The Carbon Nanotubes, Graphene and 2D Materials Global Opportunity Report

Description: This is a golden era for nanostructured carbon materials research. Graphitic carbon materials such as 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, CNTs face stiff competition in conductive applications from graphene and other 2D materials and in mechanically enhanced composites from nanocellulose. However, after considerable research efforts, numerous multi-walled carbon nanotubes (MWNTs)-enhanced products are commercially available. 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 (SWNTs) has been initiated, promising new market opportunities in transparent conductive films, transistors, sensors and memory devices. SWNTs 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.

Beyond graphene, emerging elementary 2D materials such as transition metal dichalcogenides, group V systems including phosphorene, and related isoelectronic structures will potentially allow for flexible electronics and field-effect transistors that exhibit ambipolar transport behaviour with either a direct bandgap or greater gate modulation.

Carbon nanotubes, graphene and 2D materials exhibit a unique combination of mechanical, thermal, electronic and optical properties that provide opportunities for new innovation in:

Electronics & photonics
- Conductive electrode films for flexible displays.
- Transparent conductive films for large area and high-efficiency organic light emitting diodes.
- 2D printable and transparent ultrathin electronic devices.
- 2D transistors and circuits.
- RFID tags.
- 2D magnetic semiconductors.
- Conductive inks for wearable electronics.
- 2d MOSFETs.
- Inkjet-printed electronics.
- Flexible Graphene FETs.
- Flexible TMD FETs for digital logic and RF.
- Graphene optical modulators.
- Electrically conductive textiles
- Interconnects.

Energy
- Li-ion battery additives.
- Aerogel anodes for LIBs.
- Proton exchange fuel cell membranes.
- Hydrogen fuel cells.
- CNT cathodes lithium sulfur batteries.
- Electrodes for supercapacitors.
- Transparent electrodes in photovoltaic cells.
- SiG anodes.
- Thermal spreaders.
- Catalysts for energy conversion.
- Sustainable electrocatalysis and photocatalysis.
- Nanofluids for heat dissipation.
- Flexible electrodes for polymer solar cells.

Automotive

- Tire additives for improved abrasion resistance.
- Anti-scratch and anti-corrosion coatings.
- Automotive composites.
- Anti-fogging coatings.

Aerospace

- De-icing coatings.
- Electrically conductive composites.
- EMI shielding coatings.
- Anti-corrosion coatings.
- Glass additives.
- Shape memory alloys.
- Protective glass.

Biomedicine and healthcare

- Tissue engineering scaffolds to facilitate cell growth and tissue regeneration.
- Carriers for drug delivery.
- Biosensor chips.
- Brain electrodes.
- Anti-bacterial materials.
- Gene therapy.
- Photodynamic therapy.
- Cell imaging using carbon quantum dots.
- Bone repair.
- Glucose biosensors.
- Wound management and anti-bacterial.
- Graphene hydrogels for controlled delivery of drugs.
- Porous carriers for drug delivery.
- Carbon nanoonions as imaging probes.

Polymer composites

- Nanocomposites for wind turbines.
- Barrier packaging materials.
- ESD and EMI shielding.
- Sporting goods composites (e.g. bike tires).
- Composites with improved conductive and thermal properties.
- Nanocomposite yarns.
- Adhesives and pads for thermal interface materials.
- Shape memory.

Filtration

- Gas separation membranes.
- Photocatalytic absorbents.
- Ultrathin, high-flux and energy-efficient sieving membranes.
- Arsenic removal from water.
- Water desalination.

Sensors
- Electrochemical sensors.
- DNA detection platforms.
- Pressure sensors.
- Optical sensors.
- Humidity sensors.
- Acoustic sensors.
- Wireless sensors.

This 1156 page report on the carbon nanotubes, graphene and 2D materials market is by far the most comprehensive and authoritative report produced.

- Production volumes, estimated to 2025
- Commercialization timelines and technology trends
- Carbon nanotubes and graphene products, now and planned
- Comparative analysis of carbon nanotubes and graphene
- Assessment of carbon nanomaterials market including production volumes, competitive landscape, commercial prospects, applications, demand by market and region, commercialization timelines, prices and producer profiles.
- Assessment of end user markets for carbon nanomaterials including market drivers and trends, applications, market opportunity, market challenges and application and product developer 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 producers and product developers, including products, target markets and contact details

Contents:
1 Executive Summary
  1.1 Carbon Nanotubes.
  1.1.1 Exceptional properties.
  1.1.2 Products and applications
  1.1.3 Threat from the graphene market
  1.1.4 Production
  1.1.4.1 Multi-walled nanotube (MWNT) production
  1.1.4.2 Single-walled nanotube (SWNT) production
  1.1.5 Global demand for carbon nanotubes
  1.1.5.1 Current products
  1.1.5.2 Future products
  1.1.6 Market drivers and trends
  1.1.6.1 Electronics
  1.1.6.2 Electric vehicles and lithium-ion batteries.
  1.1.7 Market and production challenges
  1.1.7.1 Safety issues
  1.1.7.2 Dispersion.
  1.1.7.3 Synthesis and supply quality
  1.1.7.4 Cost.
  1.1.7.5 Competition from other materials
  1.2 Graphene
  1.2.1 Two-dimensional (2D) materials.
  1.2.2 Graphene
  1.2.2.1 Products
  1.2.2.2 Short-term opportunities
  1.2.2.3 Medium-term opportunities.
  1.2.2.4 Remarkable properties
  1.2.2.5 Global funding and initiatives
  1.2.2.6 Products and applications
  1.2.2.7 Production
1.2.8 Market drivers and trends
1.2.9 Market and technical challenges

2 Research Methodology
2.1 Carbon Nanomaterials Nanomaterials Market Rating System
2.2 Commercial Impact Rating System.
2.3 Market Challenges Rating System

3 Properties Of Nanomaterials
3.1 Categorization

4 Graphene.
4.1 History
4.2 Forms of graphene
4.3 Properties
4.4 3D Graphene
4.5 Graphene Quantum Dots
4.5.1 Synthesis.
4.5.2 Applications.
4.5.3 Producers

5 Carbon Nanotubes
5.1 Multi-walled nanotubes (MWNT).
5.2 Single-wall carbon nanotubes (SWNT).
5.2.1 Single-chirality.
5.3 Double-walled carbon nanotubes (DWNTs)
5.4 Few-walled carbon nanotubes (FWNTs).
5.5 Carbon Nanohorns (CNHs)
5.6 Carbon Onions
5.7 Fullerenes
5.8 Boron Nitride nanotubes (BNNTs).
5.9 Properties
5.10 Applications of carbon nanotubes
5.10.1 High volume applications
5.10.2 Low volume applications
5.10.3 Novel applications

6 Carbon Nanotubes Versus Graphene
6.1 Comparative Properties
6.2 Cost And Production
6.3 Carbon Nanotube-Graphene Hybrids.
6.4 Competitive Analysis Of Carbon Nanotubes And Graphene.

7 Other 2D Materials.
7.1 Black phosphorus/Phosphorene
7.1.1 Properties
7.1.2 Applications.
7.2 C2N
7.2.1 Properties
7.2.2 Applications.
7.3 Carbon nitride.
7.3.1 Properties
7.3.2 Applications.
7.4 Germanene
7.4.1 Properties
7.4.2 Applications.
7.5 Graphdiyne
7.5.1 Properties
7.5.2 Applications.
7.6 Graphane
7.6.1 Properties
7.6.2 Applications.
7.7 Hexagonal boron nitride
7.7.1 Properties
7.7.2 Applications.
7.7.3 Producers
7.8 Molybdenum disulfide (MoS2)
7.8.1 Properties
7.8.2 Applications.
7.9 Rhenium disulfide (ReS2) and diselenide (ReSe2).
7.9.1 Properties
7.9.2 Applications.
7.10 Silicene
7.10.1 Properties
7.10.2 Applications
7.11 Stanene/tinene
7.11.1 Properties
7.11.2 Applications
7.12 Tungsten diselenide.
7.12.1 Properties
7.12.2 Applications
7.13 Comparative analysis of graphene and other 2-D nanomaterials

8 Carbon Nanotube Synthesis
8.1 Arc discharge synthesis
8.2 Chemical Vapor Deposition (CVD)
8.3 Plasma enhanced chemical vapor deposition (PECVD)
8.4 High-pressure carbon monoxide synthesis.
8.4.1 High Pressure CO (HiPco).
8.4.2 CoMoCAT
8.5 Flame synthesis
8.6 Laser ablation synthesis.
8.7 Silane solution method

9 Graphene Synthesis
9.1 Large area graphene films
9.2 Graphene oxide flakes and graphene nanoplatelets.
9.3 Production and synthesis methods
9.3.1 Graphene from graphite ore.
9.3.1.1 Production directly from natural graphite ore
9.3.1.2 Alternative starting materials
9.4 Quality.
9.5 Synthesis and production by types of graphene.
9.5.1 Graphene nanoplatelets (GNPs)
9.5.2 Graphene nanoribbons
9.5.3 Large-area graphene films.
9.5.4 Graphene oxide flakes (GO).
9.6 Pros and cons of graphene synthesis methods
9.6.1 Chemical Vapor Deposition (CVD)
9.6.2 Exfoliation method
9.6.3 Epitaxial growth method.
9.6.4 Wet chemistry method (liquid phase exfoliation)
9.6.5 Micromechanical cleavage method.
9.6.6 Green reduction of graphene oxide
9.6.7 Plasma.
9.7 Recent synthesis methods
9.7.1 Ben-Gurion University of the Negev (BGU) and University of Western Australia
9.7.2 Graphene Frontiers
9.7.3 MIT and the University of Michigan
9.7.4 Oak Ridge National Laboratory/University of Texas/General Graphene
9.7.5 University of Florida/Donghua University
9.7.6 Ulsan National Institute of Science and Technology (UNIST) and Case Western Reserve University
9.7.7 Trinity College Dublin
9.7.8 Sungkyunkwan University and Samsung Advanced Institute of Technology (SAIT)
9.7.9 Korea Institute of Science and Technology (KIST), Chonbuk National University and KRICT
9.7.10 NanoXplore.
9.7.11 Carbon Sciences Inc.
9.7.12 California Institute of Technology
9.7.13 Shanghai Institute of Microsystem and Information Technology
9.7.14 Oxford University
9.7.15 University of Tokyo
9.8 Synthesis methods by company.

10 Carbon Nanotubes Market Structure.

11 Graphene Market Structure And Routes To Commercialization

12 Regulations And Standards
12.1 Standards
12.1.1 International Organization for Standardization (ISO)
12.2 Environmental, health and safety regulation.
12.2.1 Europe
12.2.1.1 REACH
12.2.1.2 Biocidal Products Regulation
12.2.1.3 National nanomaterials registers
12.2.1.4 Cosmetics regulation
12.2.1.5 Food safety.
12.2.2 United States.
12.2.2.1 Toxic Substances Control Act (TSCA).
12.2.3 Asia-Pacific
12.2.3.1 Japan
12.2.3.2 South Korea
12.2.3.3 Taiwan
12.2.3.4 Australia
12.3 Workplace exposure

13 Patents And Publications
13.1 Carbon Nanotubes
13.2 Graphene
13.2.1 Fabrication Processes
13.2.2 Academia
13.2.3 Regional Leaders

14 Technology Readiness Level
14.1 Carbon nanotubes
14.2 Graphene

15 Carbon Nanotubes Industry News 2013-
15.1 January 2013.
15.2 August 2013.
15.3 November 2013.
15.4 December 2013.
15.5 January 2014.
15.6 February 2014
15.7 March 2014.
15.8 April
15.9 May 2014
15.10 July 2014
15.11 September 2014.
15.12 January 2015.
15.13 February 2015
15.14 March 2015
15.15 April
15.16 May 2015
15.17 June
15.18 July 2015
15.19 September 2015.
15.20 December 2015.
15.21 March 2016
15.22 June 2016

16.1 January 2013.
16.2 February 2013
16.3 April
16.4 May 2013
16.5 June
16.6 July 2013
16.7 August 2013.
16.8 September 2013.
16.9 October 2013.
16.10 November 2013
16.11 December 2013.
16.13 February 2014
16.14 March 2014
16.15 April
16.16 May 2014
16.17 June
16.18 July 2014
16.19 August 2014
16.20 September 2014.
16.21 August 2014
16.22 September 2014.
16.23 October 2014
16.24 November 2014
16.26 January 2015.
16.27 February 2015
16.28 March 2015
16.29 April
16.30 May 2015
16.31 June
16.32 July 2015
16.33 August 2015
16.34 September 2015.
16.35 October 2015
16.36 November 2015
16.37 December 2015.
16.39 February 2016
16.40 March 2016
16.41 April
16.42 May 2016

17 End User Market Segment Analysis
17.1 Carbon nanotubes production volumes 2010-
17.2 Carbon nanotube producer production capacities.
17.3 Regional demand for carbon nanotubes.
17.3.1 Japan.
17.3.2 China
17.4 Main carbon nanotubes producers.
17.4.1 SWNT production
17.4.1.1 OCSiAl
17.4.1.2 FGV Cambridge Nanosystems
17.4.1.3 Zeon Corporation
17.5 Price of carbon nanotubes-MWNTs, SWNTs and FWNTs.
17.5.1 MWNTs.
17.5.2 SWNTs
17.6 Graphene production volumes
17.7 Regional demand.
17.8 Graphene producers and production capacities
18 Adhesives
18.1 Market Drivers And Trends
18.1.1 Thermal management in high temperature electronics.
18.1.2 Environmental sustainability.
18.2 Properties And Applications.
18.3 Market Size And Opportunity
18.3.1 Total market size
18.3.2 Carbon nanomaterials opportunity.
18.4 Market Challenges
18.5 Application And Product Developers.
18.5.1 Carbon nanotubes.
18.5.2 Graphene.

19 Aerospace
19.1 Market Drivers And Trends
19.1.1 Safety
19.1.2 Reduced fuel consumption and costs
19.1.3 Increased durability
19.1.4 Multi-functionality
19.1.5 Need for new de-icing solutions.
19.1.6 Weight reduction.
19.1.7 Need for improved lightning protection materials.
19.2 Properties And Applications.
19.2.1 Composites
19.2.1.1 ESD protection
19.2.1.2 Conductive cables
19.2.1.3 Anti-friction braking systems.
19.2.2 Coatings.
19.2.2.1 Anti-icing
19.2.3 Sensors.
19.3 Market Size And Opportunity
19.3.1 Total market size
19.3.2 Carbon nanomaterials opportunity.
19.4 Market Challenges
19.5 Application And Product Developers.
19.5.1 Carbon nanotubes.
19.5.2 Graphene.

20 Automotive
20.1 Market Driver And Trends
20.1.1 Environmental regulations.
20.1.2 Lightweighting
20.1.3 Increasing use of natural fiber composites
20.1.4 Safety
20.1.5 Cost
20.1.6 Need for enhanced conductivity in fuel components
20.1.7 Increase in the use of touch-based automotive applications
20.2 Properties And Applications.
20.2.1 Composites
20.2.2 Thermally conductive additives.
20.2.3 Vehicle mass reduction
20.2.4 Lithium-ion batteries in electric and hybrid vehicles.
20.2.5 Paints and coatings
20.3 Market Size And Opportunity
20.3.1 Composites
20.3.1.1 Total market size
20.3.1.2 Carbon nanomaterials opportunity
20.3.2 Coatings.
20.3.2.1 Total market size
20.3.2.2 Carbon nanomaterials opportunity
20.3.3 Market Challenges.
20.4 Application And Product Developers.
20.4.1 Carbon nanotubes.
20.4.2 Graphene.

21 Biomedical & Healthcare
21.1 Market Drivers And Trends
21.1.1 Improved drug delivery for cancer therapy
21.1.2 Shortcomings of chemotherapies
21.1.3 Biocompatibility of medical implants.
21.1.4 Anti-biotic resistance.
21.1.5 Growth in advanced woundcare market
21.1.6 Growth in the wearable monitoring market
21.2 Properties And Applications.
21.2.1 Cancer therapy
21.2.1.1 Immunotherapy
21.2.1.2 Thermal ablation.
21.2.1.3 Stem cell therapy
21.2.1.4 Graphene oxide for therapy and drug delivery.
21.2.1.5 Graphene nanosheets
21.2.1.6 Gene delivery
21.2.1.7 Photodynamic Therapy.
21.2.2 Medical implants and devices
21.2.3 Wound dressings
21.2.4 Biosensors
21.2.4.1 FRET biosensors for DNA detection
21.2.5 Medical imaging
21.2.6 Tissue engineering
21.2.7 Dental.
21.2.8 Electrophysiology.
21.3 Market Size And Opportunity
21.4 Challenges.
21.4.1 Potential toxicity
21.4.2 Safety
21.4.3 Dispersion
21.5 Application And Product Developers.
21.5.1 Carbon nanotubes.
21.5.2 Graphene.

22 Coatings
22.1 Market Drivers And Trends
22.1.1 New functionalities and improved properties
22.1.2 Need for more effective protection.
22.1.3 Sustainability and regulation
22.1.4 Cost of corrosion
22.1.5 Need for improved hygiene
22.1.6 Cost of weather-related damage.
22.1.7 Increased demand for coatings for extreme environments.
22.2 Properties And Applications.
22.2.1 Anti-static coatings.
22.2.2 Anti-corrosion coatings.
22.2.2.1 Marine
22.2.2.2 Oil and gas.
22.2.3 Anti-microbial.
22.2.4 Anti-icing
22.2.5 Barrier coatings
22.2.6 Heat protection
22.2.7 Anti-fouling
22.2.8 Wear and abrasion resistance.
22.2.9 Smart windows
22.3 Market Size And Opportunity
22.4 Product Developers
22.4.1 Carbon nanotubes.
22.4.2 Graphene.
23 Composites.
23.1 Market Drivers And Trends
23.1.1 Growing use of polymer composites
23.1.2 Increased need for advanced, protective materials
23.1.3 Improved performance over traditional composites
23.1.4 Multi-functionality
23.1.5 Growth in use in the wind energy market
23.1.6 Need for new flame retardant materials
23.1.7 Environmental impact of carbon fibers.
23.1.8 Shortcomings of natural fiber composites and glass fiber reinforced composites

23.2 Properties And Applications.
23.2.1 Polymer composites
23.2.2 Barrier packaging
23.2.3 Electrostatic discharge (ESD) and electromagnetic interference (EMI) shielding
23.2.4 Wind turbines
23.2.5 Ballistic protection
23.2.6 Cement additives
23.2.7 Sporting goods
23.2.8 Wire and cable.
23.2.9 Thermal management.
23.2.10 Rubber and elastomers

23.3 Market Size And Opportunity
23.3.1 Total market size
23.3.2 Carbon nanomaterials opportunity.

23.4 Challenges.
23.4.1 Market Challenges.

23.5 Application And Product Developers.
23.5.1 Carbon nanotubes.
23.5.2 Graphene.

24 Electronics And Photonics
24.1 Carbon nanotubes in electronics
24.2 Graphene and 2D materials in electronics
24.2.1 Properties
24.2.2 Applications
24.3 Flexible Electronics, Conductive Films And Displays
24.3.1 Market Drivers And Trends
24.3.2 Properties And Applications
24.3.2.1 Transparent electrodes in flexible electronics
24.3.2.2 Electronic paper.
24.3.3 Market Size And Opportunity
24.3.3.1 Touch panel and ITO replacement
24.3.4 Challenges
24.3.4.1 Competing materials
24.3.4.2 Cost in comparison to ITO.
24.3.4.3 Fabricating SWNT devices.
24.3.4.4 Problems with transfer and growth
24.3.4.5 Improving sheet resistance
24.3.4.6 Difficulties in display panel integration.
24.3.5 Application And Product Developers
24.3.5.1 Carbon Nanotubes
24.3.5.2 Graphene

24.4 Conductive Inks.
24.4.1 Market Drivers And Trends
24.4.1.1 Increased demand for printed electronics
24.4.1.2 Limitations of existing conductive inks
24.4.1.3 Growth in the 3D printing market.
24.4.1.4 Growth in the printed sensors market
24.4.2 Properties And Applications
24.4.2.1 Carbon nanotubes
24.4.2.2 Graphene
24.4.3 Market Size And Opportunity
24.4.3.1 Total market size
24.4.3.2 Carbon nanomaterials opportunity
24.4.4 Market Challenges.
24.4.5 Application And Product Developers
24.4.5.1 Carbon nanotubes
24.4.5.2 Graphene
24.5 Transistors And Integrated Circuits
24.5.1 Market Drivers And Trends
24.5.1.1 Scaling
24.5.1.2 Limitations of current materials
24.5.1.3 Limitations of copper as interconnect materials.
24.5.1.4 Need to improve bonding technology
24.5.1.5 Need to improve thermal properties
24.5.2 Properties And Applications
24.5.2.1 Carbon nanotubes
24.5.2.2 Graphene
24.5.2.3 Graphene Radio Frequency (RF) circuits
24.5.2.4 Graphene spintronics
24.5.3 Market Size And Opportunity
24.5.4 Challenges
24.5.4.1 Device complexity.
24.5.4.2 Competition from other materials
24.5.4.3 Lack of band gap
24.5.4.4 Transfer and integration.
24.5.5 Application And Product Developers
24.5.5.1 Carbon nanotubes
24.5.5.2 Graphene
24.6 Memory Devices.
24.6.1 Market Drivers And Trends
24.6.1.1 Density and voltage scaling
24.6.1.2 Growth in the smartphone and tablet markets
24.6.1.3 Growth in the flexible electronics market
24.6.2 Properties And Applications
24.6.2.1 Carbon nanotubes
24.6.2.2 Graphene
24.6.3 Market Size And Opportunity
24.6.3.1 Total market size
24.6.4 Application And Product Developers
24.6.4.1 Carbon nanotubes
24.6.4.2 Graphene
24.7 Photonics
24.7.1 Market Drivers And Trends
24.7.2 Properties And Applications
24.7.2.1 Si photonics versus graphene.
24.7.2.2 Optical modulators
24.7.2.3 Photodetectors.
24.7.2.4 Plasmonics
24.7.2.5 Fiber lasers
24.7.3 Challenges
24.7.3.1 Need to design devices that harness graphene's properties
24.7.3.2 Problems with transfer
24.7.3.3 THz absorbance and nonlinearity
24.7.3.4 Stability and sensitivity
24.7.4 Market Size And Opportunity
24.7.4.1 Total market size
24.7.4.2 Nanotechnology and nanomaterials opportunity
24.7.5 Market Challenges.
24.7.6 Application And Product Developers

25 Energy Storage, Conversion And Exploration
25.1 Batteries.
25.1.1 Market Drivers And Trends
25.1.1.1 Growth in personal electronics, electric vehicles and smart grids markets
25.1.1.2 Reduce dependence on lithium.
25.1.1.3 Shortcomings of existing battery and supercapacitor technology
25.1.1.4 Reduced costs for widespread application
25.1.1.5 Power sources for flexible electronics.
25.1.2 Properties And Applications
25.1.2.1 Li-ion batteries (LIB)
25.1.2.2 Lithium-air batteries
25.1.2.3 Sodium-ion batteries.
25.1.3 Market Size And Opportunity
25.1.3.1 Total market size
25.1.3.2 Nanotechnology and nanomaterials opportunity
25.1.4 Challenges
25.1.5 Application And Product Developers
25.2 Supercapacitors
25.2.1 Market Drivers And Trends
25.2.1.1 Reducing costs.
25.2.1.2 Demand from portable electronics.
25.2.1.3 Inefficiencies of standard battery technology
25.2.1.4 Problems with activated carbon.
25.2.2 Properties And Applications
25.2.2.1 Carbon nanotubes
25.2.2.2 Graphene
25.2.2.3 Graphene/CNT hybrids
25.2.3 Market Size And Opportunity
25.2.3.1 Total market size
25.2.3.2 Carbon nanomaterials opportunity
25.2.4 Challenges
25.2.4.1 Low energy storage capacity of graphene
25.2.5 Application And Product Developers
25.3 Photovoltaics.
25.3.1 Market Drivers And Trends
25.3.1.1 Need for new materials and novel devices
25.3.1.2 Need for cost-effective solar energy for wider adoptions.
25.3.1.3 Varying environmental conditions require new coating technology
25.3.2 Properties And Applications
25.3.2.1 Solar cells.
25.3.2.2 Solar coatings
25.3.3 Market Size And Opportunity
25.3.3.1 Total Market Size
25.3.3.2 Carbon Nanomaterials Opportunity
25.3.4 Market Challenges.
25.3.5 Application And Product Developers
25.4 Fuel Cells And Hydrogen Storage.
25.4.1 Market Drivers And Trends
25.4.1.1 Need for alternative energy sources
25.4.1.2 Demand from transportation and portable and stationary power sectors
25.4.1.3 Temperature problems with current fuel cell technology.
25.4.1.4 Reducing corrosion problems.
25.4.1.5 Limitations of platinum
25.4.1.6 Reducing cost and increasing reliability of current fuel cell technology
25.4.2 Application And Product Developers
25.4.3 Properties And Applications
25.4.3.1 Fuel cells
25.4.3.2 Hydrogen storage
25.4.4 Market Size And Opportunity
25.4.4.1 Total market size
25.4.4.2 Carbon nanomaterials opportunity
25.4.5 Challenges
25.5 Led Lighting And UVC
25.5.1 Market Drivers And Trends
25.5.1.1 Need to develop low-cost lighting
25.5.1.2 Environmental regulation
25.5.1.3 Limited efficiency of phosphors in LEDs.
25.5.1.4 Shortcomings with LED lighting technologies
25.5.1.5 Improving flexibility
25.5.1.6 Improving performance and costs of UV-LEDs.
25.5.2 Properties And Applications
25.5.3 Market Size And Opportunity
25.5.3.1 Total market size
25.5.3.2 Carbon nanomaterials opportunity
25.5.4 Market Challenges.
25.5.5 Application And Product Developers
25.6 Oil And Gas Exploration.
25.6.1 Market Drivers And Trends
25.6.1.1 Need to reduce operating costs and improve operation efficiency
25.6.1.2 Increased demands of drilling environments
25.6.1.3 Increased exploration in extreme environments
25.6.1.4 Environmental and regulatory
25.6.2 Properties And Applications
25.6.2.1 Sensing and reservoir management
25.6.2.2 Coatings
25.6.2.3 Drilling fluids
25.6.2.4 Sorbent materials
25.6.2.5 Separation
25.6.3 Market Size And Opportunity
25.6.3.1 Total market size
25.6.3.2 Nanotechnology and nanomaterials opportunity
25.7 Application And Product Developers.
25.7.1 Carbon nanotubes.
25.7.2 Graphene.

26 Filtration And Separation
26.1 Market Drivers And Trends
26.1.1 Water shortage and population growth
26.1.2 Need for improved and low cost membrane technology
26.1.3 Need for improved groundwater treatment technologies
26.1.4 Cost and efficiency
26.1.5 Growth in the air filter market
26.1.6 Need for environmentally, safe filters
26.2 Properties And Applications
26.2.1.1 Desalination and water filtration
26.2.1.2 Gas separation.
26.3 Market Size And Opportunity
26.3.1.1 Total market size
26.3.1.2 Carbon nanomaterials opportunity
26.4 Challenges.
26.4.1.1 Uniform pore size and distribution
26.4.1.2 Cost.
26.5 Application And Product Developers.
26.5.1 Carbon nanotubes.
26.5.2 Graphene.

27 Lubricants
27.1 Market Drivers And Trends
27.1.1 Need for new additives that provide “more for less”
27.1.2 Need for higher-performing lubricants for fuel efficiency
27.1.3 Environmental concerns.
27.2 Properties And Applications.
27.3 Market Size And Opportunity
27.3.1 Total market size
27.3.2 Carbon nanomaterials opportunity.
27.4 Challenges.
27.5 Application And Product Developers.
27.5.1 Carbon nanotubes.
27.5.2 Graphene.

28 Sensors
28.1 Market Drivers And Trends
28.1.1 Increased power and performance with reduced cost.
28.1.2 Enhanced sensitivity
28.1.3 Replacing silver electrodes
28.1.4 Growth in the home diagnostics and point of care market.
28.1.5 Improved thermal stability.
28.2 Properties And Applications.
28.2.1 Gas sensors
28.2.2 Strain sensors
28.2.3 Biosensors
28.2.4 Food sensors.
28.2.5 Infrared (IR) sensors
28.2.6 Optical sensors
28.2.7 Pressure sensors
28.2.8 Humidity sensors
28.2.9 Acoustic sensors.
28.2.10 Wireless sensors
28.3 Market Size And Opportunity
28.3.1 Total market size
28.3.2 Carbon nanomaterials opportunity.
28.4 Challenges.
28.5 Application And Product Developers.
28.5.1 Carbon nanotubes.
28.5.2 Graphene.

29 Textiles And Apparel
29.1 Market Drivers And Trends
29.1.1 Growth in the wearable electronics market
29.1.2 Growth in remote health monitoring and diagnostics.
29.2 Properties And Applications.
29.2.1 Protective textiles.
29.2.2 Electronic textiles.
29.3 Market Size And Opportunity
29.3.1 Protective textiles
29.3.1.2 Electronic textiles
29.4 Application And Product Developers.
29.4.1 Carbon nanotubes.
29.4.2 Graphene.

30 3D Printing.
30.1 Market Drivers And Trends
30.1.1 Improved materials at lower cost
30.1.2 Limitations of current thermoplastics
30.2 Properties And Applications.
30.3 Market Size And Opportunity
30.3.1 Total market size
30.3.2 Carbon nanomaterials opportunity.
30.4 Challenges.
30.4.1 Market Challenges.
30.5 Application And Product Developers.
30.5.1 Carbon nanotubes.
30.5.2 Graphene.

31 Carbon Nanotubes Producers And Product Developers
32 Graphene Producers And Product Developers. 988 - 1155 (187 Profiles)

List of Tables
Table 1: Properties of CNTs and comparable materials.
Table 3: Annual production capacity of MWNT and SWNT producers
Table 4: SWNT producers production capacities 2015
Table 5: Global production of carbon nanotubes, 2010-2025 in tons/year. Base year for projections is
Table 6: Consumer products incorporating graphene
Table 8: Graphene producers annual production capacities
Table 9: Global production of graphene, 2010-2025 in tons/year. Base year for projections is 2014.
Table 10: Graphene types and cost per kg
Table 11: Categorization of nanomaterials.
Table 12: Properties of graphene
Table 13: Graphene quantum dot producers
Table 14: Comparison between single-walled carbon nanotubes (SWCNT) and multi-walled carbon nanotubes.
Table 15: Properties of carbon nanotubes
Table 16: Comparative properties of carbon materials
Table 17: Comparative properties of graphene with nanoclays and carbon nanotubes.
Table 18: Competitive analysis of Carbon nanotubes and graphene by application area and potential impact by 2025
Table 19: Electronic and mechanical properties of monolayer phosphorene, graphene and MoS2.
Table 20: Markets and applications of phosphorene
Table 21: Markets and applications of C2N
Table 22: Markets and applications of germanene
Table 23: Markets and applications of graphdlyne
Table 24: Markets and applications of graphehne
Table 25: Markets and applications of hexagonal boron-nitride.
Table 26: Markets and applications of MoS
Table 27: Markets and applications of Rhenium disulfide (ReS2) and diselenide (ReSe2).
Table 28: Markets and applications of silicone.
Table 29: Markets and applications of stanene/tinene
Table 30: Markets and applications of tungsten diselenide.
Table 31: Comparative analysis of graphene and other 2-D nanomaterials.
Table 32: SWNT synthesis methods.
Table 33: Large area graphene films—Markets, applications and current global market.
Table 34: Graphene oxide flakes/graphene nanoplatelets—Markets, applications and current global market
Table 35: Main production and synthesis methods for graphene
Table 36: Pros and cons of CVD for graphene synthesis
Table 37: Pros and cons of exfoliation for graphene synthesis.
Table 38: Pros and cons of epitaxial growth for graphene synthesis
Table 39: Pros and cons of liquid phase exfoliation for graphene synthesis.
Table 40: Pros and cons of micromechanical cleavage for graphene synthesis.
Table 41: Graphene synthesis methods, by company
Table 42: Carbon nanotubes market structure.
Table 43: Graphene market structure.
Table 44: National nanomaterials regulstries in Europe
Table 45: Nanomaterials regulatory bodies in Australia
Table 46: Published patent publications for graphene, 2004-2014.
Table 47: Leading graphene patentees
Table 48: Industrial graphene patents in
Table 49: Nanomaterials scorecard for carbon nanotubes.
Table 50: Markets, benefits and applications of Carbon Nanotubes
Table 51: Global production of carbon nanotubes, 2010-2025 in tons/year. Base year for projections is 2014
Table 52: Annual production capacity of main carbon nanotubes producers.
Table 53: Example carbon nanotubes prices
Table 54: Nanomaterials scorecard for graphene
Table 55: Markets, benefits and applications of graphene.
Table 56: Consumer products incorporating graphene.
Table 57: Global production of graphene, 2010-2025 in tons/year. Base year for projections is 2014.
Table 58: Graphene producers and production capacity (Current and projected), prices and target markets.
Table 59: Graphene properties relevant to application in adhesives
Table 60: Applications in adhesives, by carbon nanomaterials type and benefits thereof.
Table 61: Carbon nanomaterials in the adhesives market—applications, stage of commercialization and estimated economic impact.
Table 62: Market challenges rating for nanotechnology and nanomaterials in the adhesives market
Table 63: Carbon nanotubes product and application developers in the adhesives industry.
Table 64: Graphene product and application developers in the adhesives industry.
Table 65: Applications in aerospace composites, by carbon nanomaterials type and benefits thereof
Table 66: Applications in aerospace coatings, by carbon nanomaterials type and benefits thereof.
Table 67: Carbon nanomaterials in the aerospace market-applications, stage of commercialization and estimated economic impact.
Table 68: Market challenges rating for nanotechnology and nanomaterials in the aerospace market.
Table 69: Carbon nanotubes product and application developers in the aerospace industry.
Table 70: Graphene product and application developers in the aerospace industry.
Table 71: Applications of natural fiber composites in vehicles by manufacturers.
Table 72: Applications in automotive composites, by carbon nanomaterials type and benefits thereof.
Table 73: Nanocoatings applied in the automotive industry.
Table 74: Application markets, competing materials, nanomaterials advantages and current market size in the automotive sector.
Table 75: Carbon nanomaterials in the automotive market-applications, stage of commercialization and estimated economic impact.
Table 76: Applications and commercialization challenges in the automotive market.
Table 77: Market challenges rating for nanotechnology and nanomaterials in the automotive market.
Table 78: Carbon nanotubes product and application developers in the automotive industry.
Table 79: Graphene product and application developers in the automotive industry.
Table 80: CNTs in life sciences and biomedicine.
Table 81: Graphene properties relevant to application in biomedicine and healthcare.
Table 82: Carbon nanomaterials in the biomedical & healthcare markets-applications, stage of commercialization and estimated economic impact.
Table 83: Carbon nanotubes product and application developers in the medical and healthcare industry.
Table 84: Graphene product and application developers in the biomedical and healthcare industry.
Table 85: Properties of nanocoatings.
Table 86: Graphene properties relevant to application in coatings.
Table 87: Markets for nanocoatings.
Table 88: Carbon nanotubes in the coatings market-applications, stage of commercialization and addressable market size.
Table 89: Graphene and 2D materials in the coatings market-applications, stage of commercialization and estimated economic impact.
Table 90: Carbon nanotubes product and application developers in the coatings industry.
Table 91: Graphene product and application developers in the coatings industry.
Table 92: Graphene properties relevant to application in polymer composites.
Table 93: Applications in polymer composites, by carbon nanomaterials type and benefits thereof.
Table 94: Applications in ESD and EMI shielding composites, by carbon nanomaterials type and benefits thereof.
Table 95: Applications in thermal management composites, by carbon nanomaterials type and benefits thereof.
Table 96: Applications in rubber and elastomers, by carbon nanomaterials type and benefits thereof.
Table 97: Potential addressable market size for carbon nanomaterials composites in tons.
Table 98: Carbon nanomaterials in the composites market-applications, stage of commercialization and estimated economic impact.
Table 99: Market challenges rating for nanotechnology and nanomaterials in the composites market.
Table 100: Carbon nanotubes product and application developers in the composites industry.
Table 101: Graphene product and application developers in the composites industry.
Table 102: Graphene properties relevant to application in transparent conductive films.
Table 103: Applications in conductive inks by nanomaterials type and benefits thereof.
Table 104: Comparative properties of conductive inks.
Table 105: Applications in conductive inks by nanomaterials type and benefits thereof.
Table 106: Potential opportunities for nanomaterials in printed electronics.
Table 107: Nanomaterials in the conductive inks market-applications, stage of commercialization and estimated economic impact.
Table 108: Comparison of ITO replacements.
Table 109: Applications in conductive inks by nanomaterials type and benefits thereof.
Table 110: Opportunities for nanomaterials in printed electronics.
Table 111: Nanomaterials in the conductive inks market-applications, stage of commercialization and estimated economic impact.
Table 112: Market challenges rating for nanotechnology and nanomaterials in the conductive inks market.
Table 113: Carbon nanotubes product and application developers in conductive inks.
Table 114: Graphene product and application developers in conductive inks.
Table 115: Comparison of Cu, CNTs and graphene as interconnect materials.
Table 116: Applications in transistors, integrated circuits and other components, by carbon nanomaterials type and benefits thereof.
Table 117: Carbon nanomaterials in the transistors, integrated circuits and other components market-
applications, stage of commercialization and estimated economic impact.
Table 118: Market challenges rating for nanotechnology and nanomaterials in the transistors, integrated circuits and other components market.
Table 119: Carbon nanotubes product and application developers in integrated circuits, transistors and other components.
Table 120: Graphene product and application developers in transistors and integrated circuits.
Table 121: Nanotechnology and nanomaterials in the memory devices market-applications, stage of commercialization and estimated economic impact
Table 122: Carbon nanotubes product and application developers in memory devices.
Table 123: Graphene product and application developers in memory devices.
Table 124: Applications in photonics, by nanomaterials type and benefits thereof.
Table 125: Graphene properties relevant to application in optical modulators.
Table 126: Nanotechnology and nanomaterials in the photonics market-applications, stage of commercialization and estimated economic impact
Table 127: Market challenges rating for nanotechnology and nanomaterials in the photonics market
Table 128: Graphene product and application developers in photonics.
Table 129: Applications in LIB, by carbon nanomaterials type and benefits thereof.
Table 130: Applications in lithium-air batteries, by carbon nanomaterials type and benefits thereof.
Table 131: Applications in sodium-ion batteries, by nanomaterials type and benefits thereof.
Table 132: Carbon nanomaterials opportunity in the batteries market-applications, stage of commercialization and estimated economic impact
Table 133: Market challenges in batteries
Table 134: Market challenges rating for nanomaterials in solar
Table 135: Market challenges rating for nanotechnology and nanomaterials in the batteries market
Table 136: Carbon nanomaterials application and product developers in batteries
Table 137: Comparative properties of graphene supercapacitors and lithium-ion batteries.
Table 138: Properties of carbon materials in high-performance supercapacitors.
Table 139: Carbon nanomaterials in the supercapacitors market-applications, stage of commercialization and estimated economic impact
Table 140: Carbon nanomaterials application developers in supercapacitors.
Table 141: Applications in solar, by carbon nanomaterials type and benefits thereof.
Table 142: Applications in solar coatings, by carbon nanomaterials type and benefits thereof.
Table 143: Nanotechnology and nanomaterials in the solar market-applications, stage of commercialization and estimated economic impact
Table 144: Market challenges in batteries
Table 145: Market challenges rating for nanotechnology and nanomaterials in the solar market.
Table 146: Carbon nanomaterials application developers in solar
Table 147: Carbon nanomaterials application and product developers in fuel cells and hydrogen storage.
Table 148: Applications in fuel cells, by carbon nanomaterials type and benefits thereof.
Table 149: Applications hydrogen storage, by carbon nanomaterials type and benefits thereof.
Table 150: Carbon nanomaterials in the fuel cells and hydrogen storage market-applications, stage of commercialization and estimated economic impact
Table 151: Applications in lighting, by carbon nanomaterials type and benefits thereof.
Table 152: Carbon nanomaterials in the lighting and UVC market-applications, stage of commercialization and estimated economic impact
Table 153: Market challenges rating for nanotechnology and nanomaterials in the lighting and UVC market
Table 154: Carbon nanomaterials application developers in lighting
Table 155: Applications in sensing and reservoir management, by carbon nanomaterials type and benefits thereof.
Table 156: Applications in oil & gas exploration coatings, by carbon nanomaterials type and benefits thereof.
Table 157: Applications in oil & gas exploration drilling fluids, by carbon nanomaterials type and benefits thereof.
Table 158: Applications in oil & gas exploration sorbent materials, by carbon nanomaterials type and benefits thereof.
Table 159: Applications in separation, by carbon nanomaterials type and benefits thereof.
Table 160: Carbon nanomaterials in the oil and gas market-applications, stage of commercialization and estimated economic impact.
Table 161: Carbon nanotubes product and application developers in the energy industry.
Table 162: Graphene product and application developers in the energy industry.
Table 163: Types of filtration
Table 164: Applications in desalination and water filtration, by carbon nanomaterials type and benefits thereof.
Table 165: Applications in gas separation, by nanomaterials type and benefits thereof.
Table 166: Application markets, competing materials and current market size in filtration.
Table 167: Graphene and 2D materials in the filtration and separation market-applications, stage of commercialization and estimated economic impact
Table 168: Market challenges rating for nanotechnology and nanomaterials in the filtration and environmental remediation market
Table 169: Carbon nanotubes product and application developers in the filtration industry.
Table 170: Graphene product and application developers in the filtration industry.
Table 171: Applications in lubricants, by carbon nanomaterials type and benefits thereof.
Table 172: Applications of carbon nanomaterials in lubricants
Table 173: Applications in lubricants, by carbon nanomaterials type and benefits thereof.
Table 174: Market challenges rating for nanotechnology and nanomaterials in the lubricants market
Table 175: Carbon nanotubes product and application developers in the lubricants industry.
Table 176: Graphene product and application developers in the lubricants industry.
Table 177: Graphene properties relevant to application in sensors
Table 178: Applications in strain sensors, by carbon nanomaterials type and benefits thereof.
Table 179: Applications in biosensors, by nanomaterials type and benefits thereof.
Table 180: Applications in food sensors, by carbon nanomaterials type and benefits thereof.
Table 181: Applications in infrared (IR) sensors, by carbon nanomaterials type and benefits thereof.
Table 182: Applications in optical sensors, by nanomaterials type and benefits thereof.
Table 183: Applications in pressure sensors, by carbon nanomaterials type and benefits thereof.
Table 184: Applications in humidity sensors, by carbon nanomaterials type and benefits thereof.
Table 185: Applications in acoustic sensors, by carbon nanomaterials type and benefits thereof.
Table 186: Applications in wireless sensors, by carbon nanomaterials type and benefits thereof.
Table 187: Carbon nanomaterials in the sensors market-applications, stage of commercialization and estimated economic impact.
Table 190: Market challenges rating for nanotechnology and nanomaterials in the sensors market.
Table 191: Carbon nanotubes product and application developers in the sensors industry.
Table 192: Graphene product and application developers in the sensors industry.
Table 193: Desirable functional properties for the textiles industry afforded by the use of nanomaterials
Table 194: Applications in textiles, by carbon nanomaterials type and benefits thereof.
Table 195: Nanocoatings applied in the textiles industry-type of coating, nanomaterials utilized, benefits and applications
Table 196: Carbon nanomaterials in the textiles market-applications, stage of commercialization and estimated economic impact.
Table 197: Carbon nanotubes product and application developers in the textiles industry.
Table 198: Graphene product and application developers in the textiles industry.
Table 199: Graphene properties relevant to application in 3D printing
Table 200: Carbon nanomaterials in the 3D printing market-applications, stage of commercialization and estimated economic impact.
Table 201: Market challenges rating for nanotechnology and nanomaterials in the textiles and apparel market.
Table 202: Carbon nanotubes product and application developers in the 3D printing industry.
Table 203: Graphene product and application developers in the 3D printing industry.
Table 204: Graphene producers and types produced
Table 205: Graphene industrial collaborations and target markets

List of Figures

Figure 1: Molecular structures of SWNT and MWNT.
Figure 2: Production capacities for SWNTs in kilograms, 2005-2014.
Figure 3: Demand for graphene, by market, 2015.
Figure 4: Demand for graphene, by market, 2015.
Figure 5: Global government funding for graphene in millions USD.
Figure 6: Global market for graphene 2010-2025 in tons/year.
Figure 7: Global consumption of graphene 2015, by region.
Figure 8: Graphene layer structure schematic.
Figure 9: Graphite and graphene.
Figure 10: Graphene and its descendants: top right: graphene; top left: graphite = stacked graphene; bottom right: nanotube=rolled graphene; bottom left: fullerene=wrapped graphene.
Figure 11: 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 12: Graphene quantum dots.
Figure 13: Schematic of single-walled carbon nanotube.
Figure 14: Double-walled carbon nanotube bundle cross-section micrograph and model.
Figure 15: Schematic representation of carbon nanohorns.
Figure 16: TEM image of carbon onion
Figure 17: Fullerene schematic
Figure 18: Schematic of Boron Nitride nanotubes (BNNTs). Alternating B and N atoms are shown in blue and red
Figure 19: Graphene can be rolled up into a carbon nanotube, wrapped into a fullerene, and stacked into graphite.
Figure 20: Black phosphorus structure.
Figure 21: Structural difference between graphene and C2N-h2D crystal: (a) graphene; (b) C2N-h2D crystal
Figure 22: Schematic of germanene
Figure 23: Graphdiyne structure.
Figure 24: Schematic of Graphane crystal
Figure 25: Structure of hexagonal boron nitride
Figure 26: Structure of 2D molybdenum disulfide
Figure 27: Atomic force microscopy image of a representative MoS2 thin-film transistor.
Figure 28: Schematic of the molybdenum disulfide (MoS2) thin-film sensor with the deposited molecules that create additional charge.
Figure 29: Schematic of a monolayer of rhenium disulphide
Figure 30: Silicene structure
Figure 31: Monolayer silicene on a silver (111) substrate.
Figure 32: Silicene transistor
Figure 33: Crystal structure for stanene
Figure 34: Atomic structure model for the 2D stanene on Bi2Te3(111)
Figure 35: Schematic of tungsten diselenide.
Figure 36: Schematic representation of methods used for carbon nanotube synthesis (a) Arc discharge (b) Chemical vapor deposition (c) Laser ablation (d) hydrocarbon flames.
Figure 37: Arc discharge process for CNTs.
Figure 38: Schematic of thermal-CVD method.
Figure 39: Schematic of plasma-CVD method.
Figure 40: CoMoCAT® process.
Figure 41: 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 42: Schematic of laser ablation synthesis
Figure 43: Graphene synthesis methods
Figure 44: 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 45: Graphene nanoribbons grown on germanium.
Figure 46: Methods of synthesizing high-quality graphene
Figure 47: Roll-to-roll graphene production process
Figure 48: Schematic of roll-to-roll manufacturing process
Figure 49: Microwave irradiation of graphite to produce single-layer graphene.
Figure 50: Schematic of typical commercialization route for graphene products.
Figure 51: CNT patents filed 2000-
Figure 52: Patent distribution of CNT application areas to 2014
Figure 53: Published patent publications for graphene, 2004-2014
Figure 54: Technology Readiness Level (TRL) for Carbon Nanotubes
Figure 55: Technology Readiness Level (TRL) for graphene
Figure 56: Demand for carbon nanotubes, by market
Figure 57: Production volumes of carbon nanotubes (tons), 2010-
Figure 58: Production volumes of Carbon Nanotubes 2015, by region.
Figure 59: Global market for graphene 2010-2025 in tons/year.
Figure 60: Demand for graphene, by market
Figure 61: Production volumes of graphene 2015, by region
Figure 62: Nanomaterials-based automotive components
Figure 63: The Tesla S's touchscreen interface
Figure 64: 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 65: Graphene-Oxide based chip prototypes for biopsy-free early cancer diagnosis.
Figure 66: Heat transfer coating developed at MIT
Figure 67: Water permeation through a brick without (left) and with (right) "graphene paint" coating
Figure 68: Four layers of graphene oxide coatings on polycarbonate.
Figure 69: Global Paints and Coatings Market, share by end user market.
Figure 70: Graphene electrochromic devices. Top left: Exploded-view illustration of the graphene electrochromic device. The device is formed by attaching two graphene-coated PVC substrates face-to-face and filling the gap with a liquid ionic electrolyte.
Figure 71: Flexible transistor sheet
Figure 72: Foldable graphene E-paper.
Figure 73: Global touch panel market ($ million), 2011-
Figure 74: Capacitive touch panel market forecast by layer structure (Ksqm).
Figure 75: Global transparent conductive film market forecast (million $).
Figure 76: Global transparent conductive film market forecast by materials type, 2015, %
Figure 77: Global transparent conductive film market forecast by materials type, 2020, %
Figure 78: Global market for smart wearables (Millions US$).
Figure 79: Schematic of the wet roll-to-roll graphene transfer from copper foils to polymeric substrates
Figure 80: The transmittance of glass/ITO, glass/ITO/four organic layers, and glass/ITO/four organic layers/4-layer graphene
Figure 81: Nanotube inks.
Figure 82: Graphene printed antenna
Figure 83: BGT Materials graphene ink product
Figure 84: Global market for conductive inks and pastes in printed electronics.
Figure 85: Transistor architecture trend chart.
Figure 86: Schematic cross-section of a graphene based transistor (GBT, left) and a graphene field-effect transistor (GFET, right)
Figure 87: CMOS Technology Roadmap
Figure 88: Thin film transistor incorporating CNTs
Figure 89: Graphene IC in wafer tester
Figure 90: Schematic cross-section of a graphene based transistor (GBT, left) and a graphene field-effect transistor (GFET, right)
Figure 91: Emerging logic devices.
Figure 92: Stretchable CNT memory and logic devices for wearable electronics.
Figure 93: Graphene oxide-based RRAM device on a flexible substrate.
Figure 94: Emerging memory devices.
Figure 95: Carbon nanotubes NRAM chip
Figure 96: Schematic of NRAM cell
Figure 97: Layered structure of tantalum oxide, multilayer graphene and platinum used for resistive random access memory (RRAM).
Figure 98: A schematic diagram for the mechanism of the resistive switching in metal/GO/Pt.
Figure 99: Hybrid graphene phototransistors
Figure 100: Wearable health monitor incorporating graphene photodetectors.
Figure 101: Energy densities and specific energy of rechargeable batteries.
Figure 102: Zapgo supercapacitor phone charger
Figure 103: Suntech/TCNT nanotube frame module.
Figure 104: Perforene graphene filter
Figure 105: 3D Printed tweezers incorporating Carbon Nanotube Filament

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