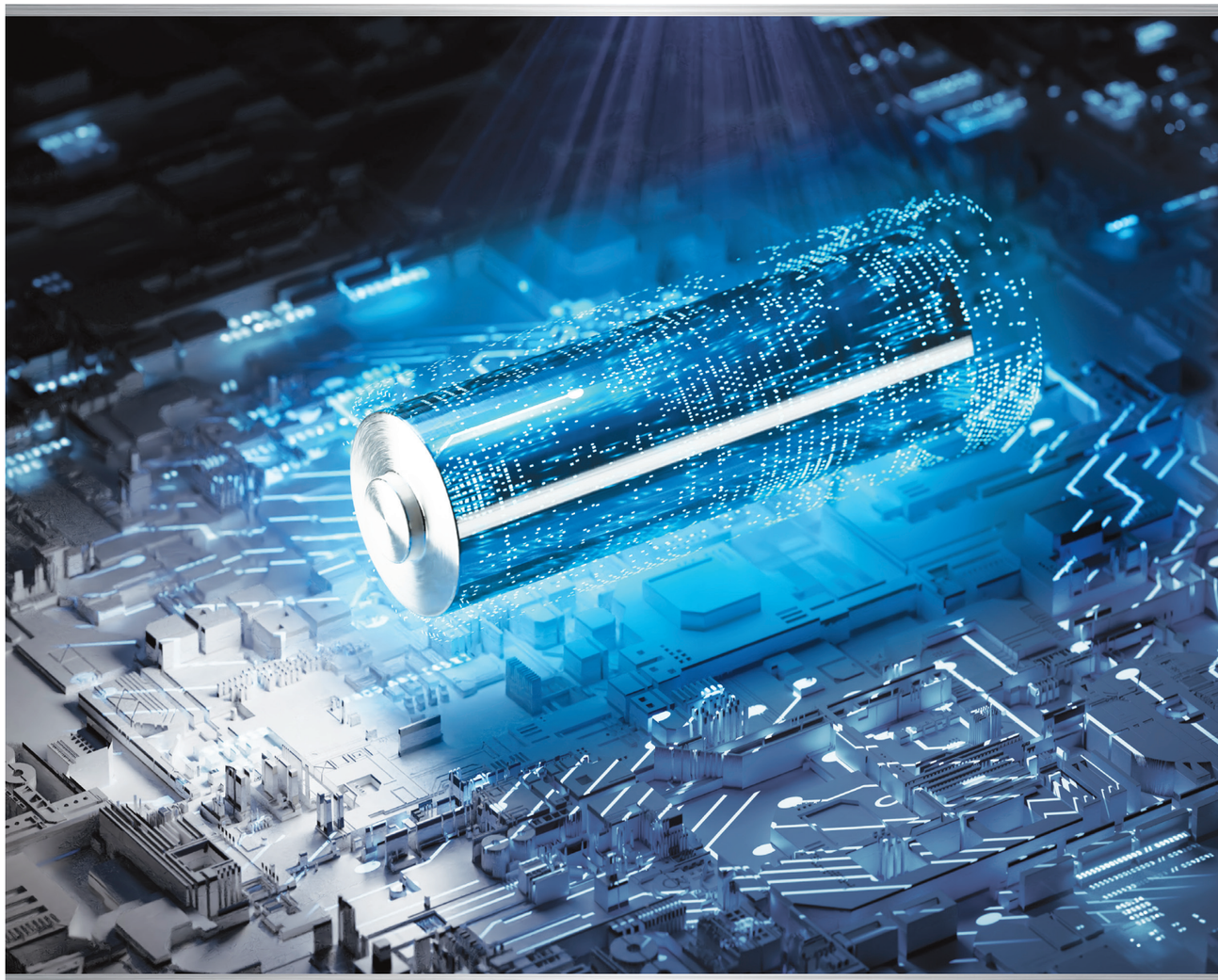
www.grapsil.com

GRAPSiL

Company, that is established the now and future of battery



Battery
- Higher performance
- Higher stability
- Long life

Technology
- Cleaner production
- Cost effective
- Smart factory

Start-up
- ESG
- Sustainable

Company, that is established the now and future of battery

GRAPSiL

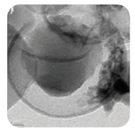
- **Head office** : C209-1, 2nd FL., 202Bldg., Gwangjang-ro 210, Baebang-eup, Asan-si, Chungcheongnam-do, Republic of Korea, 31471
- **R&D Center** : #714, Seoul Daehak-ro 59-21, Siheung-si, Gyeonggi-do, Republic of Korea, 15012
- **Factory** : #201, 26, Daeyang-ro, Mokpo-si, Jeollanam-do, Republic of Korea, 58618
- **Sales rep.** : airsanta@grapsil.com, 010-6231-0619
- **TEL** : +82-41-415-0271, +82-31-8042-7226 • **FAX** : +82-41-415-0270 • **e-mail** : grapsil@grapsil.com

Grapsil

Carbon Neutral for the future, Be with Grapsil

Grapsil has been bending over backwards trying to develop a silicon anode to grow into anode manufacturing company for 2nd battery silicon to be a representative of Korea.
Since we developed the first silicon anode own technology on 2015, Grapsil realized the future 2nd battery's quality at present by developing the safe silicon anode materials, high quality of silicon anode materials, and most profitable silicon anode materials consistently.
Grapsil will promised that we will make progress to become a significant role for 2nd battery industry, one of most important industry for eco friendly energy industry for human race with a great responsibility.

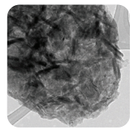
Thank you.



GA-SIC-V1.2015

The most stable and ideal silicon anode materials technically

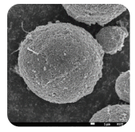
- Si-C



GA-SIC-V2.1.2019

Improved Silicon Packing factor

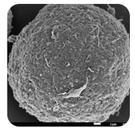
- Improved 30% of capacity
- Improved 5% of Irreversible capacity



GA-SIC-V2.2019

Improved 10% of Output

- Improved electrical conductivity
- Resistance decrease
- Improved reversible capacity



GA-SIC-V3.1.2020

Improved 5% Stability

- Multi layered core-shell sphere
- Improved function of control the volume expansion

History

2015

- Developed & patent the first Grapsil's silicon anode materials, GA-SIC-V1.2015, patent No. 10-1772659

2019

- Established company
- Certificated the venture business
- NDA with Sweden' Company N for development cooperation of Silicon Anode materials
- Established Plant in Mokpo in Korea
- Selected for Tips (Tech Incubator Program for Startup Korea)
- Selected for R&D Incubator program granted from Ministry of SMEs & Startups
- Developed & Patent the Grapsil's silicon anode materials, GA-SIC-V2.2019, Patent No. 10-2320977
- Developed & Patent the Grapsil's silicon anode materials, GA-SIC-V2.2019, Patent No. 10-224426

2020

- Selected for the Materials-Devices-systems Specialized Company
- Selected for the Root Industrial company
- Selected for the Improvement of Industrial company
- Developed & patent the Grapsil's silicon anode materials, GA-SIC-V3.1.2020, Patent No. 10-2194750

Awards

KIPO Award in Korea Invention Patent Exhibition
STARTUP NEXTCON Award
Green New Deal Award in 4th Industrial Revolution

Commendation

2021

- KIPO Award from Korea Invention Patent Exhibition2021 (KINPEX 2021)
- 4IR Award from Green New Deal Awards
- 2021 START-UP NEXTCON Award for Materials-Device-systems

2022

- Exhibited the Interbattery 2022
- Relocation of cooperation laboratory in Sihwa
- NDA with U.S's Company E for development cooperation of Silicon Anode materials

2023

- Exhibited the Interbattery 2023
- NDA with Canada cell maker co.
- Selected as a Global Leading Company 1,000+
- Visit and NDA with CEO of India cell maker co.
- Signed a sales agreement with US Sales & Marketing co. for the Indian market

Technology

Nano Materials

GO Graphene Oxide	Sheet diameter	Sheet thickness
	~ 28㎛	0.8 ~ 1.2㎛

RGO Reduced Graphene Oxide	Sheet diameter	Sheet thickness
	~ 28㎛	0.8 ~ 1.2㎛

Si-based Anode Materials

Product	GP10E	GP13	GP13H	GP15	GP18
Capacity (mAh/g)	< 1,000	1,300	1,300	1,500	1,800
Particle size (㎛)	9.5	6.0	9.5	9.5	9.5

Patent

Si/C Composite

Silicon-based anode active materials

Si active anode materials for 2nd battery

- 5 ~ 20% to graphite-based anode materials
- Complements the low output of graphite by adding Silicon
- Faster battery charging time and higher energy density compared to graphite

GP Products

GP Products 4 ~ 5 times higter capacity than graphite (372 mAh/g)

Material	
• Low-cost process	• Low temp. & Eco-friendly
• Particle size (D_{50}, ㎛)	• 9.5 ± 1.0㎛
• Tap density	• 1.0 ± 0.15g/cc
• Surface area	• < 10.0 m^2/g

GP13H	
• Capacity	• 1,300 ± 50 mAh/g
• High initial efficiency (Half Cell)	• 88 ~ 90%
• Long-term cycle	• 92.3% @100Cycles

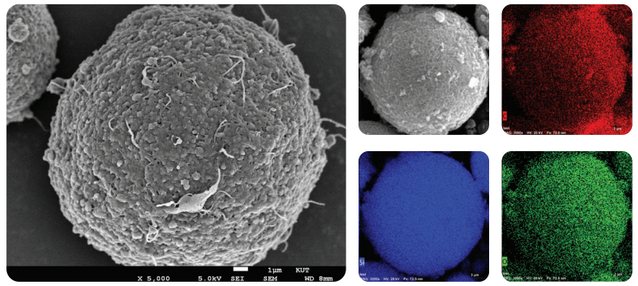
GP15	
• Capacity	• 1,500 ±50 mAh/g
• High initial efficiency (Half Cell)	• 87~89%
• Long-term cycle	• 90.2% @100Cycles

GP18	
• Capacity	• 1,800 ± 50 mAh/g
• High initial efficiency (Half Cell)	• 84~86%

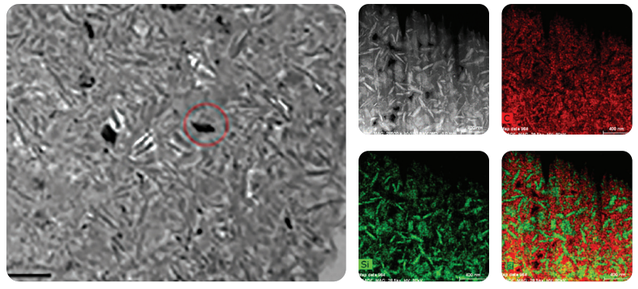
Product

Morphology & Structure

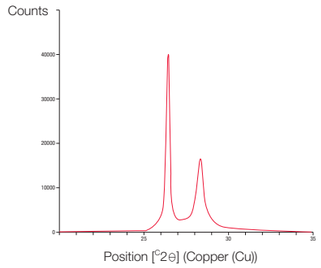
SEM



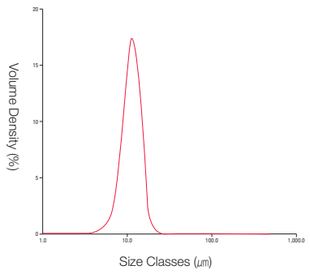
TEM



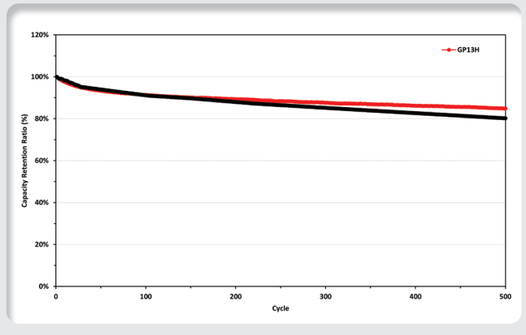
XRD **Silicon crystal size** : 17 ± 1.0nm



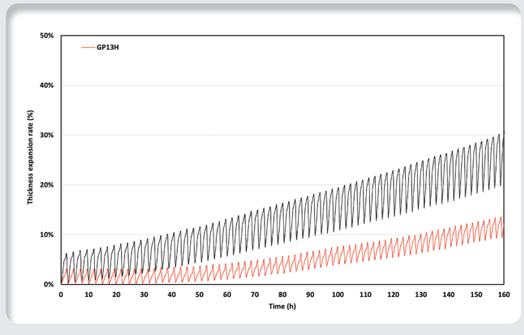
PSD D_{50} : 9.5㎛



Full cell Evaluation



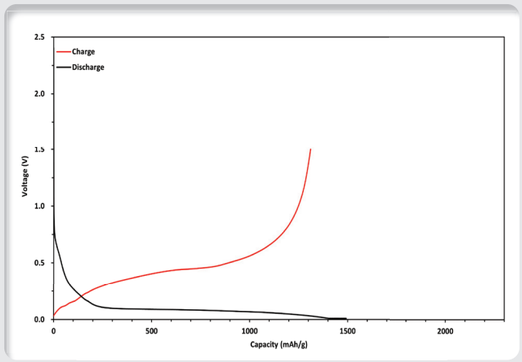
Full cell Evaluation
Graphite Blending : Capacity retention ratio 84.9% @500cycles



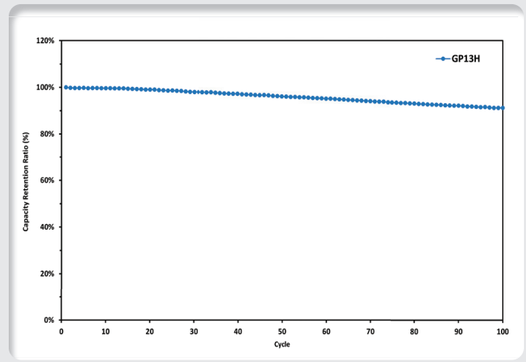
Full cell Evaluation
Small change in thickness during single cell cycles

Half cell Evaluation

GP13H

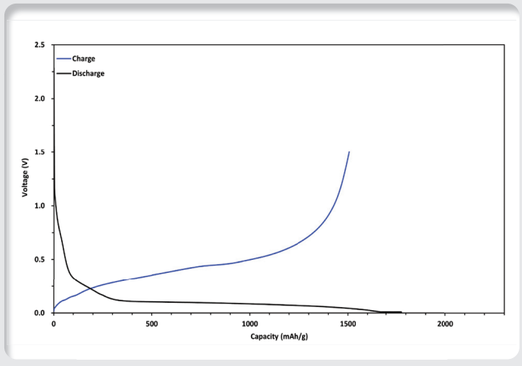


Half cell Evaluation
Only Anode material
: Measured capacity 1300mAh/g



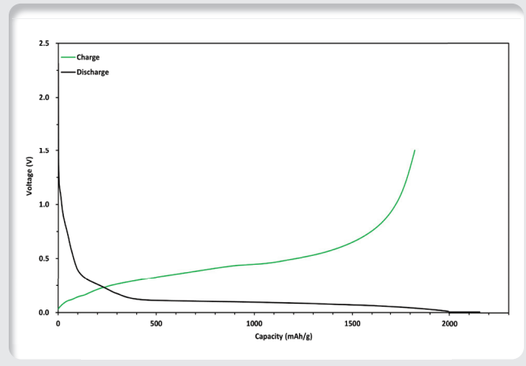
Half cell Evaluation
Graphite Blending
: Capacity retention ratio 92.3% @100cycles

GP15



Half cell Evaluation
Only Anode material
: Measured capacity 1500mAh/g

GP18



Half cell Evaluation
Only Anode material
: Measured capacity 1800mAh/g