GRAPHENE SQUARE CHEMICAL

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We will provide a healthier and better life through the development of innovative products and technologies by using a graphene, called the “new material of dreams”, in the material and bio-application industries.

2015

· Undertaking a study on graphene-based drug for Parkinson’s disease (Joint research of Seoul National University in Korea and Johns Hopkins University School of Medicine in U.S.)

2017-2018

- Foundation of Biographene (Spin-off venture company based on Researches at Department of Chemistry in Seoul National University)
- Undertaking a study on kidney fibrosis treatment with the Department of Nephrology in Seoul National University and Boramae Hospital
- Establishment of Biographene R&D Center

2020-2021

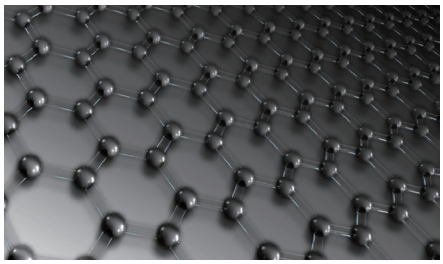
- U.S. branch establishment in Los Angeles
- Establishment of pilot facility to produce new drug candidate BGN-112 for neurodegenerative diseases
- Undertaking a study on amyotrophic lateral sclerosis (ALS) with Dong-A University College of Medicine

2023~

- Development of high-functional composite materials and high-thermal conductive films
- Change of company name to Graphene Square Chemical Inc.
- Development of graphene cooling sheets and production/ supply to Korean army units

What is Graphene?

Graphene: The future material that will change the world



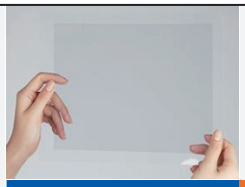
· Graphene is a substance composed of a single layer of carbon atoms arranged in a hexagonal honeycomb structure. It primarily exists in two forms: film and flake.

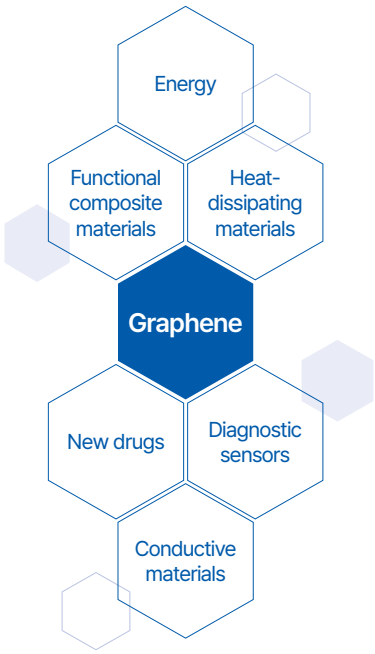
· Graphene's thermal conductivity is twice that of diamond, and its electrical conductivity is more than 100 times superior to copper. Additionally, it is 100 to 300 times stronger than steel while being extremely lightweight, making it suitable for various functional composite material applications.

· Graphene Quantum Dots (GQDs) exhibit excellent cellular delivery capabilities, antioxidant effects, low in vivo toxicity, and unique fluorescence/quenching properties, enabling their application in a wide range of biomedical fields.

Business Area

· Graphene Square Chemical is the world's first and only company that not only develops advanced functional composite materials based on the production and research of high-quality graphene flakes but also develops new drugs using graphene. (More than 20 papers published with research related to biomedical and materials of graphene.)

		
Comparison Factor	Graphene Film	Graphene Flake
Form	Thin film	Liquid, powder
Manufacturing Method	Bottom-up method (CVD)	Top-down, Bottom-up
Thechnological Barrier	High	Low (GOs, micro-graphite), High (GQDs)
Quality	High	Low to high
Size	Meter-scale (large-scale)	Micro to nano-scale
Application Fields	Transparent electrodes, battery film, etc.	Conductive ink, polymer composites, bio applications, etc.



· The efficacy and excellence of research have been validated in disease models (e.g., Parkinson's disease, Amyotrophic Lateral Sclerosis, and Alzheimer's disease), as well as in target performance models.

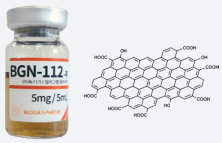
· A close collaborative research network (e.g., universities, hospitals, and research institutions) is being established with domestic and global partners.

Material Applications	Composite Materials	- Adhesives/coatings (shoes, clothing, fabrics, etc.) - High-performance polymer composites such as PU and EVA.
	Energy Sector	- Heat-dissipating materials, battery cathode/anode composite, ESS
Bio Applications	Drug Development	- Amyotrophic Lateral Sclerosis (ALS)/ Parkinson's disease/ Alzheimer's disease/ Kidney Fibrosis
	Non-Drug Applications	- gFET-based biosensors, MRI contrast agents

Core Technologies

Mass production technology for High-quality graphene flake

· Production facilities for high-quality graphene quantum dot (GQDs) in pharmaceutical and cosmetic applications and high-conductivity graphene flake



BGN-112-(For injection)

Graphene flakes

Mass production equipment for GQDs

High-speed and dry graphene production equipment

Core patent

· Completed a technology transfer agreement with Seoul National University for a patent on the treatment of neurodegenerative brain diseases **Holding 28** registered patents (13 domestic, 15 international) and **32 pending patents** (7 domestic, 12 PCT, 13 international)

Fields	Details	Patent type						
New Drug	neurodegenerative disease / lysosomal storage disorder / Inflammatory Diseases	Product	●	■	■	■	●	●
	neurodegenerative disease	Use/Composition	●	■	●	●	●	■
	lysosomal storage disorder	Use/Composition	●	■	●	■	●	●
	Inflammatory Diseases	Use/Composition	●	■	●	●	●	●
	Kidney fibrosis	Use/Composition	●	■	■	■	■	■
	Antiviral Agent	Use/Composition	●	■	■	●	●	■
	DNA/RNA carrier	Use/Composition	●	■	■	●	■	■
Non-New Drugs	MRI Contrast Agent	Use/Composition	●	-	-	-	-	-
	MRI Contrast Agent	Manufacturing	●	■	■	■	●	■
Material	High-Performance Adhesive	Use/Composition	■	■	■	■	■	■
	Air-Jet Mill Based Production Process	Manufacturing	■	■	■	■	■	■
	Graphene Cooling Sheet	Manufacturing	■	■	■	■	■	■

● Registration ■ application

Status of Pipeline in Bio Field

Program	Indication	Discovery	Pre-Clinical		Clinical
			Pre-Clinical Efficacy	IND enabling	Phase I
BGN-111, BGN-112	Amyotrophic Lateral Sclerosis(ALS)				
	Parkinson's Disease	Complete effectiveness evaluation in the animal model Preparing for nonclinical GLP toxicity evaluation			
	Alzheimer's Disease				
	Kidney fibrosis				
MRI Contrast Agent		Assessing animal model performance			
Graphene-Aptamer Complex		Assessing target tracking and treatment effect			
Graphene FET Biosensor		Assessing sensor performance			

High Functional Composite Materials

- High functional composite materials serve as core materials in various industries, including electronics, displays, automotive, aerospace, clothing, and medical fields
- By adding or compounding small amounts of graphene, the properties of polymer materials, fibers, and plastics can be enhanced, including improved heat generation/dissipation and electronic conductivity.
- Items : cooling sheets, heat-generating plastics, and high functional adhesives.

Graphene Cooling Sheet

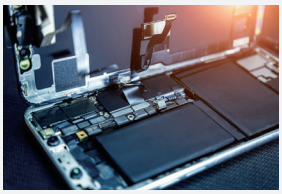
High Functional Composite Materials

High Functional Adhesives

High Heat Dissipation Films

- Recently, as devices equipped with heat-generating components such as semiconductor elements have become smaller and more integrated, heat dissipation issues have become more significant, directly impacting the quality and lifespan of the devices.
- Graphene film, with its exceptionally high in-plane thermal conductivity, lightweight properties, excellent flexibility, and mechanical strength, serves as an outstanding material for heat conductors or heat spreaders in confined spaces or areas requiring gap filling.

Graphene Heat Dissipation Films



The Heat Dissipation Solution for Electronic Devices and Batteries

High Conductive Additives

- Conductive additives are materials used to enhance the conductivity of lithium oxide-based electrodes. While carbon black is currently the most used material, recent developments are focused on improving conductivity and dispersion through composite methods involving carbon nanotubes and graphite.
- Utilizing graphene allows for the use of smaller amounts of conductive additives compared to conventional materials, enabling the incorporation of more active materials. This leads to higher energy density and improved charge/discharge cycle life.

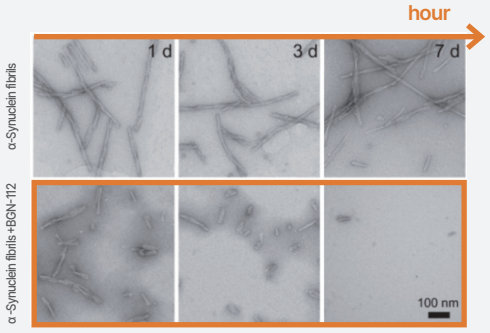
Graphene Dispersion Solution

Graphene-applied Batteries and ESS

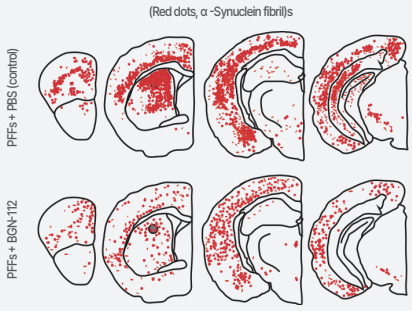
Parkinson's Disease (PD)

· Parkinson's disease causes abnormalities in brain function due to the destruction of dopaminergic neurons in substantia nigra of midbrain and is mainly characterized by symptoms such as tremors, muscle stiffness, and exercise relaxation. More than 10 million people around the world are suffering, and there is still no fundamental treatment other than symptom relievers.

· BGN-111, BGN-112 are confirmed that it not only inhibits the abnormal aggregation of α-Synuclein proteins, known as causative agents of Parkinson's disease, but also induce the disaggregation of the aggregated fibrils, which can lead to fundamental therapeutic effects.



Induction of disaggregation of α –Synuclein fibrils



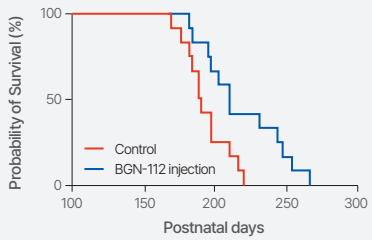
Inhibition of alpha-synuclein fibrillation in the central nervous system

Amyotrophic Lateral Sclerosis (ALS)

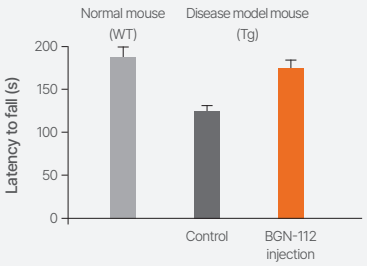
· Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, has 10% genetic characteristics but is mostly sporadic, and motor neurons in the cerebrum and spinal cord are selectively destroyed, showing symptoms such as muscular dystrophy and paralysis, decreased speech ability, stiffness, and shortness of breath.

· Like other neurodegenerative diseases, the exact cause of the disease has not been identified yet, but abnormal aggregates of TDP-43 proteins is observed in about 97% of ALS patients.

· BGN-112 inhibits such abnormal aggregation of TDP-43 proteins, inhibits cell death of motor neurons, reduces inflammation in brain, and restores motility.



Survival rate (TDP43^{A315T} Tg mouse)

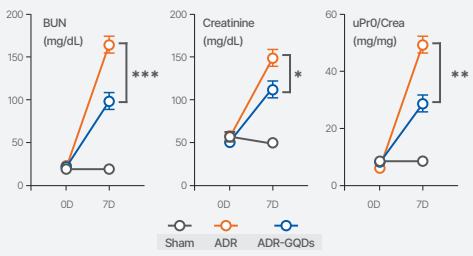


Behavioral assessment (Rotarod Performance)

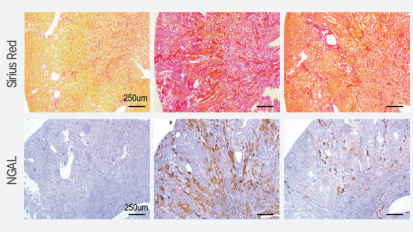
Kidney Fibrosis

· Kidney fibrosis is a common phenomenon in most kidney diseases transitioning to chronic renal failure, and fibrosis occurs when fibrous connective tissue in the organ is formed excessively following repeated chronic inflammation of renal tubules and glomeruli.

· Through various kidney fibrosis animal models, it is confirmed that BGN-112 reduces damages and inflammation of renal tubules and podocytes, recovers kidney filtration and inhibits renal fibrosis.



Recovery of filtration function in kidney



Suppression of damages and inflammation in kidney

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