

# Graphene Square Chemical Inc.

## IR Deck

Aug. 2025



GRAPHENE  
SQUARE  
CHEMICAL

# I. Company Introduction

# Corporate Overview

 Development of innovative products in the chemical and bio fields using graphene-based technology

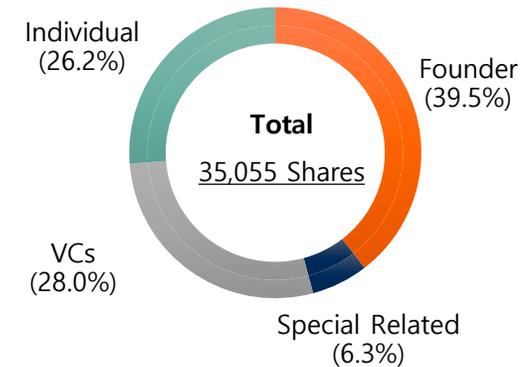
- **Name** : Graphene Square Chemical Inc. (Former Biographene Inc.)
- **Establishment Date** : Feb. 2017
- **Founder** : Byung Hee Hong  
(Prof. at Seoul National University, CEO at Graphene Square)
- **CEO** : Jong Bo Park, Young Ji Lim (Employee: 8)
- **Location** : Change-up Ground in Pohang(HQ,) Suwon-si, Gyeonggi-do (Lab),  
Los Angeles (US Branch)

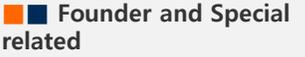


- **Main Business Pipelines:**

Material Application	Polymer composite	<ul style="list-style-type: none"> <li>• Adhesive/additive (Clothes, Shoes, Fabrics)</li> <li>• High-performance polymer composites</li> </ul>
	Energy	<ul style="list-style-type: none"> <li>• Heat dissipation pad, batteries, ESS</li> </ul>
Bio Application	New drug	<ul style="list-style-type: none"> <li>• ALS / Parkinson's / Kidney fibrosis / Alzheimer's / NPC</li> </ul>
	Non new drug	<ul style="list-style-type: none"> <li>• gFET-based bio-sensors, MRI contrast agent</li> </ul>

- **Total funding to date** : 11.4 bil. Won (at post 31 bil. won value)
- **Main investors** :  (주) 제일테크노스    대교인베스트먼트  
 
- **Stock Shareholders** : (Nov. 2024)



Name	Shares	%
 Founder and Special related	16,064	45.8 %
 VCs	9,805	28.0 %
 Others	9,186	26.2 %
<b>Total</b>	<b>35,055</b>	<b>100.0 %</b>

# Leadership Team



Excellent technology and strong teamwork comprised of a group of graphene experts



**Byung Hee Hong** Founder

#### Education

- BS/MS/PhD in Chemistry at Pohang Univ. of Science and Technology

#### Experience

- Current) Prof. at Seoul National Univ.
- Current) CEO/Founder at Graphen Square Inc.
- Former) CEO at BioGraphene Inc.(Graphene Square Chemical)



**Young Ji Lim** Co-CEO

#### Education

- MBA at Ajou Univ.
- BS at Seoul National Univ. of Education

#### Experience

- CEO, RNR Networks Inc.



**Minseok Park** CFO

#### Education

- BS UC Berkeley

#### Experience

- Former) Deloitte, USA (CPA, ABV)
- Former) PwC, USA (CPA, ABV)
- Former) CFO at GoldenTree Investment



**Jinseung Choung** CTO

#### Education

- PhD in Medical Life Science; Rehabilitation at Cha University
- MS in Department of Pharmacy; Immunology at Gachon University
- BS in Exercise Physiology at Gachon University of Medical and Science

#### Experience

- Former) Director, Theragen Health
- Former) Post-Doc., Cha Medical Center
- Former) Research Assistant, KAIST

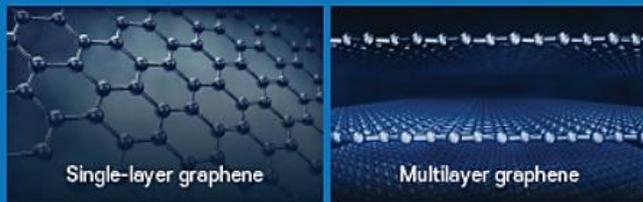


# Graphene – Material of dreams that won the Nobel Prize

 Development of innovative products in the chemical and bio fields using graphene-based technology

## Graphene, the dream material

With a continuous beehive array of carbon atoms across the two-dimensional plane, this thin-film material is physically and chemically stable



### 8 characteristics that make graphene stand out

<b>Electric conductivity</b> 100 times that of copper and silicon		<b>Flexibility / elasticity</b> Electrical properties maintained even when stretched or bent	
<b>High durability</b> 200 times that of steel		<b>Heat conductivity</b> Twice that of diamond	
Transparency	EMF shielding effect	Ultralight	Gas Barrier

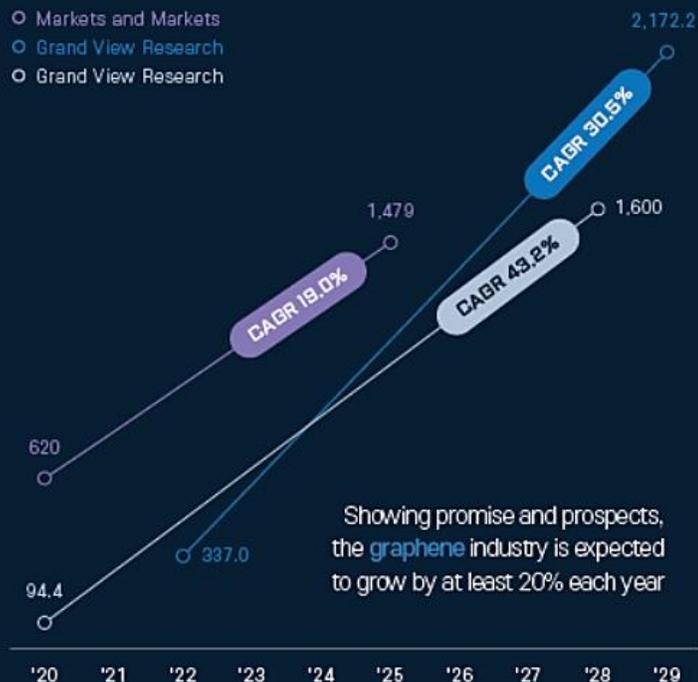
### The potential of graphene

Sought after in various industries for its physical excellence, considerable growth for graphene is expected

#### Global scale of the graphene market

Unit: USD one million, based on data from 3 major research companies

- Markets and Markets
- Grand View Research
- Grand View Research

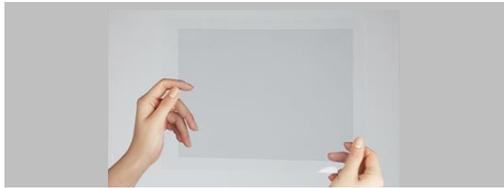


Showing promise and prospects, the graphene industry is expected to grow by at least 20% each year



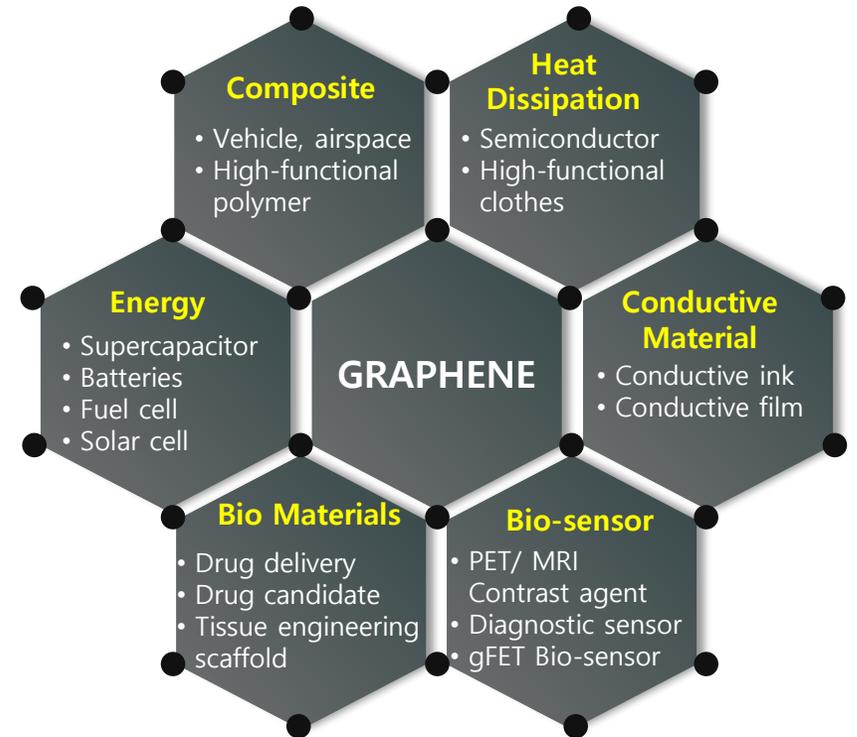
# Business Area

Development of innovative products in the chemical and bio fields using graphene-based technology



	Graphene Film	
Type	Thin Film	
Method	Bottom-up 방식 (CVD)	
Difficulty	High	
Quality	High	
Size	Meter-scale (대면적)	
Application	Flexible transparent electrode, barrier film	
Major Player	German	AIXTRON
	Korea	Graphene Square, Haesung DS, Graphene Lab
	Spain	Graphenea
	U.S.	Graphene Supermarket

Graphene Flake	
Solution, Flake	
Top-down, Bottom-up	
Low (GOs, micro-Graphite), High (GQDs)	
Low ~ High	
Micro to nano-scale	
Conductive ink, polymer composite, bio-application	
Canada	Angstrom Materials
Korea	Standard Graphene, Graphene Square, Chemical, Grapheneall
U.K.	Applied Graphene Materials, Cambridge Nano Systems
U.S.	Graphene 3D Lab.

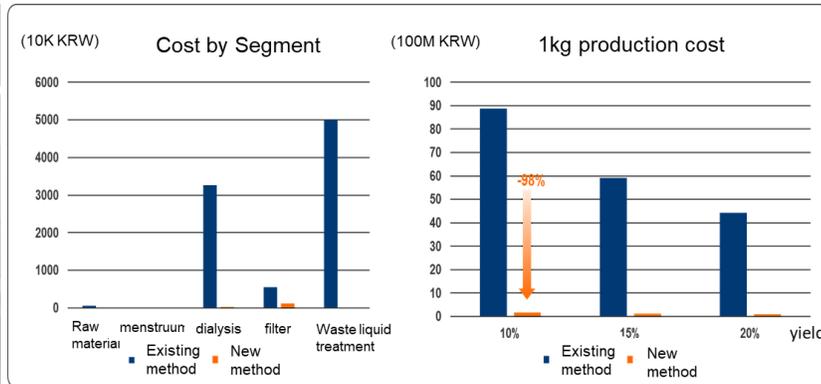


# Core Technology

## Development of innovative products in the chemical and bio fields using graphene-based technology

### ■ GQD mass production

- **Process development of graphene quantum dots (GQDs) with < avg. 5nm diameter** by using 20L Large scale reactor and continuous auto-dialysis (**Medical Grade**)
- Technical difficulties in mass producing GQDs were an obstacle to the commercialization of GQDs.
- Capable of producing ~100 g/month using process development and in-house facilities (current market price of commercial GQD is approximately 10 million won/g)



### ■ Air Jet Mill –Graphene flake mass production facilities

- **Capable of producing high-quality micro-scale graphene flakes in tons/day with high efficiency and low cost**
- The high-speed dry manufacturing method is more economical and environmentally friendly than existing chemical-based synthesis methods.
- ne-step synthesis of doped graphene flakes possible through various chemical dopants or gas injection (Related patent application completed in Korea, '23 Q2)

### Air Jet Mill 장비

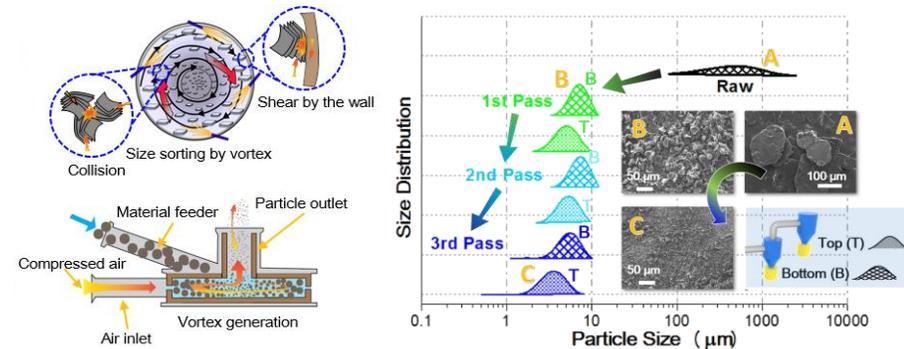
- 일 최대 1톤 생산가능
- 주입 가스에 따른 다양한 화학 기능기 다양화

우수한 범용성  
배터리 음극재, 윤활유첨가제,  
접착제첨가제, 강화 플라스틱 등으로  
응용가능

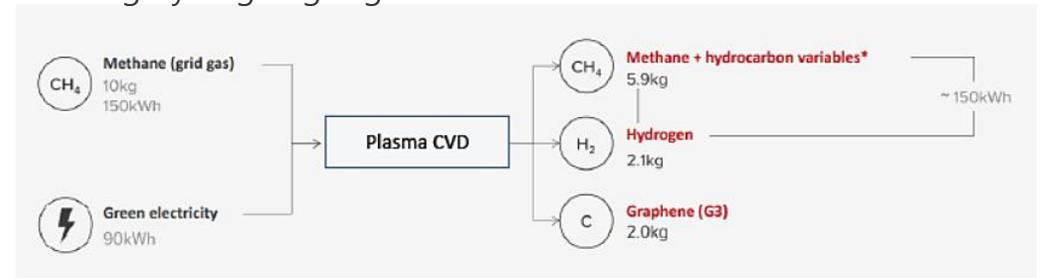
# Core Technology

Establishment of graphene mass production technology and facilities to supply raw and intermediate materials

- **Air jet mill-based production facility using reactive gas**  
: High-speed dry highly conductive graphene flake mass production and continuous doping system



- **Production of eco-friendly turquoise hydrogen and high-quality graphene flakes**  
: High-quality graphene flakes can be produced as a by-product during hydrogen gas generation



# Patent Status



## Strong Patent Portfolio for Chemical and Biomedical Application of Graphene

- Completed technology transfer agreement with Seoul National University in relation to patent for use in degenerative brain disease treatment ('22 Q1)
- 27 registered patents (13 domestic, 14 overseas) 33 patents held and applied (7 domestic, 12 PCT, 14 overseas)**

Material	Application	Types						
GQDs	Neurodegenerative disease	Material	◆	■	■	■	◆	◆
GQDs	Neurodegenerative disease	Uses/Composition	◆	■	◆	◆	◆	■
GQDs	Lysosome disease	Uses/Composition	◆	■	■	■	◆	◆
GOs/GQDs	Inflammation disease	Uses/Composition	◆	■	◆	◆	◆	■
GQDs	Kidney fibrosis	Uses/Composition	◆	■	■	■	■	■
GQDs	Anti-viral agent	Uses/Composition	◆	■	■	■	■	■
GQDs	DNA/RNA delivery	Uses/Composition	◆	■	■	◆	◆	■
GQDs	MRI contrast agent	Uses/Composition	◆	■	■	◆	■	■
GQDs	MRI contrast agent	Method	◆					
Graphene Flakes	High-performance glue	Uses/Composition	■	■	■	■	■	■
N-doped graphene flakes	Air-Jet Mil process	Method	■	■	■	■	■	■
		...	■	■	■	■	■	■



## II. Business Status

## II. Business Status – (1) Material

# 1. Graphene Cooling Sheet



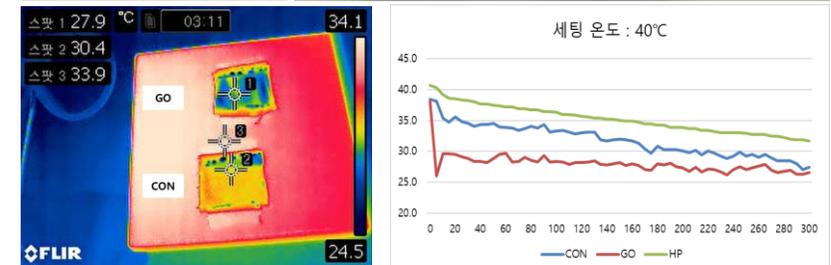
Graphene cooling sheets (emergency kits) for heatstroke patients based on graphene's excellent thermal conductivity

## ■ Unmet need

- In the event of an emergency sunstroke or heat stroke, an emergency kit is required to quickly lower the patient's body temperature during transport to a medical institution.
- Excellent cooling effect is possible when developing a cooling sheet based on the high thermal conductivity of graphene.

## ■ Status & Plan

Developed graphene cooling sheets and emergency kits	Complete ('23. 10)
Supply to Korean army (approximately 3,500 sets)	Complete ('23. 12)
Expanding domestic market	Complete ('24. 06)
Additional sales to the Army, Navy, Military Academy, etc. (approximately 2,000 sets or more)	Underway
overseas marketing (Discussing with the U.S. and other Middle East regions)	'25 Q1



# 2. Graphene Heat Dissipation

 Based on high thermal conductivity and excellent mechanical properties, a key item in the heat dissipation market

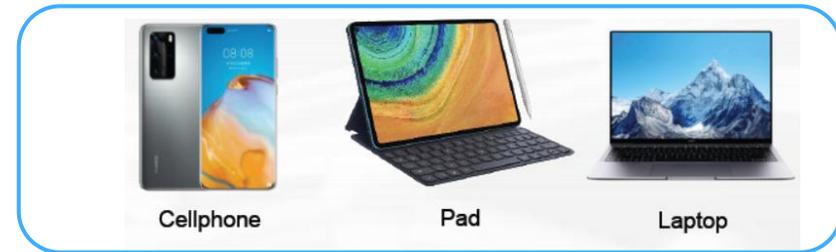
## ■ Unmet Need

- Need to solve the problem of heat generation, which is directly related to the decline in the quality and lifespan of electronic devices
- the development of better heat dissipation materials is required as the electronic devices become nanoscale and integrated

## ■ Status and Plan

Research of graphene heat dissipation film, securing intermediate materials and raw materials	Complete ('23 Q1)
Service project to develop a heat dissipation cable for charging electric vehicles (Company G)	Complete ('23 Q3)
Joint research with Company L / Company S → heat dissipation film for laptop and TV display applications	Underway ('24 Q2)
Establishment of mass production facilities for graphene heat dissipation film	'26 Q4
Securing demand companies and producing/supplying heat dissipation films	'27 Q1~

## Applications







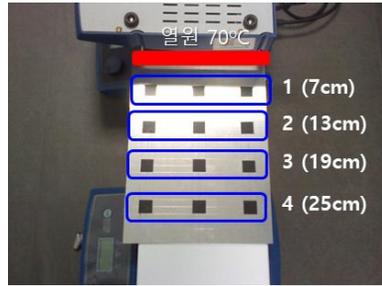
### 방열 소재 시장 전망

※( )안은 연평균 성장률, %

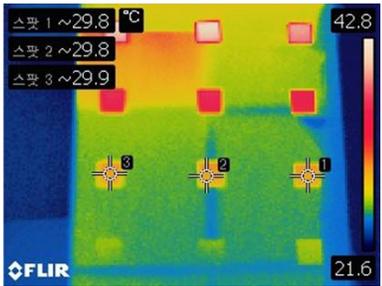
세계(억달러)		국내(억원)	
2019	111	2019	547
2023년	152 (6.5)	2023년	686 (5.8)

자료:스미더스 에이펙스





1 (7cm)  
2 (13cm)  
3 (19cm)  
4 (25cm)



스팟 1 ~29.8 °C  
스팟 2 ~29.8 °C  
스팟 3 ~29.9 °C

42.8  
21.6

FLIR

# 3. Cathode/Anode Composite in Batteries



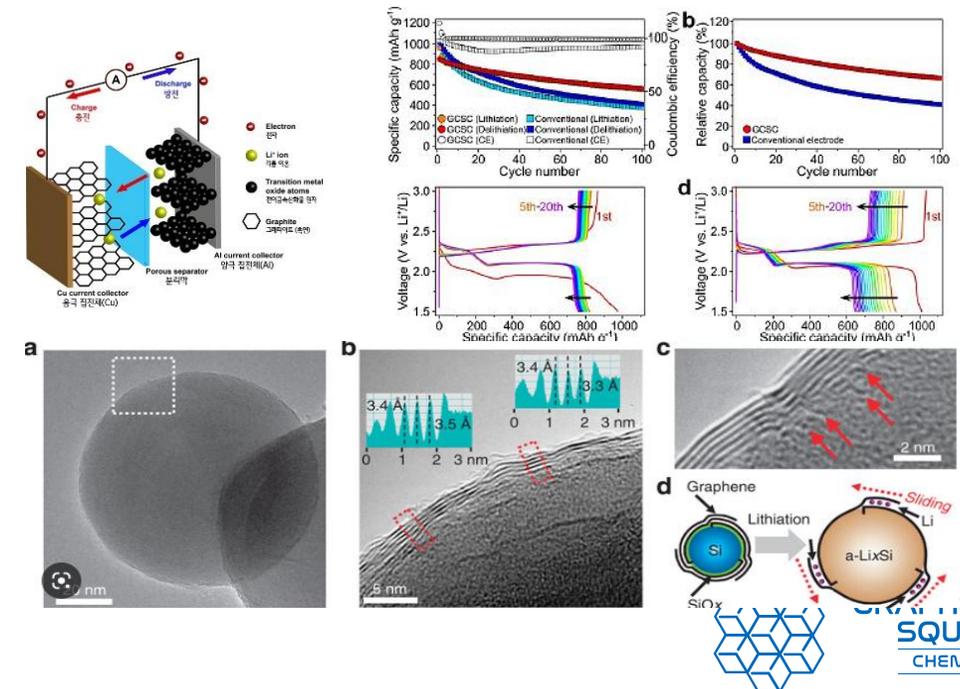
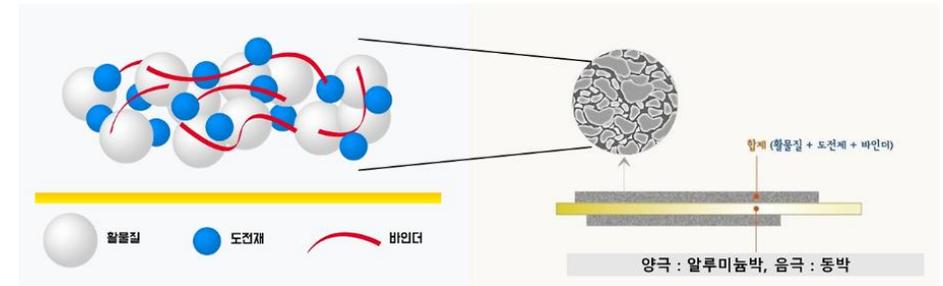
Energy density of batteries can be improved due to large specific surface area and high conductivity

## ■ Unmet Need

- High capacity and fast charging can be developed through the development of an anode composite using highly conductive graphene.
- (Core-Silicon, Shell-Graphene) composite structure can improve electrical conductivity, reduce silicon fracture (breakage), and suppress electrolyte side reactions.

## ■ Status and Plan

High-speed dry graphene flake production process development and facilities	Complete ('22 Q2)
Discussed research and development of batteries using graphene with company L and Company P	Complete ('23 Q2)
Research and development of high-capacity secondary battery anode composite using graphene	Complete ('23 Q4)
Prototype production, performance evaluation, stability evaluation	Underway ('25 Q4)
Conduct follow-up research, revise feedback, and discuss production with customers	'26 Q1~



# High-performance Graphene Adhesive

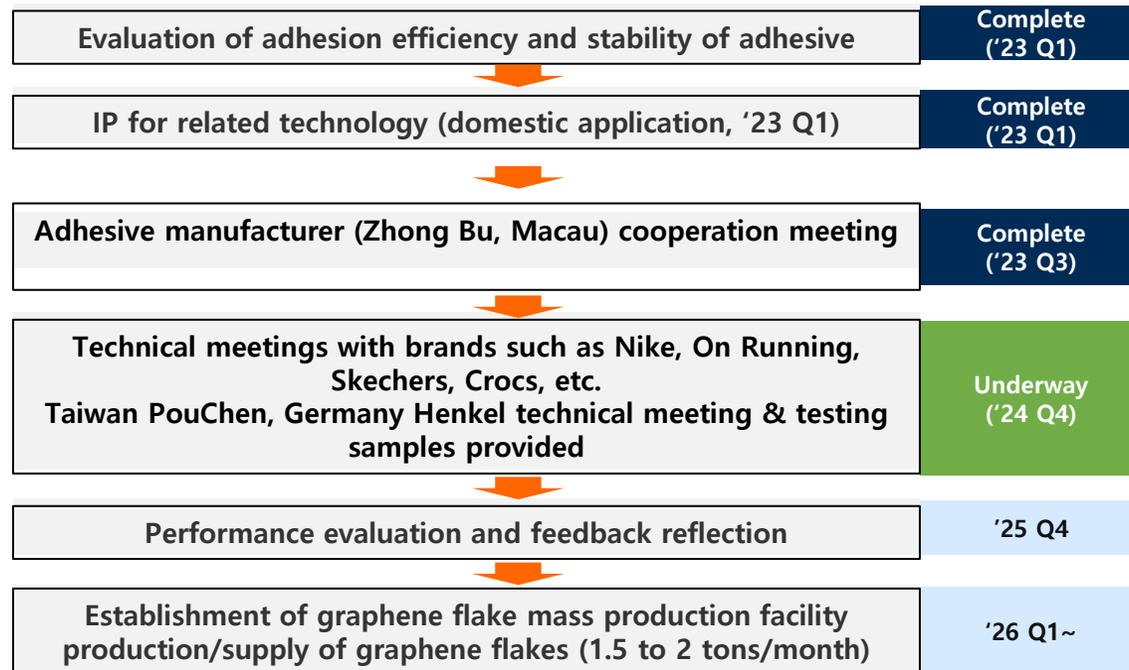


Based on high functionality and efficiency, can be a game changer in a wide range of fields such as shoes, clothing, automobile interior and exterior materials, and construction.

## ■ Unmet Need

- Conventional water-soluble PU-based adhesives need to be improved because of their high energy consumption, high defect rate
- Minimizing product damage, reducing adhesion defect rate, reducing costs, Bonding & De-bonding technology

## ■ Status and Plan



## II. Business Status – (2) Bioapplications

# Pipelines in Bioapplications

Program	Research Partner	Progress
Parkinson's (PD)	<p><b>Hanseok Ko, PhD</b></p> <ul style="list-style-type: none"> <li>Prof. in Neurology at Johns Hopkins Univ.</li> </ul> <p><b>Donghoon Kim, PhD</b></p> <ul style="list-style-type: none"> <li>Prof. in Medical School of Dongah Univ.</li> </ul>	<ul style="list-style-type: none"> <li>Non-clinical trial stage (candidate: BGN-112)</li> <li>Confirmed efficacy in Parkinson's disease animal models (2 types)</li> </ul>
Amyotrophic lateral sclerosis (ALS)	<p><b>Yeongbin Hong, PhD</b></p> <ul style="list-style-type: none"> <li>Prof. in Medical School of Dongah Univ.</li> </ul>	<ul style="list-style-type: none"> <li>Confirmed efficacy in Lou Gehrig's disease animal models (3 types) (candidate: BGN-112)</li> <li>Effective concentration confirmation and MoA analysis (in progress)</li> <li>Orphan drug designation by US FDA (planned)</li> </ul>
Alzheimer's (AD)	<p><b>Duckryul Na, MD</b></p> <ul style="list-style-type: none"> <li>Prof. in Medical School at Sungkyunkwan Univ./Samsung Seoul Hospital</li> </ul> <p><b>Sangtae Kim, PhD</b></p> <ul style="list-style-type: none"> <li>J&amp;Pharma</li> </ul>	<ul style="list-style-type: none"> <li>Efficacy testing in progress in Alzheimer's disease animal models (2 types)</li> <li>Efficacy evaluation of graphene-aptamer (amyloid beta oligomer target) complex (in progress)</li> <li>Joint research agreement with J&amp;Pharma</li> </ul>
Kidney Fibrosis	<p><b>Jungpyo Lee, MD / Seunghee Yang, PhD</b></p> <ul style="list-style-type: none"> <li>Prof. in Medical School at Seoul National Univ.</li> </ul>	<ul style="list-style-type: none"> <li>Confirmed efficacy in nephritis animal models (3 types) (candidate: BGN-112)</li> </ul>
MRI Contrast Agent	<p><b>Yoonsang Lee, PhD</b></p> <ul style="list-style-type: none"> <li>Prof. in Nuclear Medicine at Seoul National Univ.</li> </ul> <p><b>Sangtae Kim, PhD</b></p> <ul style="list-style-type: none"> <li>J&amp;Pharma</li> </ul>	<ul style="list-style-type: none"> <li>Confirmed T1 contrast agent effect of <sup>13</sup>C graphene quantum dots (animal model) and toxicity</li> </ul>
Graphene FET-based Bio-sensor	<p><b>LG Electronics</b></p> <p><b>Graphene Square</b></p>	<ul style="list-style-type: none"> <li>Evaluation of FET sensor performance using antibodies that specifically bind to target antigens such as coronavirus</li> <li>Joint research and development agreement with an in vitro diagnostic company (OneSophdigm)</li> </ul>

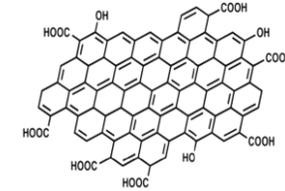
# New Drug Pipeline

Program	Indication	Discovery	Pre-Clinical		Clinical
			Pre-Clinical Efficacy	IND enabling	Phase I
<b>BGN-111, BGN-112</b>	ALS				
	PD	Complete effectiveness evaluation in the animal model Preparing for nonclinical GLP toxicity evaluation			
	AD				
	Kidney Fibrosis				
<b>MRI Contrast Agent</b>		Evaluating animal model performance			
<b>Graphene-Aptamer Conjugate</b>		Evaluating target tracking and treatment effect			
<b>Graphene FET Bio-Sensor</b>		Evaluating sensor performance			

# Novel First-in-Class Drug Candidate composed of Proprietary Biocompatible GQDs

1

Small-sized (2~5nm), amphiphilic nanoparticles consisting of a graphitic domain and oxygen-containing functional group (hydroxyl, carboxyl) around the edges



2

Anti-oxidation effect, degradation of abnormal protein aggregates, anti-inflammation effect

3

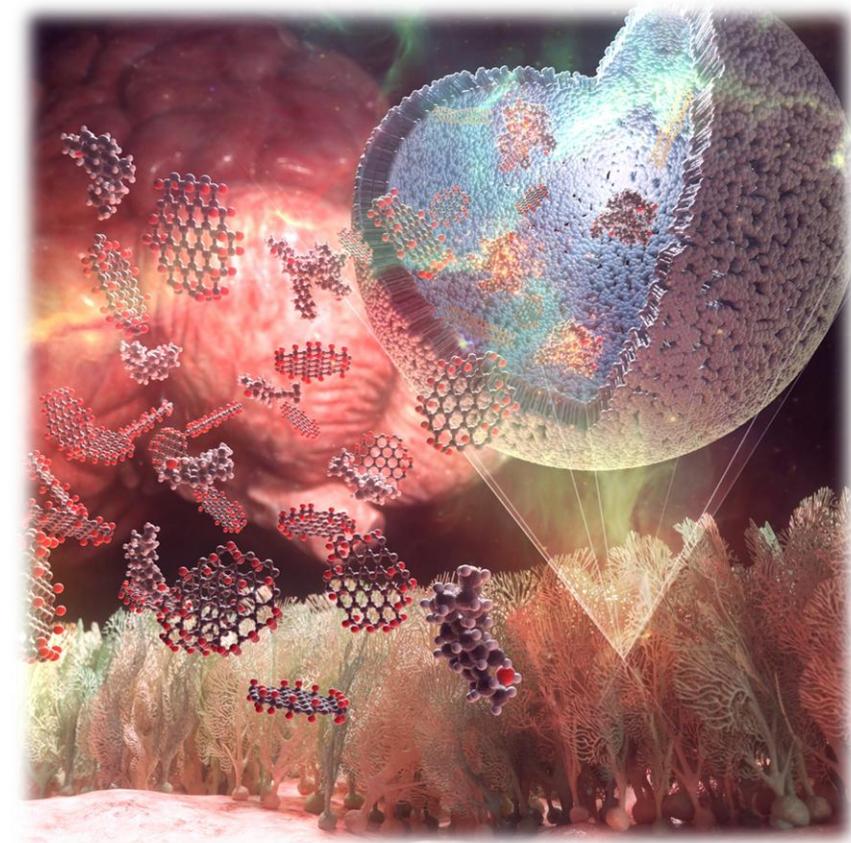
High solubility in aqueous solutions, Good Blood-Brain Barrier (BBB) permeability validated in in vitro/in vivo model

4

Confirmed therapeutic efficacy across diverse interrelated disease models (Parkinson's disease, Alzheimer's disease, Niemann-Pick disease Type C, ALS, Glomerulonephritis, Colitis).

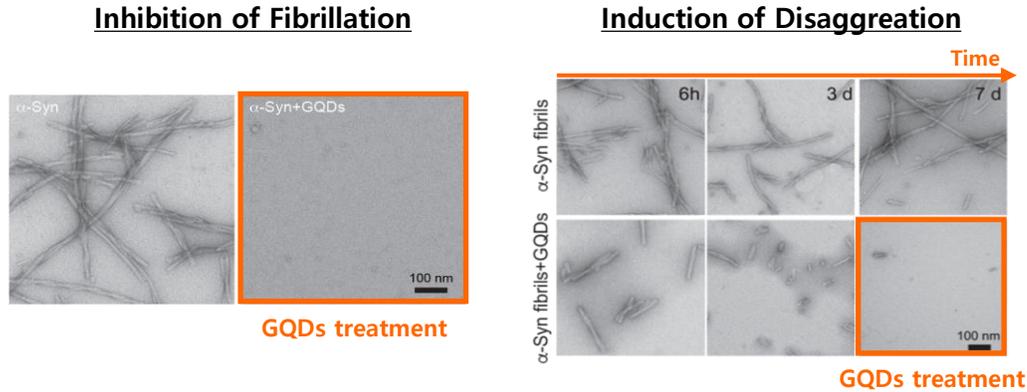
5

Negligible long-term toxicity validated in vitro/in vivo.

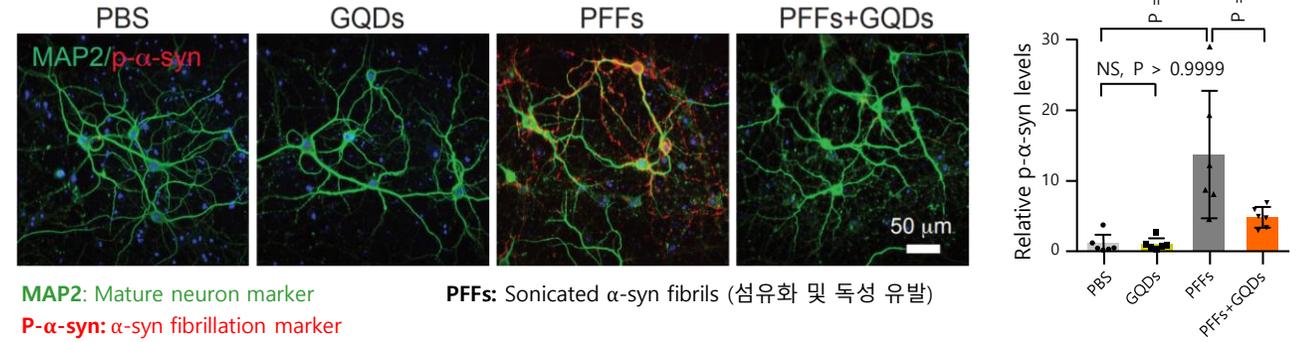


# Efficacy of BGN-112 in Parkinson's Disease (in vitro & in vivo)

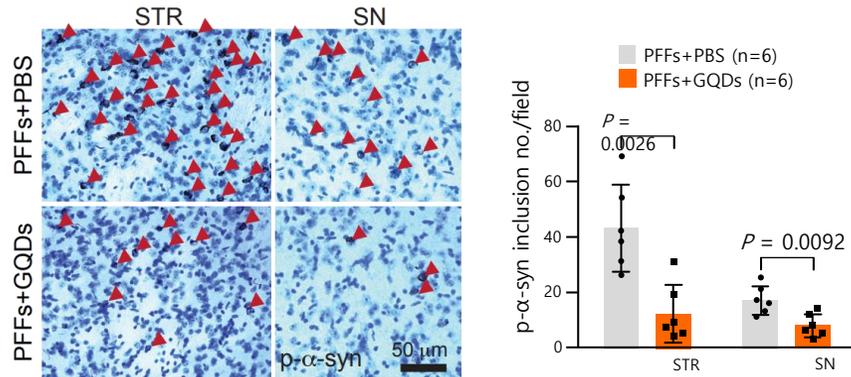
## α-syn fibrillation analysis (test tube)



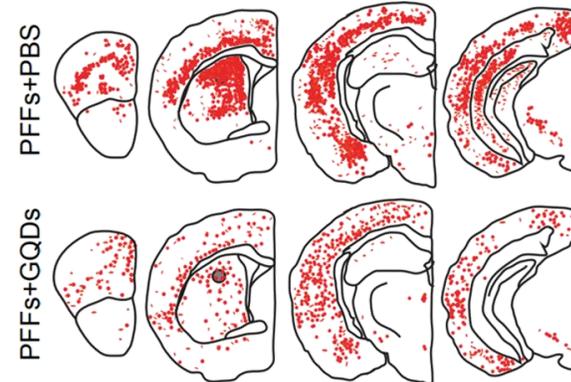
## α-syn fibrillation analysis (primary neuron)



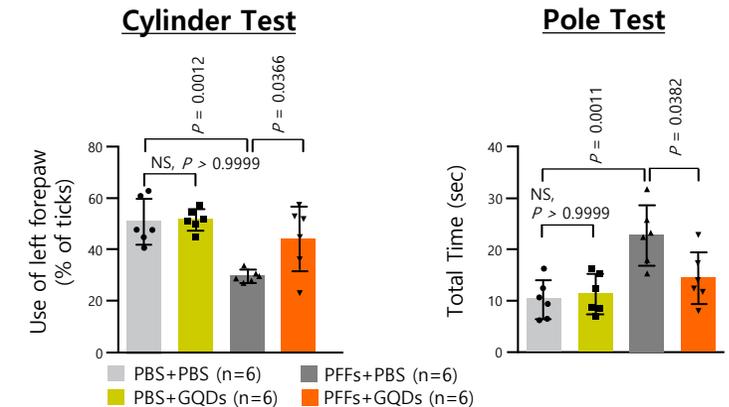
## In vivo p-α-syn analysis



## Transmission of p-α-syn in the CNS



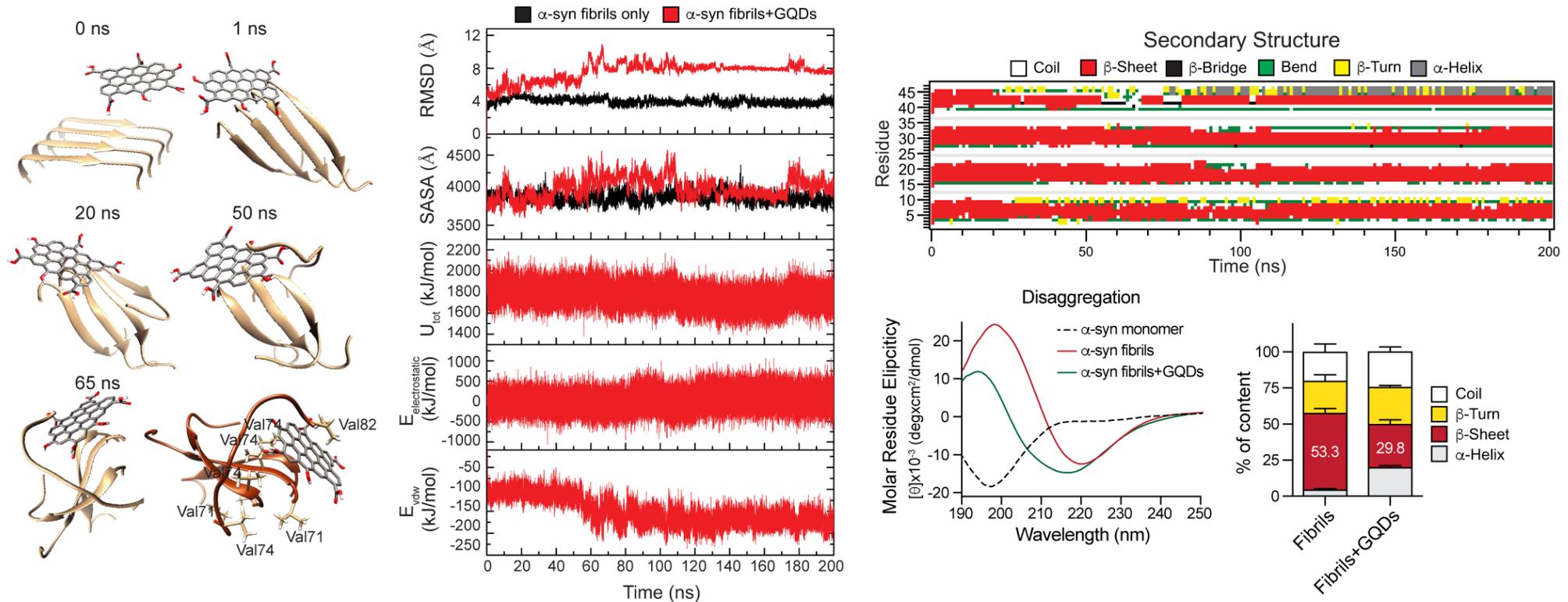
## Behavioral assessment (mice)



**GQDs 2mg/kg interaperitoneal injection (biweekly)**

# Mechanism of disaggregation of $\alpha$ -syn fibrils

Time course simulation dynamics of the interaction between GQDs and mature  $\alpha$ -syn fibrils



D. Kim and J. M. Yoo *et al.* (2018) *Nat. Nanotechnol.* **13**, 812-818

## III. Business Strategy

# Business Plan

## Commercialization Plan (2024)

Categories	Fields	Main Applications	Expected Demand Sources	Required Technologies
<b>01</b> <b>Early Business Areas</b> ( in ~ 3 years)	<b>High Functional Composites</b>	<b>High performance heat dissipation material</b>	Samsung Electronics, Lg Electronics, Hyundai Mobis Ministry of National Defense, Shinsung ST	<ul style="list-style-type: none"> <li>Securing high thermal conductivity through composite or film molding</li> <li>Items : Graphene cooling sheet, heat dissipation pad</li> </ul>
		<b>Graphene-based adhesives</b>	Nike, On, Skechers, Adidas, Under amor	<ul style="list-style-type: none"> <li>Releasing heat after absorbing external energies such as IR, microwaves</li> <li>Excellent heat conductivity</li> </ul>
		<b>Graphene / Polymer Composites</b>	Hyundai Motor, LG Chemical, KC, Lotte Chemical	<ul style="list-style-type: none"> <li>Enhancing properties of polymers (PU, EVA, PVC, etc.) by adding or mixing with a small amount of graphene</li> </ul>
<b>02</b> <b>Mid-, Long-term Business Areas</b> (in ~5 years)	<b>Energy</b>	<b>Batteries (anodes, additives)</b>	POSCO, LG Chemical, Eco-Pro	<ul style="list-style-type: none"> <li>Large specific surface area, excellent electrical conductivity, high chemical stability, improving anode/cathode composite efficiency</li> </ul>
	<b>Biosensor</b>	<b>gFET-based Biosensor</b>	LG Electronics, SD Biosensor, Seegene	<ul style="list-style-type: none"> <li>High electrical conductivity, excellent sensing effect and speed, various antibody/aptamer conjugates</li> </ul>
<b>03</b> <b>Long-term Business Areas</b> (in ~8 years)	<b>New Drug</b>	<b>Neurodegenerative Disease Drug (BGN-111, 112)</b>	BMS, Novatis, Roche, GSK, Biogen, Takeda	<ul style="list-style-type: none"> <li>Low toxicity, excellent BBB permeability, abnormal aggregated protein, excellent antioxidant</li> </ul>
		<b>Graphene-Aptamer drug</b>	BMS, Novatis, Roche, GSK, Biogen, Takeda	<ul style="list-style-type: none"> <li>Excellent delivery efficiency for target substances</li> <li>Simultaneous diagnosis and treatment of diseases</li> </ul>
		<b>Graphene-Aptamer MRI Contrast Agent</b>	Bayer AG, GE Healthcare	<ul style="list-style-type: none"> <li>Low toxicity compared to gadolinium</li> <li>Excellent BBB permeability, high T1 contrast effect</li> </ul>



# Main Business Milestone



# Competitiveness of Graphene Square Chemical

## HUGE GROWTH POTENTIAL

Applicable to various fields with high unmet demand (composite materials, batteries, heat-dissipation, and bioapplications such as degenerative brain disease treatments, MRI contrast agents, and diagnostic kits)

## EXPERTISE IN GRAPHENE RESEARCH

The first and leading company to develop new drugs using a novel approach with graphene technology, based on long-standing research on graphene (20 published papers since 2013)



## STRONG PATENT PORTFOLIO

27 granted patents & 33 applied patents covering diverse biomedical & composite materials applications

## EXPERIENCED LEADERSHIP TEAM

Talented and experienced leadership team composed of experts in graphene research, strategy, and business development

## EXTENSIVE R&D PARTNERSHIPS

Active R&D partnership with global networks (universities, hospitals, and research institutes) in Korea and US

## VALIDATED EFFICACY THROUGH VARIOUS TESTS & MODELS

Verification of excellent effectiveness in animal models of various diseases (Parkinson's disease, Alzheimer's disease, ALS, NPC, etc.) and in performance models for target application development

# Thank you !!

