main graphene production methods

Figure 35: Schematic representation of methods used for carbon nanotube synthesis (a) Arc discharge (b) Chemical vapor deposition (c) Laser ablation (d) hydrocarbon flames

Figure 36: Arc discharge process for CNTs

Figure 37: Schematic of thermal-CVD method

Figure 38: Schematic of plasma-CVD method

Figure 39: CoMoCAT® process

Figure 40: Schematic for flame synthesis of carbon nanotubes (a) premixed flame (b) counter-flow diffusion flame (c) co-flow diffusion flame (d) inverse diffusion flame

Figure 41: Schematic of laser ablation synthesis

Figure 42: Published patent publications for graphene, 2004-2018

Figure 43: MWCNT patents filed 2007-2019

Figure 44. SWCNT patent applications 2001-2018

Figure 45. Demand for graphene, 2018-2030, tons

Figure 46: Graphene oxide production capacity in tons by region, 2010-2019

Figure 47: Graphene nanoplatelets capacity in tons by region, 2010-2019

Figure 48: CVD Graphene on Cu Foil

Figure 49: Demand for carbon nanomaterials in 3-D printing (tons), 2018-2030

Figure 50. CNCTArch lightweight mounting for digital signalling

Figure 51: Demand for carbon nanomaterials in adhesives (tons), 2018-2030

Figure 52: Graphene Adhesives

Figure 53. Carbon nanotube Composite Overwrap Pressure Vessel (COPV) developed by NASA

Figure 54: Demand for carbon nanomaterials in aerospace (tons), 2018-2030

Figure 55. HeatCoat technology schematic

Figure 56. Orbex Prime rocket

Figure 57: Graphene enhanced aircraft cargo container

Figure 58: Graphene aircraft

Figure 59: Veelo carbon fiber nanotube sheet

Figure 60: Demand for carbon nanomaterials in automotive (tons), 2018-2030

Figure 61: Supercar incorporating graphene

Figure 62: Schematic of CNTs as heat-dissipation sheets

- Figure 63. Graphene anti-corrosion primer
- Figure 64. Graphene-R Brake pads
- Figure 65: Antistatic graphene tire
- Figure 66. Graphene engine oil additives
- Figure 67: Demand for carbon nanomaterials in batteries (tons), 2018-2030
- Figure 68: Nano Lithium X Battery
- Figure 69. Apollo Traveler graphene-enhanced USB-C / A fast charging power bank
- Figure 70. 6000mAh Portable graphene batteries
- Figure 71. Real Graphene Powerbank
- Figure 72. Graphene Functional Films - UniTran EH/FH
- Figure 73. Demand for carbon nanomaterials in composites (tons), 2018-2030
- Figure 74. Graphene bike
- Figure 75. Graphene lacrosse equipment
- Figure 76. CNT anti-icing coating for wind turbines
- Figure 77. Graphene-based suitcase made from recycled plastic
- Figure 78. Aros Create
- Figure 79. CSCNT Reinforced Prepreg
- Figure 80. Grays graphene hockey sticks
- Figure 81: Demand for graphene in conductive ink (tons), 2018-2030
- Figure 82: BGT Materials graphene ink product
- Figure 83: Nanotube inks
- Figure 84: Printed graphene conductive ink
- Figure 85: Textiles covered in conductive graphene ink
- Figure 86. Comparison of nanofillers with supplementary cementitious materials and aggregates in concrete
- Figure 87: Demand for carbon nanomaterials in construction (tons), 2018-2030
- Figure 88. Graphene asphalt additives
- Figure 89. OG (Original Graphene) Concrete Admix Plus
- Figure 90: Demand for carbon nanomaterials in wearable electronics and displays, 2018-2030
- Figure 91: Moxi flexible film developed for smartphone application
- Figure 92. Strategic Elements' transparent glass demonstrator
- Figure 93: Carbon nanotube-based colour active matrix electrophoretic display (EPD) e-paper
- Figure 94: Demand for carbon nanomaterials in transistors and integrated circuits, 2018-2030
- Figure 95. Graphene IC in wafer tester
- Figure 96: Schematic cross-section of a graphene based transistor (GBT, left) and a graphene field-effect transistor (GFET, right)

Figure 97: Thin film transistor incorporating CNTs

Figure 98: Demand for carbon nanomaterials in memory devices, 2018-2030

Figure 99: Carbon nanotubes NRAM chip

Figure 100: Layered structure of tantalum oxide, multilayer graphene and platinum used for resistive random-access memory (RRAM)

Figure 101: Demand for carbon nanomaterials in filtration (tons), 2018-2030

Figure 102: Graphene anti-smog mask

Figure 103: Graphene filtration membrane

Figure 104: Water filter cartridge

Figure 105: Demand for carbon nanomaterials in fuel cells (tons), 2018-2030

Figure 106: Graphene-based E-skin patch

Figure 107: Demand for carbon nanomaterials in life sciences and medical (tons), 2018-2030

Figure 108: CARESTREAM DRX-Revolution Nano Mobile X-ray System

Figure 109: Graphene medical biosensors for wound healing

Figure 110: Graphene Frontiers' Six chemical sensors consists of a field effect transistor (FET) with a graphene channel. Receptor molecules, such as DNA, are attached directly to the graphene channel.

Figure 111: GraphWear wearable sweat sensor

Figure 112: Demand for carbon nanomaterials in lighting, 2018-2030

Figure 113: Graphene LED bulbs

Figure 114: Demand for carbon nanomaterials in lubricants (tons), 2018-2030

Figure 115: Tricolit spray coating

Figure 116: Graphenoil products

Figure 117: Demand for carbon nanomaterials in oil and gas (tons), 2018-2030

Figure 118: Directa Plus Grafysorber

Figure 119: Demand for carbon nanomaterials in paints and coatings (tons), 2018-2030

Figure 120: Cryorig CPU cooling system with graphene coating

Figure 121: Four layers of graphene oxide coatings on polycarbonate

Figure 122: CSCNT Reinforced Prepreg

Figure 123: 23303 ZINCTON GNC graphene paint

Figure 124: Graphene-enhanced anti-corrosion aerosols under their Hycote brand

Figure 125: Scania Truck head lamp brackets ACT chamber 6 weeks, equivalent to 3y field use. Piece treated with GO to the left together with different non-GO coatings

Figure 126: Schematic of graphene heat film

Figure 127: Demand for carbon nanomaterials in photonics, 2018-2030

Figure 128: All-graphene optical communication link demonstrator operating at a data rate of 25 Gb/s per channel

Figure 129: Demand for carbon nanomaterials in photovoltaics (tons), 2018-2030

- Figure 130: Suntech/TCNT nanotube frame module
- Figure 131. Graphene coated glass
- Figure 132: Demand for carbon nanomaterials in rubber and tires (tons), 2018-2030
- Figure 133. Eagle F1 graphene tire
- Figure 134. Graphene floor mats
- Figure 135. Vittoria Corsa G+ tire
- Figure 136. Graphene-based sensors for health monitoring
- Figure 137: Demand for carbon nanomaterials in sensors (tons), 2018-2030
- Figure 138. AGILE R100 system
- Figure 139. Graphene fully packaged linear array detector
- Figure 140: GFET sensors
- Figure 141. Graphene is used to increase sensitivity to middle-infrared light
- Figure 142: Demand for carbon nanomaterials in textiles (tons), 2018-2030
- Figure 143. Colmar graphene ski jacket
- Figure 144. Graphene dress. The dress changes colour in sync with the wearer's breathing
- Figure 145. G+ Graphene Aero Jersey
- Figure 146: Inov-8 graphene shoes
- Figure 147. Graphene Functional Membranes - UniTran GM
- Figure 148. Graphene jacket
- Figure 149: Demand for carbon nanomaterials in supercapacitors (tons), 2018-2030
- Figure 150. Skeleton Technologies supercapacitor
- Figure 151: Zapgo supercapacitor phone charger
- Figure 152. Prototypes of nanodiamonds, fullerene and lignin sunscreen
- Figure 153. Graphene heating films
- Figure 154. Graphene flake products
- Figure 155. AIKA Black-T
- Figure 156. Printed graphene biosensors
- Figure 157. Graphene battery schematic
- Figure 158. Test performance after 6 weeks ACT II according to Scania STD4445
- Figure 159. Talcoat graphene mixed with paint
- Figure 160. T-FORCE CARDEA ZERO
- Figure 161: Prototype of Graphene-integrated UF filter cartridge
- Figure 162. AWN Nanotech water harvesting prototype
- Figure 163. Carbonics, Inc.'s carbon nanotube technology
- Figure 164. Fuji carbon nanotube products
- Figure 165. Cup Stacked Type Carbon Nano Tubes schematic
- Figure 166. CSCNT composite dispersion
- Figure 167. Flexible CNT CMOS integrated circuits with sub-10 nanoseconds stage

delays

Figure 168. Koatsu Gas Kogyo Co. Ltd CNT product

Figure 169. Hybrid battery powered electrica motorbike concept

Figure 170. Schematic illustration of three-chamber system for SWCNH production

Figure 171. TEM images of carbon nanobrush

Figure 172: Carbon nanotube paint product

Figure 173. HiPCO® Reactor

Figure 174: Schematic of 2-D materials

Figure 175: Borophene schematic

Figure 176: Black phosphorus structure

Figure 177: Black Phosphorus crystal

Figure 178: Bottom gated flexible few-layer phosphorene transistors with the hydrophobic dielectric encapsulation

Figure 179: Graphitic carbon nitride

Figure 180: Structural difference between graphene and C₂N-h₂D crystal: (a) graphene; (b) C₂N-h₂D crystal. Credit: Ulsan National Institute of Science and Technology

Figure 181: Schematic of germanene

Figure 182: Graphdiyne structure

Figure 183: Schematic of Graphane crystal

Figure 184: Structure of hexagonal boron nitride

Figure 185: BN nanosheet textiles application

Figure 186: Structure of 2D molybdenum disulfide

Figure 187: SEM image of MoS₂

Figure 188: Atomic force microscopy image of a representative MoS₂ thin-film transistor

Figure 189: Schematic of the molybdenum disulfide (MoS₂) thin-film sensor with the deposited molecules that create additional charge

Figure 190: Schematic of a monolayer of rhenium disulfide

Figure 191: Silicene structure

Figure 192: Monolayer silicene on a silver (111) substrate

Figure 193: Silicene transistor

Figure 194: Crystal structure for stanene

Figure 195: Atomic structure model for the 2D stanene on Bi₂Te₃(111)

Figure 196: Schematic of tungsten diselenide

Figure 197: Schematic of Indium Selenide (InSe)

I would like to order

Product name: The Global Market for Carbon Nanomaterials 2020: Carbon Nanotubes, Graphene, Fullerenes, Carbon and Graphene Quantum Dots and Nanodiamonds

Product link: <https://marketpublishers.com/r/G6BF3E1ED797EN.html>

Price: US\$ 1,850.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer Service:

info@marketpublishers.com

Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <https://marketpublishers.com/r/G6BF3E1ED797EN.html>

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name:
Last name:
Email:
Company:
Address:
City:
Zip code:
Country:
Tel:
Fax:
Your message:

****All fields are required**

Customer signature _____

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <https://marketpublishers.com/docs/terms.html>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970

