

Maximising high silicon anode performance

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Product portfolio in silicon enabling technologies

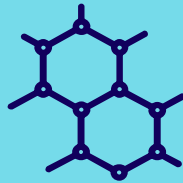
Established and growing business



Publicly listed company (ASX:ADO)

- Chemical and materials business, manufacturing and scaling binding/cross-linking reagents into Life Science (Diagnostics) and Batteries
- Headquartered in Brisbane, Australia

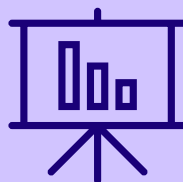
Proprietary technology



Portfolio of Lithium-ion battery (LIB) technologies

- **Anteo X** – Cross-linker for high % silicon anodes
- **Anteo S** – Cross-linker for ceramic coated separators
- **Ultranode** – Ultra-high silicon content anode technology (70% - 95% silicon)

Innovating for the next generation of batteries



Deep expertise in battery formulations and formulation development

- Silicon anode designs of >20wt% silicon active material
- Performance optimisation of silicon anode designs
- Teaming up with novel cathode material suppliers
- Anteo X and Anteo S production facility with scale-up capacity

<https://anteotech.com/>

Leading in High Silicon Anode Technology



ANTEOXTM

ADDITIVE
"CROSS LINKER"
– DROP IN
CHEMICAL



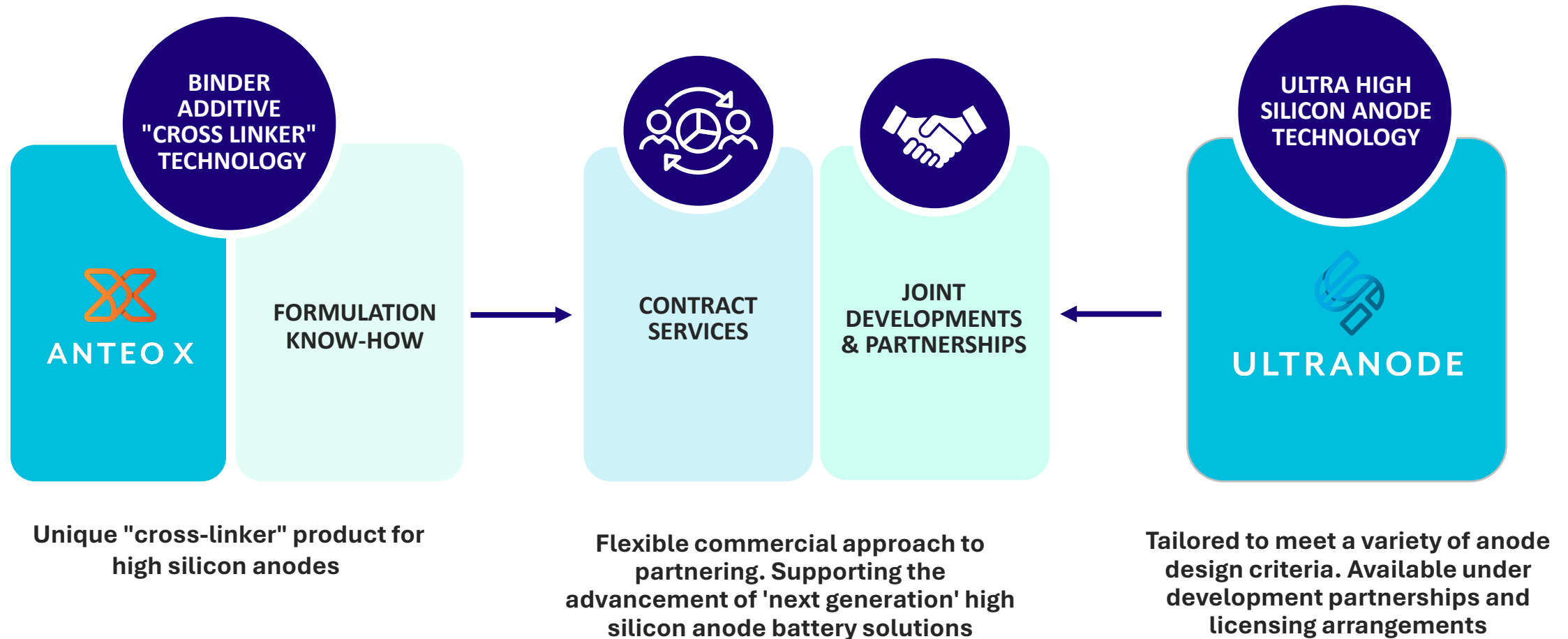
ULTRANODETM

ULTRA HIGH
SILICON ANODE
TECHNOLOGY
FORMULATION

Technology Platforms & Commercial Engagement Frameworks



Combining AnteoTech's silicon-enabling products and anode design know-how we create pathways to smaller, lighter and cheaper LiBs for our customers

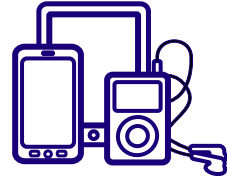


Partnerships and Customer Relationships currently in progress



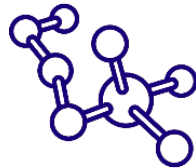
Our partnerships span the value chain from advanced materials to application OEMs

**3C Battery
Manufacturer**

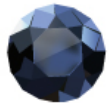


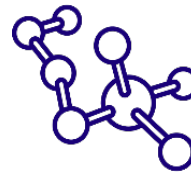
Automotive OEM

**Global Speciality
Chemical Company**



WYON
SWISS BATTERIES

 **BLACK DIAMOND
STRUCTURES™**



Separator Coatings



**Defence battery
manufacturer**

Anteo X™ – A “Cross-Linking” Chemical Additive

Supports sustained anode performance by providing structural integrity



Sustainable and Versatile

- Water-based and PFAS-free
- Compatible with a wide range of binders
- Easily integrated into existing manufacturing processes

Delivering Improved Performance

- Improved cycle life by more than 35% ¹
- Reduced expansion by up to 40% ²
- Increased capacity retention by up to 5% ³

Improving Cost Efficiency

- Reduction in CNT content by 50% ¹
- Reduction in binder content by more than 2wt% ³

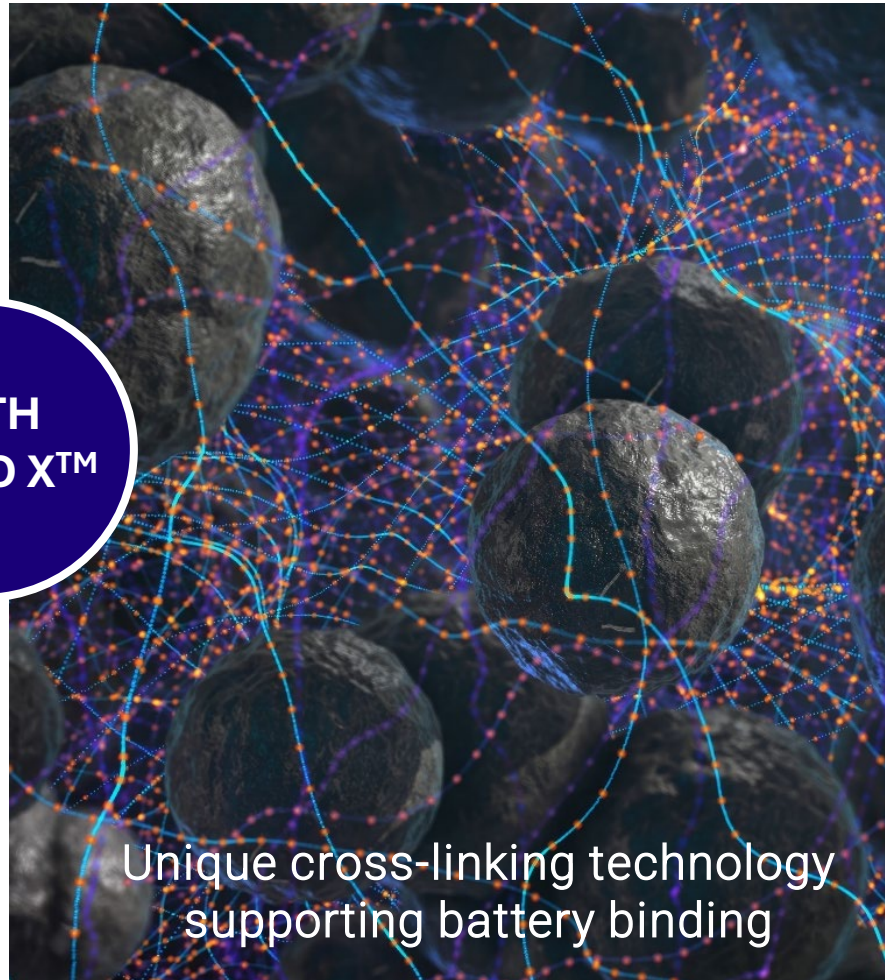
¹Demonstrated in AnteoTech's proprietary Ultranode™ design at cycle 100 at cycling capacity of 1,300mAh/g (C/2)

²Demonstrated by external party in 80% SiO_x anode for eVTOL applications

³Demonstrated in full coin cells with a 20% Si/C containing anode at 80% of original anode coating capacity



WITH
ANTEO X™



Unique cross-linking technology
supporting battery binding

Supporting Services in silicon anode formulation development



Deep experience and capabilities in silicon anode development and designs

Optimising the inactive material fraction matters

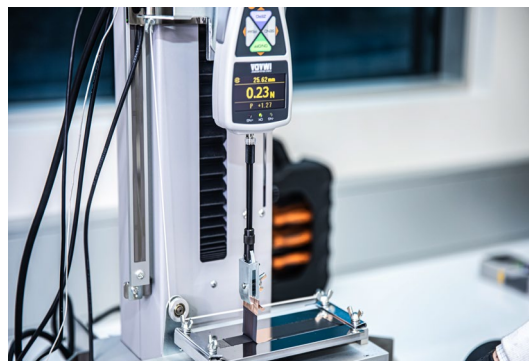
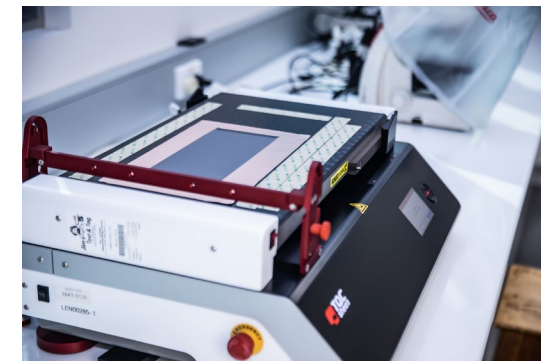
- Performance improvements and cost advantages
- Ever-growing number of design and material choices
- Optimising can be time consuming and expensive

Partnering to accelerate development timeframes

- Established team and expertise to immediately tap into
- Extensive testing data sets and experience base across materials
- Accelerated screening of formulations
- Independent assessments

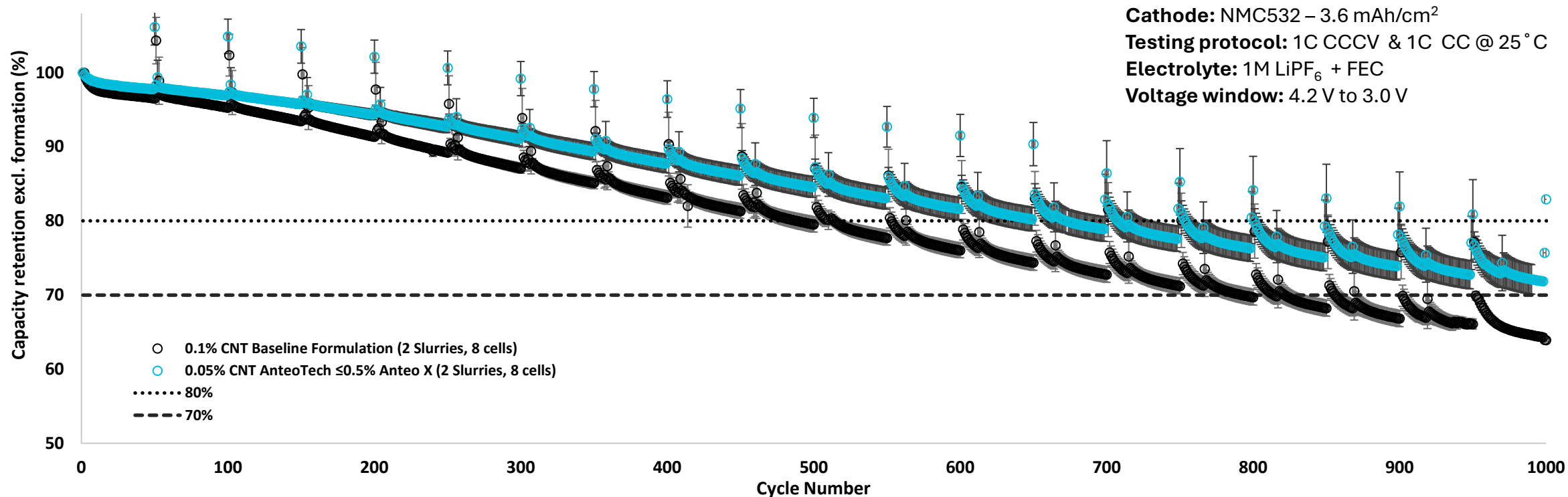
In-house capabilities

- ~250m² R&D laboratory space
- Powder processing and slurry fabrication
- Electrode coating and cell assembly
- Full cell, half cell, CV, EIS and DCIR
- Capacity for 1,000 test channels



Step 1 - Formulation Screening – 600mAh/g with Si/C and Gr

Potential cost savings by optimising the inactive material fraction of the anode



	Formation cycle discharge capacity @C/20 (mAh/g)	1 st cycle discharge capacity @1C (mAh/g)	Initial coulombic efficiency (%)	Cycle number at 80% capacity retention (excl. formation)	Cycle number at 70% capacity retention (excl. formation)	Final capacity at cycle 1,000 (mAh/g)
Baseline Formulation	603	467	84.68	489	793	287
0.05wt.% CNT ≤0.5wt.% Anteo X	603	474	86.00	674	>1000 (@71.85%)	340
Improvement	-	8	1.32	185 (38% increase)	>207 (>26% increase)	53

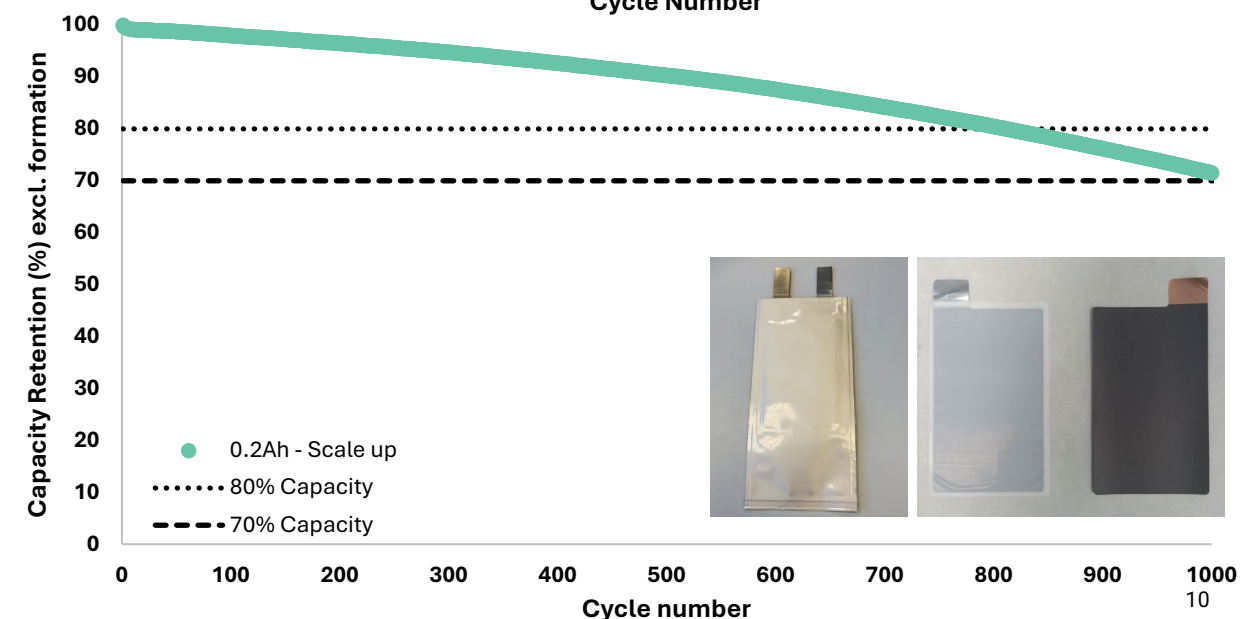
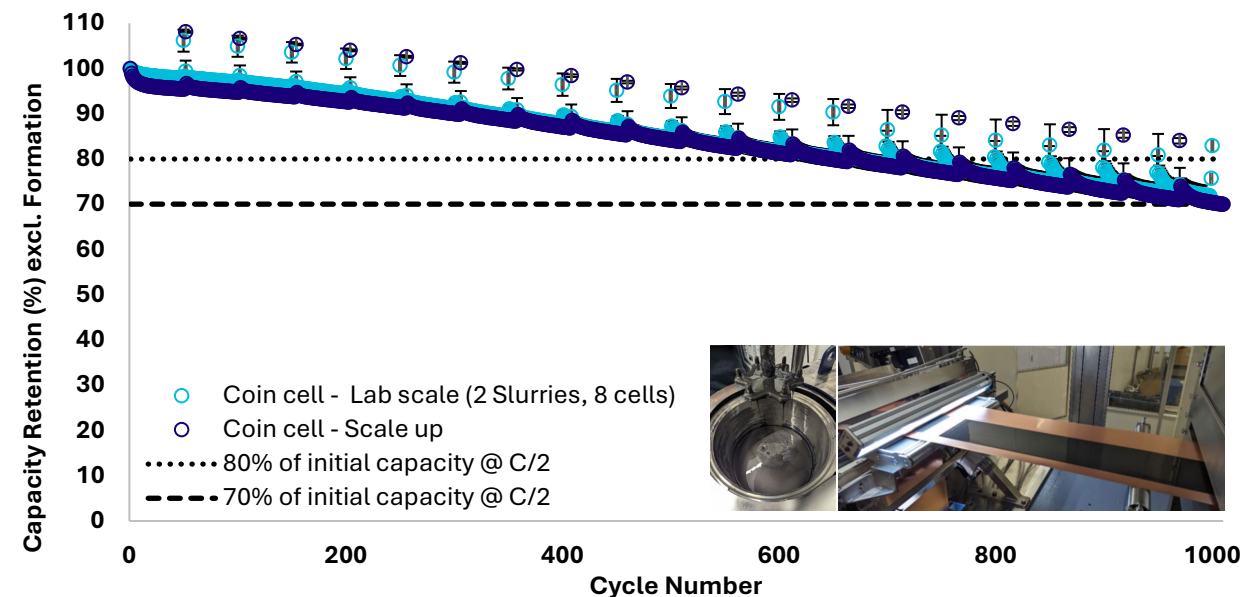
Step 2 – Single-layer or Multi-layer Pouch Cells

Lab-scale produced electrodes vs. R2R coated electrodes

- Full coin cells produced from A4 hand sheet coatings almost perfectly match results produced from R2R coated anode formulation
- **Coin cell (A4 hand sheets): 673 cycles @ 80%**
- **Coin cells (R2R coated): 653 cycles @ 80%**

Full coin cells vs. Single Layer Pouch Cells

- The R2R coated anode formulation tested in 0.2Ah SLP cells showed a 17% improvement in capacity retention when compared against coin cell data
- Results from full coin cell to SLP cells showed excellent scalability
- **0.2Ah SLPs (R2R coated): 820 cycles @ 80%**



Anteo S cross links binder polymers used in ceramic coated separator (CCS) coatings



Improves ceramic coated separator stability by keeping dimensional stability of separator for longer and/or at higher temperatures



Forms a **cross-linked particle-polymer** network by artificially increasing the molecular weight of the binder resulting in a more robust and stable ceramic coating



Potential to reduce ceramic coating thickness while maintaining adequate **stability of the ceramic coating layer** allowing for **increased Wh** of the cell



Potential for cost savings by minimising coating thickness and inactive materials (Al_2O_3 , Boehmite, Binders) required for thermal stability

Anteo S performance has been verified by a third-party ceramic coating material manufacturer



Impact on slurry rheology

No significant change on slurry rheology observed upon integration of Anteo S in standard slurry compositions¹

Gurley value test

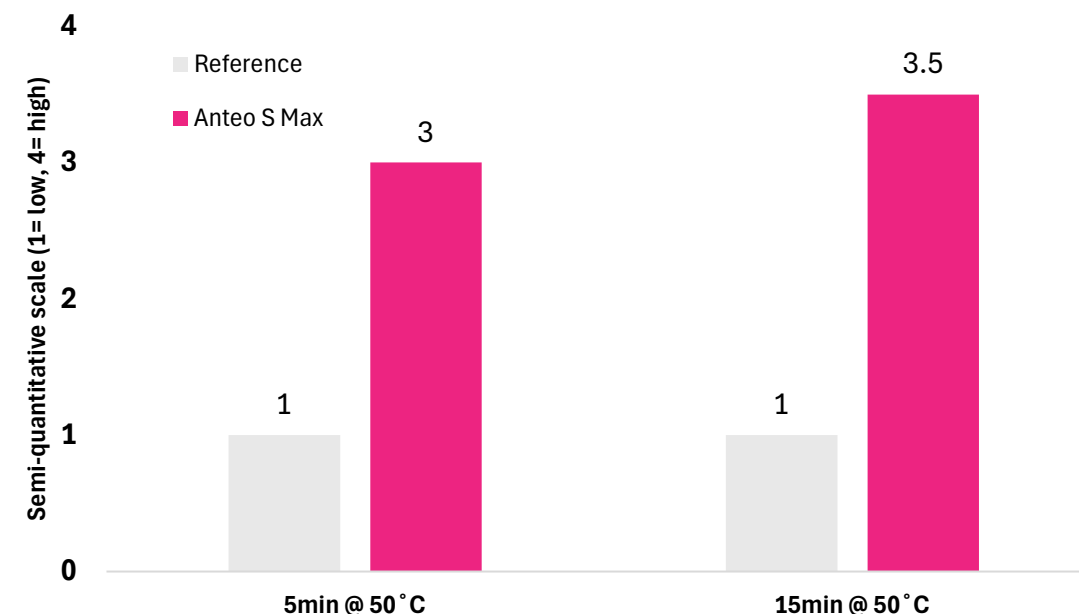
Gurley value not impacted by Anteo S integration into ceramic coating layer

Thermal stress test

- **Separator type:** PE
- **Maxium drying temperature tested:** 50 °C
- **Drying condition:** RT vs. 5min@50°C vs. 15min@50°C
- **Ceramic coating layer thickness:** ~2 µm
- **Measurement:** Dimensional stability (% shrinkage)
- **Acceptance criteria:** 2 out 3 samples <5% shrinkage

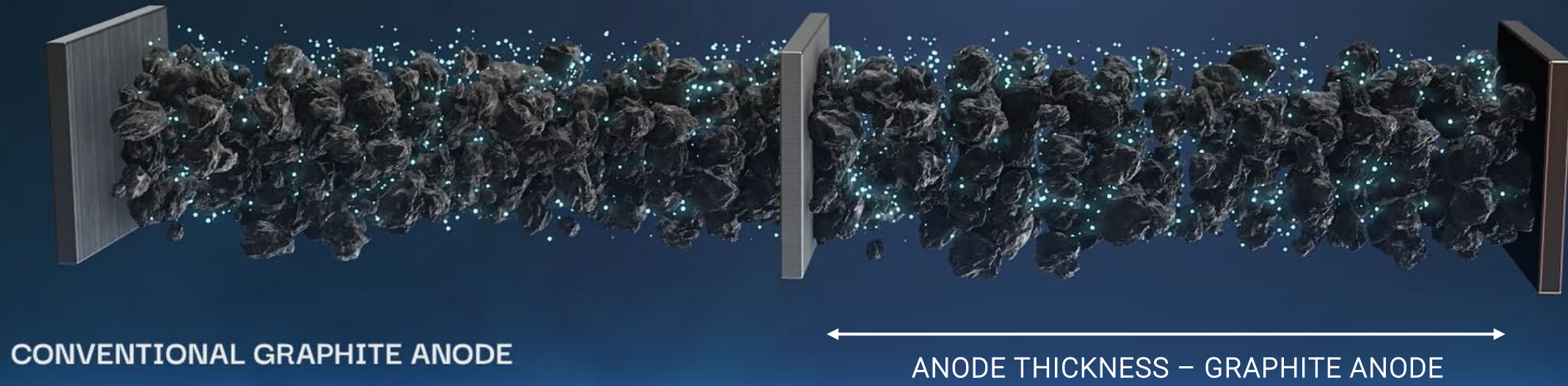
Thermal stability test

Anteo S : Improved thermal stability of separator after drying of coating film at 5min@50°C and further improves upon drying for 15min @50°C



Note: (1) Measured after slurry fabrication; Reference: No. samples tested 14, avg. dry-film thickness (µm) 1.893; Anteo S: No. samples tested 26, avg. dry-film thickness (µm) 2.019

Ultranode™ – Concept



ULTRANODE™

- 70-95% silicon active material
- Crude micron-sized elemental silicon particles
- Available up to tonne-scale in every geography



Our Competitive Advantage in Silicon Anode Technology



Up to 95% silicon delivers high energy and high performance

Specific anode coating capacities that deliver **up to 2,400 mAh/g**



Highly customizable

Ultranode™ design can be heavily customized without redesigning the active material properties



Cost effective (up to 80% cheaper active material powder compared to adv. Si/C)

Ultranode™ 95 - up to 50% cheaper (\$/m²) compared to same anode specification made from adv. Si/C ^{*1}



Sustainability

Up to 80% reduction in kg CO₂e/m² of anode compared to artificial graphite^{*2}



Supply chain security

AnteoTech's anode material is sourced from suppliers at tonne-scale in US, EU, KR, AU and others



Uses conventional manufacturing processes

Ultranode™ uses conventional slurry-based anode manufacturing process -> no new CAPEX required

^{*1} Up to 5x cheaper Si active material powder compared to adv. Si/C materials

^{*1} Based on electrodes with equivalent area capacities, Si active material content and anode formulation

^{*2} CO₂e/m² values vary with source of active materials and electricity grid mix but can be as low as 3.1 kg CO₂e/kg mSi

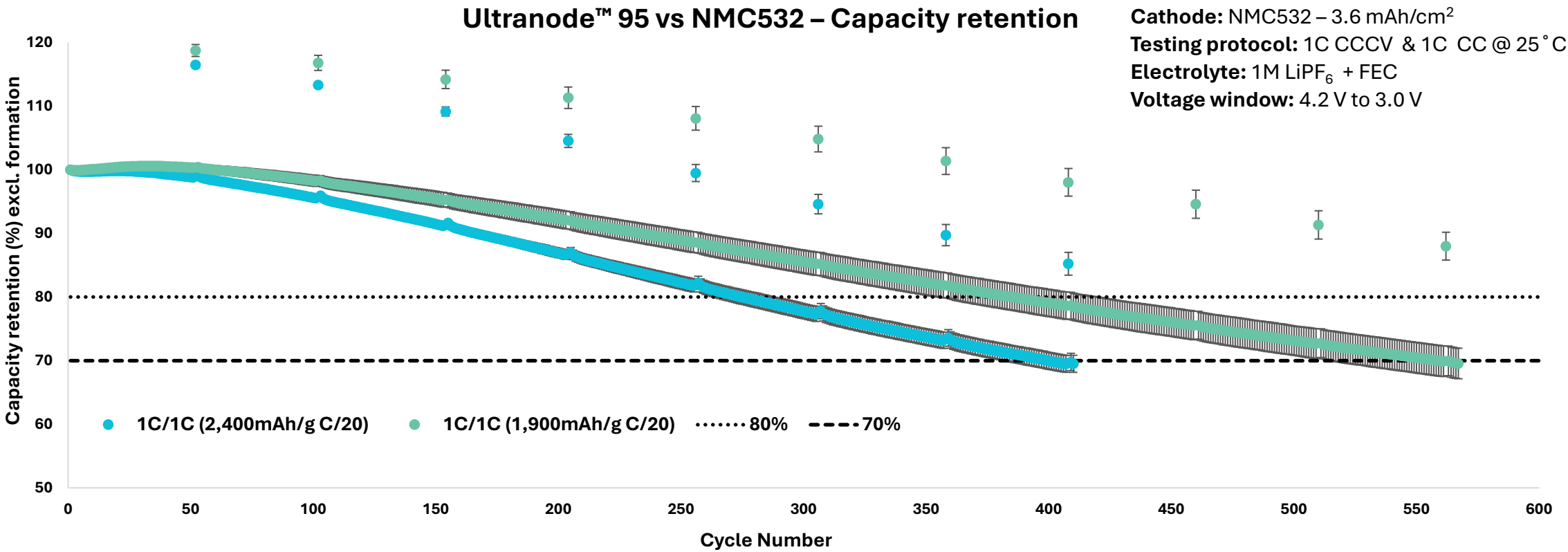
Ultranode™ is Highly Customisable by Application



	Ultranode™ 95 	Ultranode™ 70 	Ultranode™ X 
Target Applications	• Highest energy with lower cycle-life requirements targeting • Unmanned Aerial Systems • Drones	• Balanced energy density with cycle life targeting • 3C markets and Wearables • 2-3 Wheelers & Micro-mobility	• Maximised cycle life for high-energy, high-cycle life applications targeting • Electric Vehicles • eVTOLs
Engagement pathway	• Ultranode™ + Cathode sample packs • JDA's for cell development	• Ultranode™ + Cathode sample packs • R2R coated Ultranode 70 orders	• Technology partnerships • JDAs for customization, technology transfer and licensing
Performance Characteristics	• High-capacity anode coatings of 1,800 - 2,400 mAh/g @C/20 • Cycle life of up to 380 cycles at 80% capacity retention (subject to cathode chemistry employed)	• Medium-capacity anode coatings of 600 - 1,200 mAh/g • Intermediate cycle life of up to 670 cycles at 80% capacity retention	• >1,000 cycles at 80% capacity retention • Coating capacities of 850 - 1,100 mAh/g at C/20 • High first-cycle efficiencies of >90% • Customisation is driven by customer and partner specifications.

Ultranode™ 95 vs NMC532

Delivers specific coating capacities of in between 1,800 to 2,400 mAh/g



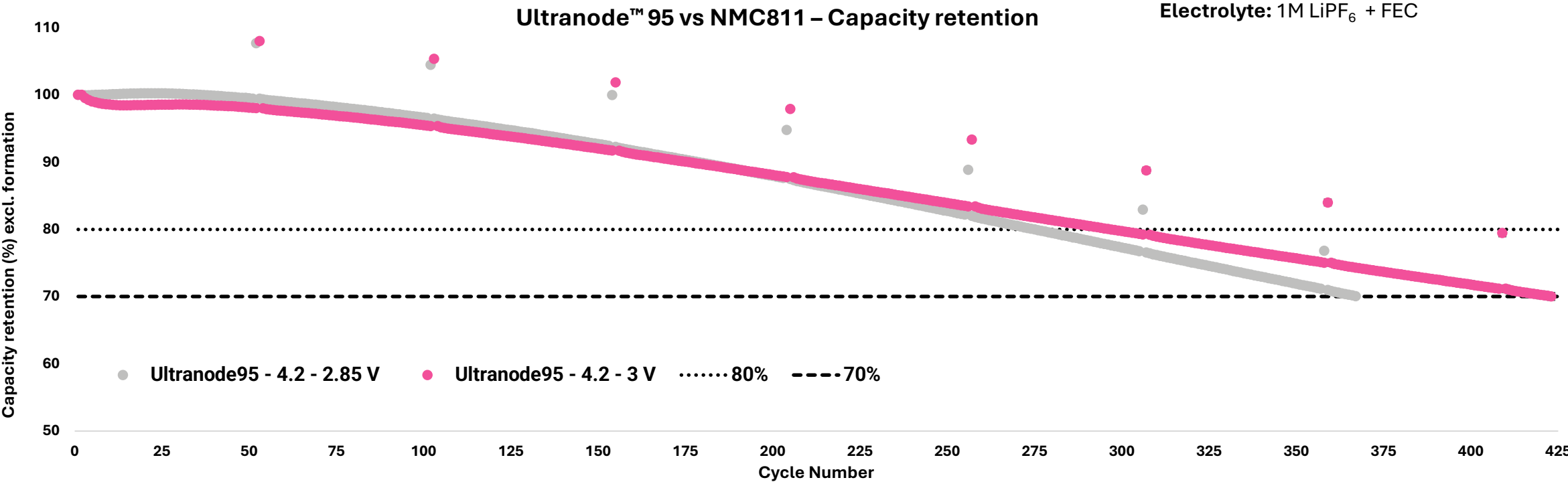
Ultranode™ 95	Formation cycle discharge capacity @C/20 (mAh/g)	1 st cycle discharge capacity @C/5 (mAh/g)	1 st cycle discharge capacity @1C (mAh/g)	Initial coulombic efficiency (%)	Cycle number at 80% capacity retention (excl. formation)	Cycle number at 70% capacity retention (excl. formation)
Ultranode 95	2,391	2,087	1,791	90.2	280	411
Ultranode 95	1,900	1,573	1,344	89.9	393	568

Ultranode™ 95 vs NMC811

Delivers specific coating capacities of >1,700 mAh/g @ 1C



Cathode: NMC811 – 3.7 mAh/cm²
 Testing protocol: 1C CCCV & 1C CC @ 25 °C
 Electrolyte: 1M LiPF₆ + FEC



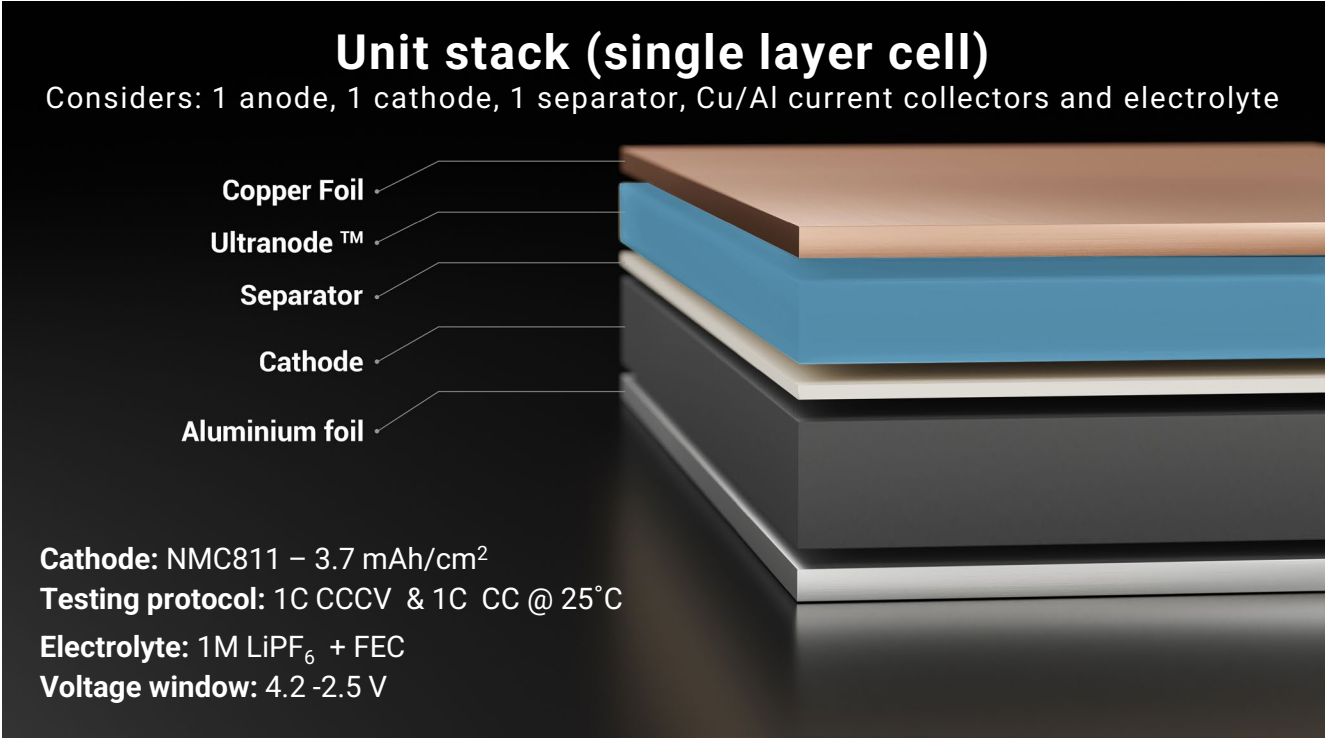
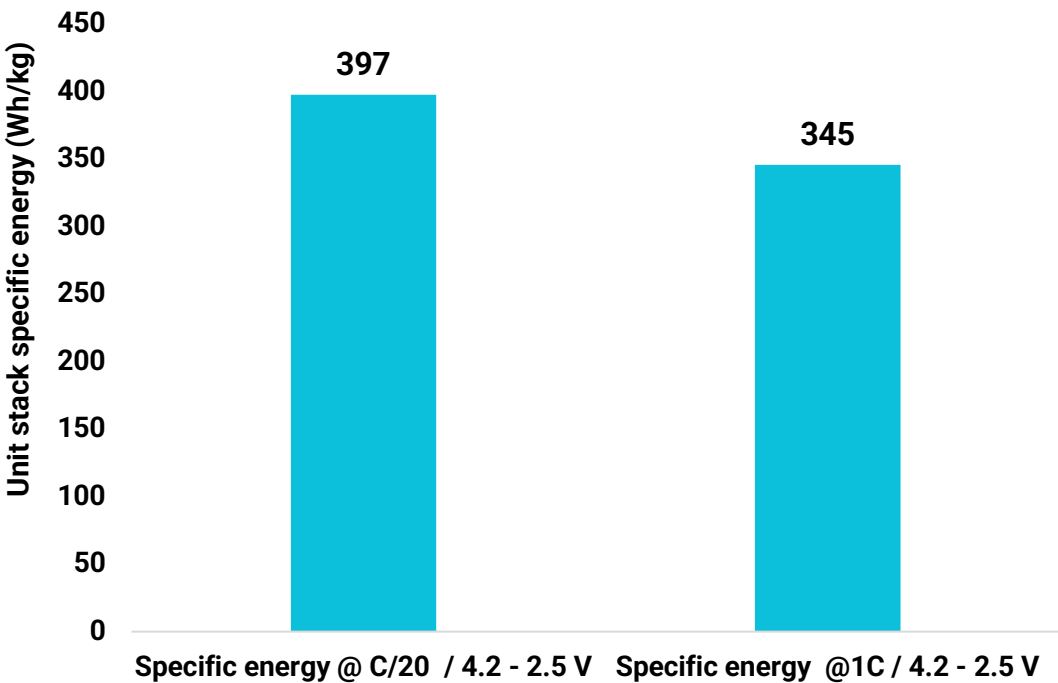
Ultranode™ 95	Formation cycle discharge capacity @C/20 (mAh/g)	1 st cycle discharge capacity @C/5 (mAh/g)	1 st cycle discharge capacity @1C (mAh/g)	Initial coulombic efficiency (%)	Cycle number at 80% capacity retention (excl. formation)	Cycle number at 70% capacity retention (excl. formation)
Ultranode 95 (4.2 V – 2.85 V)	2,028	1,874	1,733	88.8	275	367
Ultranode 95 (4.2 V – 3 V)	2,063	N/A	1,637	88.9	296	423

Ultranode™ 95 - Potential for superior Wh/kg

Unit stack level analysis based on tested cells



Unit stack – Ultranode™ 95 vs NMC 811



Note: Specific energy does not consider packaging, tabbing etc.

Ultranode™ 95	Formation cycle discharge capacity @C/20 (mAh/g)	1 st cycle discharge capacity @1C (mAh/g)	Initial coulombic efficiency (%)	Specific energy of chemical stack @/20 (Wh/kg)	Specific energy of chemical stack @/1C (Wh/kg)
Ultranode 95 - 2,000mAh/g	2,025	1,841	89.1	397	345

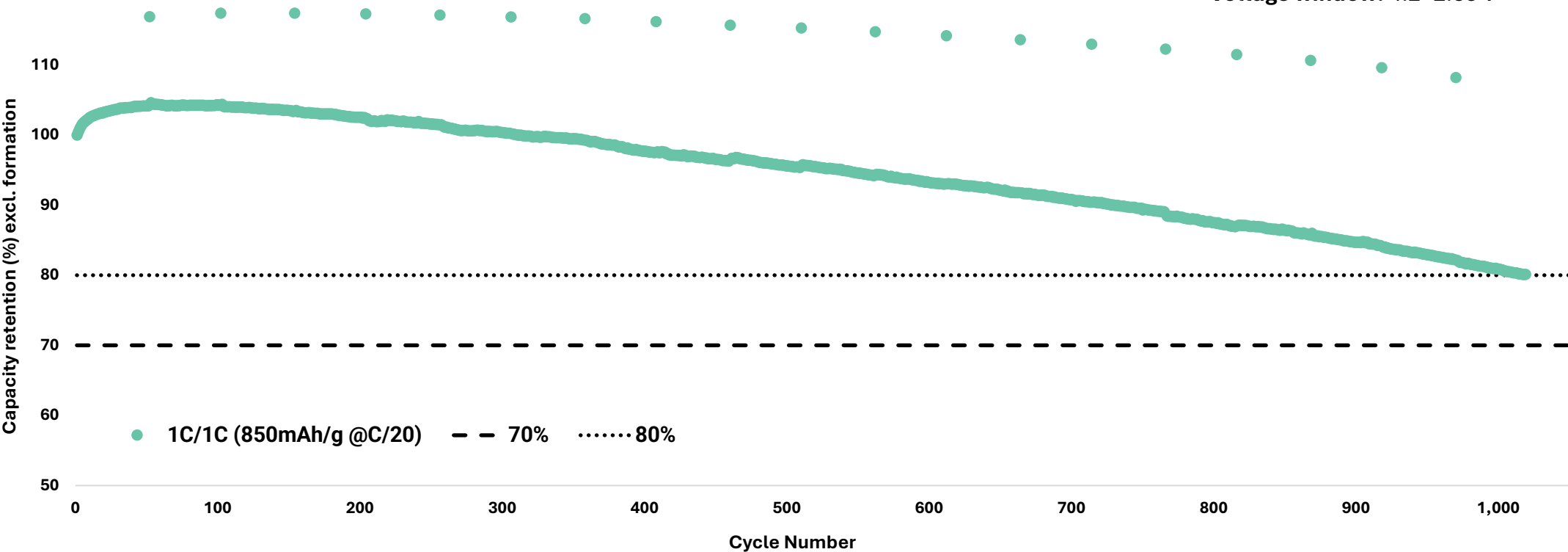
Ultranode™ X achieves >1,000 cycles at 80% capacity retention

Further improvements target 1,500 cycles at 80%



Cathode: NMC532 – 3.6 mAh/cm²
 Testing protocol: 1C CCCV & 1C CC at 25 °C
 Electrolyte: 1M LiPF₆ + FEC
 Voltage window: 4.2 -2.85 V

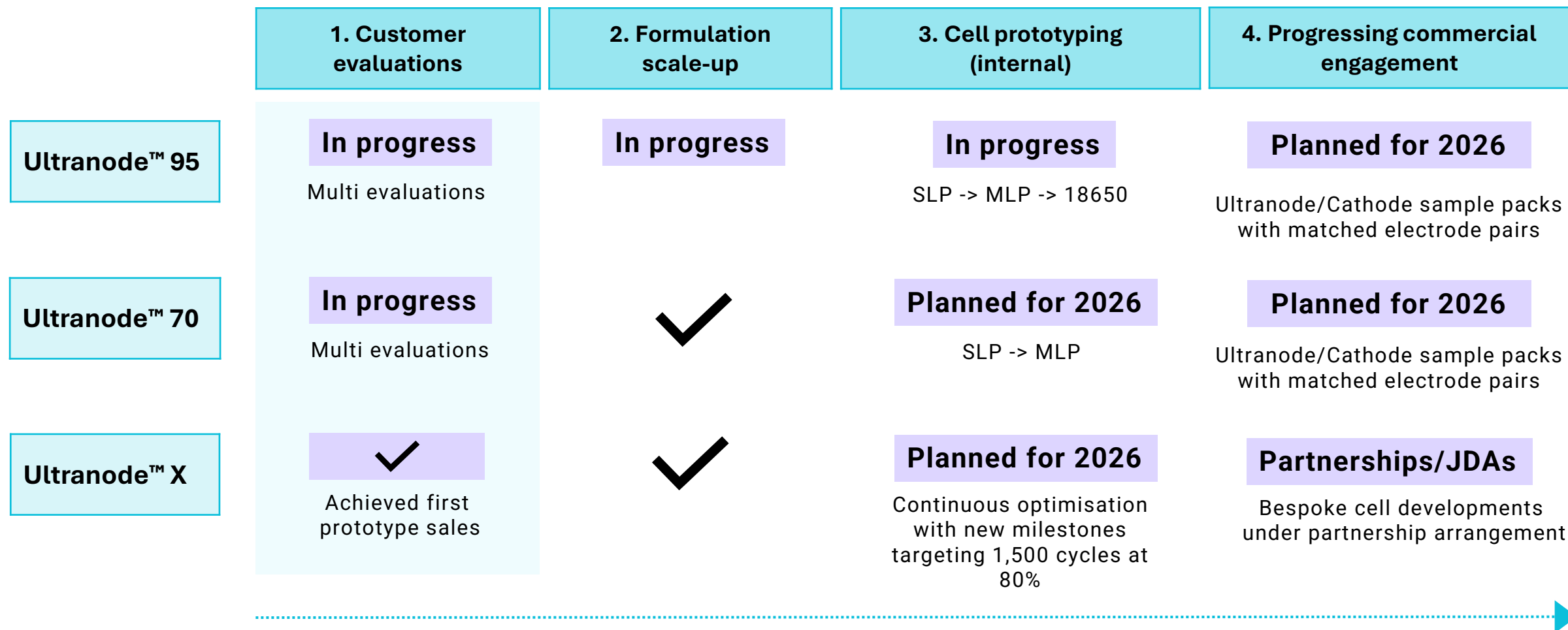
Ultranode™ X vs NMC532 – 1C/1C cycling performance



Ultranode™ X with 70% silicon	Formation cycle discharge capacity at C/20 (mAh/g)	1 st cycle discharge capacity at 1C (mAh/g)	Initial coulombic efficiency (%)	Cycle number at 80% capacity retention (excl. formation)
Ultranode X (4.2 – 2.85V)	856	601	89.69	1,020

Ultranode Technology Roadmap

Different pathways for different applications to meet customer requirements



Our Products, Technologies and What we can Deliver

Leading in silicon anode technology



ANTEO X™



ANTEO S

- **Anteo X** cross-linking additive that can improve silicon anode performance
- **Anteo S** additive for ceramic coated separators improving cost and safety
- “Jump start” Implementation support - Sample plus service package
- +20,000L existing production capacity



ULTRANODE™

- **Ultranode** is an integrated silicon anode technology
- Highly customisable for Maximum Capacity or Maximum Cycle Life
- Cost effective silicon material sourced from established supply chains
- Range of commercial partnering opportunities



**FORMULATION
SERVICES**

- Can rapidly deliver into customer’s formulation design
- Independent advice on silicon active materials
- Flexible service packages with clear pricing structures



THANK YOU

Contact us for samples or partnership opportunities!

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