

The Global Market For Graphene and 2-D Materials Technologies, Production, End User Markets and Opportunities Analysis, 2015-2025

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Abstracts

Graphene exhibits a unique combination of mechanical, thermal, electronic and optical properties that provide opportunities for new innovation in flexible displays, transistors, photosensors, RFID tags, solar cells, secondary batteries, fuel cells, supercapacitors, conductive inks, EMI shielding heat insulation, anti-oxidation, LEDs across multiple industries including consumer electronics, automotive, aerospace, medicine, energy, 3D printing, polymer composites, wireless technology, filtration and coatings.

Graphene possesses (theoretically) record high electrical and thermal conductivity, transparency at all wavelengths, flexibility and outstanding mechanical strength.

The global market for graphene continues to grow with weekly technology and production breakthroughs, new public and private investments and public listings of graphene producers. There are now over 150 companies either producing graphene or developing applications, with as many multi-nationals conducting R&D on these materials.

Relatively few graphene products have reached the market as yet, and until recently those that have mainly incorporate graphene additives to enhance toughness and flexibility. Products include smartphone touchscreens (Wuxi), tennis rackets (Head), bicycle rims (Vittoria), flexible battery straps and printed RFID antennas (Vorbeck), paint (Graphenstone), cycle helmets (Catlike), thermometers (Linktop Technology) and oil-drilling muds (Graphene Nanochem).

However, a number of energy related products have hit the market in 2015, including Zap&Go, a graphene supercapacitor that can help extend the battery life of

smartphones, produced by Zapgocharger. Skeleton Technologies has also launched a graphene-enhanced supercapacitor with a capacitance of 4500 farads.

Graphene Lighting PLC has announced that a graphene light bulb with lower energy emissions, longer lifetime and lower manufacturing cost will be launched in 2015. In March, Graphene 3D Labs, Inc. announced the commercial availability of 3D graphene filaments for 3D printing applications. Sher-Wood Hockey has announced they are bringing a graphene-enhanced carbon fibre Rekker EK60 hockey stick to market. UK company Xefro has created a graphene-based heating system that can reduce energy costs up to 70 per cent. The product, gRAD, uses graphene as a heating element. Graphene Nanochem recently won a \$28 million order from an oil company for its PlatDrill Series drilling fluid.

There is likely to be significant short-term opportunities in applications such as conductive formulations and inks for printable electronics, coatings and electronic textiles; anti-corrosion coatings; current collector and separator coatings; thermal management; Li-ion batteries; Li-S batteries; supercapacitors (mainly for mobile electronics applications); EMI shielding materials and in anti-static and mechanical reinforced composites and barrier films. In most of these applications scale-up is relatively straightforward and performance benefits have been clearly demonstrated.

Medium-term growth will be witnessed in sensors and desalination membranes. Longer-term bets are in organic electronics applications (OLED, displays and solar PV), semiconductors and biomedicine. For graphene to meet its outstanding potential a number of significant challenges must be overcome. Low cost production processes must be developed and these production processes must be both scalable and suitable for integration into existing manufacturing processes and regulations. The challenges of consistently integrating graphene into products, either as graphene compounds or graphene components must also be met. Graphene also faces competition from incumbent materials such as carbon black, graphite and activated carbon that are relatively cheaper at present and already large-volume commodities.

WHAT DOES THE REPORT INCLUDE?

Comprehensive quantitative data and forecasts for the global graphene market to 2025

Qualitative insight and perspective on the current market and future trends in end user markets based on interviews with key executives

End user market analysis and technology timelines

Financial estimates for the markets graphene will impact

Patent analysis

Tables and figures illustrating graphene market size

Full company profiles of graphene producers and application developers including technology descriptions and end user markets targeted

Profiles of prominent research centres

Industry activity and breakthroughs by market 2013-2015

Contents

1 RESEARCH METHODOLOGY

2 EXECUTIVE SUMMARY

- 2.1 Remarkable properties
- 2.2 Global funding
- 2.3 Products and applications
- 2.4 Production
- 2.5 Market drivers and trends
 - 2.5.1 Production exceeds demand
 - 2.5.2 Market revenues remain small but are growing
 - 2.5.3 Scalability and cost
 - 2.5.4 Applications hitting the market
 - 2.5.5 Wait and see?
 - 2.5.6 Asia and US lead the race
 - 2.5.7 Competition from other materials
- 2.6 Market and technical challenges
 - 2.6.1 Supply quality
 - 2.6.2 Cost
 - 2.6.3 Product integration
 - 2.6.4 Regulation and standards

3 INTRODUCTION

- 3.1 Properties of nanomaterials
- 3.2 Categorization
- 3.3 Graphene
 - 3.3.1 3D Graphene
 - 3.3.2 Graphene Quantum Dots
- 3.4 Properties
- 3.5 Comparison with carbon nanotubes
 - 3.5.1.1 Cost and production
- 3.6 Other 2D Materials
 - 3.6.1 Phosphorene
 - 3.6.1.1 Properties
 - 3.6.1.2 Applications
 - 3.6.1.3 Recent research news

- 3.6.2 Silicene
 - 3.6.2.1 Properties
 - 3.6.2.2 Applications
 - 3.6.2.3 Recent research news
- 3.6.3 Molybdenum disulfide
 - 3.6.3.1 Properties
 - 3.6.3.2 Applications
 - 3.6.3.3 Recent research news
- 3.6.4 Hexagonal boron nitride
 - 3.6.4.1 Properties
 - 3.6.4.2 Applications
 - 3.6.4.3 Recent research news
- 3.6.5 Germanene
 - 3.6.5.1 Properties
 - 3.6.5.2 Applications
 - 3.6.5.3 Recent research news
- 3.6.6 Graphdiyne
 - 3.6.6.1 Properties
 - 3.6.6.2 Applications
- 3.6.7 Graphane
 - 3.6.7.1 Properties
 - 3.6.7.2 Applications
- 3.6.8 Stanene/tinene
 - 3.6.8.1 Properties
 - 3.6.8.2 Applications
- 3.6.9 Tungsten diselenide
 - 3.6.9.1 Properties
 - 3.6.9.2 Applications
- 3.6.10 Rhenium disulphide
 - 3.6.10.1 Properties
 - 3.6.10.2 Applications
- 3.7 Types of graphene
 - 3.7.1 Large area graphene films
 - 3.7.2 Graphene oxide flakes and graphene nanoplatelets
- 3.8 Production methods
 - 3.8.1 Quality
 - 3.8.2 Industrial scale production
 - 3.8.3 Graphene nanoplatelets (GNPs)
 - 3.8.4 Graphene Nanoribbons

3.8.5 Large-area graphene films

3.8.6 Graphene oxide flakes (GO)

3.8.7 Pros and cons of graphene production methods

3.8.7.1 Chemical Vapor Deposition (CVD)

3.8.7.2 Exfoliation method

3.8.7.3 Epitaxial growth method

3.8.7.4 Wet chemistry method

3.8.7.5 Micromechanical cleavage method

3.8.7.6 Green reduction of graphene oxide

3.8.7.7 Plasma

3.8.8 Recent synthesis methods

3.8.8.1 Ben-Gurion University of the Negev (BGU) and University of Western Australia

3.8.8.2 Graphene Frontiers

3.8.8.3 MIT and the University of Michigan

3.8.8.4 Oak Ridge National Laboratory

3.8.8.5 University of Florida and Donghua University

3.8.8.6 Ulsan National Institute of Science and Technology (UNIST) and Case Western Reserve University

3.8.8.7 Trinity College Dublin

3.8.8.8 Sungkyunkwan University and Samsung Advanced Institute of Technology (SAIT)

3.8.8.9 Korea Institute of Science and Technology (KIST), Chonbuk National University and KRICT

3.8.8.10 NanoXplore

3.8.8.11 Carbon Sciences Inc.

3.8.8.12 California Institute of Technology

3.8.8.13 Shanghai Institute of Microsystem and Information Technology

3.8.8.14 Oxford University

3.8.9 Synthesis methods by company

4. GRAPHENE MARKET STRUCTURE

5. REGULATIONS AND STANDARDS

5.1 Standards

5.2 Regulation

6. GLOBAL GRAPHENE GOVERNMENT FUNDING AND INITIATIVES

6.1 Europe

6.1.1 European Union (EU)

6.1.2 The United Kingdom

6.1.3 Germany

6.1.4 France

6.1.5 Spain

6.1.6 Denmark

6.1.7 Sweden

6.1.8 Poland

6.2 United States

6.3 Asia

6.3.1 Japan

6.3.2 China

6.3.3 South Korea

6.3.4 Singapore

6.4 Brazil

6.5 Argentina

7. GRAPHENE APPLICATIONS ROADMAP

8. GRAPHENE END USER MARKET SEGMENT ANALYSIS

8.1 Production volumes 2010-2025

8.2 Graphene industry news 2013-2015

8.3 Producers, production capacity and prices

8.4 Graphene patents & publications

8.4.1 Fabrication processes

8.4.2 Academia

8.4.3 Regional leaders

8.5 Graphene product integration

8.5.1 Carbon nanomaterials

8.5.2 Graphene in the supply chain

8.5.3 Dispersion

8.5.4 Requirements

8.5.5 Production

8.5.6 Commercialization

8.6 Electronics And Photonics

8.6.1 Transparent conductive films

- 8.6.1.1 Market drivers and trends
- 8.6.1.2 Market size and opportunity
- 8.6.1.3 Properties and applications
- 8.6.1.4 Challenges
- 8.6.1.5 Graphene transparent conductors developments, 2013-2015
- 8.6.2 Conductive inks
 - 8.6.2.1 Market drivers and trends
 - 8.6.2.2 Market size and opportunity
 - 8.6.2.3 Properties and applications
 - 8.6.2.4 Graphene conductive inks developments, 2013-2015
- 8.6.3 Integrated circuits
 - 8.6.3.1 Market drivers and trends
 - 8.6.3.2 Market size and opportunity
 - 8.6.3.3 Properties and applications
 - 8.6.3.4 Challenges
 - 8.6.3.5 Graphene integrated circuits developments, 2013-2015
- 8.6.4 Memory devices
 - 8.6.4.1 Market drivers and trends
 - 8.6.4.2 Market size and opportunity
 - 8.6.4.3 Properties and applications
 - 8.6.4.4 Graphene memory devices developments, 2013-2015
- 8.6.5 Photonics
 - 8.6.5.1 Optical modulators
 - 8.6.5.2 Photodetectors
 - 8.6.5.3 Plasmonics
 - 8.6.5.4 Challenges
 - 8.6.5.5 Graphene photonics developments, 2013-2015
 - 8.6.5.6 Product and application developers
- 8.7 Polymer Composites
 - 8.7.1 Market drivers and trends
 - 8.7.1.1 Improved performance
 - 8.7.1.2 Multi-functionality
 - 8.7.2 Market size and opportunity
 - 8.7.3 Properties and applications
 - 8.7.3.1 Barrier packaging
 - 8.7.3.2 Electrostatic discharge (ESD) and electromagnetic interference (EMI) shielding
 - 8.7.3.3 Wind turbines
 - 8.7.4 Challenges

8.7.5 Graphene polymer composites developments, 2013-2015

8.7.6 Product and application developers

8.8 Aerospace

8.8.1 Market drivers and trends

8.8.1.1 Safety

8.8.1.2 Reduced fuel consumption and costs

8.8.1.3 Increased durability

8.8.1.4 Multi-functionality

8.8.1.5 Need for new de-icing solutions

8.8.2 Market size and opportunity

8.8.3 Properties and applications

8.8.3.1 Composites

8.8.3.2 Coatings

8.8.4 Graphene aerospace developments, 2013-2015

8.8.5 Product and application developers

8.9 Automotive

8.9.1 Market drivers and trends

8.9.1.1 Environmental

8.9.1.2 Safety

8.9.1.3 Lightweighting

8.9.1.4 Cost

8.9.2 Market size and opportunity

8.9.3 Properties and applications

8.9.4 Products and product developers

8.10 Biomedical & Healthcare

8.10.1 Market drivers and trends

8.10.1.1 Improved drug delivery

8.10.1.2 Biocompatibility

8.10.1.3 Anti-biotic resistance

8.10.1.4 Growth in advanced woundcare market

8.10.2 Market size and opportunity

8.10.3 Properties and applications

8.10.3.1 Drug delivery

8.10.3.2 Gene delivery

8.10.3.3 Photodynamic Therapy

8.10.3.4 Wound dressings

8.10.3.5 Medical devices

8.10.3.6 Biosensors

8.10.3.7 Medical imaging

- 8.10.3.8 Dental
- 8.10.3.9 Tissue engineering
- 8.10.4 Challenges
- 8.10.5 Graphene medical and healthcare developments, 2013-2015
- 8.10.6 Product and application developers
- 8.11 Coatings
 - 8.11.1 Market drivers and trends
 - 8.11.1.1 Sustainability and regulation
 - 8.11.1.2 Cost of corrosion
 - 8.11.1.3 Improved hygiene
 - 8.11.1.4 Cost of weather-related damage
 - 8.11.2 Market size and opportunity
 - 8.11.3 Properties and applications
 - 8.11.3.1 Anti-corrosion coatings
 - 8.11.3.2 Anti-microbial
 - 8.11.3.3 Anti-icing
 - 8.11.3.4 Barrier coatings
 - 8.11.3.5 Heat protection
 - 8.11.3.6 Smart windows
 - 8.11.4 Graphene coatings developments, 2013-2015
 - 8.11.5 Products and application developers
- 8.12 Filtration And Separation
 - 8.12.1 Market drivers and trends
 - 8.12.1.1 Water shortage and population growth
 - 8.12.1.2 Contamination
 - 8.12.1.3 Cost
 - 8.12.2 Market size and opportunity
 - 8.12.3 Properties and applications
 - 8.12.3.1 Water filtration
 - 8.12.3.2 Gas separation
 - 8.12.3.3 Photocatalytic absorbents
 - 8.12.4 Graphene filtration developments, 2013-2015
 - 8.12.5 Product and application developers
- 8.13 Energy
 - 8.13.1 Lithium-ion batteries (LIB)
 - 8.13.1.1 Market drivers and trends
 - 8.13.1.2 Market size and opportunity
 - 8.13.1.3 Properties and applications
 - 8.13.1.4 Graphene Li-ion battery developments 2013-2015

8.13.2 Supercapacitors

8.13.2.1 Market drivers and trends

8.13.2.2 Market size and opportunity

8.13.2.3 Properties and applications

8.13.2.4 Challenges

8.13.2.5 Graphene supercapacitors developments, 2013-2015

8.13.3 Photovoltaics

8.13.3.1 Market drivers and trends

8.13.3.2 Market size and opportunity

8.13.3.3 Properties and applications

8.13.3.4 Graphene photovoltaics developments, 2013-2015

8.13.4 Fuel cells

8.13.4.1 Market drivers and trends

8.13.4.2 Market size and opportunity

8.13.4.3 Properties and applications

8.13.4.4 Challenges

8.13.4.5 Graphene fuel cell developments, 2013-2015

8.13.5 LED Lighting and UVC

8.13.5.1 Market drivers and trends

8.13.5.2 Market size

8.13.5.3 Properties and applications

8.13.5.4 Graphene LED developments, 2013-2015

8.13.6 Oil and gas

8.13.6.1 Market drivers and trends

8.13.6.2 Market size and opportunity

8.13.6.3 Properties and applications

8.13.7 Product and application developers

8.14 Sensors

8.14.1 Market drivers and trends

8.14.1.1 Increased power and performance with reduced cost

8.14.1.2 Enhanced sensitivity

8.14.1.3 Replacing silver electrodes

8.14.1.4 Growth of home diagnostics and point of care market

8.14.1.5 Improved thermal stability

8.14.1.6 Environmental conditions

8.14.2 Market size and opportunity

8.14.3 Graphene properties and applications

8.14.3.1 Infrared (IR) sensors

8.14.3.2 Gas and chemicals sensors

- 8.14.3.3 Pressure sensors
- 8.14.3.4 Biosensors
- 8.14.3.5 Optical sensors
- 8.14.3.6 Humidity sensors
- 8.14.3.7 Acoustic sensors
- 8.14.3.8 Wireless sensors
- 8.14.4 Challenges
- 8.14.5 Graphene sensors developments, 2013-2015
- 8.14.6 Product and application developers
- 8.15 3D Printing
 - 8.15.1 Market trends and drivers
 - 8.15.1.1 Improved materials at lower cost
 - 8.15.2 Market size and opportunity
 - 8.15.3 Properties and applications
 - 8.15.4 Challenges
 - 8.15.5 Graphene 3D printing developments, 2013-2015
 - 8.15.6 Products and product developers
- 8.16 Adhesives
 - 8.16.1 Market drivers and trends
 - 8.16.1.1 Thermal management in electronics
 - 8.16.1.2 Environmental sustainability
 - 8.16.1.3 Properties and applications
 - 8.16.2 Market size and opportunity
 - 8.16.3 Products and product developers
- 8.17 Lubricants
 - 8.17.1 Market drivers and trends
 - 8.17.1.1 Cost effective alternatives
 - 8.17.1.2 Need for higher-performing lubricants for fuel efficiency
 - 8.17.1.3 Environmental concerns
 - 8.17.2 Properties and applications
 - 8.17.3 Market size and opportunity
 - 8.17.4 Products and product developers

9. GRAPHENE PRODUCERS AND PRODUCT DEVELOPERS

- 9.1 Producers and types of graphene produced matrix
- 9.2 Graphene industrial collaborations
- 9.3 2D Carbon Graphene Material Co., Ltd.
- 9.4 2-Dtech Limited

- 9.5 3D Graphtech Industries
- 9.6 Abalonyx As
- 9.7 ACS Materials LLC
- 9.8 Advanced Graphene Products
- 9.9 Advanced Micro Devices, Inc.
- 9.10 Adven Solutions, Inc.
- 9.11 Ad-Nano Technologies
- 9.12 Agar Scientific
- 9.13 Aixtron SE
- 9.14 American Graphite Technologies
- 9.15 Amo Gmbh
- 9.16 Anderlab Technologies
- 9.17 Aneeve Nanotechnologies LLC
- 9.18 Angstron Materials LLC
- 9.19 Apex Graphene LLC
- 9.20 Applied Graphene Materials PLC
- 9.21 Applied Nanolayers Bv
- 9.22 Ar Brown Co. Ltd.
- 9.23 Archimedes Polymer Technologies
- 9.24 Arvia Technology
- 9.25 Asbury Carbons
- 9.26 Avanzare Innovacion Tecnologica S.L.
- 9.27 Basf AG
- 9.28 BGT Materials Limited
- 9.29 Biopharma Chemicals
- 9.30 Bluevine Graphene Industries, Inc.
- 9.31 BST Nano Carbon LLC
- 9.32 BTR New Energy Materials Inc.
- 9.33 California Lithium Battery, Inc.
- 9.34 Calevia, Inc.
- 9.35 Cambridge Nanosystems
- 9.36 Carbon Nano-Material Technology Co., Ltd.
- 9.37 Carbon Sciences, Inc.
- 9.38 China Carbon Graphite Group
- 9.39 Chongqing Moxi Science And Technology Co., Ltd.
- 9.40 Crayonano As
- 9.41 CVD Equipment Corporation
- 9.42 Danubia Nanotech S.R.O.
- 9.43 Deyang Carbonene Technology

- 9.44 Directa Plus Spa
- 9.45 Enanotec
- 9.46 EPL Composite Solutions Ltd.
- 9.47 Flexenable Ltd
- 9.48 Flextrapower
- 9.49 Focus Graphite Inc.
- 9.50 Fujitsu Laboratories
- 9.51 Garmor, Inc.
- 9.52 Gnanomat S.L.
- 9.53 Grafen Chemical Industries Cp.
- 9.54 Grafentek
- 9.55 Graftech International
- 9.56 Grafoid, Inc.
- 9.57 Granph Nanotec
- 9.58 Graphenano S.L.
- 9.59 Graphendo Ltd.
- 9.60 Graphenex Uk Ltd.
- 9.61 Graphene 3D Lab Inc.
- 9.62 Graphene ESD Corporation
- 9.63 Graphene Frontiers
- 9.64 Graphene Industries Ltd.
- 9.65 Graphene Leaders Canada
- 9.66 Graphene Nanochem PLC
- 9.67 Graphene Platform
- 9.68 Graphene Sensors, Inc.
- 9.69 Graphene Semiconductor Services Pvt. Ltd.
- 9.70 Graphene Square
- 9.71 Graphene Technologies
- 9.72 Graphenotech
- 9.73 Graphenea Nanomaterials
- 9.74 Graphenhex
- 9.75 Graphensic AB
- 9.76 Graphite Zero PTE. Ltd.
- 9.77 Graphos
- 9.78 Grolltrex
- 9.79 Group Nanoplore Inc.
- 9.80 Hangzhou Gelanfeng Nanotechnology
- 9.81 Hanwha Chemical
- 9.82 Harbin Mulan

- 9.83 Harper International Corp.
- 9.84 Haydale Limited
- 9.85 HQ Graphene
- 9.86 HRL Laboratories, LLC
- 9.87 IBM Corporation
- 9.88 Iedisa
- 9.89 Imagine Intelligent Materials Pty Limited
- 9.90 Incubation Alliance Inc.
- 9.91 Innophene
- 9.92 Intel Corporation
- 9.93 Jiangsu Yueda New Material Technology Co., Ltd
- 9.94 Jinan Moxi New Material Technology Co., Ltd
- 9.95 Jining Leadernano Tech LLC
- 9.96 Laslumin LLC
- 9.97 Meijo Nano Carbon
- 9.98 Merck Performance Materials
- 9.99 Nanjing Scf Nanotech, Ltd.
- 9.100 Nano Carbon Sp. Z.O.O.
- 9.101 Nanografen
- 9.102 Nanografi Nanotechnology
- 9.103 Nanoinnova Technologies SI
- 9.104 Nanointegris
- 9.105 Nanospense LLC
- 9.106 Nanostructured & Amorphous Materials, Inc.
- 9.107 Nanotech Biomachines, Inc.
- 9.108 National Nanomaterials
- 9.109 Ningbo Morsh Technology Co., Ltd.
- 9.110 Nokia
- 9.111 Ovation Polymers
- 9.112 Perpetuus Advanced Materials PLC
- 9.113 Planartech
- 9.114 Posco
- 9.115 Powerbooster Technology
- 9.116 Quantum Seed LLC
- 9.117 Qingdao Huagao Energy Technology Co., Ltd.
- 9.118 R-Nano
- 9.119 Samsung Electronics Co., Ltd.
- 9.120 Sandisk Corporation
- 9.121 Shanghai Simbatt Energy Technology Co., Ltd.

- 9.122 Sinocarbon Materials Technology Co., Ltd.
- 9.123 Sinode Systems
- 9.124 The Sixth Element Materials Technology Co. Ltd.
- 9.125 Ser Graphitech
- 9.126 Skeleton Technologies
- 9.127 Solan Corp
- 9.128 Superc Technology Ltd.
- 9.129 Strem Chemicals
- 9.130 Sunvault Energy Inc.
- 9.131 Taiwan Carbon Nanotube Technology
- 9.132 Taizhou Sunano New Energy Corporation
- 9.133 Talga Resources
- 9.134 Texas Instruments, Inc.
- 9.135 Theragnostic Technologies, Inc.
- 9.136 Thomas Swan & Co. Ltd.
- 9.137 Tianjin Pulan Nano Technologies Ltd
- 9.138 True 2 Materials Pte. Ltd.
- 9.139 Ugent Tech SDN BHD
- 9.140 University Of Exeter
- 9.141 Valence Industries Limited
- 9.142 Vorbeck Materials Corporation
- 9.143 Wavve Stream
- 9.144 Wuxi Graphene Film Co., Ltd
- 9.145 XF Nano
- 9.146 XG Sciences
- 9.147 Xiamen Knano
- 9.148 Xolve, Inc.
- 9.149 XP Nano Material Co. Ltd.
- 9.150 Zapgocharger Ltd.

10 GRAPHENE RESEARCH CENTRES

- 10.1 Brookhaven Center for Functional Nanomaterials
- 10.2 CEMES, Toulouse
- 10.3 Chinese Academy of Sciences, Chongqing Green Smart Technology Research Institute (Chongqing Research Institute)
- 10.4 Chinese Academy of Sciences, Institute of Metal Research
- 10.5 CRANN (the Centre for Research on Adaptive Nanostructures and Nanodevices), Trinity College Dublin

- 10.6 Cornell University, Department of Chemistry and Chemical Biology
- 10.7 Georgia Tech, Epitaxial Graphene Lab
- 10.8 Institute of Electronic Materials Technology (ITME)
- 10.9 Massachusetts Institute of Technology (MIT)
- 10.10 Michigan State University
- 10.11 Monash University
- 10.12 National University of Singapore
- 10.13 Princeton University
- 10.14 Rensselaer Polytechnic Institute
- 10.15 Rutgers University
- 10.16 Stanford University
- 10.17 Sungkyunkwan University
- 10.18 Technical University of Denmark, DTU Nanotech
- 10.19 University of California Los Angeles (UCLA)
- 10.20 University of Cambridge
- 10.21 University of Exeter
- 10.22 University of Manchester
- 10.23 University of Pennsylvania
- 10.24 University of Texas, Austin
- 10.25 University of Wisconsin-Milwaukee

List Of Tables

LIST OF TABLES AND FIGURES

Figure 1: Global government funding for graphene.

Table 1: Graphene target markets-Applications, stage of commercialization and potential addressable market size.

Table 2: Graphene production plants worldwide, by country, and production capacity.

Table 3: Global production of graphene, 2010-2025 in tons/year. Base year for projections is 2014.

Figure 2: Global market for graphene 2010-2025 in tons/year.

Table 4: Market penetration and volume estimates (tons) for graphene in key markets.

Table 5: Graphene types and cost per kg (Source: Haydale).

Table 6: Categorization of nanomaterials.

Figure 3: Graphene layer structure schematic.

Figure 4: Graphite and graphene.

Figure 5: Graphene and its descendants.

Table 7: Properties of graphene.

Figure 6: Graphene can be rolled up into a carbon nanotube, wrapped into a fullerene, and stacked into graphite.

Table 8: Comparative properties of carbon materials.

Table 9: Comparative properties of graphene with nanoclays and carbon nanotubes.

Figure 7: Phosphorene structure.

Table 10: Recent phosphorene research news.

Figure 8: Silicene structure (Source: Nature).

Table 11: Recent silicene research news.

Figure 9: Structure of 2D molybdenum disulfide.

Figure 10: Atomic force microscopy image of a representative MoS₂ thin-film transistor.

Figure 11: Schematic of the molybdenum disulfide (MoS₂) thin-film sensor with the deposited molecules that create additional charge.

Table 12: Recent Molybdenum disulfide research news.

Figure 12: Structure of hexagonal boron nitride.

Table 13: Recent hexagonal boron nitride research news.

Figure 13: Schematic of germanane.

Table 14: Recent germanane research news.

Figure 14: Graphdiyne structure.

Figure 15: Schematic of Graphane crystal.

Figure 16: Crystal structure for stanene.

Figure 17: Schematic of tungsten diselenide.

Figure 18: Schematic of a monolayer of rhenium disulphide.

Table 15: Comparative analysis of graphene and other 2-D nanomaterials.

Table 16: Large area graphene films-Markets, applications and current global market.

Table 17: Graphene oxide flakes/graphene nanoplatelets-Markets, applications and current global market.

Table 18: Main production methods for graphene.

Figure 19: Graphene synthesis methods.

Table 19: Recent graphene synthesis methods.

Table 20: Graphene synthesis methods, by company.

Table 21: Graphene market structure.

Table 22: Global government funding for graphene, total.

Figure 20: Global government funding for graphene.

Table 23: Graphene applications roadmap-Stage of commercialization, from basic concept to mass production.

Table 24: Global production of graphene, 2010-2025 in tons/year. Base year for projections is 2014.

Figure 21: Global production of graphene, 2010-2025 in tons/year. Base year for projections is 2014.

Table 25: Market penetration and volume estimates (tons) for graphene in key applications.

Table 26: Graphene producers and production capacity (Current and projected), prices and target markets.

Table 27: Published patent publications for graphene, 2004-2014.

Figure 22: Published patent publications for graphene, 2004-2014.

Table 28: Leading graphene patentees.

Table 29: Industrial graphene patents in 2014.

Figure 23: CamGraph powder from Cambridge Nanosystems.

Figure 24: Graphenstone paint.

Table 30: Graphene in the electronics and photonics market-applications, stage of commercialization and addressable market size.

Table 31: Comparison of ITO replacements.

Figure 25: A large transparent conductive graphene film.

Figure 26: Flexible transistor sheet.

Figure 27: The transmittance of glass/ITO, glass/ITO/four organic layers, and glass/ITO/four organic layers/4-layer graphene.

Table 32: Graphene transparent conductors developments, 2013-2015.

Table 33: Comparative properties of conductive inks.

Figure 28: Vorbeck Materials conductive ink products (Image credit: Vorbeck Materials).

Figure 29: Graphene printed antenna.

Figure 30: Graphene ink product.

Table 34: Graphene conductive inks developments, 2013-2015.

Figure 31: Schematic cross-section of a graphene base transistor and a graphene field-effect transistor.

Figure 32: Graphene IC in wafer tester.

Figure 33: Graphene barristor.

Table 35: Graphene integrated circuits developments, 2013-2015.

Figure 34: A schematic diagram for the mechanism of the resistive switching in metal/GO/Pt.

Table 36: Graphene memory devices developments, 2013-2015.

Table 37: Graphene properties relevant to application in optical modulators.

Table 38: Graphene product and application developers in the electronics industry.

Table 39: Dispersion of graphene in polymers.

Table 40: Graphene in the polymer composites market-applications, stage of commercialization and addressable market size.

Table 41: Addressable market size for graphene composites.

Table 42: Graphene properties relevant to application in polymer composites.

Table 43: Graphene product and application developers in the composites industry.

Table 44: Graphene in the aerospace market-applications, stage of commercialization and addressable market size.

Table 45: Graphene aerospace developments, 2013-2015.

Table 46: Graphene product and application developers in the aerospace industry.

Table 47: Graphene in the automotive market-applications, stage of commercialization and addressable market size.

Table 48: Graphene product and application developers in the automotive industry.

Table 49: Graphene in the biomedical and healthcare markets-applications, stage of commercialization and addressable market size.

Table 50: Graphene properties relevant to application in biomedicine and healthcare.

Table 51: Graphene medical and healthcare developments, 2013-2015.

Table 52: Graphene product and application developers in the medical and healthcare industry.

Figure 35: Global Paints and Coatings Market, share by end user market.

Table 53: Graphene in the coatings market-applications, stage of commercialization and addressable market size.

Table 54: Graphene properties relevant to application in coatings.

Figure 36: Water permeation through a brick without (left) and with (right) "graphene paint" coating.

Table 55: Graphene product and application developers in the coatings industry.

Figure 37: Degradation of organic dye molecules by graphene hybrid composite

photocatalysts.

Table 56: Graphene filtration developments, 2013-2015.

Table 57: Graphene product and application developers in the filtration industry.

Table 58: Graphene in the energy market-Applications, stage of commercialization and addressable market size.

Table 59: Graphene Li-ion battery developments 2013-2015.

Figure 38: Skeleton Technologies ultracapacitor.

Figure 39: Zapgo supercapacitor phone charger.

Table 60: Comparative properties of graphene supercapacitors and lithium-ion batteries.

Table 61: Graphene supercapacitors developments 2013-2015.

Figure 40: Solar cell with nanowires and graphene electrode (Image credit: MIT).

Table 62: Graphene photovoltaics developments 2013-2015.

Table 63: Graphene fuel cell developments, 2013-2015.

Table 64: Graphene product and application developers in the energy industry.

Table 65: Graphene in the sensors market-applications, stage of commercialization and addressable market size.

Table 66: Graphene properties relevant to application in sensors.

Figure 41: GFET sensors.

Figure 42: Graphene Field Effect Transistor Schematic.

Figure 43: First generation point of care diagnostics.

Table 67: Comparison of ELISA (enzyme-linked immunosorbent assay) and graphene biosensor.

Table 68: Graphene sensors developments, 2013-2015.

Table 69: Graphene product and application developers in the sensors industry.

Table 70: Graphene properties relevant to application in 3D printing.

Table 71: Graphene product and application developers in the 3D printing industry.

Table 72: Graphene properties relevant to application in adhesives.

Table 73: Graphene product and application developers in the adhesives industry.

Table 74: Applications of graphene in lubricants.

Table 75: Graphene product and application developers in the lubricants industry.

Table 76: Graphene producers and types produced.

Table 77: Graphene industrial collaborations and target markets.

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