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SiNTL™ Nanotechnology

Low Temperature Synthesis of Silicon Nanoparticles for Next Generation Li-ion Battery Anodes

Leveraging Carbon Capture by 14D's SyPHyR technology

Based on technology developed at the George Washington University

ASX:14D

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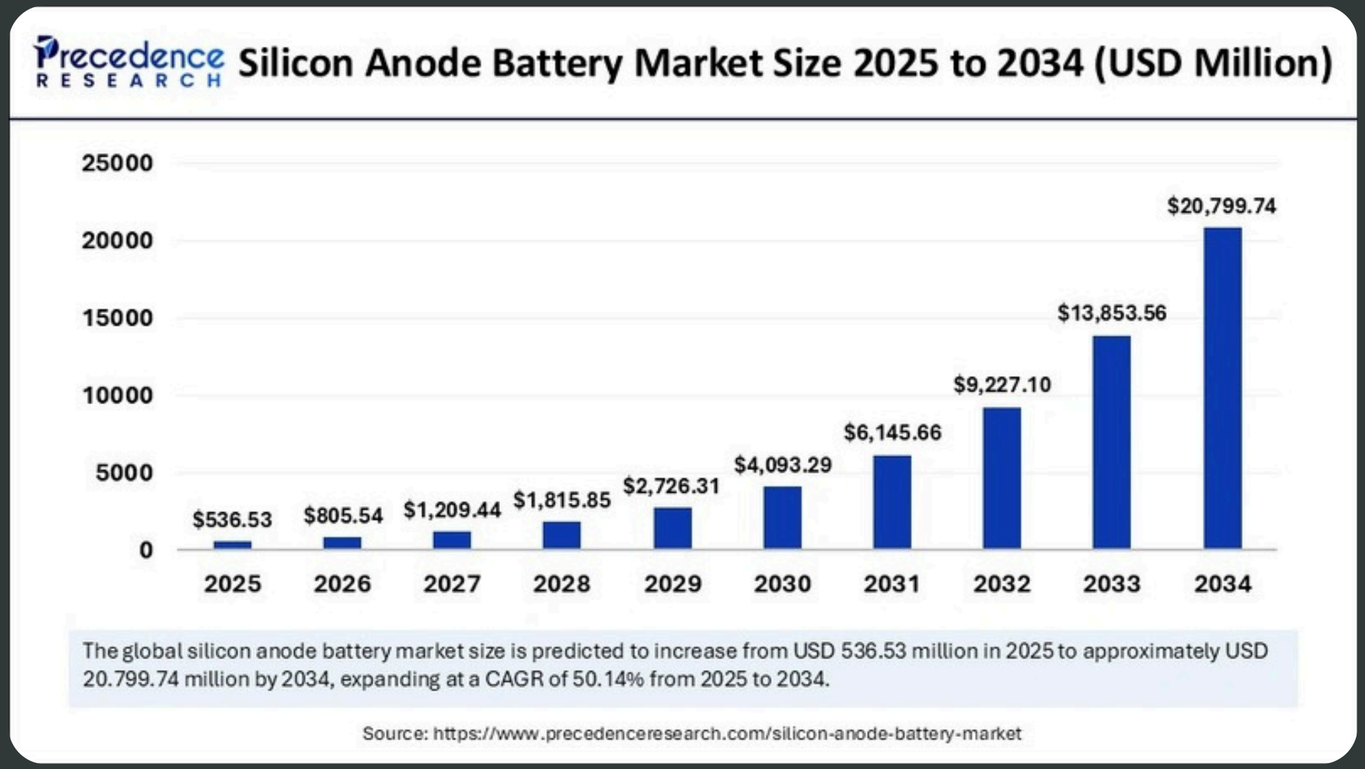
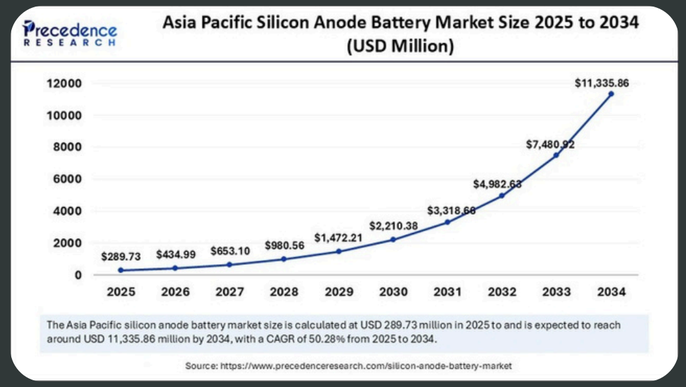
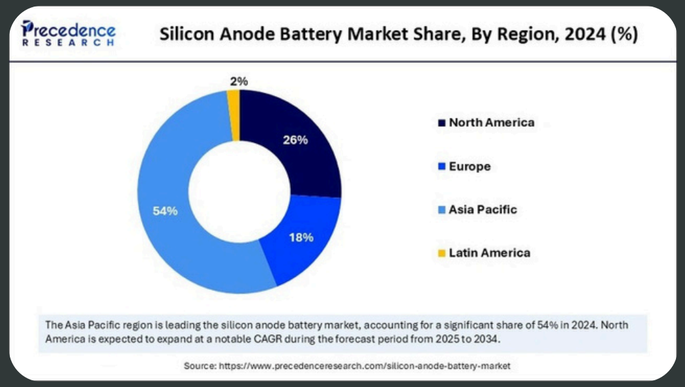
Silicon Anode Battery Market

KEY TAKEAWAYS

- Market revenue valued at USD 536.53 million in 2025, projected to reach **USD 20.8 billion by 2034**
- Strong growth outlook with a **CAGR of 50.14 %** 2025 to 2034
- **Asia Pacific** held **54% revenue share** in 2024; **North America** forecast fastest growth
- By capacity
  - **<1,500 mAh** held the largest market share at 47% in 2024
  - **1,500 to 2,500 mAh** is forecast to record the highest growth
- By application
  - **Automotive:** largest segment **38% share in 2024**
  - **Energy & Power:** strong growth outlook







Silicon vs. Graphite (Traditional Anode)

ADVANTAGES OF SILICON:

- **~10× higher theoretical capacity**
  - silicon can store ~10 x more lithium ions
  - (graphite: ~372 mAh/g; silicon: ~3,600–4,200 mAh/g)
- **Greater energy density** → longer range / smaller batteries
- **20–40% higher capacity** achievable in real-world applications
- **Faster charging potential** → sub-15-minute EV charging enabled by silicon anodes

KEY CHALLENGE:

- Volume expansion (~300–400%) during lithiation → causes cracking, capacity fade and shorter cycle life

OPPORTUNITIES:

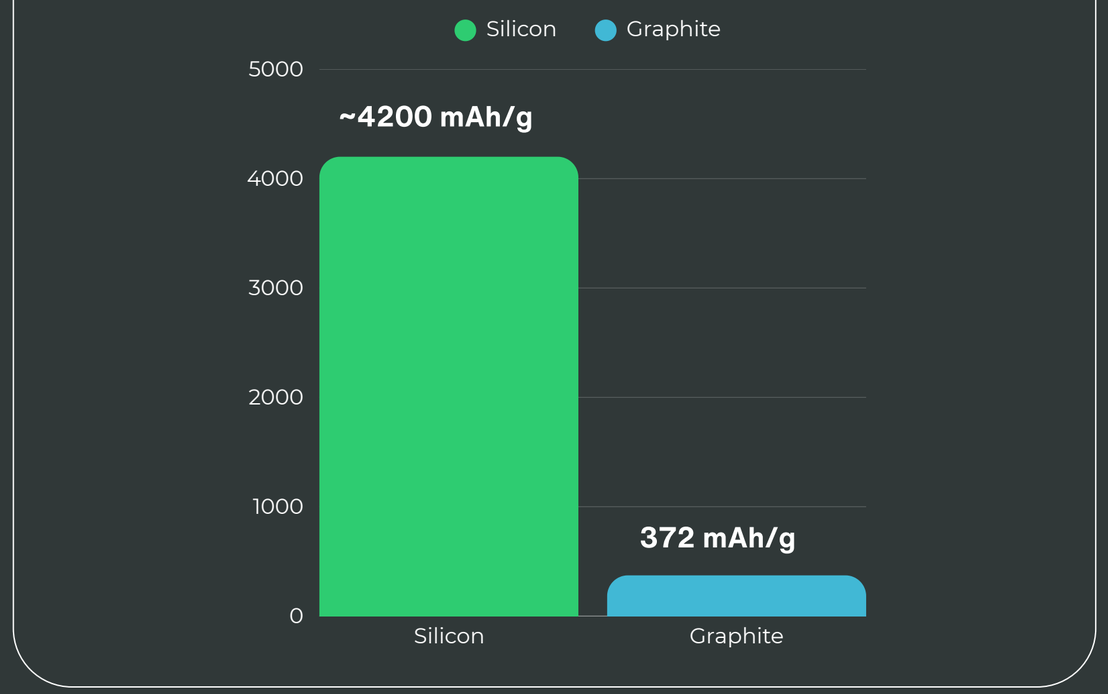
- Nanostructures, composites and protective coatings
- Artificial SEI layers and prelithiation techniques
- Self-healing binders and metal nanocrystals
- **Coated nanoparticles - SiNTL**

Higher Energy Density

Faster Charging

Longer Cycle Life

Lighter and Smaller Batteries



A Potential Breakthrough for Li-ion Batteries

LOW COST, LOW TEMPERATURE.

14D has secured the exclusive global license to a breakthrough aluminum-coated silicon nanoparticle technology developed at the George Washington University, Washington DC.

The patented process enables scalable, low-temperature synthesis of air- and water-stable silicon nanoparticles and composites, tailored for next-generation lithium-ion battery anodes

A thin aluminum coating forms in-situ during synthesis, enhancing conductivity and oxidation resistance, while also simplifying storage, handling, and integration into existing battery manufacturing lines.

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Clean energy compatible:
Runs on solar-powered furnaces or resistive heating

No HF or SiH_4 used:
Safer for scale-up and regulatory approval

Recyclable salt system:
$MgCl_2$ and $AlCl_3$ fully recoverable

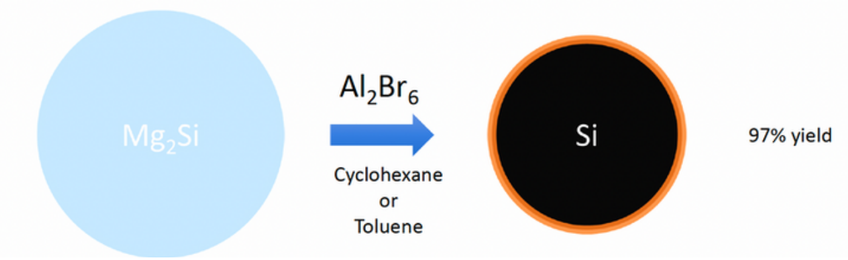
Low CapEx potential and Modular scale-up:
Each module could produce 25 – 100 tonnes/year

Strong ESG positioning:
Supports decarbonisation of battery supply chains

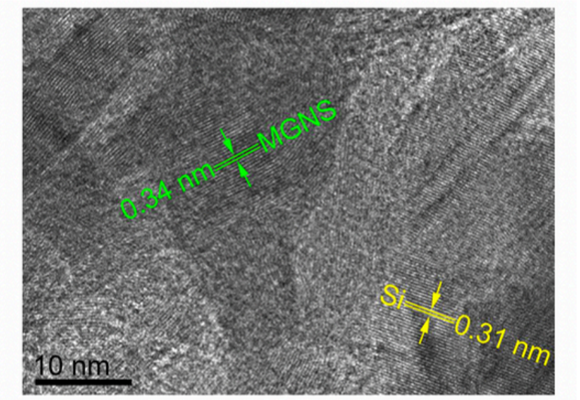
Clean-tech grants
(e.g. ARENA, Powering the Regions, U.S. DOE)

Key Features & Benefits

- **Low-temperature, one-pot synthesis** **~125–180°C**
- Produces **aluminium-coated silicon nanoparticles and composites** directly during synthesis — high yield, simple, and scalable
- High yield: **~97% conversion** of Mg_2Si to crystalline silicon nanoparticles
- **Air and water stable nanoparticles**: no glovebox or special storage required
- Composite-ready: enables direct formation of **silicon–carbon composites** without post-mixing — lower cost, greater uniformity, superior performance
- **Recyclable byproducts:** $MgBr_2$, $AlCl_3$ can be recovered or reused

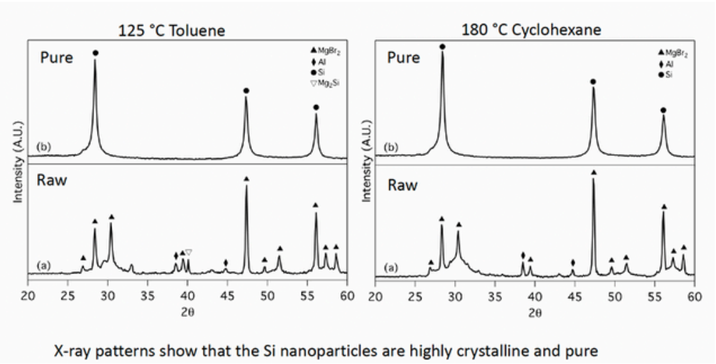


Air stable Silicon nanoparticle with Al coating



Silicon nanoparticles synthesised in the presence of carbon materials forms homogenous composites without further mixing

Al and $MgBr_2$ are removed with HCl



X-ray patterns show that the Si nanoparticles are highly crystalline and pure

14D history with silicon

1414 Degrees - silicon expertise since 2009

1414 Degrees is a clean energy company using proprietary silicon based technologies to deliver delivering scalable solutions for renewable heat and clean hydrogen to advanced battery materials

Prototype

Silicon thermal energy storage with Stirling heat engine

Storing electric energy
Regenerating 30KW electricity

TESS-IND

Electrically heated 6 MWh_{th} silicon thermal storage coupled to gas turbine

Storing electric energy
Regenerating 180KW electricity

GAS-TESS

Biogas powered 6 MWh_{th} storage coupled to gas turbine installed at SA Water's Glenelg WWTP

Burning and storing biogas energy, regenerating 180KW electricity on National Electricity Market (NEM)

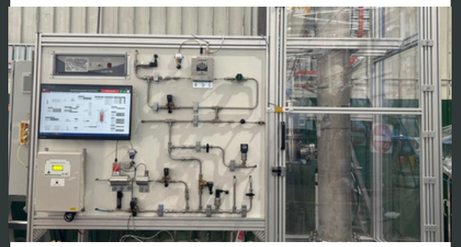
SiBox®

Latent heat battery outputting up to 1000°C stable hot air or steam

Electric energy to high temperature heat for industry up to GWh scale

SiPHyR®

Storage integrated methane pyrolysis hydrogen reactor



Converts natural gas into low-emission hydrogen and solid carbon

SiNTL Development and Commercialisation Timeline

Continuous sample fabrication and testing targeting **>500 mAh/g**, advancing toward **600 mAh/g** within 12 months

OCT'25

Execute exclusive global license agreement with GW

OCT'25 →

Ongoing fabrication and testing of SiNTL samples for performance and durability

OCT'25 - MAR'26

Commercial engagement with anode OEMs

JAN'26 - MAR'26

Provide SINTL samples to OEMs for testing in production lines

JUN'26 - DEC'26

Execute agreements with OEMs for supply and set up manufacturing facility

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