

The Global Market for Graphene 2020-2030

<https://marketpublishers.com/r/GDE0BA24D40EN.html>

Date: October 2020

Pages: 550

Price: US\$ 1,300.00 (Single User License)

ID: GDE0BA24D40EN

Abstracts

The market for graphene has grown hugely in the past decade, with numerous products now on the market and more to come as graphene producers record steadily increasing revenues and OEMs witnessing significant returns in clothing, sportswear, footwear, tires, batteries etc. Graphene is attracting increasing attention from investors, researchers and industrial players due to exceptional mechanical, electronic, and thermal properties. Graphene is available in multi-ton quantities from many producers and has been identified by many industry sectors as a key materials that will drive future product development in flexible electronics, smart textiles, biosensors, drug delivery, water filtration, supercapacitors and more.

Future Markets, Inc., publisher of the first ever market report on Graphene in 2009 and publisher of Graphene Magazine (www.2dmaterialsmag.com) presents The Global Market for Graphene 2020-2030, the most comprehensive and up-to date report on graphene currently available, by the world's leading market authority on graphene. Profiling over 200 companies, the report provides key information for investors and executives to enable them to understand and take advantage of the opportunities provided by graphene (other 2D materials are also covered).

The Global Market for Graphene 2020-2030 contains:

- Unique market assessment tools to assess the viability of graphene, by market, and application.

- Tabular data on current graphene products.

- Market assessment of other 2D materials.

- Assessment of graphene by market including applications, key benefits, market

megatrends, market drivers for graphene, technology drawbacks, competing materials, potential consumption of graphene to 2030 and main players.

Graphical depictions of graphene applications by market.

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

Global market for graphene in tons, by sector, historical and forecast to 2030. Global graphene market size split by market in 2019 and for each application to 2030.

Full list of technology collaborations, strategic partnerships, and M&As in the global graphene market including collaboration dates.

In-depth profiles of 252 graphene producers including products, production capacities, manufacturing methods, collaborations, licensing, customers and target markets. Companies profiled include Directa Plus, Global Graphene Group, ZEN Graphene Solutions, HP1 Technologies Ltd, GrapheneCA, Saint Jean Carbon, SafeLi LLC, Versarien, Talga Resources, Archer Materials, Haydale Graphene, Paragraf, Graphenea and many more.

List of ex-graphene producers.

Detailed forecasts for key growth areas, opportunities and demand.

Market impact of COVID-19 pandemic on graphene market, by end user industry.

Contents

1 EXECUTIVE SUMMARY

- 1.1 Why graphene?
 - 1.1.1 Exceptional properties
 - 1.1.2 Commercial opportunities
 - 1.1.3 Collaboration key?
- 1.2 The market in 2019
- 1.3 Future global market outlook
- 1.4 Graphene producers and production capacities
- 1.5 Global graphene demand, 2018-2030, tons
- 1.6 Graphene market by region
 - 1.6.1 Asia-Pacific
 - 1.6.2 North America
 - 1.6.3 Europe
- 1.7 Graphene products
- 1.8 Graphene investments
- 1.9 Industrial collaborations and licence agreements
- 1.10 Graphene market challenges
- 1.11 Market impact from COVID-19 pandemic

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 GRAPHENE PRODUCTION

3.1 Quality

3.2 Assessment of graphene production methods

4 REGULATIONS

4.1 Environmental, health and safety regulation

4.1.1 Europe

4.1.2 United States

4.1.3 Asia-Pacific

4.2 Workplace exposure

5 GRAPHENE PATENTS AND PUBLICATIONS

6 GRAPHENE PRODUCTION

6.1 Commercial production capacities

6.2 Graphene oxide and reduced Graphene Oxide production capacities

6.2.1 By producer

6.2.2 By region

6.3 Graphene nanoplatelets production capacities

6.3.1 By producer

6.3.2 Production capacity by region

6.4 CVD graphene film

6.4.1 By producer

6.5 Graphene production issues and challenges

6.5.1 Oversupply

6.5.2 Quality

6.5.3 Large-volume markets

6.5.4 Commoditisation

6.5.5 Industrial end-user perspective

7 GRAPHENE PRICING

7.1 Pristine graphene flakes pricing/CVD graphene

7.2 Few-Layer graphene pricing

7.3 Graphene nanoplatelets pricing

7.4 Graphene oxide (GO) and reduced Graphene Oxide (rGO) pricing

7.5 Graphene quantum dots pricing

7.6 Multilayer graphene (MLG) pricing

7.7 Graphene ink

8 GRAPHENE IN 3D PRINTING

8.1 Market overview

8.2 Market prospects

8.3 Market assessment

8.4 Applications map

8.5 Global market in tons, historical and forecast to 2030

8.6 Product developers

9 GRAPHENE IN ADHESIVES

9.1 Market overview

9.2 Market prospects

9.3 Market assessment

9.4 Applications map

9.5 Global market in tons, historical and forecast to 2030

9.6 Product developers

10 GRAPHENE IN AUTOMOTIVE

10.1 Market overview

10.2 Market prospects

10.3 Market assessment

10.4 Applications Map

10.5 Global market in tons, historical and forecast to 2030

10.6 Product developers

11 GRAPHENE IN AEROSPACE

11.1 Market overview

11.2 Market prospects

11.3 Market assessment

11.4 Applications Map

11.5 Global market in tons, historical and forecast to 2030

11.6 Product developers

12 GRAPHENE IN BATTERIES

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

13 GRAPHENE IN COMPOSITES

- 13.1 Market overview
- 13.2 Fiber-based polymer composite parts
 - 13.2.1 Market prospects
 - 13.2.2 Market assessment
 - 13.2.3 Applications map
- 13.3 Metal-matrix composites
 - 13.3.1 Market assessment
- 13.4 Global market in tons, historical and forecast to 2030
- 13.5 Product developers

14 GRAPHENE IN CONDUCTIVE INKS

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

15 GRAPHENE IN CONSTRUCTION MATERIALS

- 15.1 Market overview
- 15.2 Market prospects
- 15.3 Market assessment
 - 15.3.1 Cement
 - 15.3.2 Asphalt bitumen
- 15.4 Global market in tons, historical and forecast to 2030
- 15.5 Product developers

16 GRAPHENE IN ELECTRONICS

16.1 WEARABLE ELECTRONICS AND DISPLAYS

16.1.1 Market overview

16.1.2 Market prospects

16.1.3 Market assessment

16.1.4 Global market, historical and forecast to 2030

16.1.5 Product developers

16.2 GRAPHENE IN TRANSISTORS AND INTEGRATED CIRCUITS

16.2.1 Market overview

16.2.2 Market prospects

16.2.3 Market assessment

16.2.4 Applications map

16.2.5 Global market, historical and forecast to 2030

16.2.6 Product developers

16.3 GRAPHENE IN MEMORY DEVICES

16.3.1 Market overview

16.3.2 Market prospects

16.3.3 Market assessment

16.3.4 Global market in tons, historical and forecast to 2030

16.3.5 Product developers

17 GRAPHENE IN FILTRATION

17.1 Market overview

17.2 Market prospects

17.3 Market assessment

17.4 Applications map

17.5 Global market in tons, historical and forecast to 2030

17.6 Product developers

18 GRAPHENE IN FUEL CELLS

18.1 Market overview

18.2 Market prospects

18.3 Market assessment

18.4 Applications map

18.5 Global market in tons, historical and forecast to 2030

18.6 Product developers

19 GRAPHENE IN LIFE SCIENCES AND MEDICINE

- 19.1 Market overview
- 19.2 Market prospects
 - 19.2.1 Drug delivery
 - 19.2.2 Imaging and diagnostics
 - 19.2.3 Implants
 - 19.2.4 Medical biosensors
 - 19.2.5 Woundcare
- 19.3 Market assessment
- 19.4 Applications map
- 19.5 Global market in tons, historical and forecast to 2030
- 19.6 Product developers

20 GRAPHENE IN LIGHTING

- 20.1 Market overview
- 20.2 Market prospects
- 20.3 Market assessment
- 20.4 Applications map
- 20.5 Global market in tons, historical and forecast to 2030
- 20.6 Product developers

21 GRAPHENE IN LUBRICANTS

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

22 GRAPHENE IN OIL AND GAS

- 22.1 Market overview
- 22.2 Market prospects
- 22.3 Market assessment
- 22.4 Applications map

22.5 Global market in tons, historical and forecast to 2030

22.6 Product developers

23 GRAPHENE IN PAINTS AND COATINGS

23.1 Market overview

23.2 Market prospects

23.3 Market assessment

23.4 Applications map

23.5 Global market in tons, historical and forecast to 2030

23.6 Product developers

24 GRAPHENE IN PHOTONICS

24.1 Market overview

24.2 Market prospects

24.3 Market assessment

24.4 Applications map

24.5 Global market in tons, historical and forecast to 2030

24.6 Product developers

25 GRAPHENE IN PHOTOVOLTAICS

25.1 Market overview

25.2 Market prospects

25.3 Market assessment

25.4 Applications map

25.5 Global market in tons, historical and forecast to 2030

25.6 Product developers

26 GRAPHENE IN RUBBER AND TIRES

26.1 Market overview

26.2 Market prospects

26.3 Market assessment

26.4 Applications map

26.5 Global market in tons, historical and forecast to 2030

26.6 Product developers

27 GRAPHENE IN SENSORS

- 27.1 Market overview
- 27.2 Market prospects
- 27.3 Market assessment
- 27.4 Applications map
- 27.5 Global market in tons, historical and forecast to 2030
- 27.6 Product developers

28 GRAPHENE IN SMART TEXTILES AND APPAREL

- 28.1 Market overview
- 28.2 Market prospects
- 28.3 Market assessment
- 28.4 Applications map
- 28.5 Global market in tons, historical and forecast to 2030
- 28.6 Product developers

29 GRAPHENE IN SUPERCAPACITORS

- 29.1 Market overview
- 29.2 Market prospects
- 29.3 Market assessment
- 29.4 Applications map
- 29.5 Global market in tons, historical and forecast to 2030
- 29.6 Product developers

30 GRAPHENE PRODUCER ASSESSMENT

- 30.1 Types of graphene produced, by producer
- 30.2 Markets targeted, by producer
- 30.3 Graphene product developers target markets

31 GRAPHENE COMPANY PROFILES-PRODUCERS AND PRODUCT DEVELOPERS 319 (252 COMPANY PROFILES)

32 APPLICATIONS ANALYSIS

33 GRAPHENE EX-PRODUCERS AND PRODUCT DEVELOPERS

34 OTHER 2-D MATERIALS

34.1 BOROPHENE

34.1.1 Properties

34.1.2 Applications

34.2 PHOSPHORENE

34.2.1 Properties

34.2.1.1 Fabrication methods

34.2.1.2 Challenges for the use of phosphorene in devices

34.2.2 Applications

34.2.2.1 Electronics

34.2.2.2 Batteries

34.2.2.3 Photodetectors

34.2.2.4 Sensors

34.3 GRAPHITIC CARBON NITRIDE (g-C₃N₄)

34.3.1 Properties

34.3.2 Synthesis

34.3.3 C₂N

34.3.4 Applications

34.3.4.1 Electronics

34.3.4.2 Filtration membranes

34.3.4.3 Photocatalysts

34.3.4.4 Batteries (LIBs)

34.3.4.5 Sensors

34.4 GERMANENE

34.4.1 Properties

34.4.2 Applications

34.4.2.1 Electronics

34.4.2.2 Batteries

34.5 GRAPHDIYNE

34.5.1 Properties

34.5.2 Applications

34.5.2.1 Electronics

34.5.2.2 Batteries

34.5.2.3 Separation membranes

34.5.2.4 Water filtration

34.5.2.5 Photocatalysts

34.5.2.6 Photovoltaics

34.6 GRAPHANE

34.6.1 Properties

34.6.2 Applications

34.6.2.1 Electronics

34.6.2.2 Hydrogen storage

34.7 HEXAGONAL BORON-NITRIDE

34.7.1 Properties

34.7.2 Applications

34.7.2.1 Electronics

34.7.2.2 Fuel cells

34.7.2.3 Adsorbents

34.7.2.4 Photodetectors

34.7.2.5 Textiles

34.7.2.6 Biomedical

34.8 MOLYBDENUM DISULFIDE (MoS₂)

34.8.1 Properties

34.8.2 Applications

34.8.2.1 Electronics

34.8.2.2 Photovoltaics

34.8.2.3 Piezoelectrics

34.8.2.4 Sensors

34.8.2.5 Filtration

34.8.2.6 Batteries

34.8.2.7 Fiber lasers

34.9 RHENIUM DISULFIDE (ReS₂) AND DISELENIDE (ReSe₂)

34.9.1 Properties

34.9.2 Applications

34.9.2.1 Electronics

34.10 SILICENE

34.10.1 Properties

34.10.2 Applications

34.10.2.1 Electronics

34.10.2.2 Photovoltaics

34.10.2.3 Thermoelectrics

34.10.2.4 Batteries

34.10.2.5 Sensors

34.11 STANENE/TINENE

34.11.1 Properties

34.11.2 Applications

34.11.2.1 Electronics

34.12 TUNGSTEN DISELENIDE

34.12.1 Properties

34.12.2 Applications

34.12.2.1 Electronics

34.13 ANTIMONENE

34.13.1 Properties

34.13.2 Applications

34.14 DIAMENE

34.14.1 Properties

34.14.2 Applications

34.15 INDIUM SELENIDE

34.15.1 Properties

34.15.2 Applications

34.15.2.1 Electronics

34.16 COMPARATIVE ANALYSIS OF GRAPHENE AND OTHER 2D MATERIALS

35 RESEARCH METHODOLOGY

36 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. Assessment of impact from COVID-19 by end user market. Key: Low, little impact and market will continue to grow. Medium, market impacted to some degree affecting growth prospects over next 1-2 years. High: Market significantly impacted.

Table 10: Properties of graphene, properties of competing materials, applications thereof.

Table 11. Comparison of graphene QDs and semiconductor QDs.

Table 12. Graphene quantum dot producers.

Table 13. Assessment of graphene production methods.

Table 14. Regulations and rulings related to graphene in Europe.

Table 15. Regulations and rulings related to graphene in North America.

Table 16. Regulations and rulings related to graphene in Asia-Pacific.

Table 17: Accumulated number of patent publications for graphene, 2004-2018.

Table 18. Demand for graphene (tons), 2018-2030.

Table 19: Graphene oxide production capacity by producer, 2010-2019.

Table 20: Graphene oxide production capacity in tons by region, 2010-2019.

Table 21: Graphene nanoplatelets capacity in tons by producer, 2010-2018.

Table 22: Graphene nanoplatelets capacity in tons by region, 2010-2019.

Table 23: CVD graphene film capacity by producer, 2010-2018/ 000s m2.

Table 24: Types of graphene and typical prices.

Table 25: Pristine graphene flakes pricing by producer.

Table 26: Few-layer graphene pricing by producer.

Table 27: Graphene nanoplatelets pricing by producer.

Table 28: Graphene oxide and reduced graphene oxide pricing, by producer.

Table 29: Graphene quantum dots pricing by producer.

Table 30: Multi-layer graphene pricing by producer.

Table 31: Graphene ink pricing by producer.

Table 32. Market overview for graphene in 3D printing.
Table 33. Scorecard for graphene in 3D printing.
Table 34. Market and applications for graphene in 3D printing.
Table 35: Demand for graphene in 3-D printing (tons), 2018-2030.
Table 36: Product developers in graphene 3D printing.
Table 37. Market overview for graphene in adhesives.
Table 38. Scorecard for graphene in adhesives.
Table 39. Market and applications for graphene in adhesives.
Table 40: Demand for graphene in adhesives (tons), 2018-2030.
Table 41: Product developers in graphene adhesives.
Table 42. Market overview for graphene in automotive.
Table 43. Scorecard for graphene in automotive.
Table 44. Market and applications for graphene in automotive.
Table 45: Demand for graphene in automotive (tons), 2018-2030.
Table 46: Product developers in the graphene automotive market.
Table 47. Market overview for graphene in aerospace.
Table 48. Scorecard for graphene in aerospace.
Table 49. Market and applications for graphene in aerospace.
Table 50: Demand for graphene in aerospace (tons), 2018-2030.
Table 51: Product developers in graphene for aerospace.
Table 52. Market overview for graphene in batteries.
Table 53. Scorecard for graphene in batteries.
Table 54. Market and applications for graphene in batteries.
Table 55: Estimated demand for graphene in batteries (tons), 2018-2030.
Table 56: Product developers in graphene batteries.
Table 57. Market overview for graphene in composites.
Table 58. Scorecard for graphene in fiber-based polymer composite parts.
Table 59. Market and applications for graphene in fiber-based composite parts.
Table 60. Market and applications for graphene in metal matrix composites.
Table 61. Global market for graphene in composites 2018-2030, tons.
Table 62: Product developers in graphene composites.
Table 63. Market overview for graphene in conductive inks.
Table 64. Scorecard for graphene in conductive inks.
Table 65. Market and applications for graphene in conductive inks.
Table 66. Comparative properties of conductive inks.
Table 67: Demand for graphene in conductive ink (tons), 2018-2027.
Table 68: Product developers in graphene conductive inks.
Table 69. Market overview for graphene in construction.
Table 70. Scorecard for graphene in construction.

Table 71. Graphene for cement.
Table 72. Graphene for asphalt bitumen.
Table 73: Demand for graphene in construction (tons), 2018-2030.
Table 74: Graphene product developers in construction.
Table 75. Market overview for graphene in wearable electronics and displays.
Table 76. Scorecard for graphene in wearable electronics and displays.
Table 77. Market and applications for graphene in electronics.
Table 78: Comparison of ITO replacements.
Table 79: Demand for graphene in flexible electronics, 2018-2030.
Table 80: Product developers in graphene-based electronics.
Table 81. Market overview for graphene in transistors and integrated circuits.
Table 82. Comparative properties of silicon and graphene transistors.
Table 83. Scorecard for graphene in transistors and integrated circuits.
Table 84. Market and applications for graphene in transistors and integrated circuits.
Table 85: Demand for graphene in transistors and integrated circuits, 2018-2030.
Table 86: Product developers in graphene transistors and integrated circuits.
Table 87. Market overview for graphene in memory devices.
Table 88. Scorecard for graphene in memory devices.
Table 89. Market and applications for graphene in memory devices.
Table 90: Demand for graphene in memory devices, 2018-2030.
Table 91: Product developers in graphene memory devices.
Table 92. Market overview for graphene in filtration.
Table 93. Scorecard for graphene in filtration.
Table 94. Market and applications for graphene in filtration.
Table 95: Demand for graphene in filtration (tons), 2018-2030.
Table 96: Graphene companies in filtration.
Table 97. Market overview for graphene in fuel cells.
Table 98. Scorecard for graphene in fuel cells.
Table 99. Market and applications for graphene in fuel cells.
Table 100: Demand for graphene in fuel cells (tons), 2018-2030.
Table 101: Product developers in graphene fuel cells.
Table 102. Market overview for graphene in life sciences and medicine.
Table 103. Scorecard for graphene in drug delivery.
Table 104. Scorecard for graphene in imaging and diagnostics.
Table 105. Scorecard for graphene in medical implants.
Table 106. Scorecard for graphene in medical biosensors.
Table 107. Scorecard for graphene in woundcare.
Table 108. Market and applications for graphene in life sciences and medicine.
Table 109: Demand for graphene in life sciences and medical (tons), 2018-2030.

Table 110: Product developers in graphene life sciences and biomedicine.

Table 111. Market overview for graphene in lighting.

Table 112. Scorecard for graphene in lighting.

Table 113. Market and applications for graphene in lighting.

Table 114: Demand for graphene in lighting, 2018-2030.

Table 115: Product developers in graphene lighting.

Table 116. Market overview for graphene in lubricants.

Table 117. Nanomaterial lubricant products.

Table 118. Scorecard for graphene in lubricants.

Table 119. Market and applications for graphene in lubricants.

Table 120: Demand for graphene in lubricants (tons), 2018-2030.

Table 121: Product developers in graphene lubricants.

Table 122. Market overview for graphene in oil and gas.

Table 123. Scorecard for graphene in oil and gas.

Table 124. Market and applications for graphene in oil and gas.

Table 125: Demand for graphene in oil and gas (tons), 2018-2030.

Table 126: Product developers in graphene oil and gas.

Table 127. Market overview for graphene in paints and coatings.

Table 128. Scorecard for graphene in paints and coatings.

Table 129. Market and applications for graphene in paints and coatings.

Table 130: Demand for graphene in paints and coatings (tons), 2018-2030.

Table 131: Product developers in graphene paints and coatings.

Table 132. Market overview for graphene in photonics.

Table 133. Scorecard for graphene in photonics.

Table 134. Market and applications for graphene in photonics.

Table 135: Demand for graphene in photonics, 2018-2030.

Table 136: Product developers in graphene photonics.

Table 137. Market overview for graphene in photovoltaics.

Table 138. Scorecard for graphene in photovoltaics.

Table 139. Market and applications for graphene in photovoltaics.

Table 140: Demand for graphene in photovoltaics (tons), 2018-2030.

Table 141: Product developers in graphene solar.

Table 142. Market overview for graphene in rubber and tires.

Table 143. Scorecard for graphene in rubber and tires.

Table 144. Market and applications for graphene in rubber and tires.

Table 145: Demand for graphene in rubber and tires (tons), 2018-2030.

Table 146: Product developers in rubber and tires.

Table 147. Market overview for graphene in sensors.

Table 148. Scorecard for graphene in sensors.

- Table 149. Market and applications for graphene in sensors.
- Table 150: Demand for graphene in sensors (tons), 2018-2030.
- Table 151: Product developers in graphene sensors.
- Table 152. Market overview for graphene in smart textiles and apparel.
- Table 153. Scorecard for graphene in smart textiles and apparel.
- Table 154. Market and applications for graphene in smart textiles and apparel.
- Table 155: Demand for graphene in textiles (tons), 2018-2030.
- Table 156: Graphene product developers in smart textiles and apparel.
- Table 157. Market overview for graphene in supercapacitors.
- Table 158. Scorecard for graphene in supercapacitors.
- Table 159: Comparative properties of graphene supercapacitors and lithium-ion batteries.
- Table 160. Market and applications for graphene in supercapacitors.
- Table 161: Demand for graphene in supercapacitors (tons), 2018-2030.
- Table 162: Product developers in graphene supercapacitors.
- Table 163: Graphene producers and types produced.
- Table 164: Graphene producers target market matrix.
- Table 165: Graphene product developers and end users target market matrix.
- Table 166. Sensor surface.
- Table 167. Market opportunity assessment for main graphene applications.
- Table 168: 2D materials types.
- Table 169: Electronic and mechanical properties of monolayer phosphorene, graphene and MoS₂.
- Table 170: Comparative analysis of graphene and other 2-D nanomaterials.
- Table 171: 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: Graphene layer structure schematic.

Figure 13: Illustrative procedure of the Scotch-tape based micromechanical cleavage of HOPG.

Figure 14: Graphite and graphene.

Figure 15: Graphene and its descendants: top right: graphene; top left: graphite = stacked graphene; bottom right: nanotube=rolled graphene; bottom left: fullerene=wrapped graphene.

Figure 16: Green-fluorescing graphene quantum dots.

Figure 17. 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 18. Graphene quantum dots.

Figure 19. Fabrication methods of graphene.

Figure 20. 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 21: (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 22. Schematic illustration of the main graphene production methods.

Figure 23: Published patent publications for graphene, 2004-2018.

Figure 24. Demand for graphene, 2018-2030, tons.

Figure 25: Graphene oxide production capacity in tons by region, 2010-2019.

Figure 26: Graphene nanoplatelets capacity in tons by region, 2010-2019.

Figure 27: CVD Graphene on Cu Foil.

- Figure 28. Applications of graphene in 3D printing.
- Figure 29: Demand for graphene in 3-D printing (tons), 2018-2030.
- Figure 30. CNCTArch lightweight mounting for digital signalling.
- Figure 31. Applications of graphene in adhesives.
- Figure 32: Demand for graphene in adhesives (tons), 2018-2030.
- Figure 33: Graphene Adhesives.
- Figure 34. Applications of graphene in automotive.
- Figure 35: Demand for graphene in automotive (tons), 2018-2030.
- Figure 36: Supercar incorporating graphene.
- Figure 37. Graphene anti-corrosion primer.
- Figure 38. Graphene-R Brake pads.
- Figure 39: Antistatic graphene tire.
- Figure 40. Graphene engine oil additives.
- Figure 41. Applications of graphene in aerospace.
- Figure 42: Demand for graphene in aerospace (tons), 2018-2030.
- Figure 43. Orbex Prime rocket.
- Figure 44: Graphene enhanced aircraft cargo container.
- Figure 45: Graphene aircraft.
- Figure 46. Applications of graphene in batteries.
- Figure 47: Demand for graphene in batteries (tons), 2018-2030.
- Figure 48. Apollo Traveler graphene-enhanced USB-C / A fast charging power bank.
- Figure 49. 6000mAh Portable graphene batteries.
- Figure 50. Real Graphene Powerbank.
- Figure 51. Graphene Functional Films - UniTran EH/FH.
- Figure 52. Applications of graphene in composites.
- Figure 53. Demand for graphene in composites (tons), 2018-2030.
- Figure 54. Graphene bike.
- Figure 55. Graphene lacrosse equipment.
- Figure 56. Graphene-based suitcase made from recycled plastic.
- Figure 57. Aros Create.
- Figure 58. Grays graphene hockey sticks.
- Figure 59. Applications of graphene in conductive inks.
- Figure 60: Demand for graphene in conductive ink (tons), 2018-2030.
- Figure 61: BGT Materials graphene ink product.
- Figure 62: Printed graphene conductive ink.
- Figure 63: Textiles covered in conductive graphene ink.
- Figure 64. Comparison of nanofillers with supplementary cementitious materials and aggregates in concrete.
- Figure 65: Demand for graphene in construction (tons), 2018-2030.

- Figure 66. Graphene asphalt additives.
- Figure 67. OG (Original Graphene) Concrete Admix Plus.
- Figure 68: Demand for graphene in electronics, 2018-2030.
- Figure 69: Moxi flexible film developed for smartphone application.
- Figure 70. Applications of graphene in transistors and integrated circuits.
- Figure 71: Demand for graphene in transistors and integrated circuits, 2018-2030.
- Figure 72. Graphene IC in wafer tester.
- Figure 73: Schematic cross-section of a graphene based transistor (GBT, left) and a graphene field-effect transistor (GFET, right).
- Figure 74: Demand for graphene in memory devices, 2018-2030.
- Figure 75. Layered structure of tantalum oxide, multilayer graphene and platinum used for resistive random-access memory (RRAM).
- Figure 76. Applications of graphene in filtration.
- Figure 77: Demand for graphene in filtration (tons), 2018-2030.
- Figure 78. Graphene anti-smog mask.
- Figure 79. Graphene filtration membrane.
- Figure 80. Water filter cartridge.
- Figure 81. Applications of graphene in fuel cells.
- Figure 82: Demand for graphene in fuel cells (tons), 2018-2030.
- Figure 83. Graphene-based E-skin patch.
- Figure 84. Applications of graphene in life sciences and medicine
- Figure 85: Demand for graphene in life sciences and medical (tons), 2018-2030.
- Figure 86. Graphene medical biosensors for wound healing.
- Figure 87: 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 88: GraphWear wearable sweat sensor.
- Figure 89. Applications of graphene in lighting.
- Figure 90: Demand for graphene in lighting, 2018-2030.
- Figure 91. Graphene LED bulbs.
- Figure 92. Applications of graphene in lubricants.
- Figure 93: Demand for graphene in lubricants (tons), 2018-2030.
- Figure 94. Tricolit spray coating.
- Figure 95. Graphenoil products.
- Figure 96. Applications of graphene in oil and gas.
- Figure 97: Demand for graphene in oil and gas (tons), 2018-2030.
- Figure 98: Directa Plus Grafysorber.
- Figure 99: Demand for graphene in paints and coatings (tons), 2018-2030.
- Figure 100. Cryorig CPU cooling system with graphene coating.

Figure 101: Four layers of graphene oxide coatings on polycarbonate.

Figure 102. 23303 ZINCTON GNC graphene paint.

Figure 103. Graphene-enhanced anti-corrosion aerosols under their Hycote brand.

Figure 104. 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 105. Schematic of graphene heat film.

Figure 106. Applications of graphene in photonics.

Figure 107: Demand for graphene in photonics, 2018-2030.

Figure 108. All-graphene optical communication link demonstrator operating at a data rate of 25 Gb/s per channel.

Figure 109. Applications of graphene in photovoltaics.

Figure 110: Demand for graphene in photovoltaics (tons), 2018-2030.

Figure 111. Graphene coated glass.

Figure 112. Applications of graphene in rubber and tires.

Figure 113: Demand for graphene in rubber and tires (tons), 2018-2030.

Figure 114. Eagle F1 graphene tire.

Figure 115. Graphene floor mats.

Figure 116. Vittoria Corsa G+ tire.

Figure 117. Graphene-based sensors for health monitoring.

Figure 118. Applications of graphene in sensors.

Figure 119: Demand for graphene in sensors (tons), 2018-2030.

Figure 120. AGILE R100 system.

Figure 121. Graphene fully packaged linear array detector.

Figure 122: GFET sensors.

Figure 123. Graphene is used to increase sensitivity to middle-infrared light.

Figure 124. Applications of graphene in smart textiles and apparel.

Figure 125: Demand for graphene in textiles (tons), 2018-2030.

Figure 126. Colmar graphene ski jacket.

Figure 127. Graphene dress. The dress changes colour in sync with the wearer's breathing.

Figure 128. G+ Graphene Aero Jersey.

Figure 129: Inov-8 graphene shoes.

Figure 130. Graphene Functional Membranes - UniTran GM.

Figure 131. Graphene jacket.

Figure 132. Applications of graphene in supercapacitors.

Figure 133: Demand for graphene in supercapacitors (tons), 2018-2030.

Figure 134. Skeleton Technologies supercapacitor.

Figure 135: Zapgo supercapacitor phone charger.

Figure 136. Graphene heating films.

Figure 137. Graphene flake products.

Figure 138. AIKA Black-T.

Figure 139. Printed graphene biosensors.

Figure 140. Graphene battery schematic.

Figure 141. Test performance after 6 weeks ACT II according to Scania STD4445.

Figure 142. Talcoat graphene mixed with paint.

Figure 143. T-FORCE CARDEA ZERO.

Figure 144: Prototype of Graphene-integrated UF filter cartridge.

Figure 145: Schematic of 2-D materials.

Figure 146: Borophene schematic.

Figure 147: Black phosphorus structure.

Figure 148: Black Phosphorus crystal.

Figure 149: Bottom gated flexible few-layer phosphorene transistors with the hydrophobic dielectric encapsulation.

Figure 150: Graphitic carbon nitride.

Figure 151: Structural difference between graphene and C₂N-h₂D crystal: (a) graphene; (b) C₂N-h₂D crystal. Credit: Ulsan National Institute of Science and Technology.

Figure 152: Schematic of germanene.

Figure 153: Graphdiyne structure.

Figure 154: Schematic of Graphane crystal.

Figure 155: Structure of hexagonal boron nitride.

Figure 156: BN nanosheet textiles application.

Figure 157: Structure of 2D molybdenum disulfide.

Figure 158: SEM image of MoS₂.

Figure 159: Atomic force microscopy image of a representative MoS₂ thin-film transistor.

Figure 160: Schematic of the molybdenum disulfide (MoS₂) thin-film sensor with the deposited molecules that create additional charge.

Figure 161: Schematic of a monolayer of rhenium disulfide.

Figure 162: Silicene structure.

Figure 163: Monolayer silicene on a silver (111) substrate.

Figure 164: Silicene transistor.

Figure 165: Crystal structure for stanene.

Figure 166: Atomic structure model for the 2D stanene on Bi₂Te₃(111).

Figure 167: Schematic of tungsten diselenide.

Figure 168: Schematic of Indium Selenide (InSe).

I would like to order

Product name: The Global Market for Graphene 2020-2030

Product link: <https://marketpublishers.com/r/GDE0BA24D40EN.html>

Price: US\$ 1,300.00 (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/GDE0BA24D40EN.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