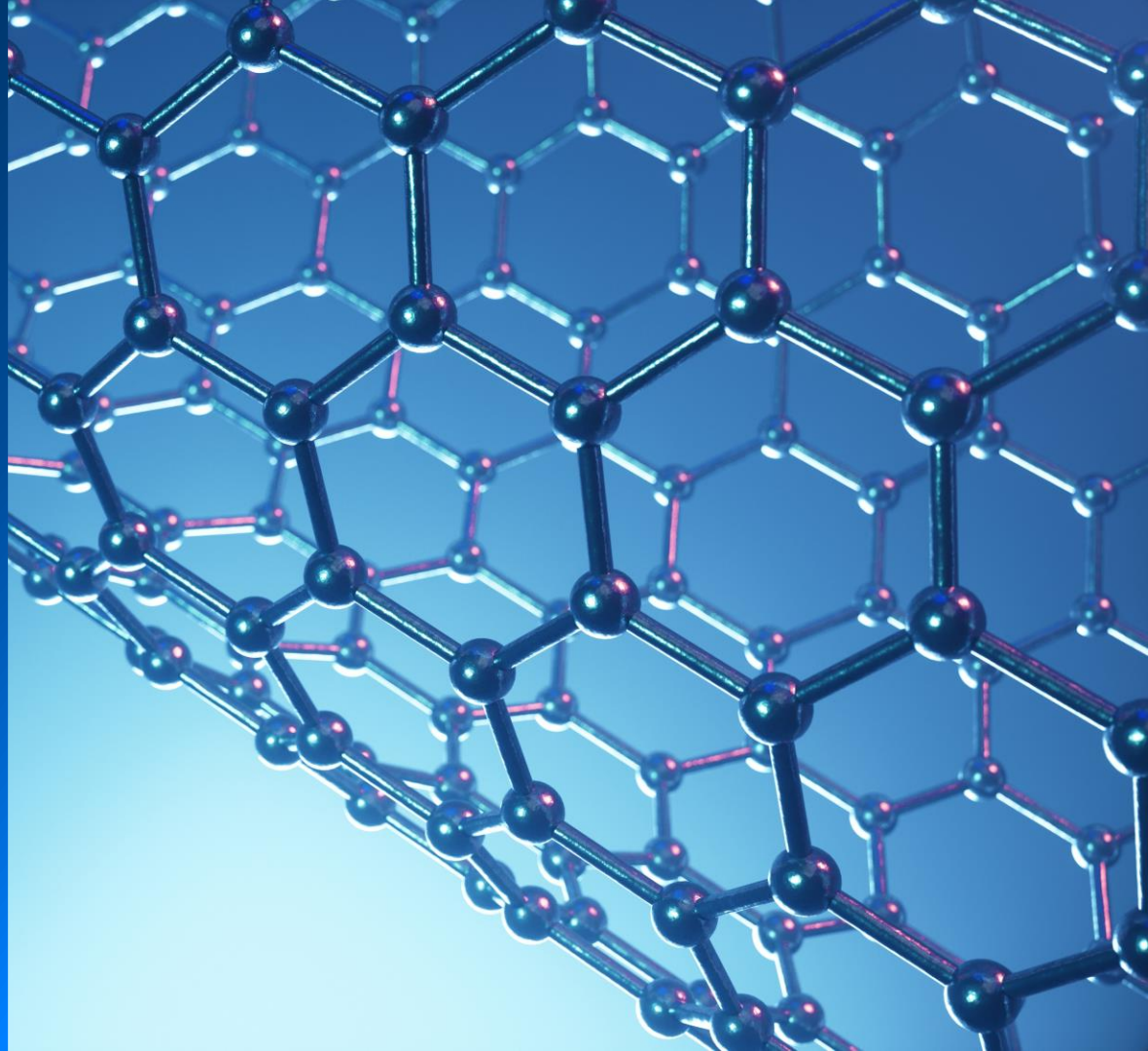
GRAPHENE
Manufacturing in 2022

PRESCOUTER 2022



Suppliers of graphene - Timeline

Estimated total production capacity

2015 — Small, privately-held companies

Estimated total production capacity

2020 — **~800 tons/year**

2022 — **~20,000 tons/year**

Currently

Graphene production

has advanced immensely in under a decade, unlocking new commercial applications and technologies.

In 2015, all suppliers of graphene were small, privately-held companies. With the development of reliable cost-effective processes to mass-produce large quantities of graphene, such as industrial exfoliation methods and chemical vapor deposition (CVD), and educate the customers on how to use this material, the gap between R&D and commercialization has been reduced, enabling new products and technologies. Even so, **in 2020 our findings estimated a total production capacity of around 800 tons/year, and the companies were located in a few main areas** (mostly Canada, Australia, and the UK).

This Intelligence Brief gathers updates on 23 companies previously profiled and/or mentioned in our reports, summarizing the key milestones for graphene producers. **Currently, the total production capacity is estimated at around 20,000 tons/year**. Only 2 out of the 23 companies went out of business, while two others **increased their production by over 150% each**. Five additional players were identified and profiled. One supplier was interviewed to address technical questions regarding manufacturing capacity, production methods, and specific product applications amongst others.

Key Takeaways

23 Previously profiled companies

Products

In the last two years, **27 new products** with graphene have been launched

Growth

8 companies partnered or made collaboration agreements with companies and R&D institutions

News

Comet Resources and Talga Resources entered this space betting on graphene-enhanced lithium batteries

Grants

At least **$408M were raised** across companies in the last two years

5 Additional companies founded between 2007 and 2013

Products

Besides graphene powder, 3 of them produce graphene films and 2 produce graphene-enhanced batteries

Capacities

Ranging from **~4 to 1,000 tons/year**

Production Method

All of them produce graphene by **exfoliation methods** and only two also by CVD

Location

Three of them are located in China, one in Brazil, and one in the US

Updates on graphene players covered in previous reports

Company	2D Carbon Graphene	Applied Graphene Materials	Archer	Cealtech	Comet Resources		Elcora Advanced Materials			Grafoid	GPNT Graphene Nanotech	Graphene Nanochem The future. Now.
Company Size	N/A	11-50	11-50	2-10	2-10	11-50	51-200	11-50	11-50	11-50	2-10	11-50
Year Founded	2011	2010	2007	2012	1993	2005	2011	2016	2009	2011	2014	2006
Headquarter	China	UK	Australia	Norway	Australia	Italy	Canada	Australia	USA	Canada	Spain	Malaysia
Market Cap (US$ million)	N/A	18.3	175.1	N/A	2.5	83.9	9.9	71.9	18.1	N/A	N/A	2.6
Capacity per year	200,000 m² (in 2014)	N/A	N/A	10,000 m³ (in 2016)	N/A	30 tons	4,800-10,000 tons (in 2017)	100 tons	N/A	N/A	N/A	N/A
Production Method	CVD	Solution-based Decomposition Of Metal Alkoxide	Electronic Exfoliation	CVD	Electronic Exfoliation	Thermal Expansion followed by Exfoliation	Exfoliation	Electroch. Exfoliation	CVD and Chem. Exfoliation	Exfoliation	Epitaxial Growth	Chemical Synthesis
Company Category	Producer	Producer	Application developer	Producer	Mining	Producer	Mining, Producer, & Application Developer	Mining & Producer	Application Developer	Producer	Producer	Producer
Current Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Out of Business 2019/2020	Out of Business 2021

Updates on graphene players covered in previous reports

Company	Graphenea	graphensic	haydale	NanoXplore	talga	Thomas Swan	Versarien	XGSciences	zentek	williamblythe GOgraphene	LayerOne
Company Size	11-50	2-10	51-200	201-500	11-50	51-200	51-200	51-200	2-10	51-200	11-50
Year Founded	2010	2011	2010	2011	2010	1926	2010	2006	2008	1845	2005
Headquarter	Spain	Sweden	UK	Canada	Australia	UK	UK	USA	Canada	UK	Norway
Market Cap (US$ million)	N/A	N/A	28.1	700.0	49.2	N/A	61.1	N/A	292.3	N/A	N/A
Capacity per year	1 ton (in 2016)	N/A	30 tons (in 2021)	4,000 tons (in 2020)	1,000 tons (in 2018)	1,000 tons (in 2021)	10 tons (in 2021)	300-600 tons	40 tons (in 2019)	N/A	0.3 tons (in 2015)
Production Method	CVD	Epitaxial Growth	Plasma Exfoliation	Liquid Exfoliation	Electroch. Exfoliation	Liquid Exfoliation	CVD and Exfoliation	Chem. and Mec. Exfoliation	Chem. and Mec. Exfoliation	Chemical Exfoliation	Chemical Synthesis
Company Category	Producer & Application Developer	Producer	Producer	Producer	Producer & Application Developer	Producer	Producer & Application Developer	Producer & Application Developer	Mining & Application Developer	Producer	Producer
Current Status	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active

Additional 5 players we found on the market

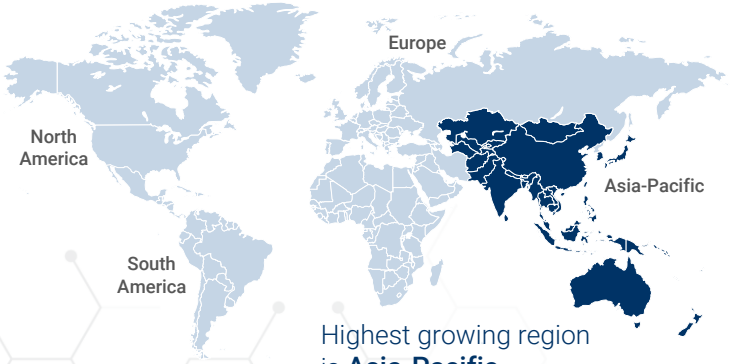
Company	BoomaTech	The Sixth Element Inc.	Global Graphene Group	墨西科技 MORSH	KNANO
Company Size	2-50	51-200	51-200	11-50	51-200
Year Founded	2013	2011	2007	2012	2010
Headquarter	Brazil	China	USA	China	China
Capacity per year	3.6 – 6 tons	1,000 tons	300 tons	500 tons	200 tons
Production Method	Chemical electro-exfoliation	Exfoliation and CVD	Exfoliation and CVD	Exfoliation	Exfoliation
Products	Powder, flakes, & graphene-enhanced batteries	Powder, suspensions, & films	Powder, dispersions, films, & graphene-enhanced batteries	Powder, films, pastes, & coatings	Powder, nanoplatelets powder, & pastes
Current Category	Producer & Application Developer	Producer	Producer & Application Developer	Producer & Application Developer	Producer

Introduction

A look at the current graphene market

In 2019, the global graphene market size was estimated to be 91.3M USD

The global graphene market size is projected to grow from 620M USD in 2020 to 1,479M USD by 2025; it is expected to register a CAGR of 19%. Asia-Pacific continues to dominate the market (60%) due to the increase in demand from the electronics and healthcare industries.



Highest growing region is **Asia-Pacific**

Global value of the graphene market from 2020 to 2025. **Source:** Markets and Markets

Driving Factors:

The 3 main drivers of the graphene market are:

Next generation transistors, sensors, capacitors, etc.

Graphene is used as a coating to improve the touch screens in wearable and flexible electronic devices. Graphenea, profiled in previous reports, is supplying several types of graphene-based field effect transistors for applications in biosensing, microelectronics, and rapid testing.

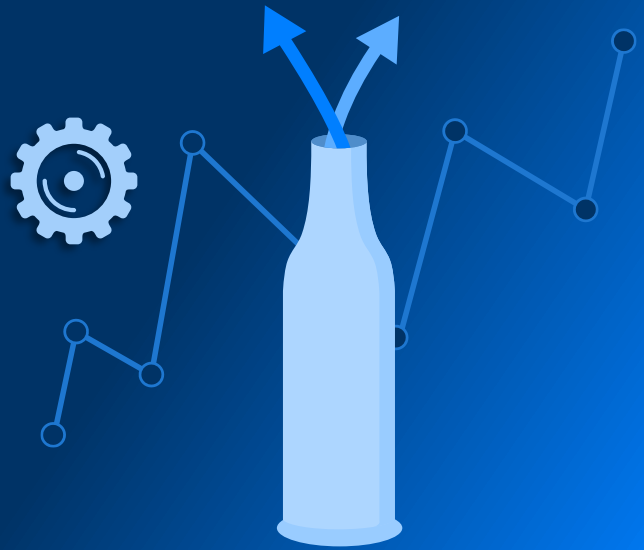
High conducting thin films and ink

The very high conductivity of graphene is used in making next-generation computer chips which can conduct even at room temperature. Graphene-XT, an additional company that is located in Italy, is supplying graphene inks and coatings of only a 10 nm thin layer of graphene that can withstand high temperature and pressure.

Graphene batteries and graphene electrodes for Li-ion batteries

Graphene batteries and graphene aluminum-ion batteries are already present in the market and are still in the best interests of the research world to further develop them to reach theoretical capacities.

Bottlenecks and Challenges



The global graphene market witnessed a decline of 27% in the year 2020 due to the impact of the SARS-CoV-2 pandemic. This has created a huge challenge within the companies to bring back the production rate by keeping the budget less since some **equipment used in the production of graphene is expensive**. Given that the material must have consistent properties for any application, **producing single-layer graphene with the same properties in each iteration is another challenge and scientists are working on removing graphene from the substrate**.

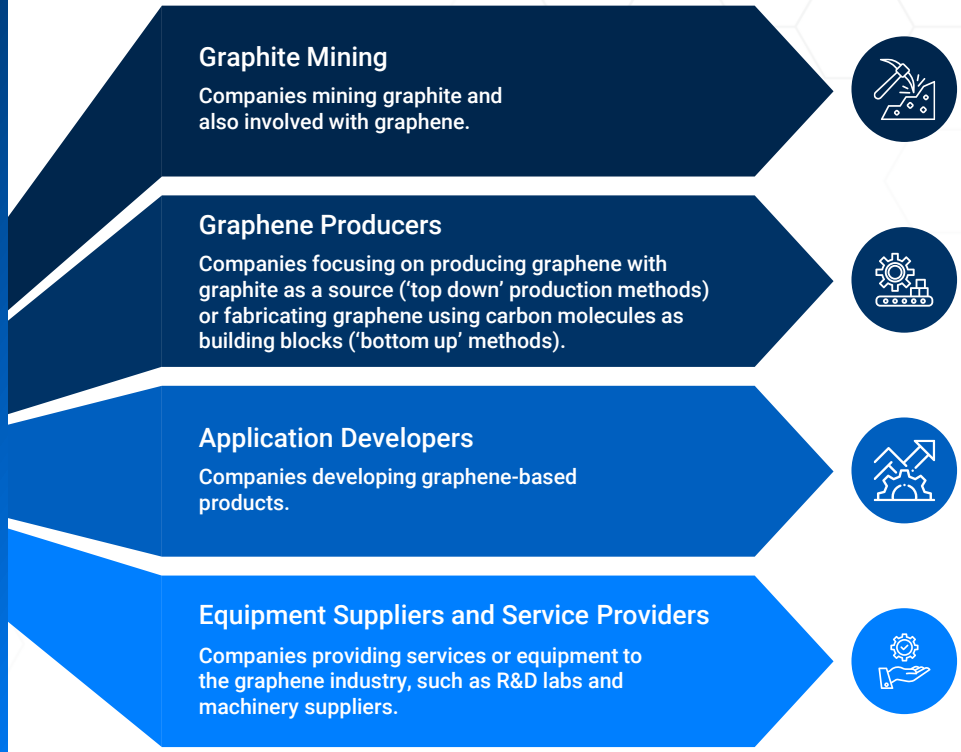
Concerning the properties of graphene, it is **inflammable in nature**, which requires massive precautions to be taken. Graphene oxide (GO) nanoparticles are toxic to humans and animals. They are also very mobile through streams and lakes and can cause a **negative impact on the environment** if released.

The graphene industry has done only a small amount of work in terms of regulations and standards. Several companies are producing various types of graphene, which is causing confusion in the industry. This factor has resulted in fake graphene in the market, which is difficult to realize at the product stage. This is leading to diminishing trust among end-users.

The lack of a skilled workforce is another hurdle that the industry is facing.

Despite being an emerging technology, the graphene industry already has more than 300 players in various categories

VALUE CHAIN PLAYERS



Applications: How can companies use graphene?

Graphene is the thinnest material (1 atomic layer thick) known to humans, which makes its applications endless. Graphene can be used in simple applications like a conductive additive in electronics all the way to the most complex applications like building space armors and bullet proof armors.

Chemicals

As part of composite materials, in boats or automotive parts, to decrease weight, absorb impact, etc. Or as an additive in formulating polymeric-based products such as car waxes, etc.

Hygiene

Incorporation in textiles or safety boots, with an antimicrobial purpose, or in membranes for water sanitization, industrial filtration, etc.

Coating

Usage in inks, paints, primers, and coatings to protect a substrate against harsh chemicals, preventing corrosion/rust in highly aggressive environments as an anti-static agent, etc.

Building Materials & Construction

As reinforced concrete to improve strength, in cements to reduce clinker factor (low-carbon footprint), etc.

Packaging

In high barrier monolayer films for food packaging as simultaneous oxygen, water vapor barriers, etc.

Electronics

In integrated circuits in electronic components and as a precursor material in lithium-ion battery anodes used in electric vehicles, providing thermal/heat dissipation, electrical conductivity at room temperature, etc.

What’s new?

Updates on previously profiled companies

2D Carbon Tech

2D CARBON GRAPHENE

2020

Dec

Invited to join the Triumph Group to expand multi-field cooperation and the exchange of graphene applications

2021

Jan

Announced application of graphene in an electric heating film for residential floor heating

Applied Graphene Materials (AGM)

APPLIED GRAPHENE MATERIALS

2021

Jan — Raised about £6.0M in a fundraising to accelerate the growth of the business

Feb — Announced the application of graphene in a graphene-based car wax launched by Infinity Wax

Mar — Announced the application of graphene in graphene-based car sealants launched by Constellation Chemicals

Apr — AGM's distribution partner, Maroon Group, acquired by Barentz International

May — Announced the application of graphene in graphene-based bike detailer launched by Tru-tension

Jul — Launched a new product line series, Genable 1700, which are eco-friendly graphene nanoplatelet dispersions

Aug — Received £47,500 funding to install a new paint and a coating spray booth facility

Dec — Received a UK patent for graphene nanoplatelets use in water-based anti-corrosion protective coatings applications

2022

Jan — Launched two epoxy-based graphene-enhanced primers, Genable Epoxy Primer, and HC primer

Feb — Stanvac-Superon started using AGM's graphene dispersions in coatings for cable joints in industrial power transmission

Archer Materials Limited (formerly Archer Exploration)

ARCHER

2021

Mar

Further development of a biochip (using graphene-based materials as integrated circuits), reducing the size to nanoscale, potentially allowing droplets of biological specimens to be analyzed and processed using graphene-based sensors

Oct

Transitioned from a focused minerals exploration company to a diverse materials technology company

Raised $15 M using a share purchase plan after a 12% higher intraday achieved by its shares

2022

Jan

Shares rose by 29% intraday after successfully integrating a single-atom-thick sheet of graphene into a silicon wafer using an electron beam lithography system

Feb

Received a EU patent for its 12CQ quantum computing chip technology. Now, it has protection in 16 countries around the world

Technical validation of quantum information on their 12CQ carbon-based qubit quantum computing chip at room temperature showed its usage potential in mobile technology

CealTech

CEALTECH™

..

Their PE-CVD graphene flakes were used in a 2021 research paper for the application of low-defect graphene and graphene oxide on the pH-responsive release of phenformin

Tests with graphene combined with other materials have been done in collaboration with Future Materials. This catapult center helps Cealtech to develop and promote new graphene-based materials

2021-2023

Received $729,837.90 funding for the development, optimization, and scale-up of a silicon-graphene nanoengineered anode for Li-ion battery

Comet Resources

2021

Feb

Raised $1M in a placement to expand exploration in Australia and Mexico and to use for working capital purposes

Mar

Enhanced portfolio of base/precious metal projects by acquiring the high-grade Santa Teresa Gold Project in Mexico and the Barraba Copper Project in Australia

Oct

Agreement with International Graphite Ltd. to form a vertically integrated high-technology graphite business. Upon an $8M transaction in shares with a public offering and listing on the ASX

Adopted an Environmental, Social, and Governance (ESG) framework to ensure that their mineral exploration activities are taken in a manner that addresses the investors' and society's expectations and concerns

Nov

Graphite micronization final results from test work showed a 50% increase in yield compared to previous tests. This processed graphite is a precursor material for lithium-ion battery anode production

DirectaPlus

DIRECTAPLUS
PARTNERS IN NANOTECHNOLOGY

2021

- **Jan** — Extended contract with OMV Petrom for oil decontamination and recovery using graphene-based Grafysorber® solution
- **Feb** — $109,544.50 grant received to further enhance SARS-CoV-2- resistant face masks
- **Apr** — Advances in its research into printing graphene-based inks onto textiles
- **Jun** — NexTech Batteries established an Italian subsidiary in which Directa Plus' graphene technology is a component
- **Sep** — Revenue increased by 41% in a 6-month period
- **Nov** — Graphene-based trail shoes launched by Norse
- **Dec** — Granted EU patent for rubber-based shoe outsoles

2022

- **Mar** — Trials of an asphalt concrete modifier, graphene-enhanced, developed by Iterchemica
- Granted GRAPH-EU project to further develop the graphene-enhanced face mask, Graphene Plus® Co-mask™
- Granted GRAFYFILTER project to develop graphene for industrial filtration devices

Elcora Advanced Materials

Elcora
Advanced Materials

2021

Oct

Engaged with Lab 4 Inc. to develop and scale up a new graphite production site in Tanzania

Nov-Dec

Acquired STE Ermazone A.R.L, a company owing 10 vanadium sites in Morocco

2022

..

Announced plans on extracting and processing battery-grade minerals and metals from current projects and applying the materials to proprietary energy storage applications, aiming to become a vertically integrated battery material company

First Graphene

FIRSTGRAPHENE

2021

Jan — Application of graphene platelets as an enabler for low carbon concrete in a research paper showing the best performance with 56 microns size

Mar — Positive results in researching new graphene catalysts for low-cost hydrogen fuel cells

Released a new product line, PureGRAPH® AQUA, a range of water dispersed graphene additives

Collaboration with Gerdau to grow the graphene industry in the Americas

Apr — Product line extension with a new 50-micron platelet size designed for concrete strengthening and polymer reinforcement

Jun — Distribution agreement signed with GtM Action Ltd to provide representation into the New Zealand concrete market

Agreement with Advanced Material Development to collaborate in AMD's portfolio of conductive inks

Launched new product line: a graphene-loaded low-density polyethylene (LDPE) masterbatch for easier dispersion into thermoplastics

New graphene-enhanced products

- Graphene-enhanced **safety boots** launched by Steel Blue Boots
- Graphene-enhanced **surfboard** line launched by Katana Surf
- Glass- reinforced plastic **boat** launched by Ascent Shipwrights
- Polyurethane **wear liner material** launched by newGen Group

First Graphene

FIRSTGRAPHENE

2021

Jul
Released a whitepaper on patented hydrodynamic cavitation process to transform petroleum into graphite and graphene

Aug
Swimming pools manufactured with graphene-infused resin launched by Aquatic Leisure Technologies

Oct
Review of its go-to-market strategy and adoption of a 'market-maker' approach, driving demand for graphene

Nov
Product line expansion with new MB-EVA Bitumen masterbatch for blending into asphalt mixture

Dec
UK patent filed on graphene-enhanced cement admixtures to scale up the production

2022

Jan
Collaboration agreement signed with Fosroc for the development of grinding aids as cement additives

Feb
UK patent granted for coating battery anode particles with graphene

Collaboration agreement signed with Mayur Resources for the development of low-carbon cement products to reduce carbon dioxide emissions

Mar
10-year partnership agreement signed with NeoGraf Solutions for the development and growth of the graphene market in the U.S.

G6 Materials

G6 Materials™
TSX-V: GGG | OTCQB: GPHBF

2021

Mar — Announced plans to acquire GX Technologies, LLC in a $7.5 M CAD deal

Apr — Successfully closed a $5.4 M private offering for funding the acquisition of GX and expanding a pilot facility

May — Granted patents related to a method of graphene enrichment and a water-soluble 3D printing material

Aug — Completed transaction to acquire GX Technologies, LLC

Sep — Positive results on antimicrobial efficacy tests for a graphene-based air purifier prototype

Nov — New pilot-scale graphene oxide reactor providing a 5-fold production capacity increase

Dec — New location in California, to be used as an office and warehouse facility

2022

Jan — Graphene Laboratories, Inc., its subsidiary, received the ISO 9001 certification for a manufacturing facility in NY, which was also a prerequisite to an exclusive 5-year supply agreement with a EU-based global micro connector company

Feb — Graphene Laboratories, Inc. entered into a testing services agreement with the U.S. Army to research graphene oxide adsorption capabilities for the removal of complex contaminants

Grafoid

2021

Mar

Terminated merging plans with Stria Lithium due to *"matters beyond the reasonable control"*

In 2018, companies co-developed a graphene-based filtration membrane to separate magnesium and calcium from salars

Jul

Acquired part of Braille Energy Systems Inc. for investment purposes

Graphenea

Graphenea

2021

Feb — Started a collaborative project to develop the terahertz spectroscopy technique, a novel measurement tool for graphene characterization that can penetrate graphene films

Oct — Obtained ISO 13485 certification for manufacturing medical device components, in particular non-implantable biosensors

Nov — Joined the European Photonics Industry Consortium to increase presence in the photonics industry

2022

Feb — Developed a manufacturing process to create transistor structures on graphene, enabling the fabrication of pixelated structures for photodetector arrays and electro-optical modulation in waveguides, for example

Nov — Launched Cartridge S2X, a product for easy fabrication of graphene-based sensors especially designed for biosensing

GraphenSic

2021

GraphenSic's epitaxial graphene samples were used in a 2021 research paper for the application of graphene-based aqueous systems for enhanced and selective ion separations showing great potential

Haydale Graphene

2021

Aug

Filed a joint patent with Airbus on graphene composites with improved lightning strike performance alleviating the need for copper mesh

Dec

Agreement of graphene nano-platelets exclusive supply for being incorporated into iCraft's PPE face masks

2022

Jan

Launch of a nylon jacket made with graphene-coated fabric, THERMiT™, with increased thermal insulation rate

Feb

Awarded £135,000 contract collaboration with Cadent Gas to develop graphene ink-based heaters for low power hot water

Mar

Awarded £168,573 funding to develop high-barrier monolayer films for food packaging using functionalized nanomaterials, HiBarFilm2 Project by Innovate UK

NanoXplore

2021

Apr
Received regulatory approval to produce and sell GrapheneBlackTM in Canada for uses as an additive in plastics, thermosetting composites, paints and coatings, and as a component of battery electrodes

Jun
Agreement with Gerdau Graphene, application developer, to supply and distribute graphene in the Americas region

Agreement with Techmer PM, LLC to supply GrapheneBlack™ grade of products

Aug
Awarded a multi-year contract to supply graphene for fuel and brake lines for passenger vehicles produced by Martinrea

2022

Feb
Announced a $30 M public offering intended for general corporate purposes which may include pursuing potential acquisitions and fund its growth strategies

Experts at Paradigm Capital, investment dealer, positively analyzed NanoXplore after the Q2 2022 financial results release and claimed to expect the production to achieve 12,000 tons/year by the end of 2023

Mar
Announced the commissioning of VoltaXplore's demonstration facility, a Joint Venture between NanoXplore and Martinrea

Talga Resources

2021

Sep

Started a graphite mining campaign in Sweden, extracting a 2,500-ton sample, to be processed into lithium-ion battery anode products

2022

Feb

Successfully produced lithium-ion battery anode product, Talnode®-C, during commissioning of new electric vehicle anode plant in Sweden. Product will be shipped to battery cell makers to undergo large-scale commercial trials in electric vehicle batteries

Thomas Swan

2021

May — Joined the Graphene Engineering Innovation Centre (GEIC) as a partner in a flexible support model

Jun — Teamed up with Johnson Matthey and the Graphene Application Center at CPI to optimize battery technology using graphene and carbon nanotubes

Jul — Announced a new joining venture with Mason Graphite to launch Black Swan Graphene for bulk graphene production

Sep — Announced the first commercial use of graphene-enhanced concrete patented by Black Swan Graphene

Dec — Black Swan Graphene planned to trade at the TSX and raised $5 M CAD

Versarien

Versarien PLC

2021

Feb — Graphene-enhanced face masks met the FFP3 European protection standard, demonstrating <2% inward leakage and filtering at least 99% of particulate matter

Apr — Entered into agreements with Graphene Lab, specialized in chemical vapor deposition graphene

May — First-time use of Concretene, a concrete containing graphene-based additive, in a commercial setting

Aug — Scheduled proof of concept trials to test 3D printing of graphene-reinforced concrete using 'Printfrastructure' technology in a new high-speed rail network, by SCS JV

Sep — University of Gloucestershire carried out trials on Versarien's graphene-coated sportswear

Sep — Provided graphene, through Concretene, to the Graphene Engineering Innovation Centre (GEIC) for building a 'living lab' to test performance in exterior conditions

Nov — Partnership to produce graphene-enhanced garments with DKH Retail Limited to improve thermal and moisture management properties

2022

Feb — Pre-launch of graphene-enhanced shoes by Flux Footwear LLC to improve the rubber outsole

Mar — Launched 'Lunar' lifestyle pods, rooms that could be used as office/studio/gym, building printed with Cementene™

XG Sciences

2020

May

Announced the use of graphene nanoplatelets in hockey sticks made by Grays Hockey with energy being more efficiently transferred and more shock absorbed

2021

Sep

Provided graphene to graphene-enhanced polyurethane foam development for lowering noise and weight in vehicles, produced by Ford Motor

Zentek (formerly Zen Graphene Solutions)

zentek

2021

Jan — Agreement with Trebor Rx for the application of a graphene-based coating on nitrile gloves

Feb — Recognized as a Venture 50 company by the TSX Venture Exchange for 2020, based on market capitalization growth, share price appreciation, and trading volume

Mar — Agreement to accelerate the development of a large graphite deposit in Albany, Canada

Jun — Filed patent for graphene-based diesel fuel additive technology

Sep — Commercial agreement with Trebor Rx for the manufacturing of graphene-enhanced personal protective equipment

Nov — Awarded the Innovation Solutions Canada Testing Stream contract to test ZENGuard™-coated HVAC filters

Issued a Medical Device Establishment License by Health Canada, for the manufacture and distribution of class one medical devices, such as graphene-enhanced PPE

Developed a nanotechnology-enhanced coating with dispersed graphene, designed to prevent ice accretion for aircraft, wind turbines, ocean vessels, and building structures applications

Zentek (formerly Zen Graphene Solutions)

zentek

2022

Jan

- Successfully closed a C$33 M offering for capital expenses, research and development, acceleration of business growth opportunities and working capital
- Cooperated with GMAF Circular Medico to incorporate ZENGuard™ into surgical masks recycling program and convert them into polypropylene pellets

Feb

- Filed a provisional patent on graphene-wrapped silicon anode material to improve lithium-ion battery technologies

Mar

- Partnered with Vimta Labs to study ZenGUARD™ active ingredient as a potential treatment of infectious skin disease
- Filed patent on ZenGUARD™ technology, graphene silver nanocomposites for coating as an antimicrobial agent

GOgraphene

williamblythe
Chemistry for tomorrow

GOgraphene

2021

Feb — Application of graphene oxide in nanofiltration membranes to functionalize poly(benzimidazole) in a research paper

Mar — Application of graphene oxide in silver nanoparticles as an antiviral agent against influenza A and OC43 coronavirus infection in vitro in a research paper

Synthomer Plc invested in William Blythe's battery testing facilities giving them the ability to test electrochemical properties of graphene-based materials

Apr — Application of graphene oxide in cancer cells in vitro with positive results when compared to normal cells in a research paper

Jul — Application of graphene oxide in a nano-silver matrix for dentistry root canal treatment showing graphene oxide potential as an irrigation agent in a research paper

Sep — Graphene oxide products were assigned with a CAS number during the REACH registration process

2022

Feb — Application of graphene oxide, carbon nanotubes, and silver nanoparticles as reinforcement fillers of a polyetheretherketone (PEEK) matrix in a research paper showing potential as semiconductors for aerospace and automobile applications

Mar — Announced exhibition in June of 2022 at the Advanced Materials Show. It planned on bringing news on the development and scale-up of its advanced materials portfolio

LayerOne (formerly Abalonyx)

2020

Jan

Abalonyx rebranded as LayerOne after Aker acquisition (in 2021)

Acquired by Clara Venture Labs, venture platform, aiming to focus on industrial scaling and building R&D

References:

2D Carbon Tech

1. http://cz2dcarbon.com/news/2020-12-22/256.html
2. http://cz2dcarbon.com/news/2021-6-15/278.html

Applied Graphene Materials (AGM)

1. https://www.appliedgraphenematerials.com/agm-announce-successful-fundraise/
2. https://appliedgraphene2020tf.q4web.com/real-time-regulatory-news/news-details/2021/Applied-Graphene---Result-of-Fundraise/default.aspx
3. https://www.appliedgraphenematerials.com/agm-customer-infinity-wax-launches-second-graphene-enhanced-product/
4. https://www.appliedgraphenematerials.com/car-care-customer-launches-two-innovative-graphene-based-sealants/
5. https://www.appliedgraphenematerials.com/agm-distribution-partner-becomes-part-of-barentz-international/
6. https://www.appliedgraphenematerials.com/cycle-product-innovator-introduces-new-graphene-based-detailer/
7. https://www.appliedgraphenematerials.com/agm-launches-a-range-of-eco-friendly-graphene-dispersions/
8. https://www.appliedgraphenematerials.com/agm-wins-funding-to-further-expand-inhouse-capabilities/
9. https://www.appliedgraphenematerials.com/agm-receives-uk-patent-for-water-based-corrosion-innovation/
10. https://www.appliedgraphenematerials.com/graphene-enhances-barrier-and-anti-corrosion-coating-performance/
11. https://www.appliedgraphenematerials.com/graphene-enhanced-coating-successfully-developed-for-indian-power-transmission-assets/

Archer Materials Limited (formerly Archer Exploration)

1. https://www.proactiveinvestors.com.au/companies/news/944422/archer-materials-strengthens-graphene-based-biochip-nanofabrication-capabilities-944422.html
2. https://www.proactiveinvestors.com.au/companies/news/962639/archer-materials-set-to-complete-transition-to-pure-play-deep-technology-company-962639.html
3. https://www.proactiveinvestors.co.uk/companies/news/964076/archer-materials-raises-a15-million-in-heavily-backed-spp-964076.html
4. https://www.proactiveinvestors.com.au/companies/news/971050/archer-materials-shares-surge-after-integrating-single-atom-thick-graphene-on-a-silicon-wafer-971050.html
5. https://www.proactiveinvestors.co.uk/companies/news/974817/archer-materials-granted-patent-protection-in-europe-for-12cq-quantum-computing-chip-974817.html
6. https://thequantuminsider.com/2022/02/01/archer-materials-report-on-progress-toward-quantum-powered-mobile-tech/

CealTech

1. https://pubs.acs.org/doi/10.1021/acsomega.1c03283
2. https://teal.no/news/cealtech/
3. https://prosjektbanken.forskningsradet.no/en/project/FORISS/321451?Kilde=FORISS&distribution=Ar&chart=bar&calcType=funding&Sprak=no&sortBy=date&sortOrder=desc&resultCount=30&offset=0&Organisasjon.3=CEALTECH+AS

Comet Resources

1. https://www.proactiveinvestors.com.au/companies/news/940588/comet-resources-raises-1-million-in-placement-to-support-exploration-in-australia-and-mexico-940588.html
2. https://www.proactiveinvestors.com.au/companies/news/944318/comet-resources-to-enhance-portfolio-by-acquiring-prospective-copper-gold-and-base-metals-assets-in-nt-944318.html
3. https://wcsecure.weblink.com.au/pdf/CRL/02481409.pdf
4. https://www.proactiveinvestors.com.au/companies/news/962334/comet-resources-adopts-esg-strategy-962334.html
5. https://www.proactiveinvestors.com.au/companies/news/967669/comet-resources-completes-springdale-optimisation-tests-spherical-graphite-yield-lifted-to-60-967669.html

DirectaPlus

1. https://www.directa-plus.com/_files/ugd/1f30fc_65d90af0af414da59f2150d548601136.pdf
2. https://www.directa-plus.com/_files/ugd/1f30fc_0da610105d8f41cba2c22bb1fcae17db.pdf
3. https://www.fibre2fashion.com/news/textile-news/uk-s-directa-plus-advances-textile-printing-with-graphene-inks-273704-newsdetails.htm
4. https://www.graphene-info.com/directa-plus-partner-nextech-batteries-takes-step-towards-graphene-based
5. https://www.proactiveinvestors.co.uk/companies/news/961668/directa-plus-posts-best-results-in-its-history-961668.html
6. https://www.graphene-info.com/directa-plus-announces-new-line-high-tech-trail-shoes-enhanced-its-graphene
7. https://www.proactiveinvestors.com/companies/news/969725/directa-plus-granted-eu-wide-patent-for-rubber-outsole-product-969725.html
8. https://www.sharesmagazine.co.uk/news/market/164668989735242330 0/in-brief-directa-plus-notes-second-graphene-plus-trial-in-oxford
9. https://www.directa-plus.com/grants

Elcora Advanced Materials

1. https://www.juniorminingnetwork.com/junior-miner-news/press-releases/1562-tsx-venture/era/108708-elcora-advanced-materials-launches-production-strategy-in-tanzania.html
2. https://stockhouse.com/news/press-releases/2021/12/20/elcora-advanced-materials-closes-acquisition-of-moroccan-vanadium-exploration
3. https://stockhouse.com/news/press-releases/2022/02/03/elcora-advanced-materials-corp-2022-development-plans

References:

First Graphene

1. https://firstgraphene.net/new-evidence-confirms-potential-for-graphene-as-an-enabler-for-low-carbon-concrete/
2. https://firstgraphene.net/low-cost-hydrogen-fuel-cells/
3. https://firstgraphene.net/puregraph-product-line-to-include-water-dispersed-additive-2/
4. https://firstgraphene.net/collaboration-with-gerdau-s-a-to-grow-the-graphene-industry-in-the-americas/
5. https://firstgraphene.net/puregraph-50-added-to-product-line/
6. https://firstgraphene.net/distribution-agreement-targets-nz-concrete-industry/
7. https://firstgraphene.net/memorandum-of-understanding-signed-to-collaborate-on-conductive-ink-development/
8. https://firstgraphene.net/graphene-polymer-masterbatch-launched-to-further-open-thermoplastics-market/
9. https://firstgraphene.net/commercial-updates/
10. https://firstgraphene.net/whitepaper-highlights-promise-of-cavitation-chemistry/
11. https://www.graphene-info.com/graphene-enhanced-pools-aquatic-leisure-technologies-hit-market/
12. https://firstgraphene.net/first-graphene-gears-for-growth-through-new-market-maker-strategy/
13. https://firstgraphene.net/bitumen-masterbatch-formulation-added-to-puregraph-product-range/
14. https://firstgraphene.net/patent-filing-strengthens-pathway-to-reducing-co2-emissions-in-cement-production/
15. https://firstgraphene.net/fosroc-agreement-cements-carbon-reduction-strategy
16. https://firstgraphene.net/next-generation-battery-technology-patent-granted-to-coat-anode-particles-with-graphene/
17. https://firstgraphene.net/mayur-resources-agreement-paves-way-for-low-carbon-cement-products/
18. https://www.graphene-info.com/first-graphene-signs-partnership-agreement-neograf-solutions-exposure-us-market

G6 Materials

1. https://g6-materials.com/g6-materials-raises-5-million-cad-acquire-go-application-developer-gx/
2. https://g6-materials.com/g6-materials-announces-successful-closing-of-5-4-million-non-brokered-equity-financing/
3. https://g6-materials.com/g6-materials-announces-granting-of-two-us-patents/
4. https://g6-materials.com/g6-materials-signs-definitive-purchase-agreement-to-acquire-gx-technologies/
5. https://g6-materials.com/g6-materials-air-purifier-prototype-reduces-pathogenic-microorganisms-by-99-9-in-antimicrobial-efficacy-test/
6. https://g6-materials.com/g6-materials-new-graphene-oxide-reactor/
7. https://g6-materials.com/g6-materials-establishes-california-facility/
8. https://g6-materials.com/g6-materials-receives-iso-9001-certification/
9. https://g6-materials.com/g6-materials-tsa-with-the-us-army-erdc/

Grafoid

1. https://www.graphene-info.com/grafoid-and-stria-terminate-their-plan-marge
2. https://grafoid.com/grafoid-acquires-common-shares-of-braille-energy-systems-inc/

Graphenea

1. https://www.graphene-info.com/terahertz-imaging-graphene-could-promote-industrialization
2. https://www.graphene-info.com/graphenea-certified-medical-device-components
3. https://www.thegraphenecouncil.org/blogpost/1501180/383797/Graphenea-joins-EPIC
4. https://www.graphenea.com/blogs/graphene-news/graphenea-foundry-qualifies-a-hkmg-process-flow-with-an-eot-down-to-5nm-an-industry-first
5. https://www.graphene-info.com/graphenea-launches-cartridge-s2x-easy-fabrication-graphene-based-sensors

GraphenSic

1. https://arxiv.org/ftp/arxiv/papers/2111/2111.10516.pdf

Haydale Graphene

1. https://haydale.com/news/filing-of-joint-patent-with-airbus/
2. https://haydale.com/news/haydale-signs-sole-distributor-agreement-for-graphene-nano-platelets-enhanced-icraft-ppe-mask/
3. https://haydale.com/news/haydale-gnps-enhance-clothing-for-icraft-and-pro-specs/
4. https://haydale.com/news/contract-awarded-to-develop-graphene-ink-based-heaters-for-low-power-hot-water/
5. https://haydale.com/news/raising-the-bar-in-plastic-food-packaging/

NanoXplore

1. https://nanoxplore.ca/nanoxplore-provides-an-update-on-grapheneblack%ef%b8%8f-regulatory-approval/
2. https://nanoxplore.ca/nanoxplore-bolsters-its-leadership-with-graphene-supply-and-distribution-agreement-with-gerdau-graphene-ltda/
3. https://nanoxplore.ca/nanoxplore-concludes-agreement-to-supply-techmer-pm-llc-with-grapheneblack/
4. https://nanoxplore.ca/nanoxplore-announces-purchase-order-from-martinrea-international-inc-for-passenger-vehicles/
5. https://nanoxplore.ca/nanoxplore-inc-announces-30-million-bought-deal-public-offering/
6. https://www.cantechletter.com/2022/02/nows-the-time-to-buy-nanoxplore-says-paradigm-capital/
7. https://finance.yahoo.com/news/voltaxplore-inc-joint-venture-between-133000757.html

References:

Talga Resources

1. https://www.miningweekly.com/article/talga-starts-trial-mining-in-sweden-2021-09-23
2. https://www.talgagroup.com/irm/PDF/8d9f4b9a-5637-4e50-adb9-51c5fec9dcfe/TalgaproducesEurope39sfirstbatteryanode
3. https://www.graphene-info.com/talga-and-mitsui-collaborate-battery-anode-project

Thomas Swan

1. https://www.thegraphenecouncil.org/blogpost/1501180/370731/Thomas-Swan-joins-Graphene-Manchester
2. https://www.graphene-info.com/new-ice-batt-project-sets-out-optimize-battery-technology-using-graphene-and
3. https://thomas-swan.co.uk/thomas-swan-announces-graphene-deal-with-mason-graphite-to-create-a-new-venture-black-swan-graphene-for-bulk-graphene-production/
4. https://www.graphene-info.com/mason-graphite-announces-commercial-use-graphene-enhanced-concrete
5. https://www.graphene-info.com/black-swan-graphene-plans-go-public-tsx

Versarien

1. https://www.graphene-info.com/versarien-s-graphene-enhanced-face-masks-meet-ffp3-european-protection-standard
2. https://www.graphene-info.com/versarien-enters-agreement-promote-interests-south-korea-secures-193-million
3. https://www.graphene-info.com/graphene-based-concrete-used-commercial-setting-first-time
4. https://www.graphene-info.com/3d-printed-graphene-reinforced-concrete-trials-begin-train-station
5. https://www.graphene-info.com/sportswear-enhanced-versariens-graphene-inks-be-tested-university
6. https://www.graphene-info.com/university-manchesters-geic-hosts-first-exterior-pour-graphene-enhanced
7. https://www.voxmarkets.co.uk/xsrns/17de2859-aa2d-49f5-a827-63e3270d987b/
8. https://www.voxmarkets.co.uk/xsrns/45c4c0ae-786e-42f2-8eee-ba0b45d2e104/
9. https://www.voxmarkets.co.uk/xsrns/03827916-2001-4d5a-906d-43f87bb36adb/

XG Sciences

1. https://xgsciences.com/grays-field-hockey-sticks/
2. https://www.graphene-info.com/ford-motor-develops-graphene-enhanced-pu-foam-lowers-noise-and-weight-vehicles

Zentek (formerly Zen Graphene Solutions)

1. https://www.zentek.com/news/zen-graphene-solutions-and-treborrx-announce-nitrile-glove-agreement-and-provide-health-canada-update/
2. https://www.zentek.com/news/zen-graphene-solutions-named-to-the-tsx-venture-50/
3. https://www.zentek.com/news/zen-graphene-solutions-and-constance-lake-first-nation-sign-implementation-agreement-for-albany-project-development/
4. https://www.zentek.com/news/zen-graphene-solutions-develops-fuel-additive/
5. https://www.zentek.com/news/zen-graphene-solutions-finalizes-definitive-commercial-agreement-with-trebor-rx/
6. https://www.zentek.com/news/zentek-awarded-isc-testing-stream-contract-to-test-zenguard-coated-hvac-filters/
7. https://www.zentek.com/news/zentek-receives-medical-device-establishment-license-from-health-canada/
8. https://www.zentek.com/news/zentek-develops-new-carbon-based-nanotechnology-enhanced-icephobic-coating-to-reduce-ice-accretion/
9. https://www.zentek.com/news/zentek-announces-closing-of-c-23-million-bought-deal-public-offering-and-c-10-million-non-brokered-private-placement-for-aggregate-proceeds-of-c-33-million/
10. https://www.zentek.com/news/zentek-announces-binding-letter-of-intent-with-gmaf-circular-medico-for-zenguard-enhanced-circular-ppe/
11. https://www.zentek.com/news/zentek-announces-development-of-graphene-wrapped-silicon-anodes/
12. https://www.zentek.com/news/zentek-engages-vimta-labs-for-clinical-research/
13. https://www.zentek.com/news/zenteks-zenguard-patent-application-publishes/

GOgraphene

1. https://www.go-graphene.com/blogs/news/graphene-oxide-enhanced-organic-solvent-nanofiltration
2. https://www.williamblythe.com/company/news-events/product-business-news/news-details/?tx_ttnews%5Btt_news%5D=149&cHash=542ea6a105b5f4c2230199e25cfd2995
3. https://www.williamblythe.com/company/news-events/product-business-news/news-details/?tx_ttnews%5Btt_news%5D=147&cHash=42addf0f1b6cc66e41e04ecacd07e6b5
4. https://www.go-graphene.com/blogs/news/gopubliciations-anticancer-properties-of-graphene-oxide-demonstrated-in-bone-cancer-treatment
5. https://www.go-graphene.com/blogs/news/gopublications-nano-silver-graphene-oxide-in-the-fight-against-root-canal-infections
6. https://www.williamblythe.com/company/news-events/product-business-news/news-details/?tx_ttnews%5Btt_news%5D=156&cHash=d25603b98bdf652020877958b44a9c74
7. https://www.sciencedirect.com/science/article/pii/S0266353821005571
8. https://www.williamblythe.com/company/news-events/product-business-news/news-details/?tx_ttnews%5Btt_news%5D=160&cHash=9850557fac52a4205e9d4e8dd93b3d97

LayerOne (formerly Abalonyx)

1. https://www.nanospain.org/en/RELATED_NEWS_PHAN.php?Noticia=3031
2. https://www.linkedin.com/posts/layerone-as_clara-venture-labs-and-the-future-plans-for-activity-6884604294218211328-ONme?utm_source=linkedin_share&utm_medium=member_desktop_web

Additional Players

Newly profiled companies

BoomaTech Graphene Technology

BoomaTech

Website: https://boomatech.com.br/
Contact: Contact form
HQ: Brazil
Company size: 2-10 employees
Founded: 2013

1. https://www.consultasocio.com/q/sa/eduardo-letti-borghetti
2. https://www.linkedin.com/posts/booma-tech_boomatech-grafeno-fabricaaexaeto-activity-6889647686815887360-Q1Bp
3. https://www.instagram.com/p/CRCIlb8ry9k/

Boomatech is a Brazilian graphene startup producer and supplier. Its focus is on graphene in its wide range of forms (film, powder, flakes, water, and solvent-based solutions) and graphene oxide. It also offers R&D services (know-how) and graphene-based lithium-ion batteries.

Product type	Powder, flakes, and solutions
Production methods	Chemical electro-exfoliation
Production capacity	3.6 - 6 tons/year (2022)
Applications	Cementitious materials, conductive glasses, inks and coatings, electronics, automotive, agriculture, biomedical, and energy storage industries

BoomaTech

Boomatech

Investors Overview

The company was officially launched in 2019, after almost 10 years of investments in research and development. Boomatech is a spin-off from Master Power Turbo, a Brazilian manufacturer of turbochargers, founded in 1966.

Recent Developments

May 2021

Featured and runner-up in a startup challenge

The challenge "Sebrae Like a Boss" happened during the Gramado Summit 2021 event and had 24 startup representatives pitching their innovative solutions and business operations ideas.

Nov 2021

Participation at the Graphene Brazil Tech event

Isabella Borghetti's talk, "The Startups' role on the graphene market development in Brazil", emphasized how startups connect new technologies to the industry.

Award as Innovative Project

"Gigia Bandera" is awarded annually to small companies investing in innovation.

Dec 2021

One of the 15 startups to watch in 2022

Ranked as a promising startup, according to Sebrae RS

1. https://www.linkedin.com/posts/isabellaborghetti_boomateam-boomatech-graphene-activity-6837017808702861312-ghuQ
2. https://boomatech.com.br/sobre
3. https://start.gramadosummit.com/startup-nichada-aposta-na-fabricacao-e-na-venda-de-grafeno-gramado-summit
4. https://saomarcosonline.com/sem-categoria/boomatech-de-sao-marcos-e-segundo-lugar-do-sebrae-like-a-boss/
5. https://www.linkedin.com/posts/booma-tech_boomatech-grafeno-graphenebraziltech-activity-6862727890069426176-lh_-/ https://www.simecs.com.br/blog/simecs-com-voce/simecs-apresenta-os-agraciados-do-27-merito-metalurgico-gigia-bandera https://conteudo.simecs.com.br/inscricao-merito-metalurgico-gigia-bandera
6. https://digital.sebraers.com.br/blog/15-startups-gauchas-para-ficar-de-olho-em-2022/

Boomatech

Product Overview

GRAPHENE PRODUCTS		
Product	**Type**	**Applications**
Reduced Graphene Oxide	Powder	Polymers, injection processes, rotational molding, etc.
Reduced Graphene Oxide in Formic Acid	Solution	Polymers, polyamides, reinforcement, etc.
Graphene Oxide in PGMEA	Solution	Waxes, varnish, and coating
Reduced Graphene Oxide in Butyl Acetate	Solution	Waxes, special paints, and coating
Graphene Oxide Water	Solution	Inks, ultra-resistant gels, biosensors, metal coatings, and polymeric resins
Graphene Oxide	Flakes	Inks, anticorrosion coatings, and thermal protectors
	Film	Membranes, aerogels, and conductive or resistive films

1. https://www.instagram.com/p/CYjSofqtbml/
2. https://www.linkedin.com/posts/booma-tech_boomatech-grafeno-aplicaaexaeles-activity-6866122650398285824-dDb1
3. https://www.linkedin.com/posts/booma-tech_boomatech-grafeno-materiaiscompostos-activity-6876994322487631875-3KZQ
4. https://www.linkedin.com/posts/booma-tech_boomatech-graphene-nanotechnology-activity-6897167228043939840-aAUS
5. https://www.linkedin.com/posts/booma-tech_boomatech-graphene-nanotechnology-activity-6840644852493889536-YTfT
6. https://www.linkedin.com/posts/booma-tech_boomatech-graphene-nanotechnology-activity-6845718290501795840-cmdJ
7. https://www.linkedin.com/posts/booma-tech_boomatech-grafeno-materiaiscompostos-activity-6856227573936996353-htaV

Boomatech

Case Study

Manufactured a **graphene-based compressor** housing in partnership with Master Power Turbo. The graphene composite, blended with polymers, replaced a metallic alloy

1. https://www.instagram.com/p/CU5xUT_BNKf/

The Sixth Element Materials Technology Co. Ltd.

Website: https://www.c6th.com/
Contact: Contact form
HQ: Changzhou, China
Company size: 51-200 employees
Founded: 2011
Estimated revenue: $15.91M

1. https://www.linkedin.com/company/the-sixth-element-changzhou-materials-technology/about/
2. https://www.dnb.com/business-directory/company-profiles.element_materials_technology_ab.4ceb6e2775f75d091aa8489963b5d083.html
3. https://www.c6th.com/

The Sixth Element Inc. is a Chinese graphene and graphene oxide manufacturer, R&D, and nanotechnology research company. Since 2014, it is part of the Chinese National SME share transfer system and has REACH registration. The company is ISO 9001 certified since 2014, ISO 14001 since 2018, and IAFT 16949 since 2019. It counts on Wuxi Graphene Film as its subsidiary.

Product type	Powder, suspensions, and films
Production methods	Exfoliation and CVD
Production capacity	1,000 tons/year
Applications	Batteries, energy storage, electronics, reinforced plastics, anti-corrosion coatings, and adhesives for automotive and marine

The Sixth Element Inc.

The Sixth Element Inc.

Investors Overview

Mar 8, 2019

It holds 30% of Wuxi Graphene Film (Mar 8, 2019)

Grahope New Materials acquired 70% and The Sixth Element Inc. 30% of Wuxi Graphene Film. The latter has a production capacity of 5M films per year. Thenceforth, The Sixth Element Inc. has focused mainly on graphene flake production.

Sep 9, 2021

Expansion of production capacity in Nantong

It has been investing €60Mat a new site in Nantong in two parts: the first part was finalized in May 2020, expanding the production capacity to 650 tons/year being 500 of graphene oxide and 150 of reduced graphene. It plans on concluding the second part of the investment in mid-2022 to establish a total capacity of 1950 tons/year in Nantong.

1. https://www.azonano.com/article.aspx?ArticleID=5811
2. https://www.graphene-info.com/grahope-new-materials-acquired-70-wuxi-graphene-film
3. https://www.graphene-info.com/huawei-mate-p30-pro-adopts-graphene-based-heat-management-film
   https://www.graphene-info.com/huawei-continues-use-graphene-cooling-films-its-new-p40-series
4. https://www.c6th.com/news/the-industrialization-of-graphene-in-china-t-39086410.html
5. https://www.c6th.com/news/for-european-customers-the-sixth-element-pro-53958008.html

Recent Developments

Apr 26, 2019

Graphene products provided for smartphone development

It supplied graphene cooling films to Huawei Mate 20 X and P30 Pro new smartphones. In 2020, a new smartphone model was launched, the Huawei P40 Pro Plus, which is believed to have the same graphene film cooling technology for heat management from The Sixth Element Inc.

Oct 23, 2020

Enhanced production capacity

It announced that a new plant in Nantong, China has the capacity to produce 500 tons/year of graphene oxide and 150 tons/year of graphene. This expansion takes the company's total production capacity to 1000 tons/year.

Feb 10, 2022

Graphene products in Europe

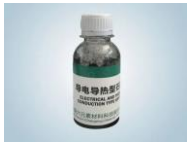
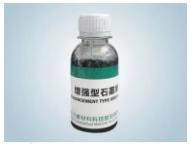
It started supplying graphene products from stock in Europe by a collaboration with a European logistics provider.

The Sixth Element Inc.

Product Overview

The company provides graphene, graphite powder, and suspensions (water and solvent-based graphene suspensions)

GRAPHENE PRODUCTS

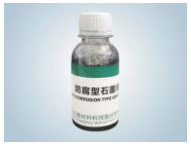
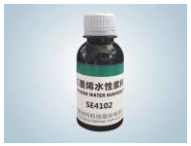
Product	Description	Main characteristics	Applications
SE1231 | SE1232 | SE1233 | 	Electrical and thermal conduction type graphene	• Black powder | pH 6-8 | Tap density: <0.1g/cm³ • Surface area: 180-280 | 260-350 | 400-600m²/g • Particle size D_{50} : <10 | <10 | <50 μm • C (wt%): ≥ 97% | H_2O (wt%): <1.0	Coatings, printing inks, polymers, batteries, thermal conductive gels, and LED
SE1430 | 	Enhancement type graphene	• Black powder | pH 2-5 | Tap density: <0.1g/cm³ • Surface area: 180-280 m²/g • Particle size D_{50}: <10 μm • C (wt%): 75±5% | H_2O (wt%): <4.0 • S (wt%): <0.5 | O (wt%): 16±3%	As reinforcement of polymer and carbon fiber composites

1. https://www.c6th.com/graphene/

The Sixth Element Inc.

Product Overview

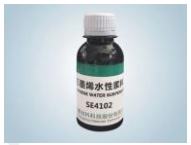
GRAPHENE PRODUCTS

Product	Description	Main characteristics	Applications
SE1132 | SE1133 | 	Anti-corrosion type graphene	• Black powder | pH 6-8 | Tap density: <0.1g/cm³ • Surface area (m²/g): 180-280 | 260-350 • Particle size D50: <10 μm • C (wt%): ≥ 93 | H_2O (wt%): <1.0 • S (wt%): ≥ 0.2 | O (wt%): ≥ 3 • Oil absorption (mL/100g): 500±100 | 600±100	All types of (heavy duty) anti-corrosive coatings
SE4102-1 | SE4102-2 | 	Graphene water suspension	• Black solution • pH 6-9 • Particle size D50: ≤2 μm | D_{90}: ≤4 μm • Solid content (%): 14±1 | H_2O (wt%): <1.0 • Cosolvent (%): 25±1 | 0	Water-based coating fields
SE4102-1 | SE4102-2 | 	Graphene NMP suspension	• Black solution | pH 6-9 | H_2O (ppm): ≤1000 • Particle size D_{10}:≥2 μm | D_{50}: 7-20 μm | D_{90}: - • Impurity metal content (ppm): ＜5.0 • Fraction of iron ions (ppm): ＜20 • Total solid content (%): 5.2±0.2 | SC: 4.2±0.2% • Viscosity (m pa.s): ≤3500 $10S^{-1}$ | ≤1500 $100S^{-1}$	In conductive agent of lithium batteries, anti-static coatings, and other fields

1. https://www.c6th.com/graphene/

Product Overview

GRAPHITE PRODUCTS

Product		Description	Main characteristics	Applications
SE2430W-N		Graphite Oxide	• Black paste • pH 1.8-2.3 • Solid content (%): 43 ± 5 • C (wt%): 51±5 • S (wt%): ≤2.0	Polymer composites, anode and cathode materials of Li-ion batteries, graphene thermal conductive film, and catalyst loading
SE3122 | SE3522 |		Graphite Oxide Suspension	• Black suspension • pH 1.5-2.5 | 1.5-2.5 • Solid content (%): 1±0.2 • Particle size D_{50}: 8±4 μm | <4 • Packaging: 1L, 3L, 20L, 200L sealed barrel	Polymer composites, anode and cathode materials of Li-ion batteries, graphene thermal conductive film, and catalyst loading

1. https://www.c6th.com/graphene/

Global Graphene Group Inc.
(formerly Angstron Materials)

Website: Link
Contact: +1 (937) 331-9884
HQ: Ohio, US
Company size: 51-200 employees
Founded: 2007

1. https://www.graphene-info.com/angstron-materials
2. https://www.linkedin.com/company/angstron-materials/about/
3. https://www.zoominfo.com/c/angstron-materials-inc/353644156
4. https://www.theglobalgraphenegroup.com/technical-services/
5. https://www.theglobalgraphenegroup.com/quality/
6. https://patents.justia.com/assignee/global-graphene-group-inc
7. https://www.theglobalgraphenegroup.com/technologies/

Global Graphene Group (G3) is a graphene, graphene-products, and first advanced materials manufacturer. It is ISO 9001 certified since 2015, its products have TSCA and REACH certification, and it is a holding company for various subsidiaries, such as Taiwan Graphene Company (single-layer graphene producer), Honeycomb Battery and Angstron Energy Company (both lithium-ion battery electrodes producers), and Nanotek Instruments (IP-holding). Angstrom Materials Group was assigned as a R&D company on graphene-reinforced products.

Product type	Powder, dispersions (resins, solvents, and masterbatches), films, and graphene-enhanced batteries
Production methods	Exfoliation and CVD
Production capacity	300 tons/year
Applications	Automotive, energy and electronics, paints and coating, biomaterials, aerospace, sensors, etc.

Global Graphene Group

Investors & Partnerships Overview

2016-2018

Raised a total of $13M in funding over 2 rounds

Raised $10M in June 2016 and $3M in April 2018

Nov 2019

Joint Development Agreement (Nov 2019)

Signed a JDA with a so-called "major Taiwan-based manufacturer" to incorporate graphene-enhanced materials into polyetheretherketone (PEEK)-based products. This initiative aimed to cover different portions of Asia within the semiconductor industry

Dec 2019

Letter of Intention with Alison Asia Pacific (Dec 2019)

Signed a 5-year LOI to provide over 300 metric tons of graphene-enhanced silicon oxide anode material to Alison Asia Pacific based in Hong Kong, which drove G³ expansion production

Recent Developments

Oct 2020

Lithium batteries materials patented in the U.S.

Awarded a US patent on elastomer-encapsulated particles of high-capacity anode active materials for lithium batteries. Afterward, it will expand its silicon-based anode materials production. As of 2022, its patent portfolio includes +600 patent applications and issued patents

Jan 2021

Presentation during the Virtual Silicon Symposium

CEO, Dr. Bor Jang, talked about the gaps in today's Li-ion batteries and how its battery tech addresses driving range, safety, recharging, and life issues

Jan 2022

Global Top 100 Innovator recognition by LexisNexis®

One of the 12 companies recognized in the Chemicals and Materials industry sector by the "Innovation Momentum 2022: The Global Top 100". This report, produced by LexisNexis, is an intellectual property report that recognizes global technology companies with exceptional technological relevance for the future

1. https://www.crunchbase.com/organization/global-graphene-group
2. https://www.thegraphenecouncil.org/blogpost/1501180/335313/Global-Graphene-Group-Taiwan-Company-Sign-JDA
3. https://www.graphene-info.com/global-graphene-group-signs-loi-alison-asia-pacific-fro-graphene-enhanced
4. https://www.thegraphenecouncil.org/blogpost/1501180/356914/Global-Graphene-Group-Awarded-Patent-on-Elastic-Anode-Battery-Materials
5. https://twitter.com/AMIGraphene/status/1352614968315830273?cxt=HHwWgoC7hbaJusUIAAAA
6. https://www.theglobalgraphenegroup.com/global-graphene-group-recognized-by-lexisnexis-as-a-global-top-100-innovator/

Global Graphene Group

Product Overview

GRAPHENE PRODUCTS

Product	Description	Main characteristics
 **N002-PDRAM | N002-PDEAM**	Fluffy powder	• Average lateral dimension: 2-4 μm • Thickness: 1-2 nm • Tap density: 0.01-0.02g/cm³ • Surface area (m²/g): 400-800 • C (wt%): ≥ 95 | H (wt%): ≤ 2 | N (wt%):≤ 0.05 • O (%): <2.5 | 10-30
N002-PDRAM | N002-PDEAM	Powder	• Average Lateral dimension: 7 μm • Thickness: 30-50 nm | 70-100 nm | 30-50 nm • Tap density (g/cm³): 0.1-0.2 | 0.1-0.3 | 0.05-0.15 • Surface area (m²/g): 20-30 | 10-15 | 20-30 • C (wt%): ≥ 95 | ≥ 97 | ≥ 96 | O (%): ≤4 | ≤ 2 | ≤ 1 • H (wt%): ≤ 1 | N (wt%): ≤ 0.2 | ≤ 0.5 | ≤ 0.2
N008-P-40	Powder	• Average Lateral dimension: 10 μm • Thickness: 50-100 nm • Tap density (g/cm³): 0.05-0.15 • Surface area (m²/g): 10-30 • C (wt%): ≥ 97 | O (%): ≤ 1 • H (wt%): ≤ 1 | N (wt%): ≤ 0.2

1. https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Powders-and-Intermediates-04152019.pdf
2. https://www.taiwantrade.com/product/n002-pde-single-layer-nano-graphene-oxide-platelet-1731339.html#

Product Overview

Graphene dispersed in composite pastes

GRAPHENE PRODUCTS

Product	Main characteristics	Applications
Ge-TH-G000 | Ge-TH-G030	• Thermal conductivity (W/m·K): 2 | 5 • Specific gravity: 2.05 g/cm³ • Working temperature: 0-130 °C	Epoxy paste: ideal for electronic applications
Ge-TH-G040 | Ge-TH-G042	• Thermal conductivity (W/m·K): > 6 • Specific gravity: 3.8 ± 0.2 g/cm³ • Working temperature: -40 - 150 °C	Rubber paste: provides thermal management solutions

1. https://www.theglobalgraphenegroup.com/graphene-nano-intermediates/
https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Thermal-Management-Brochure-03192019.pdf

Global Graphene Group

Product Overview

Graphene masterbatches included in graphene nano-intermediates materials

GRAPHENE PRODUCTS		
Product	**Details**	**Applications**
GRAPHENE THERMOPLASTIC	Thermoplastic polymers: PE, HDPLE, LDPE, LLDPE, PET, PA6, PA66, TPEs, and PVC	Sporting goods, clothing and textiles, ESD protection equipment, automobile, and packaging
EPOXY COMPOSITE MASTERBATCH	Patent protected dispersion technique to embed graphene into epoxy matrix for custom projects	Sporting goods, fiber-reinforcement, automobile and powder coating

1. https://www.theglobalgraphenegroup.com/graphene-nano-intermediates/
   https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Thermal-Management-Brochure-03192019.pdf
2. https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Powders-and-Intermediates-04152019.pdf

Product Overview

Graphene dispersions also included in graphene nano-intermediates materials

GRAPHENE PRODUCTS

Powder product	Graphene type	Possible solvents	Main characteristics
N002-PDRAM **N002-PDEAM**	Graphene	• 1-Methyl-2-pyrrolidone (NMP) • Diethylene Glycol • Ethylene Glycol • DMSO • DMAC • THF • MIBK & MEK • n-Butyl Acetate • Benzyl Alcohol • 1-phenoxy-2-propanol • Ethyl Benzene	• Average lateral dimension: 5 **μ**m • Thickness: 0.35 - 2 nm • Concentration (wt%): 0.1 | 0.5 - 1.0 | 0.1 - 2.0 • Average aspect ratio (l : w): 3000 : 1
EPOXY COMPOSITE MASTERBATCH	Graphene oxide	• Water • DMAC • Aniline • Propylene Carbonate	• Average lateral dimension: 5 **μ**m | 0.01 - 0.06 **μ**m • Thickness: 0.35 - 2 nm | 0.35 - 1 nm • Concentration (wt%): 0.1 | 0.15 | 0.5, 1.0 • Average aspect ratio (l : w): 3000 : 1

1. https://www.theglobalgraphenegroup.com/graphene-nano-intermediates/
   https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Thermal-Management-Brochure-03192019.pdf
2. https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Powders-and-Intermediates-04152019.pdf

Global Graphene Group

Product Overview

Graphene-enhanced coatings and paints

GRAPHENE PRODUCTS

Product	Details	Applications
THERMAL COATING & PAINT	Graphene-enabled heat-dissipating coatings / paints	Specifically designed for use with bulk heat sources
CONDUCTIVE COATING & INK	Graphene-enabled liquid / anti-static liquids	Conductive printable inks, touch screens, and flexible displays
ANTI-CORROSION PRIMER	Modified graphene primer	Protects metal surfaces providing a barrier to oxygen, water, and acids
ANTI-CORROSION MID-COATING	Modified graphene mid-coating layer between primer and surface coatings	Anti-corrosive end products, such as paints

1. https://www.theglobalgraphenegroup.com/paints-and-coatings/

Product Overview

Graphene thermal spreader films/sheets

GRAPHENE PRODUCTS

Product		Description	Main characteristics	Applications
AT1500-100 AT1500-90	F 	Anti-corrosion type graphene	• Free standing sheets • Flexible • High thermal conductivity	3C industry, large screen displays, LED lighting
	L 	• Heat spreader layer • Release coating layer • PET film layer	• PET backing on one side	
	LP 	• Heat spreader layer • One-sided adhesive • PET film layer	• PET backing on one side • Weak bonding	
	LX 	• PET layer • One-sided adhesive layer	• Insulating materials on both sides	

Thickness:

AT1500-100 series

100±15μm

AT1500-90 series

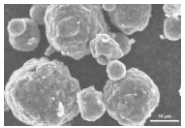
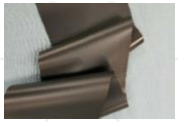
90±10μm

1. https://www.theglobalgraphenegroup.com/wp-content/uploads/2019/10/Thermal-Management-Brochure-03192019.pdf
2. https://www.theglobalgraphenegroup.com/thermal-management-heat-spreader/

Product Overview

Graphene-enhanced coatings and paints

GRAPHENE PRODUCTS

Product		Details	Applications
GRAPHENE SULFUR COMPOSITE CATHODE		• Black powder | Particle Size D_{50}: 10 - 15 µm (tunable) • Specific surface Area: 10 - 20 m²/g (tunable) • Packing density: 1.1 - 1.3 g/cm³ | Tap Density: 0.5 - 1.0 g/cm³ • Specific capacity: 850 - 950 mAh/g | First cycle efficiency: > 95%	Li-ion batteries, Li-metal batteries, Capacitors
GRAPHENE ALUMINUM (GA-14) CURRENT COLLECTOR		• Graphene layer thickness: 30 - 50 µm • Width: 410 mm | Areal Density: 37 - 39 g/m² • Electrical conductivity (in plane): 3.0 x10⁵ - 3.1 x10⁵ S/cm • Anti-oxidation (200°C - 30 minutes): No color change • Storage at RT(<50°C) with low humidity	
GRAPHENE COPPER (GC-08) CURRENT COLLECTOR		• Thickness: 8 ± 1m | Graphene layer thickness 30 - 50 nm • Tensile strength: > 32 gf/mm2 | Elongation: >3% • Areal density: 71 ± 1 g/m² | Anti-oxidation: No Color Change • Carbon content: >90% | Electrical conductivity: 5.4 - 5.6 x 10³ S/m	

1. https://www.theglobalgraphenegroup.com/paints-and-coatings/

Global Graphene Group

Case Study

Manufactured a limited edition of **Rebel + Graphene heads graphene-based compressor housing** in partnership with ECD Lacrosse. G³ graphene composite increased impact strength, stiffness, and kept the light weight.

1. https://www.graphene-info.com/ecd-lacrosse-and-global-graphene-group-g3-develop-graphene-enhanced-lacrosse-gear
2. https://lax-zone.com/collections/mens-lacrosse-heads/products/ecd-rebel-graphene-head-offense

Ningbo Morsh Technology Co. Ltd.

墨西科技
MORSH

Website: https://www.morsh.cn/
Contact: admin@morsh.cn
HQ: Ningbo, China
Company size: 11-50 employees
Founded: 2012
Estimated revenue: $5M

1. https://www.marketsandmarkets.com/Market-Reports/graphene-market-83933068.html
2. https://worldwide.espacenet.com/patent/search/family/047051728/publication/CN102757038B?q=pn%3DCN102757038B
3. https://worldwide.espacenet.com/patent/search/family/056372684/publication/US10385189B2?q=pn%3DUS10385189B2
4. https://www.zoominfo.com/c/ningbo-graphite-technology-co-ltd/532120203

Ningbo Morsh Tech. is a Chinese company focused on the production, sales, and R&D of graphene materials application technology. The company is one of Beijing Moxi Holding Group Co., Ltd. subsidiaries and is ISO 9001 certified. It is also a member of the Nanjiang Group Company.

Product type	Powder, films, pastes, and coatings
Production methods	Exfoliation
Production capacity	500 tons/year
Applications	Cementitious materials, batteries, coating and paints, electronics

墨西科技
MORSH

Ningbo Morsh Technology

Recent Developments

Nov 2018

Announced environmental protection

Announced an environmental protection acceptance after the completion of a technical transformation in the production line of graphene-modified polymer plastic masterbatch.

Mar 2020

Successful R&D cooperation

After supplying graphene slurry to Ningbo Fuli Battery Material Technology Co. Ltd. (NFB) for more than two years, IT announced that its R&D cooperation with NFB has achieved significant progress in lithium-rich manganese-based cathode materials

Feb 2020

Provided graphene materials for medical purposes

Started to supply graphene composite powder materials to companies producing medical masks during the SARS-CoV-2 pandemics

Nov 2021

Direction and Executive Board Inspection

The company's general manager and the R&D chief presented updates on the graphene conductive agent production line and the following work plan to the board of directors during a facility inspection

1. http://www.morsh.cn/h-nd-187.html#_np=125_377
2. http://www.morsh.cn/h-nd-210.html#_np=125_377
3. http://www.morsh.cn/h-nd-208.html#_np=125_377
4. http://www.morsh.cn/h-nd-215.html#_np=125_377

Ningbo Morsh Technology

Product Overview

Graphene-enhanced pastes

GRAPHENE PRODUCTS

Product	Main characteristics	Applications
G-PASTE 	• Gray/black paste • Solid content (wt%): 4.0 • The average thickness of the lamella: 2.4 nm • Slice size: 5-15 μm | pH 6-7	Battery, starting capacitor, thermal/heat dissipating materials, water-based functional coatings, composite materials
GC-PASTE4B 	• Gray/black slurry • Graphene content (wt%): 4.0±0.1 • Super P content (wt%): 4.0±0.1 • Metal ions content (ppm): <30 | pH 6-7	Lithium, nickel MH, zinc manganese alkaline, advanced lead-acid batteries, and supercapacitor
G-SLURRY4FC 	• Gray/black paste • Solid content (wt%): 3 | pH 7-8 • Slurry viscosity: 200-1000 cps • Coating conductivity (PET substrate): 100 $S.cm^{-1}$	Ion batteries, supercapacitor

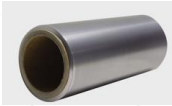
1. http://www.morsh.cn/col.jsp?id=132
2. http://www.morsh.cn/h-pd-29.html#_pp=132_381
3. http://www.morsh.cn/h-pd-27.html#_pp=132_381
4. http://www.morsh.cn/h-pd-25.html#_pp=132_381

Ningbo Morsh Technology

Product Overview

Graphene-enhanced slurry and graphene powder and film

GRAPHENE PRODUCTS

Product	Main characteristics	Applications
G-SLURRY4WC 	• Gray/black liquid • Fixed amount (wt%): 2.5±0.1 • Viscosity: 200-1000 mPa.s • Density: 1.02-1.15 g/cm³ | pH 7.5-9	Water-based: anti-corrosion, antistatic, architectural, and non-stick coatings
GC-POWDER4B 	• Black powder • Graphene content (wt%): 47.5±0.2 • SP content (wt%): 47.5±0.2 • Bulk density: 0.15 g/cm³ • Specific area: 36 m²/g | Ash (wt%): <0.1	Lithium, nickel MH, zinc manganese alkaline, advanced lead-acid batteries, and supercapacitor
GC-FOIL 	• Gray/black coating • Coating thickness on both sides: 0.61 μm • Coating on both sides: 0.04-0.1mg/cm²	Lithium-ion battery and supercapacitor

1. http://www.morsh.cn/col.jsp?id=132

Xiamen Knano Graphene Technology Co.

Website: https://www.matsolint.com/
Contact: yxcheng@knano.com.cn
Founded: 2010
HQ: Xiamen, China
Company size: 51-200 employees
Estimated revenue: about $5M

1. https://pitchbook.com/profiles/company/484066-90#overview
2. https://www.zoominfo.com/c/knano-company/430248623
3. https://www.matsolint.com/En/about.aspx?IntroCateID=1661
4. https://worldwide.espacenet.com/patent/search/family/051140759/publication/CN103922323A?q=pn%3DCN103922323A

Knano is a Chinese R&D and graphene manufacturer. The company has filed over 40 patents and is ISO 9001, ISO 14001, and ISO 45001 certified.

Product type	Powder, nanoplatelets powder, and pastes
Production methods	Exfoliation
Production capacity	200 tons/year
Applications	Cementitious materials, coatings, batteries, electronics

Xiamen Knano Graphene Tech

Investors Overview

Since 2016

A NEEQ listed company

In 2016, it was listed under the stock code: 836410 at the National Equities Exchange and Quotations. NEEQ is the Chinese over-the-counter system for trading the shares of public limited companies.

Recent Developments

Oct 2016

Six more patents were granted

Over 10 patents were applied, of which six were granted, all of them were graphene and graphene products-related

Mar 2020

Medical supplies during the pandemic

Provided medical supplies for front-line workers during the SARS-CoV-2 pandemics

May 2020

Company's 10th-anniversary celebration

Celebrated its 10th year anniversary and its graphene project was launched in 2006 and was set up in 2010

1. https://www.matsolint.com/En/about.aspx?IntroCateID=1661
2. https://www.matsolint.com/En/news_detail.aspx?NewsID=161
3. https://www.matsolint.com/news/19.html
4. https://www.matsolint.com/En/news_detail.aspx?NewsID=226

Xiamen Knano Graphene Tech

Product Overview

Graphene powders and paste

Product	Main characteristics	Applications
KNG-G2	• Gray/black powder • Moisture (%): <2 | Thickness: 1-3 layers • Diameter(D_{50}): 7-12 μm | Bulk density: 0.01-0.02 g/cc	Polymers and coating
GC-PASTE4B	• Gray/black powder • Fe content (wt%): 150 ppm max • Thickness: 1-3 layers	Batteries
G-SLURRY4FC	• Gray/black paste • Total solids: 5.30±0.20% | Viscosity: ≤3000 mPa.s • Conductive C content: 5.00±0.19% • Moisture content: ≤1000 ppm • Cu, Zn, Cr, Co, Ni content: ≤5 ppm | Fe ≤10 ppm	Lithium-ion batteries

1. https://www.matsolint.com/En/product.aspx?IntroCateID=1803
2. https://www.matsolint.com/En/product.aspx?IntroCateID=1915
3. https://www.matsolint.com/En/product.aspx?IntroCateID=1852

Xiamen Knano Graphene Tech

Product Overview

Graphene nanoplatelets

Product	Main characteristics	Applications
KNG-150	• Gray/black powder | Bulk density: 0.15-0.2 g/ml • Specific surface area: 30-60 nm² • Powder conductivity: ~12000 S/m • Thickness: <15nm | C content (wt%): >98 • Thermal conductivity: ~3000 W/mK	Battery, starting capacitor, thermal/heat dissipating materials, water-based functional coatings, composite materials
KNG-180-3	• Gray/black powder • Diameter (D50):10-14 μm • C content (wt%): >98.0 | Moisture: ≤1.5% • Bulk density: 0.20-0.28 g/ml	Thermal conductive silicone grease, electrothermal films, heat dissipation coatings
KNG-181-2	• Gray/black pellets • Bulk density: 0.33-0.38 g/ml • Moisture: 2% max • Diameter (D50):0.8-8 mm	Thermal conductive polymers

1. https://www.matsolint.com/En/product.aspx?IntroCateID=1667

Xiamen Knano Graphene Tech

Product Scientific Application

Its graphene products KNG-150 and KNG-G2 have been used in 2021 published research papers for:

nanoplatelets dispersion optimization and nano-filler loading in bio-based polymer nanocomposites based on tensile and thermogravimetry analysis

and

nanoplatelets application in composite films for electromagnetic shielding and flame retardancy evaluation, respectively.

1. https://www.instagram.com/p/CU5xUT_BNKf/

Supplier Interview

A deep dive into BoomaTech Graphene’s technology

Expert Interview

BoomaTech

Isabella Borghetti

Director, BoomaTech Graphene Technology

Isabella Borghetti is an industrial manager working in the automotive and nanotechnology industry. She has a bachelor's degree focused in international business specialized in negotiation and graphene market.

Isabella Borghetti, BoomaTech

Expert Interview

Could you please tell me a bit more about your technology?

“BoomaTech's process and product technology were developed over 12 years of research and testing. Our graphene in different typologies have been tested and approved by several renowned universities around the globe, as well as private companies that have used them in different applications. The current process technology is via chemical electro exfoliation using controlled atmospheres, extracting a product of high purity, large surface area, and with 3 to 6 layers.”

You mention lithium-graphene batteries on the company's website. Is BoomaTech currently offering this product to the market?

“Our lithium-graphene batteries are in the prototyping stage. We have the technology being developed and some prototypes being tested in the laboratory. We've already got batteries that charge in up to 6 times less time, weigh up to 50% less, and yield 5 times more cycles. We are using graphene on both electrodes, positive and negative.”

> *We've got batteries that charge in up to 6 times less time, weigh up to 50% less, and yield 5 times more cycles*

Isabella Borghetti, BoomaTech

Expert Interview

Some companies offer their products based on the average thickness of the layers (in nanometers) and/or the size of the flakes/platelets (in microns). Do you also provide this information to your clients? How important is the thickness?

"Yes, we do. All our products come with a datasheet, a technical report, with information regarding the characterization of that graphene batch."

"Depending on the application, information on thickness and particle size is essential to ensure the existence of enough functionalized graphene crosslinks to the substrate, and no efficiency loss will occur to the expected results."

Isabella Borghetti, BoomaTech

Expert Interview

You mention nine different routes for making graphene. Are all these routes related to the electrochemical exfoliation method? Do you have other processes?

"Yes, *route variations are basically different parameters within the same machinery and the same electrochemical exfoliation process*. So, what really changes are the parameters involved, for instance, time, temperature, amount of reagents, machinery arrangement, and raw material preparation."

"The final application demand dictates the substrate to incorporate and the properties to be improved, thus those process variations."

Isabella Borghetti, BoomaTech

Expert Interview

Could you comment on the importance of raw material preparation and final characterization in graphene manufacturing? Can they vary depending on the chosen application?

"Of course, as I mentioned in the previous answer, *the importance of raw material preparation is precisely due to quality control itself*. The supplied graphites have high metal levels and other pollutants (depending on the supplier), which can disrupt the graphene manufacturing process. By preparing all graphite received, we reassure the quality of the final graphene, regardless of the graphite purchased."

"As for the final characterization, we have two partner companies that characterize the materials. *The characterization results are included in the product report so that the customers can certify the graphene chemical information they are receiving*. In addition to private companies, several universities provide us characterizations services, such as Mackenzie, USP, Unisinos, Feevale, Poli SP, Unicamp, University of Manchester, and several Senai institutes throughout the country."

Isabella Borghetti, BoomaTech

Expert Interview

Would you be willing to share any information related to past or current financing (such as investors, acquisitions, or plant expansions)?

"*Our investment comes entirely from the group that originated the company, Master Power Turbo*.

We started by producing a few grams of graphene monthly, using a sensitive and laboring laboratory process. Then we increased production to 1 kg per month.

Currently, we have a manufacturing capacity of 300 – 500 kg per month (depending on the typology).

Our plant has already undergone three expansions."

> *We intend to expand graphene production again to produce 12 t/a by the end of 2022*

Isabella Borghetti, BoomaTech

Expert Interview

Do you have any case studies related to your graphene products application that you would like to share?

"The markets we currently operate in are the energy market (including batteries, conductive glass, supercapacitors, solar cells, etc.), composites (polymers, elastomers, etc.), paints and coatings (such as waxes, pre-treatment, baths, conductive paints, etc.), and biosensors (for disease detection, biological and electronic sensors). In addition to these major ones, we also have minor activities in additives for concrete and construction, textile industry (special fabrics, fibers, and yarn), agriculture (fertilizers, containers, silos, etc.), electronic circuits and sensors, and paper and cellulose.

We cannot share our partners' names, but here are some examples:

- Multinational tech company: *application of graphene oxide in biocompatible microchips and biosensors for disease detection*
- Energy company: *application of reduced graphene oxide in organic solar cells, increasing their efficiency to 43%, capturing visible + UV and IR spectra"*

About the Authors

Marija Jović

Technical Director

Marija is the Technical Director for PreScouter's Chemical, Materials, and Packaging verticals. She has worked across topics such as product and process improvement and development and sustainability throughout the chemicals, materials, and packaging industry. Marija completed her Master's degree in Chemical Engineering from Belgrade University and her Ph.D. in Organometallic Chemistry and Catalysis at the Swiss Federal Institute of Technology (ETH Zurich). Prior to her Ph.D., Marija worked in the chemical industry on the synthesis of new textile dyes.

Beatriz Gonçalves

Project Manager

Beatriz leads projects covering product and process improvement and development for the Chemicals, Materials, and Packaging industry. She is a Materials Engineer with 4+ years of hybrid experience, in both the materials area as well as corporate data analysis. She received her M.Sc. with distinction in Materials Science and Engineering from the Federal University of Sao Carlos, in Brazil. Before joining PreScouter, she gained professional experience in project management, data analysis, and product cost estimation, working in large-sized companies.

Sanierlly Nascimento

Researcher

Sanierlly holds a BSc and an MSc degree in Chemical Engineering. Her main study areas were food preservation and Excel VBA applied to thermodynamics problems. She is a specialist in Food Quality and Safety and has gained experience as a scholar here in PreScouter, working on Chemicals, Natural Resources, Materials, and Healthcare and Life Sciences projects. Currently, Sanierlly is pursuing her Ph.D. in Organic Chemistry focused on injectable hydrogels for drug delivery.

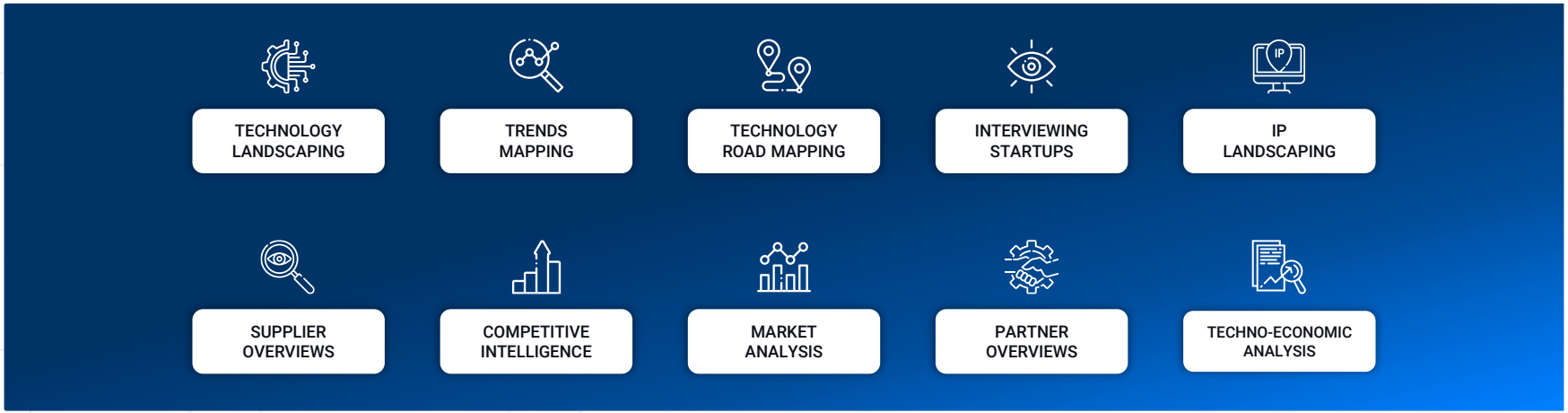
Renjini G R

Researcher

Renjini is a Scientist working in NoPo Nanotechnologies, an Indian company specializing in the field of Single Walled Carbon Nanotubes. She holds a BSc in Physics and an MSc in Nanoscience and Nanotechnology. Her expertise is in water purification and desalination using Thin Film Composite Membranes and is now working along with Indian Navy and other Government bodies to supply water filtration membranes and desalination membranes all over India.

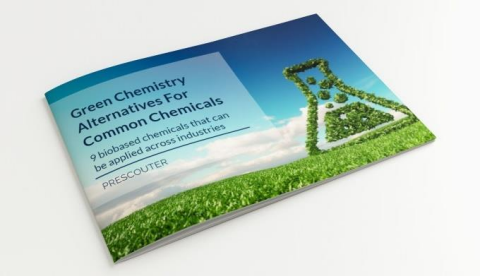
Potential Next Steps

- ✓ PreScouter can conduct anonymous interviews with companies profiled to help you learn more about their technologies, processes, and partnership potential.
- ✓ PreScouter can identify the intellectual property position of these players and understand patent trend evolution.
- ✓ PreScouter can identify additional suppliers located in specific regions to source products and other services.



Other reports from PreScouter that you might like

Recycling of Thermoset Materials



Green Chemistry Alternatives for Common Chemicals

Startups Developing Nanocellulose Products

Engage our network of experts and researchers on your topic.

CONTACT US HERE

About PreScouter

PRESCOUTER PROVIDES CUSTOMIZED RESEARCH AND ANALYSIS

PreScouter helps clients gain competitive advantage by providing customized global research. We act as an extension to your in-house research and business data teams to provide you with a holistic view of trends, technologies, and markets.

Our model leverages a network of 4,000+ advanced degree researchers, industrial experts, engineers, and analysts across the globe to tap into information from small businesses, national labs, markets, universities, patents, startups, and entrepreneurs.

CLIENTS RELY ON US FOR:

Innovation Discovery: PreScouter provides clients with a constant flow of high-value opportunities and ideas by keeping you up to date on new and emerging technologies and businesses.

Privileged Information: PreScouter interviews innovators to uncover emerging trends and non-public information.

Customized Insights: PreScouter finds and makes sense of technology and market information to help you make informed decisions.

500+
CLIENTS WORLDWIDE

5,000+
RESEARCH REPORTS CREATED

150,000+
HOURS OF RESEARCH COMPLETED FOR CLIENTS