Altech Chemicals Limited ASX: ATC FRA:A3Y

Silumina Anode Project

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Managing Director

Altech Batteries Limited

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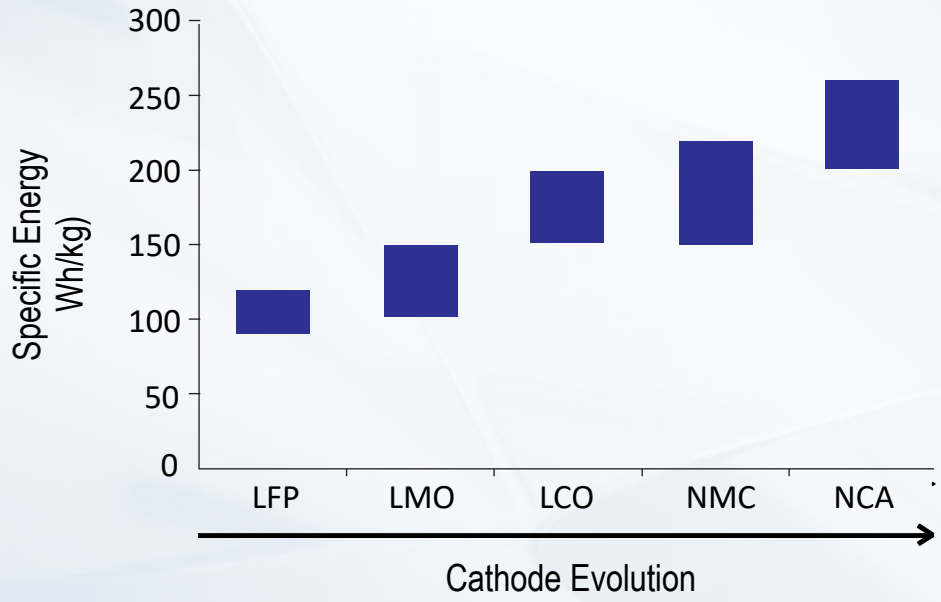
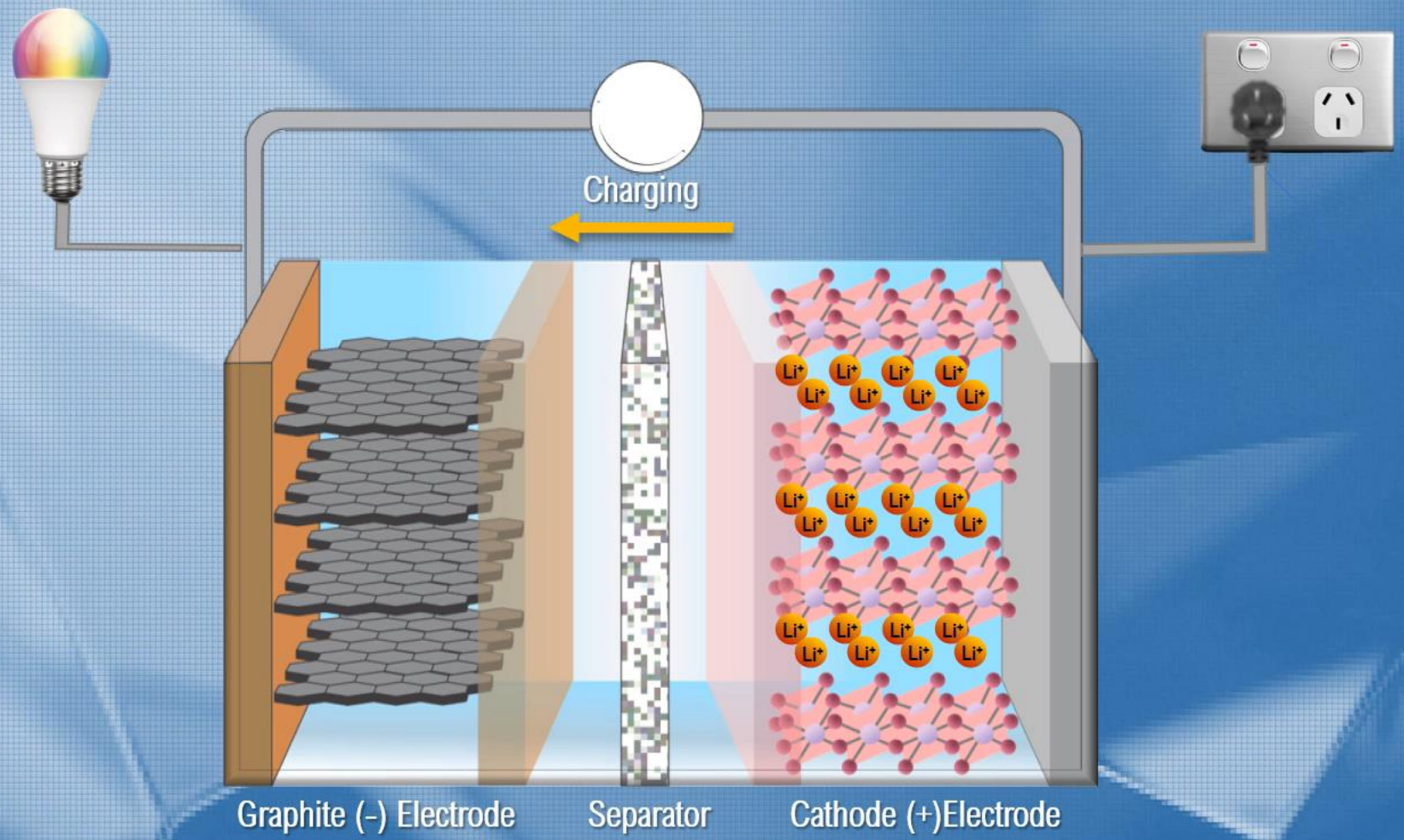
Tesla Vision

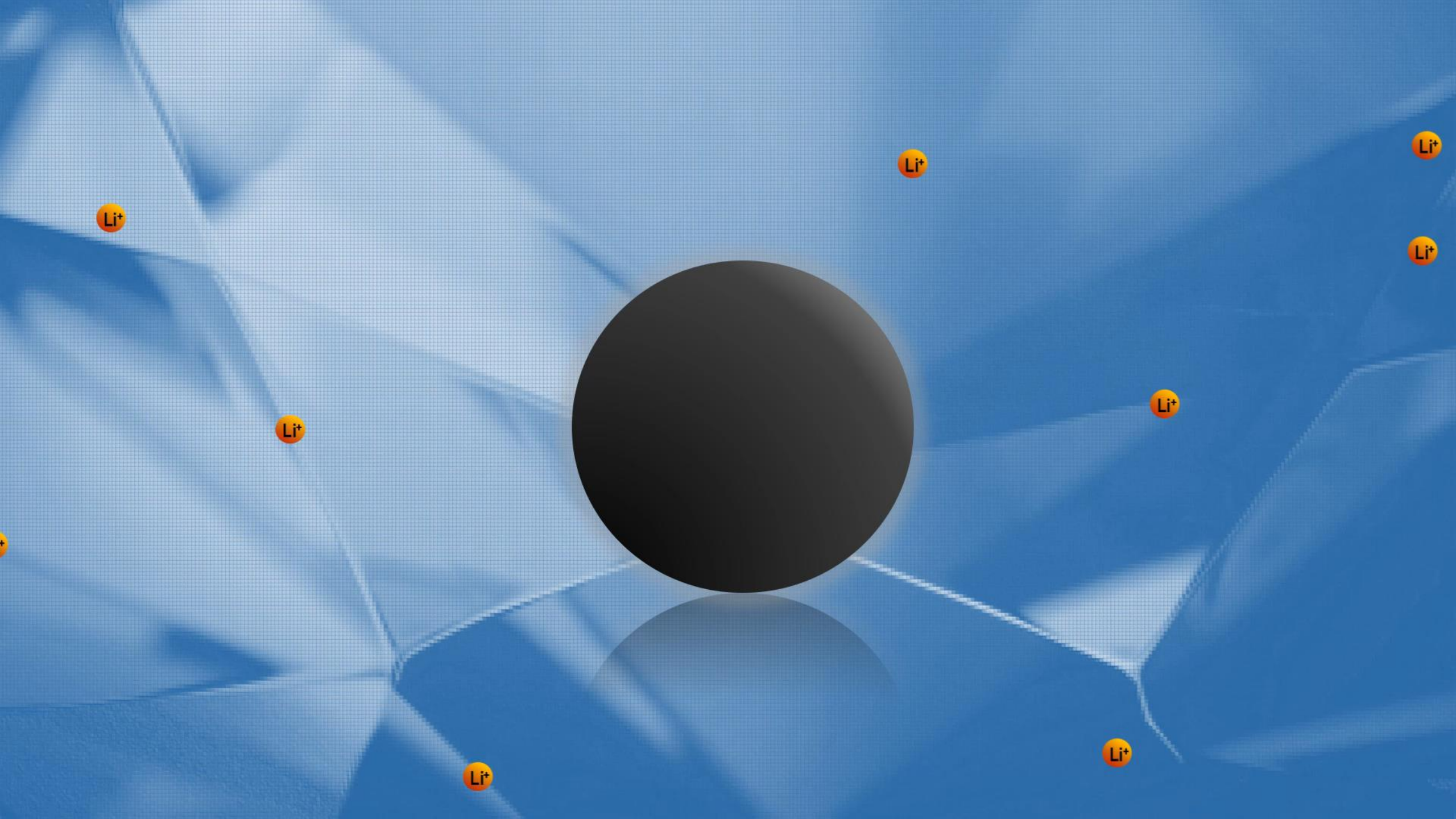
- Halve the cost per KWh of battery production
- Below the $US100/KWh threshold
- “4680” Tesla cell (5x energy, 6x power)
- 3TWh per year at its own factories by 2030
- Equal 20 giga factories
- Increased use of Silicon in anodes

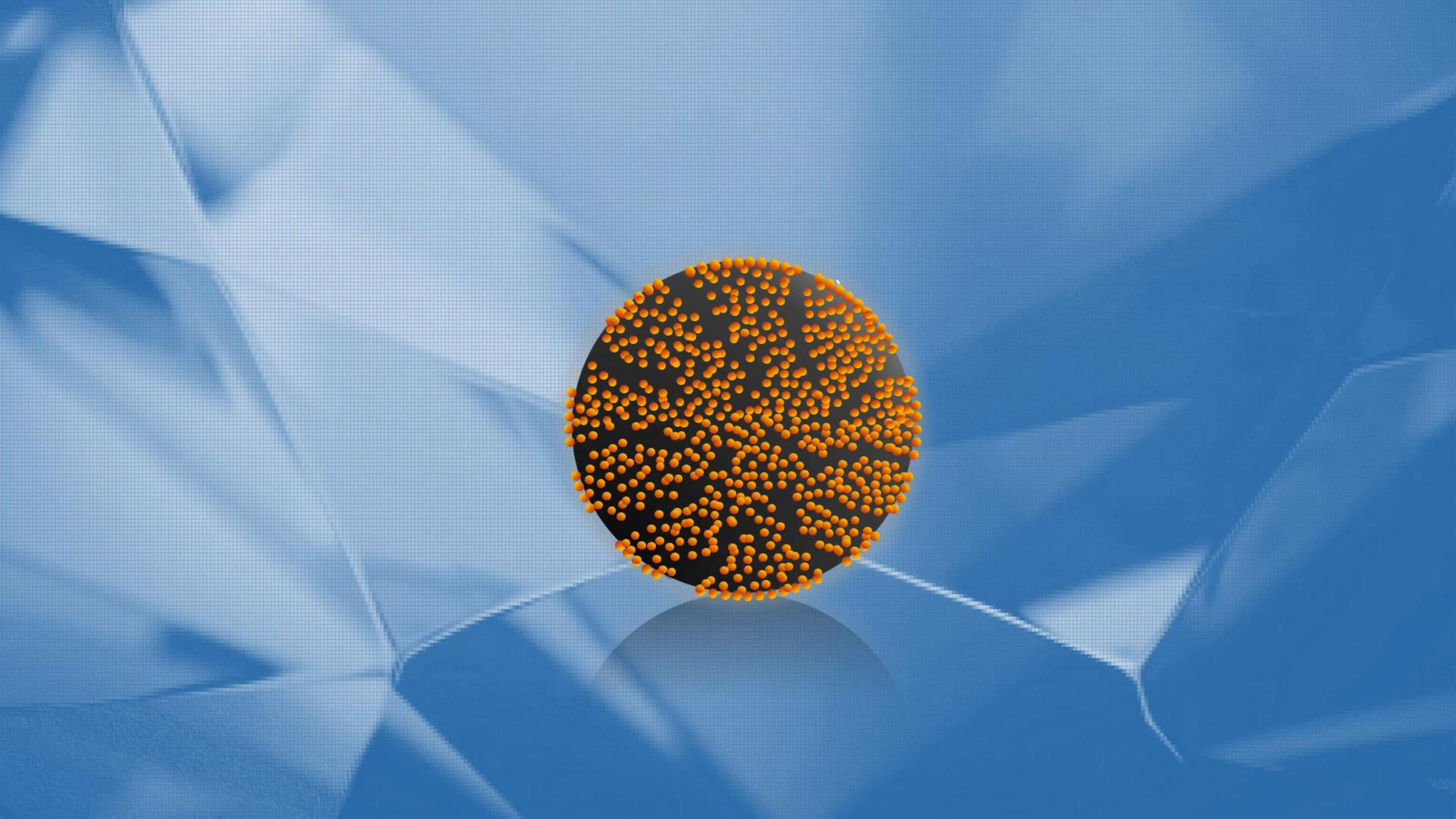
Capacity development in cathodes

- Predominant development of cathodes
- Increasing Ni, Co content
- Higher energy density




Charging
Li+
Graphite (-) Electrode
Separator
Cathode (+)Electrode


Li+
Li+
Li+
Li+
Li+
Li+
Li+



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First cycle loss capacity

- 8-10% of Li forms SEI coating on anode particles
- Becomes inactive on first charge
- Reduces battery life
- Industry has been trying to solve this problem
- Many research literature shows alumina coating works
- But currently expensive and not commercial

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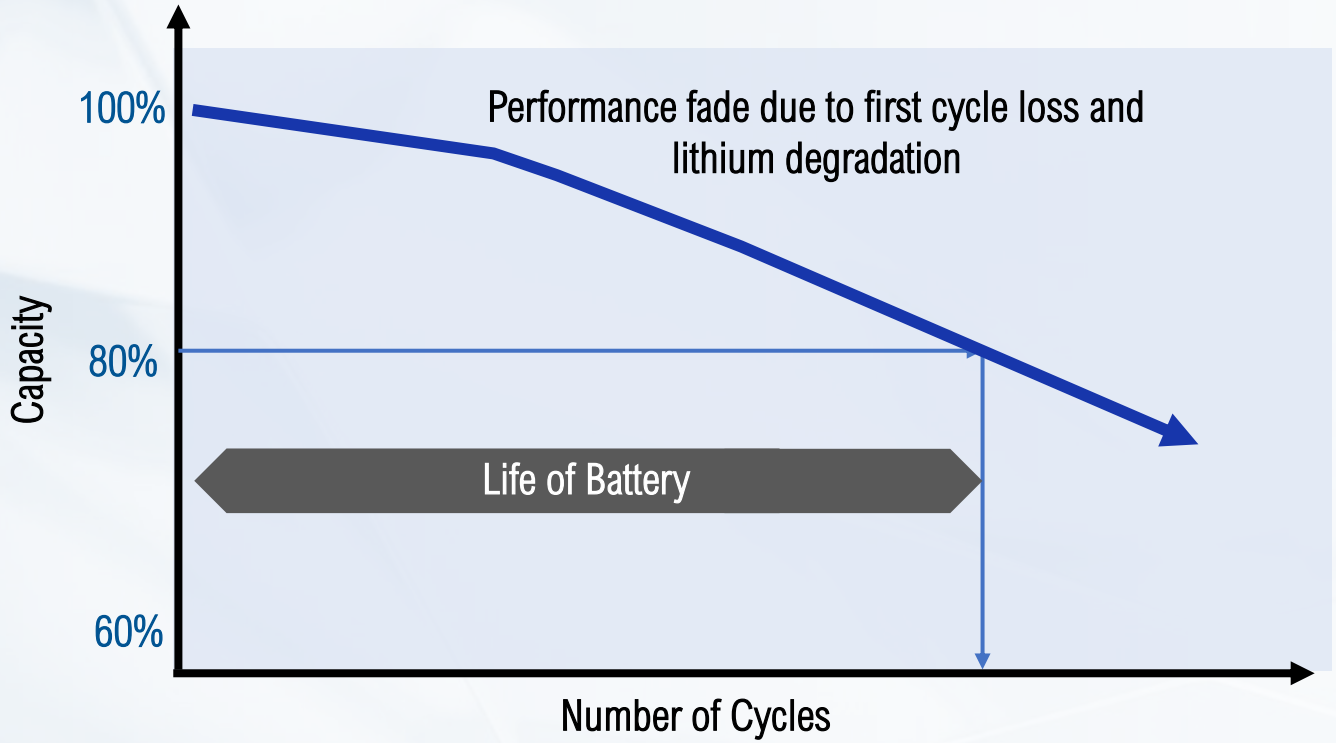

First cycle loss capacity - reduced battery life

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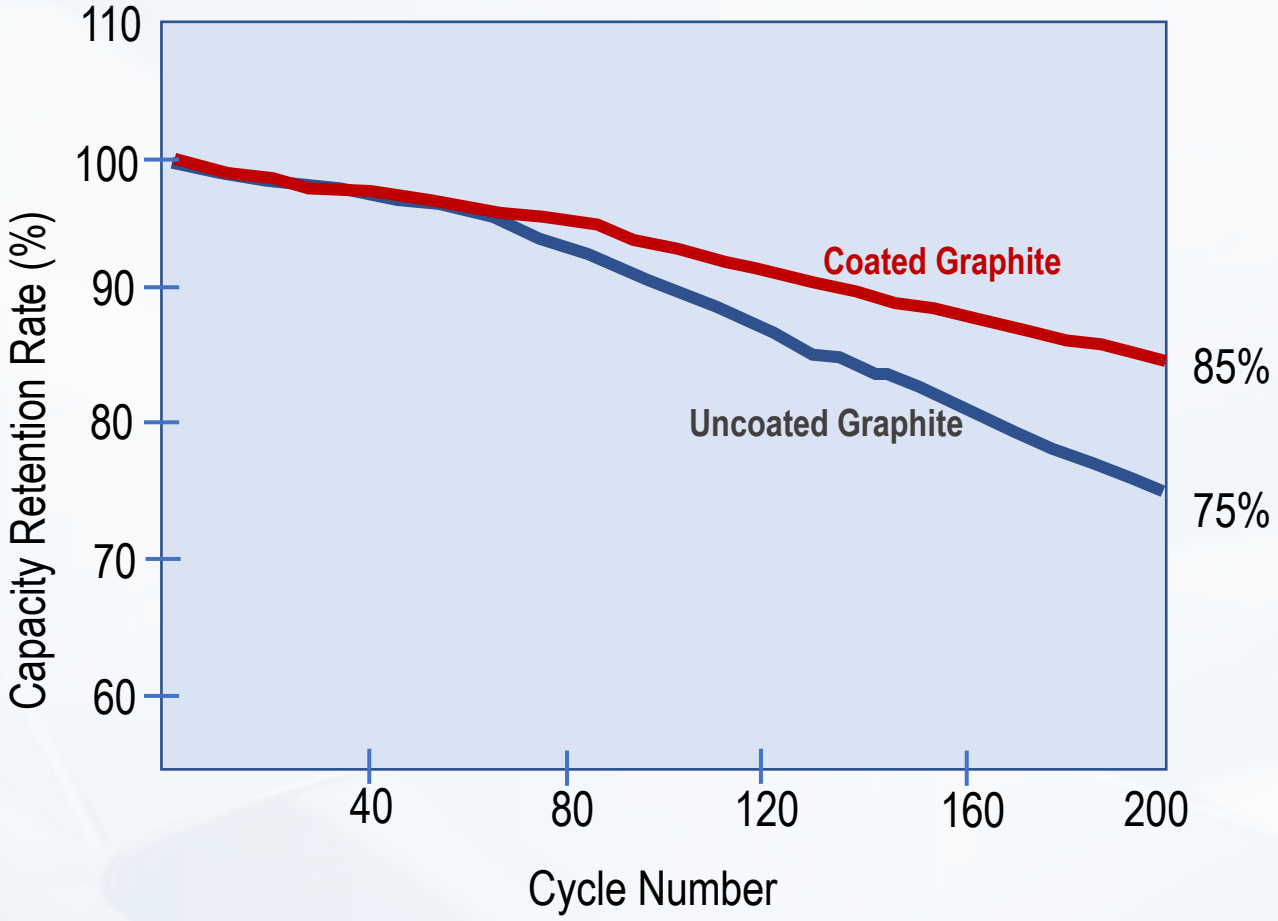
Why HPA Coating ?

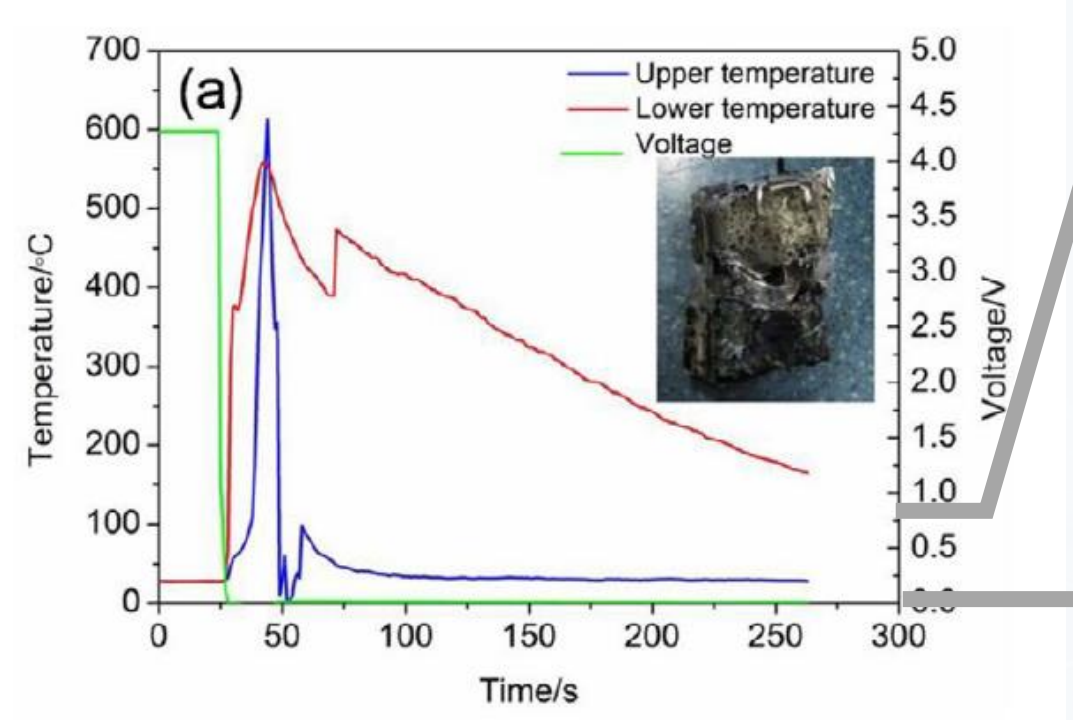
- Reduces first cycle loss (Tau et al., 2019)
- Improves cycling stability
- Improves high-rate performance (Feng et al., 2016)
- Improves fast charging capability (Kim et al., 2016)
- Prevents thermal runaway under mechanical abuse (Xu et al. 2019)

Literature - Alumina coated graphite performance [1]

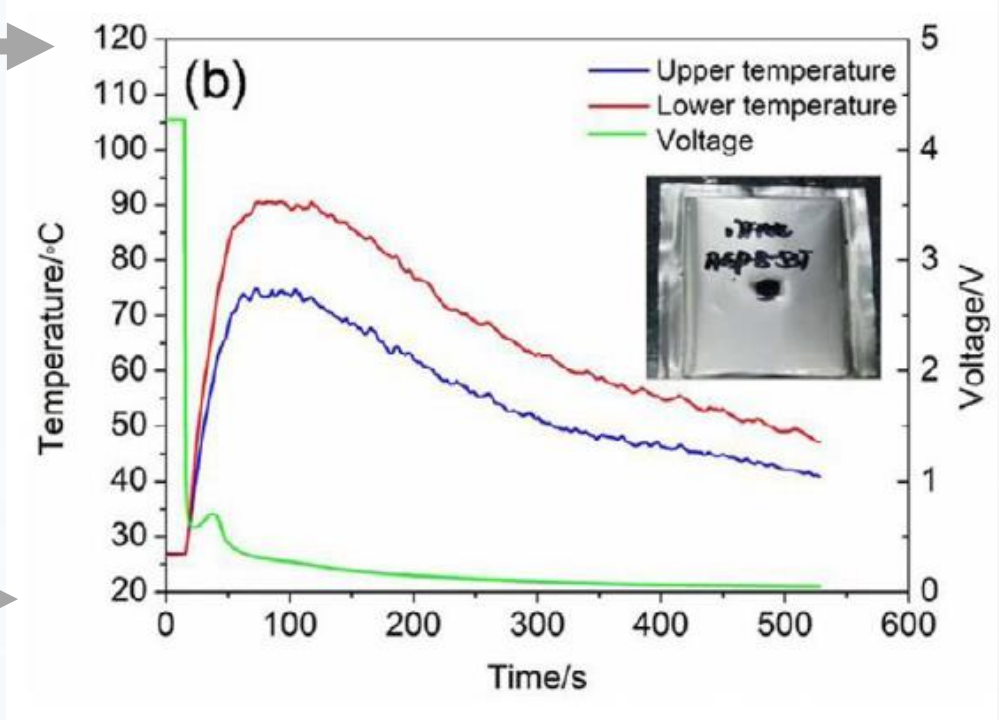


1. Synthesis of Alumina-Coated Natural Graphite for Highly Cycling Stability and Safety of Li-Ion Batteries
Tao Xu, Chengkun Zhou, Haihui Zhou,* ZekunWang, Jianguo Ren

Nail Test – Coated graphite prevents runaway [1]



Non Coated graphite 600 Deg C



Coated graphite 100 Deg C

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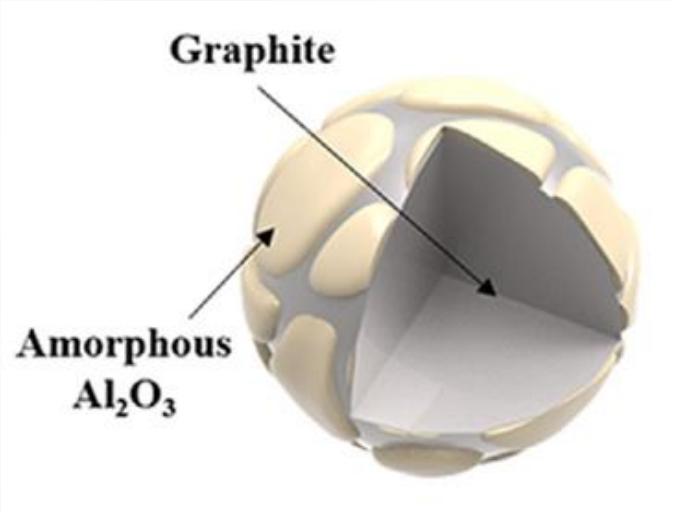
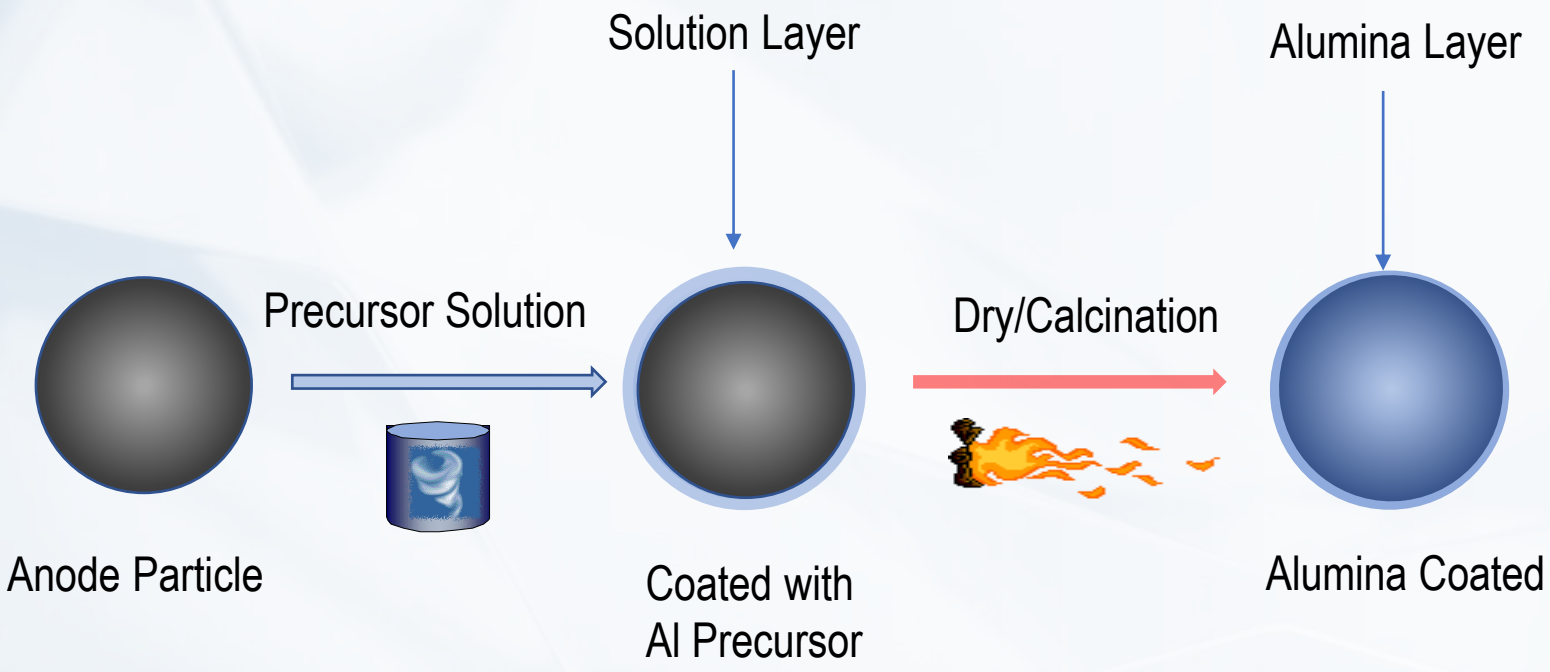
Coating Methods

1. Vapour Method
    - Atomic Layer Deposition – costly, complex, not mass production
2. Solids Method
    - Non continuous layer
3. Liquid Method
    - Most promising
    - Easy to comercialise



Altech Coating Method




C


Al_2O_3

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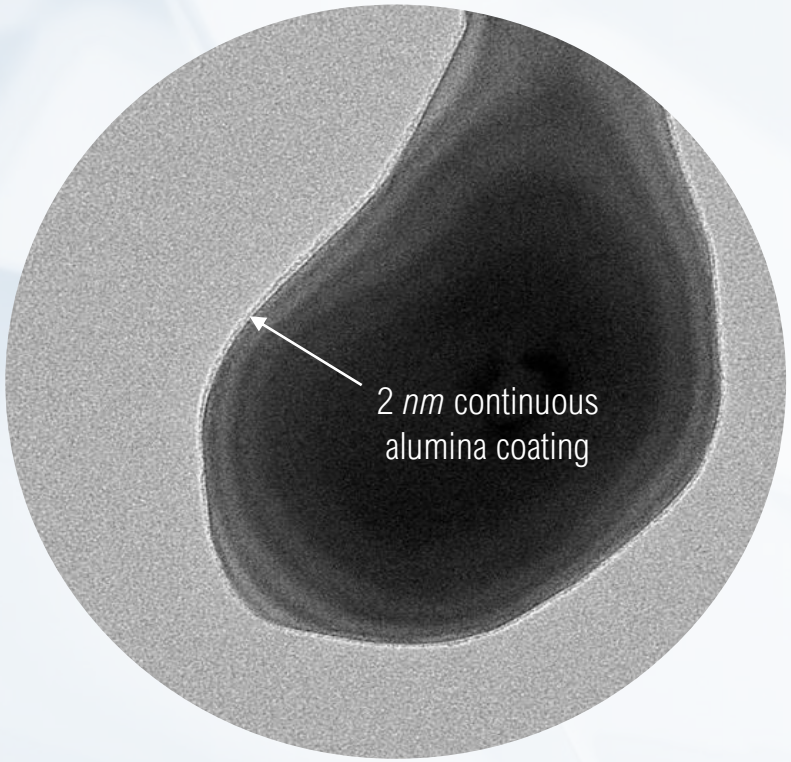
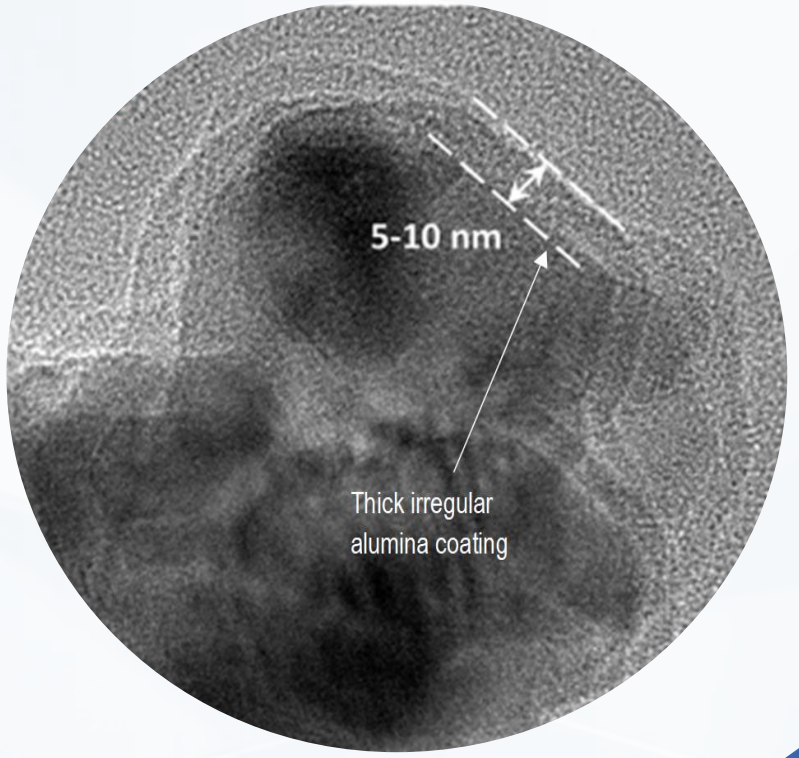
Under the Electron Microscope



Altech alumina coating technology



Current attempts at alumina coating

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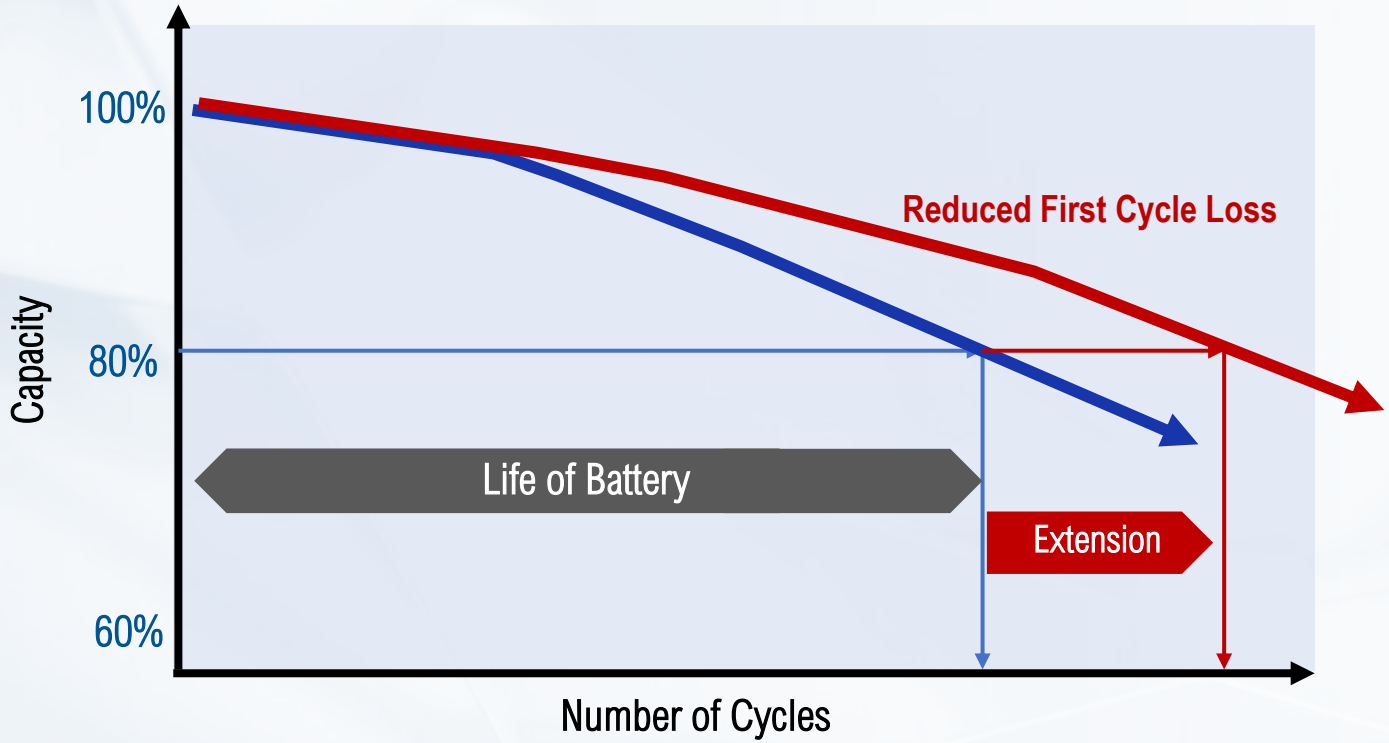

Potential increased battery life

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Our Coating Advantages

- Cheaper process
- Easier and simple to commercialize
- High purity alumina coating – less contamination
- Coating layer uniform
- Lower processing temperature
- Adjust layer thickness – diff applications

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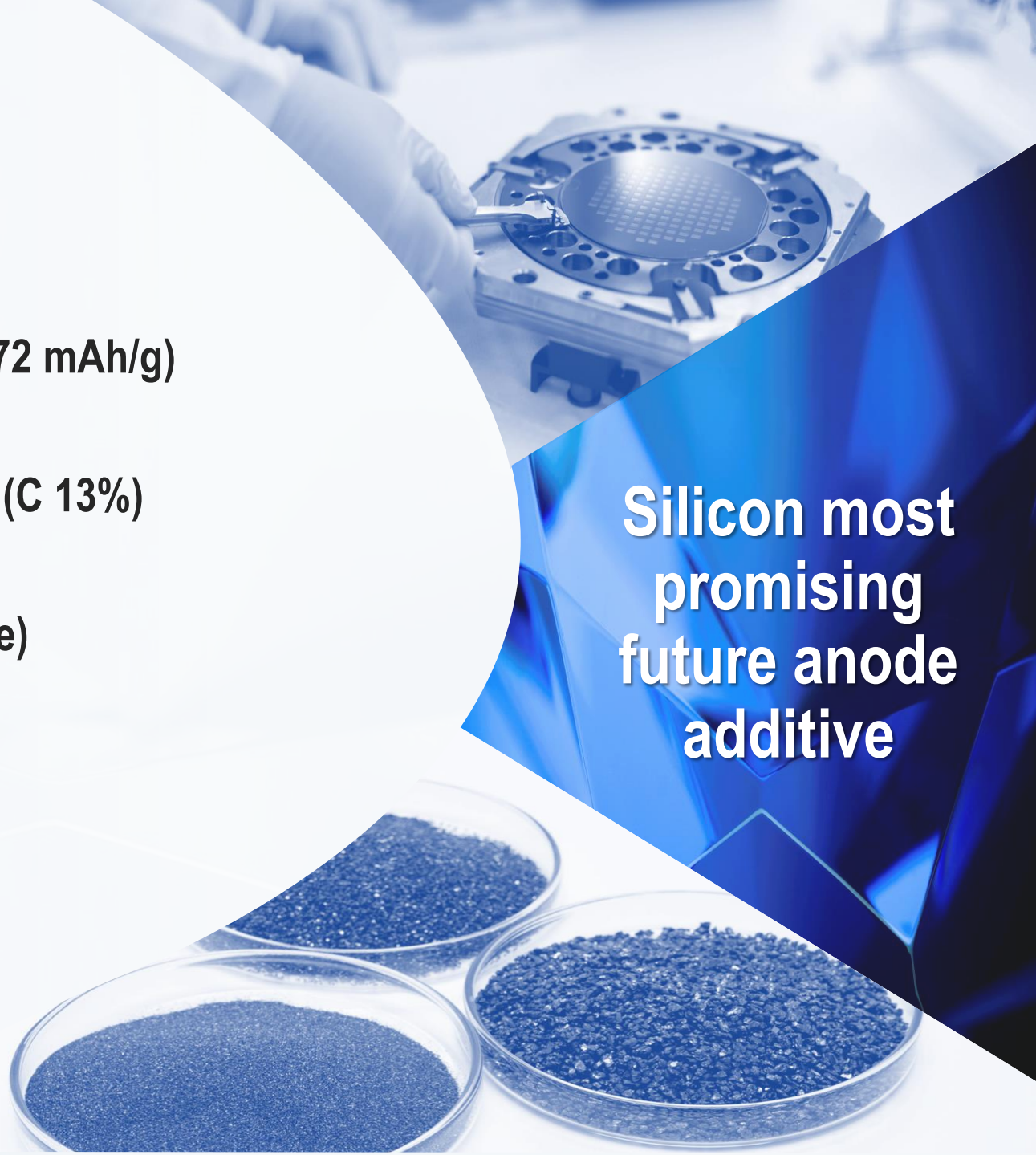
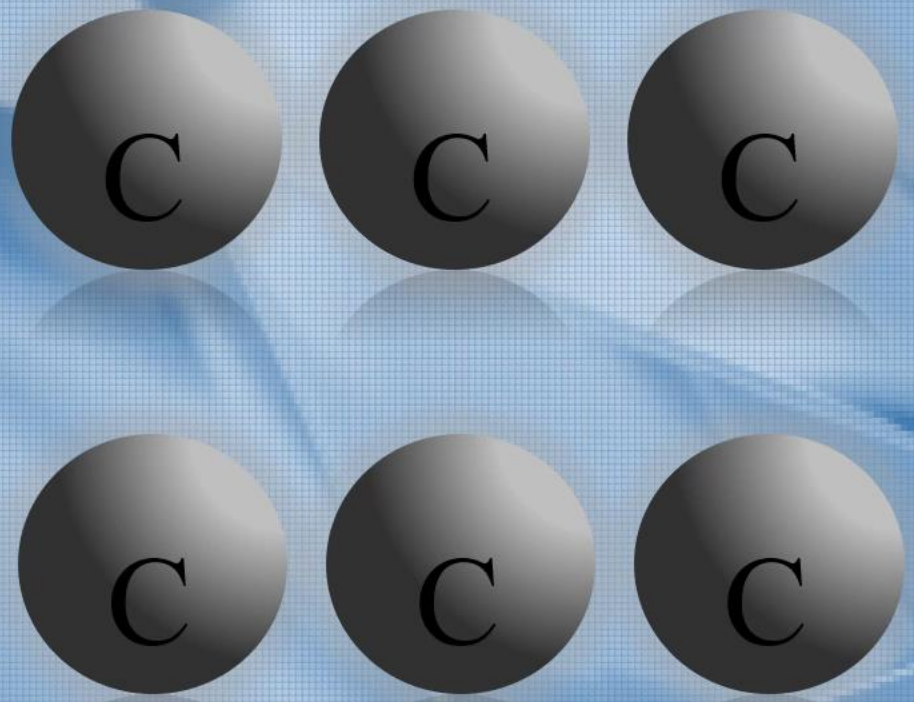
- Ten times capacity Si (3,579 mAh/g) C (372 mAh/g)
- Promising anode material
- But volume expansion 300% on lithiation (C 13%)
- But 40-50% first cycle loss
- But higher fade during life (short cycle life)



Silicon most promising future anode additive


C C C
C C C


Si

Silicon

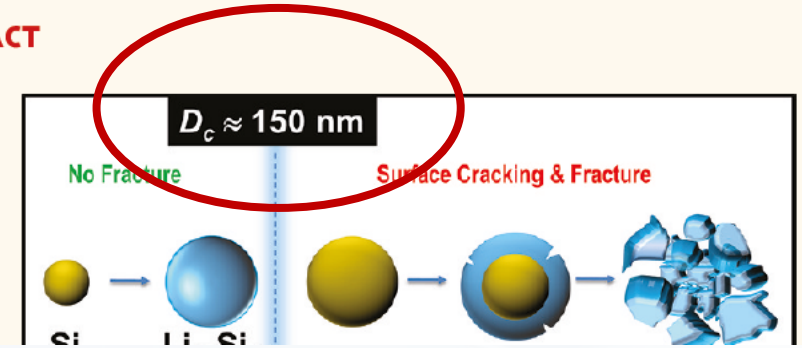
Size-Dependent Fracture of Silicon Nanoparticles During Lithiation

Xiao Hua Liu,[†] Li Zhong,[‡] Shan Huang,[§] Scott X. Mao,[‡] Ting Zhu,[§,*] and Jian Yu Huang[†,*]

[†]Center for Integrated Nanotechnologies (CINT), Sandia National Laboratories, Albuquerque, New Mexico 87185, United States, [‡]Department of Mechanical Engineering and Materials Science, University of Pittsburgh, Pittsburgh, Pennsylvania 15261, United States, and [§]Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332, United States

Lithium ion batteries (LIBs) are widely used as power devices for portable electronics. For more demanding applications such as powering electric vehicles, LIBs with radically improved energy density and power capability are highly desirable.[1−4] Silicon represents one of the most promising anode materials for the

ABSTRACT



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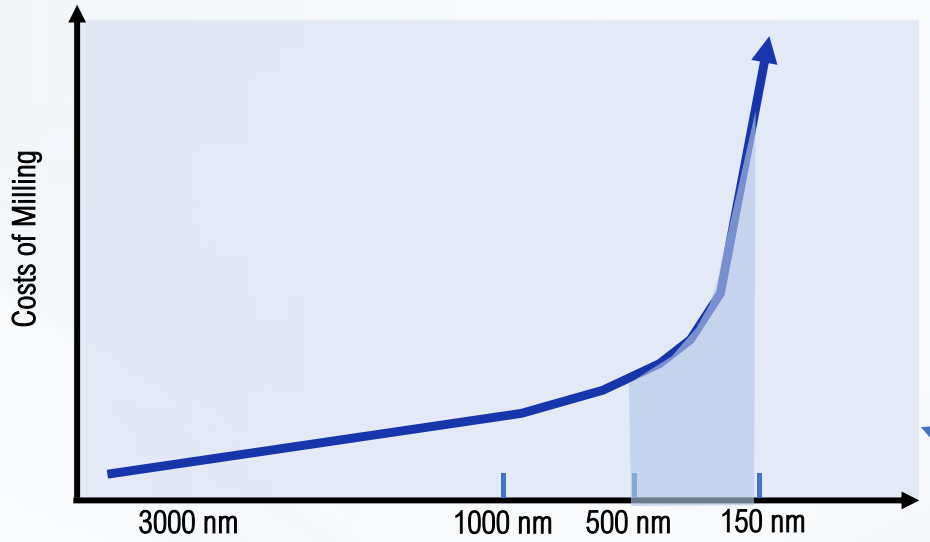
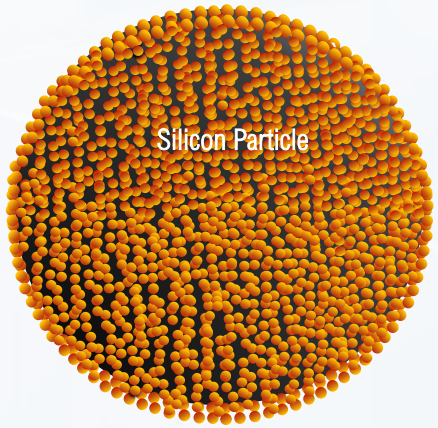
Milling costly to get to 150 *nm*



150 *nm*

Not the long term solution

Larger surface areas in small particles – Larger first cycle loss



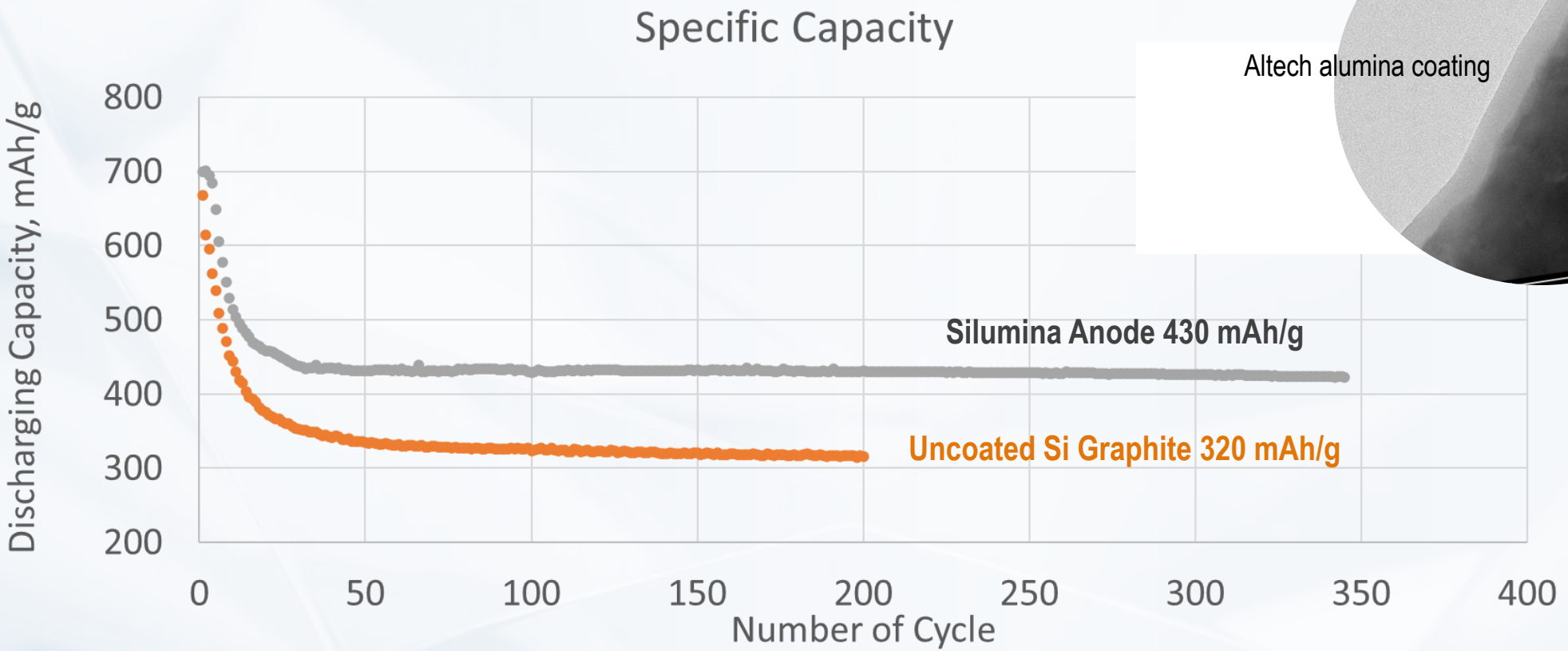
Altech's R&D Facility – Perth, Western Australia

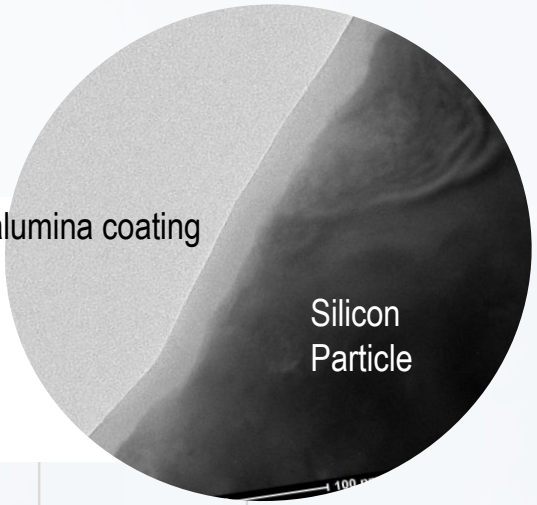

Si

BREAKTHROUGH 30% HIGHER ENERGY DENSITY IN LITHIUM-ION BATTERIES

Today, an Australian company has achieved the game changing breakthrough and produced a lithium-ion battery with 30% more anode energy capacity than a conventional lithium-ion battery. The Company was able to successfully incorporate alumina coated silicon into the graphite anode of lithium-ion batteries and achieve higher energy capacity as well as good stability and cycling performance.

Silicon Graphite Anode Performance





Impact of Silicon in anodes on Tesla Model 3

0% Silicon	423km		
10% Silicon	423km		- 16kgs 
20% Silicon	423km		- 23kgs 
30% Silicon	423km		- 27kgs 

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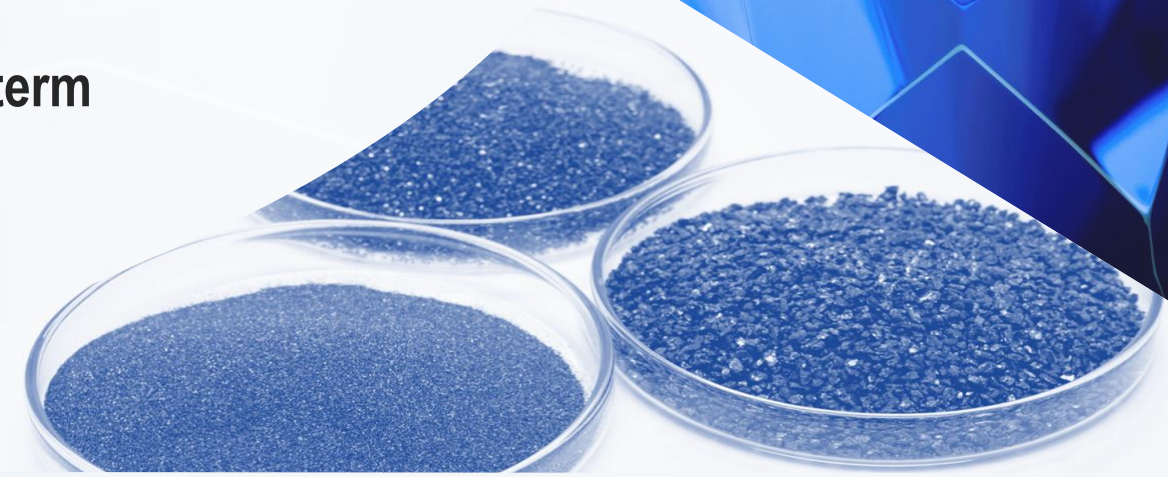
Collaboration Agreements with European Partners

- Collaboration agreement with SGL Carbon
- Europe leading synthetic graphite producer

SGL GROUP THE CARBON COMPANY

Ferroglobe

- Collaboration agreement with Ferroglobe
- Leading Li-ion battery Si supplier
- Alumina coating of silicon seen as long-term solution



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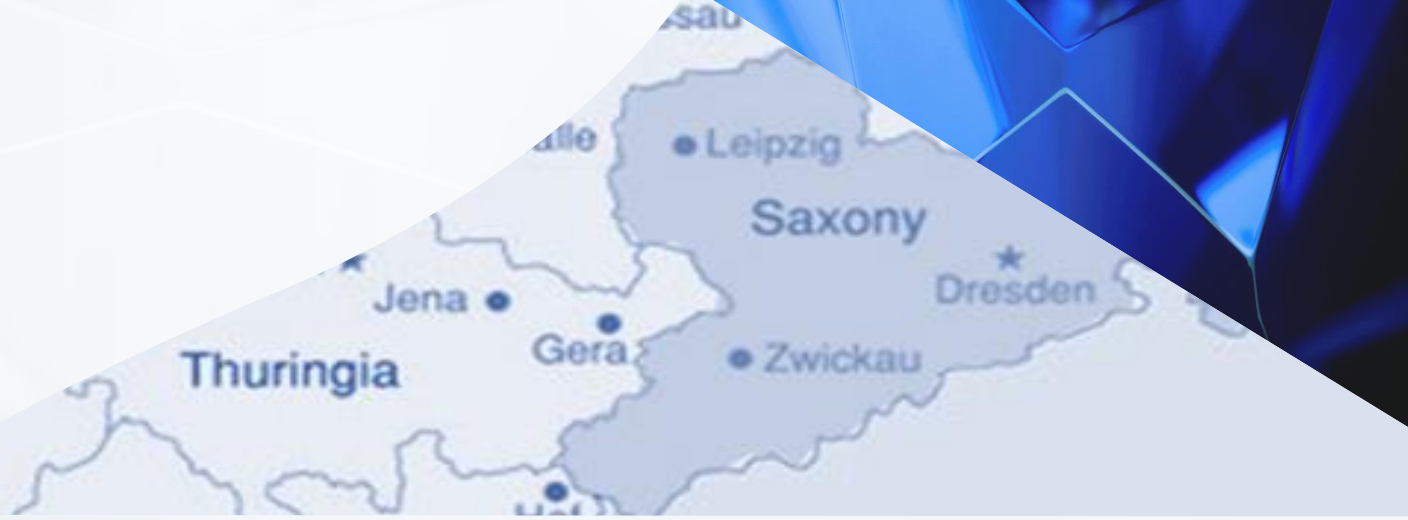
Silumina Anode Project 15 GW

- 10,0000 tpa Silumina Anode Plant
- Or 15 GW capacity
- Schwarze Pumpe, Saxony State, Germany
- Accredited as a Green Project (CICERO)
- Pre-feasibility battery materials completed




Germany
Dresden
Saxony
Poland

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Economics Preliminary Feasibility Study (PFS)

- Low capital cost of US$95 million
- Pre-tax NPV_8 US$507 million
- Attractive Internal Rate of Return of 40%
- EBITDA US$63 million p.a.
- Payback (full rate) 3.1 years
- Revenue per annum of US$185 million
- Proceeding with Definitive Feasibility Study

Notes:

- Pre-tax and pre-finance equity model
- (Refer to ASX Announcement "Outstanding preliminary feasibility study for Silumina Anode battery materials project" dated 20 April 2022. The Company confirms that as at the date of this announcement there are no material changes to the material assumptions adopted in the study, including the production target, that underpins the financial information derived from the study.)


Silumina Anodes
SILUMINA ANODE
PROJECT

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Europe's Push for Battery Industry

- Next chapter of Li-ion battery story is Europe
- Europe major battery industry
- Stringent 2020 EU CO2 emission (95g/km)
- Push to EVs by European car manufacturers
- Capacity of 600 GWh by 2024
- Less reliant on Asia

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European auto market all electric by

JAGUAR — By 2025 $3.5b pa

BENTLEY — By 2030

BMW — By 2030 $6.5b

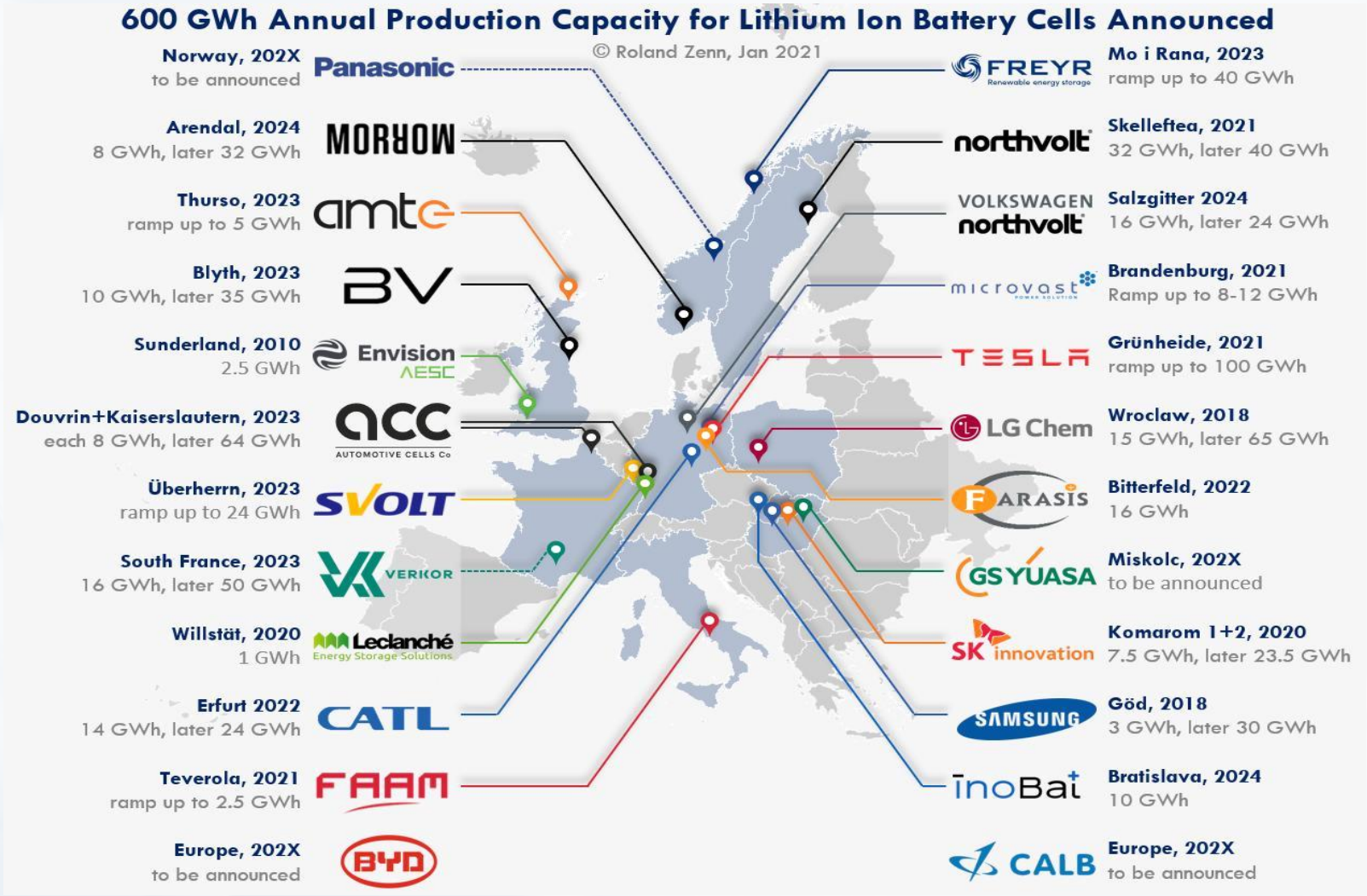
Audi — By 2033

VOLVO — By 2030 $1b pa

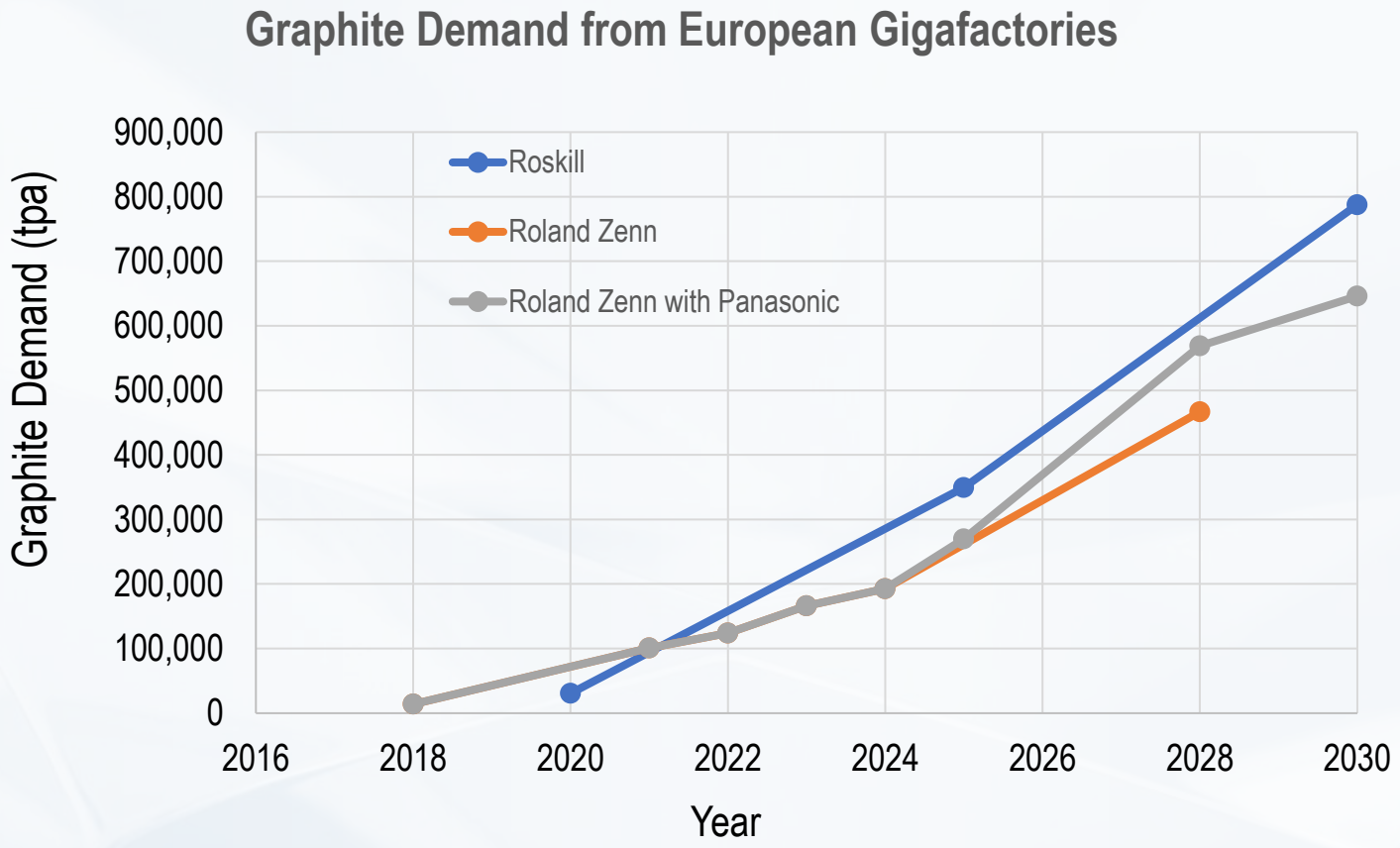
By 2026 $86b

Daimler Mercedes-Benz — By 2040 $47b

Li-Ion Battery Cell Capacity - Europe



Europe Graphite Demand of 600ktpa by 2030



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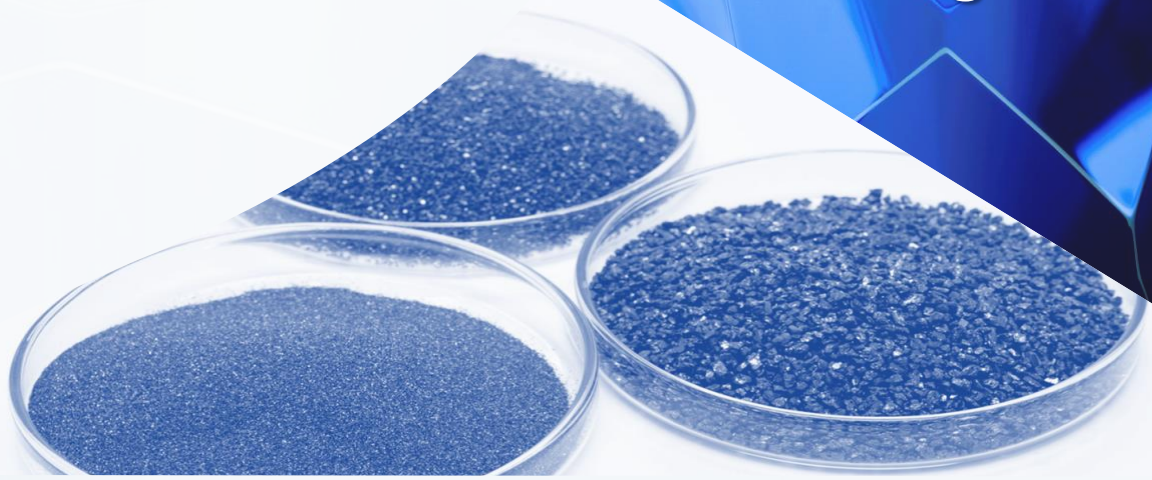
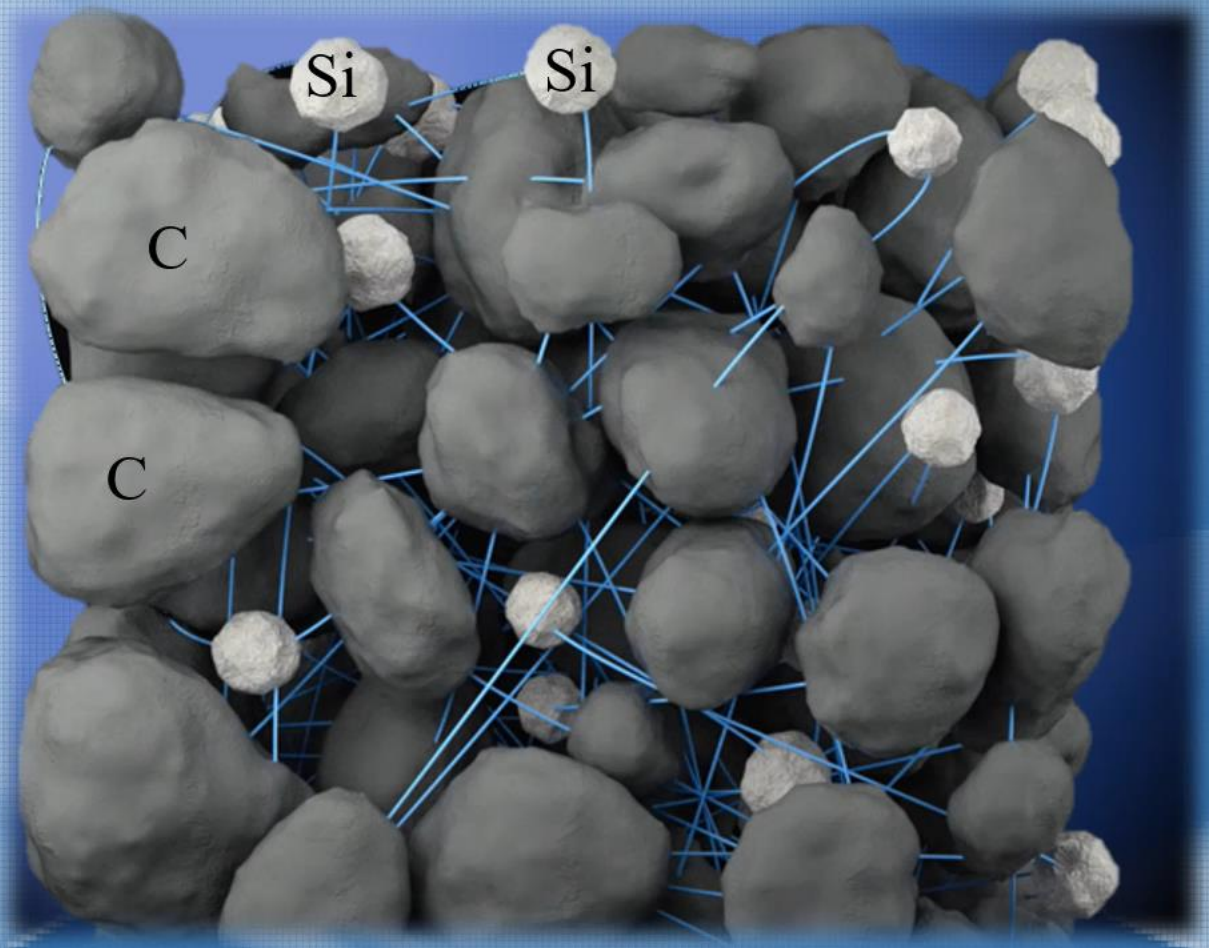
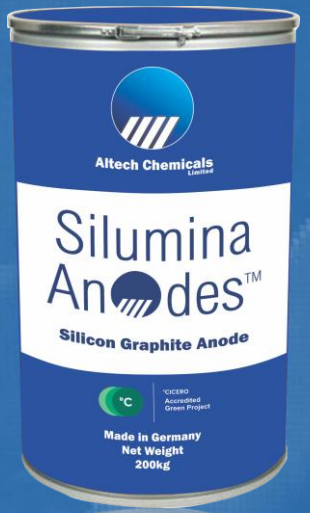
Silumina Anode Pilot Plant In Progress

- For commercial samples to interested customers
- 120 Kg day Pilot Plant been constructed
- At Dock3 Schwarze Pumpe Complex
- Front end in commissioning







Silumina Anodes™