

Graphene Market Report by Type (Mono-layer & Bi-layer Graphene, Few Layer Graphene (FLG), Graphene Oxide (GO), Graphene Nano Platelets (GNP), and Others), Application (Batteries, Supercapacitors, Transparent Electrodes, Integrated Circuits, and Others), End-Use Industry (Electronics and Telecommunication, Bio-medical and Healthcare, Energy, Aerospace and Defense, and Others), and Region 2024-2032

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Abstracts

The global graphene market size reached US\$ 200 Million in 2023. Looking forward, IMARC Group expects the market to reach US\$ 4,900 Million by 2032, exhibiting a growth rate (CAGR) of 41.1% during 2024-2032. The growing advancements in the production of semiconductors, rising improvements in various biomedical applications, and increasing demand for stronger, lighter, and more durable construction materials are some of the major factors propelling the market.

Graphene is a two-dimensional allotrope of carbon, including a mono-layer of carbon atoms placed in a hexagonal lattice. It possesses enhanced tensile strength and allows electrons to flow through it nearly without resistance, making it an efficient conductor of electricity. It is available as single-layer and multi-layer graphene, and graphene oxide, which is a derivative of graphene, is created by oxidizing graphene, introducing oxygen-containing functional groups. It increases energy storage capacity, shortens charging times, and enhances the lifespan of energy storage devices. It can be used in high-speed transistors, flexible and transparent displays, and even quantum computing.

At present, the increasing demand for graphene for the manufacturing of next-generation electronics is impelling the growth of the market. Besides this, the rising employment of graphene-based materials in batteries and supercapacitors, as they increase energy storage capacity, shorten charging times, and enhance the lifespan of energy storage devices, is contributing to the growth of the market. In addition, the growing utilization of graphene-based materials in water purifiers for effectively filtering out contaminants and providing a sustainable solution for water purification is offering a favorable market outlook. Apart from this, the increasing popularity of graphene as a reinforcement material in composites to improve their mechanical strength while keeping them lightweight is supporting the growth of the market. Additionally, rising improvements in chemical vapor deposition (CVD), liquid-phase exfoliation, and other production techniques of graphene are bolstering the growth of the market.

Graphene Market Trends/Drivers:

Growing advancements in the production of semiconductors

The growing advancements in the production of semiconductors are currently exerting a significant and positive influence on the growth of the graphene market. Besides this, the rising innovations in semiconductor fabrication processes are leading to the development of smaller and more efficient electronic components. Graphene, due to its exceptional electrical conductivity and heat dissipation properties, is emerging as a crucial material for enhancing the performance of these advanced semiconductors. As manufacturers continue to seek ways to make electronics faster and more energy-efficient, the demand for graphene is increasing. Moreover, the continuous integration of graphene into semiconductor manufacturing processes is bolstering its adoption in various electronic applications. Researchers and engineers are exploring novel methods to incorporate graphene into transistors, interconnects, and other semiconductor components, thereby improving their overall performance. This integration is bolstering the demand for graphene in the semiconductor industry.

Rising improvements in biomedical applications

At present, the rising advancements in biomedical applications are propelling the demand for graphene in the medical sector. Researchers and healthcare professionals are actively employing graphene-based biosensors to detect biomarkers, pathogens, and various health-related indicators with unparalleled sensitivity and precision. This continuous integration of graphene into biosensing technologies is fueling the expansion of the graphene market. Graphene-based materials are employed for wound dressings and healing applications as they exhibit antimicrobial properties and can help fasten the

wound healing process by maintaining a sterile environment and promoting tissue regeneration. Furthermore, as graphene is widely utilized for the manufacturing of glucose monitors, their demand is rising in the biomedical sector.

Increasing demand for stronger, lighter, and more durable construction materials

The increasing demand for stronger, lighter, and more durable construction materials is currently bolstering the growth of the graphene market. As construction projects are becoming more ambitious and complex, the quest for innovative solutions is intensifying. Graphene, being a two-dimensional material composed of carbon atoms arranged in a hexagonal lattice, exhibits unparalleled strength and lightness, making it an ideal candidate for enhancing the durability and performance of construction materials. Its incorporation into various building components, such as concrete, composites, and coatings, is essential to reinforce infrastructure projects and extend their lifespan. Moreover, as the world seeks eco-friendly alternatives, the potential of graphene to reduce the carbon footprint through the development of longer-lasting structures is emerging as an appealing option.

Graphene Industry Segmentation:

IMARC Group provides an analysis of the key trends in each segment of the global graphene market report, along with forecasts at the global, regional, and country levels for 2024-2032. Our report has categorized the market based on type, application, and end-use industry.

Breakup by Type:

Mono-layer & Bi-layer Graphene

Few Layer Graphene (FLG)

Graphene Oxide (GO)

Graphene Nano Platelets (GNP)

Others

Graphene nano platelets (GNP) dominate the market

The report has provided a detailed breakup and analysis of the market based on the type. This includes mono-layer and bi-layer graphene, few layer graphene (FLG), graphene oxide (GO), graphene nano platelets (GNP), and others. According to the report, graphene nano platelets (GNP) represented the largest segment.

Graphene nano platelets (GNPs) are a type of nanomaterial that consists of stacks of

graphene sheets. They typically consist of 2 to 10 layers of graphene sheets placed on top of each other. They are considered to be a type of graphene-based nanoplatelet. They inherit many of the extraordinary properties of graphene, such as exceptional electrical conductivity, high thermal conductivity, mechanical strength, and flexibility. They are used as conductive additives in various applications, such as batteries, supercapacitors, and printed electronics, to enhance electrical conductivity and mechanical properties. They are incorporated into composite materials, like polymer composites and coatings, to improve mechanical strength, thermal conductivity, and electromagnetic shielding properties.

Breakup by Application:

Batteries

Supercapacitors

Transparent Electrodes

Integrated Circuits

Others

Batteries hold the largest share in the market

A detailed breakup and analysis of the market based on the application have also been provided in the report. This includes batteries, supercapacitors, transparent electrodes, integrated circuits, and others. According to the report, batteries accounted for the largest market share.

Graphene can be used as an anode material in lithium-ion batteries. Its high electrical conductivity and large surface area enhance the capacity and charge-discharge efficiency of batteries. Graphene-based anodes also exhibit better cycling stability, which means they can maintain their performance over more charge-discharge cycles. Graphene oxide and reduced graphene oxide are adopted as components of battery separators. These materials can enhance the thermal and mechanical stability of the separator while maintaining good ionic conductivity. This also improves the safety and overall performance of the battery. The lightweight nature of graphene makes it ideal for flexible and wearable battery applications. It can be integrated into clothing, sensors, or other devices where traditional bulky batteries may not be suitable.

Breakup by End-Use Industry:

Electronics and Telecommunication

Bio-medical and Healthcare
Energy
Aerospace and Defense
Others

Electronics and telecommunication hold the biggest share in the market

A detailed breakup and analysis of the market based on the end-use industry has also been provided in the report. This includes electronics and telecommunication, bio-medical and healthcare, energy, aerospace and defense, and others. According to the report, electronics and telecommunication accounted for the largest market share.

The electronics and telecommunication sector uses graphene for manufacturing flexible and bendable electronic components. This is particularly useful for applications like flexible displays, wearable electronics, and flexible sensors, where traditional materials would be less suitable. Graphene-based sensors are highly sensitive to a wide range of signals, including temperature, pressure, gas molecules, and even single molecules. These sensors find applications in various fields, including telecommunications, where they can be used for signal detection and analysis. Graphene antennas can be used to enhance the performance of wireless communication devices. They can function over a wide array of frequencies and offer improved radiation efficiency.

Breakup by Region:

North America
United States
Canada
Asia Pacific
China
Japan
India
South Korea
Australia
Indonesia
Others
Europe
Germany
France
United Kingdom
Italy

Spain
Russia
Others
Latin America
Brazil
Mexico
Others
Middle East and Africa

Asia Pacific exhibits a clear dominance, accounting for the largest graphene market share

The market research report has also provided a comprehensive analysis of all the major regional markets, which include North America (the United States and Canada); Asia Pacific (China, Japan, India, South Korea, Australia, Indonesia, and others); Europe (Germany, France, the United Kingdom, Italy, Spain, Russia, and others); Latin America (Brazil, Mexico, and others); and the Middle East and Africa. According to the report, Asia Pacific accounted for the largest market share.

Asia Pacific held the biggest market share due to the increasing focus on developing efficient semiconductor materials. Besides this, the rising demand for more efficient and longer-lasting energy storage solutions is contributing to the growth of the market. Apart from this, the increasing investment in improving healthcare facilities, along with the development of drug delivery, tissue engineering, and diagnostic devices, is supporting the growth of the market.

North America is estimated to expand further in this domain due to the rising focus on conducting efficient pollution control and sensing. Moreover, the increasing purchase of electric vehicles (EVs) as a sustainable alternative to fuel-run cars is bolstering the growth of the market.

Competitive Landscape:

Key market players are investing to expand the range of applications for graphene, which includes developing new manufacturing techniques, improving the quality of graphene products, and discovering novel uses for graphene in various industries. They are also diversifying their product portfolios to include a wider range of graphene-based materials and products. Top companies are forming strategic partnerships and collaborations with other organizations, including universities, research institutions, and other industry players. They are also working on scaling up their production processes

through the development of large-scale production facilities and the optimization of manufacturing techniques. Leading companies are investing in quality control measures and participating in standardization efforts to build trust among customers.

The report has provided a comprehensive analysis of the competitive landscape in the market. Detailed profiles of all major companies have also been provided. Some of the key players in the market include:

ACS Material, LLC
Global Graphene Group, Inc.
CVD Equipment Corporation
Grafoid Inc.
G6 Materials Corp. (Graphene 3D Lab Inc.)
Graphene NanoChem PLC
Graphenea Inc.
Haydale Graphene Industries Plc
Vorbeck Materials Corp.
XG Sciences Inc.

Recent Developments:

In 2023, G6 Materials Corp. announced the launch of a new thermally conductive G6-EPOXY® product line to expand its reach into a new area of the epoxy market.

In 2020, Global Graphene Group announced the issuance of eight key patents for long-range lithium metal battery technology, which will provide electric vehicles (EVs) with an extended driving range on a single charge.

In 2023, Haydale Graphene Industries Plc announced its collaboration with PETRONAS to functionalize graphene for various product applications and accelerate the commercialization of graphene-based formulations in numerous industries.

Key Questions Answered in This Report

1. What was the size of the global graphene market in 2023?
2. What is the expected growth rate of the global graphene market during 2024-2032?
3. What are the key factors driving the global graphene market?
4. What has been the impact of COVID-19 on the global graphene market?
5. What is the breakup of the global graphene market based on the type?
6. What is the breakup of the global graphene market based on the application?
7. What is the breakup of the global graphene market based on the end-use industry?
8. What are the key regions in the global graphene market?

9. Who are the key players/companies in the global graphene market?

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