



Elementium

Unlocking extreme all-temperature operation of commercial Li-ion batteries with drop-in liquid electrolytes

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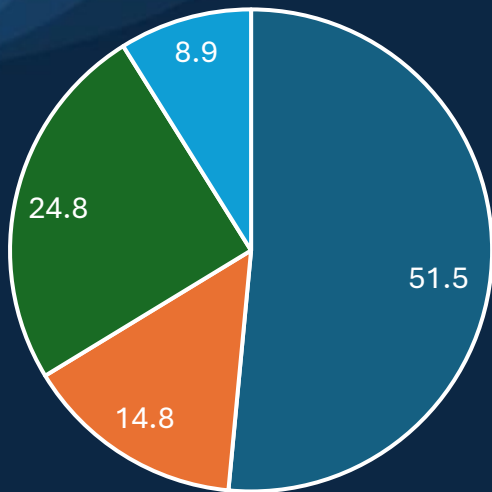
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Space Power Workshop 2026

Approved for Public Release

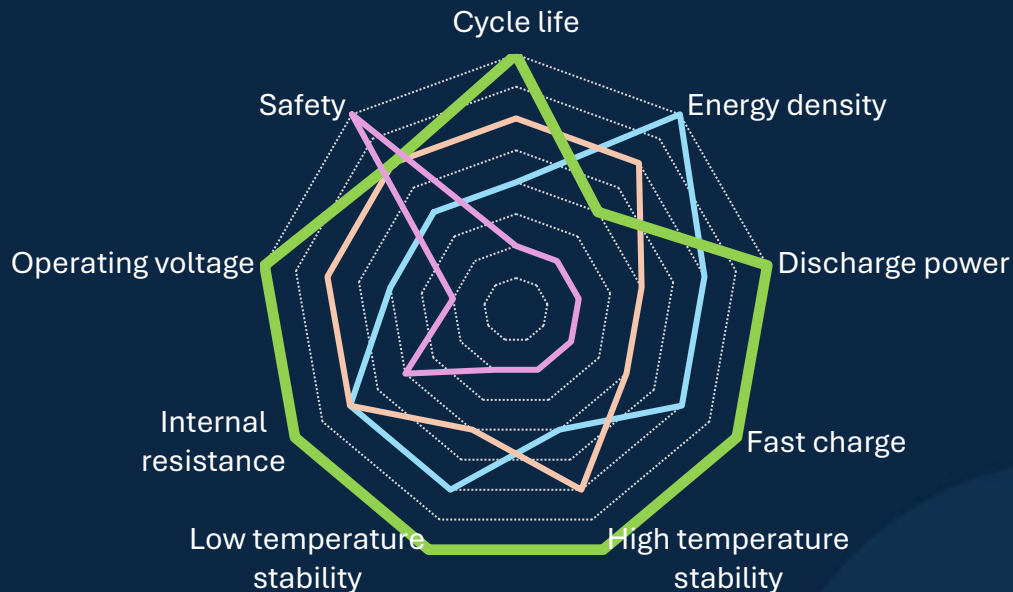
Electrolytes punch way below their weight in cell performance

Cost breakdown of cell components

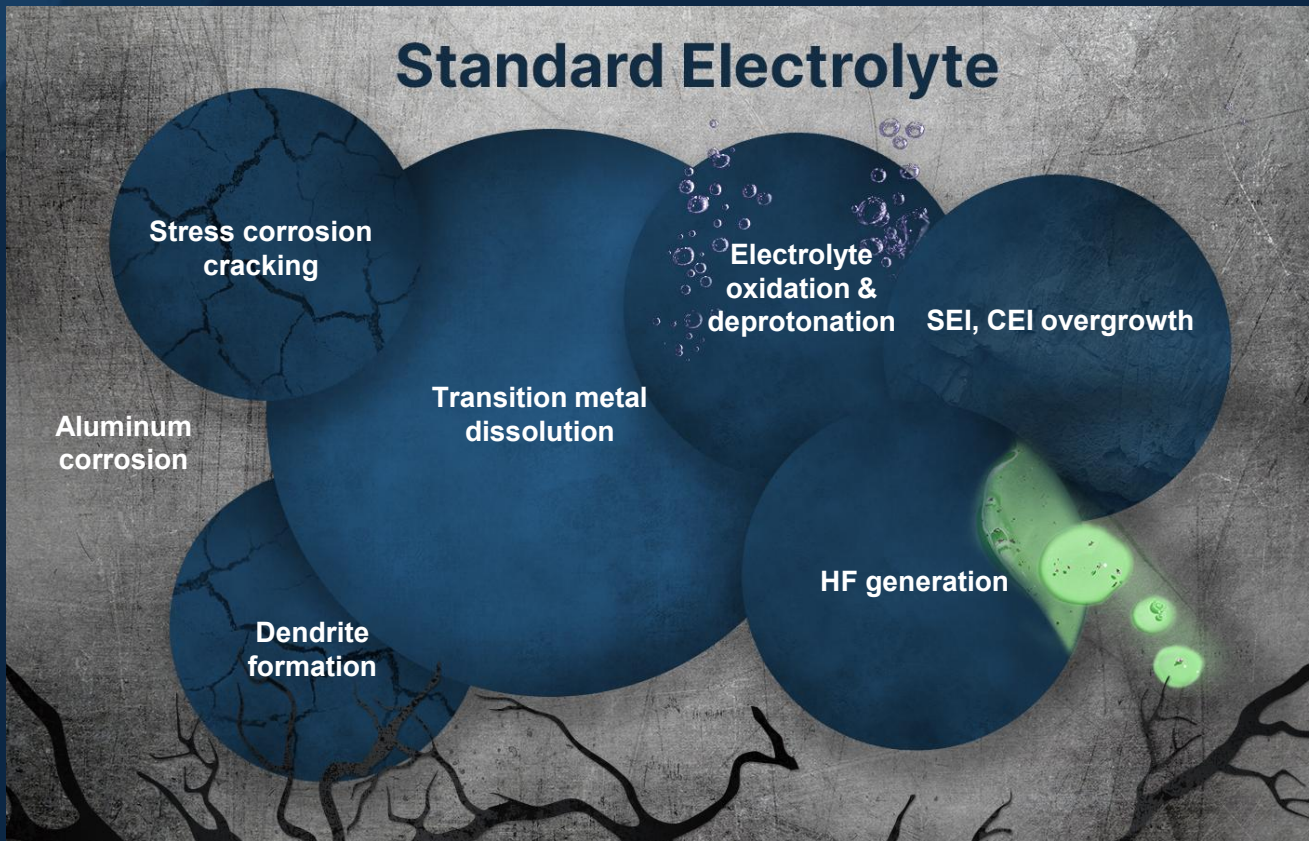


- Cathode
- Anode
- Inactive
- Electrolyte

- Anode design
- Cathode design
- Electrolyte
- Inert materials



It's not your cell/material that's failing, it's your electrolyte!



But carbonate/esters are **scalable and drop-in!**

How does a cell for extreme operation look like?



- Small cells with low capacity (generally <5 Ah)
- Metallic casing avoids evaporation of volatile solvents
- Low impedance from tabs/multi-tab design

Introduces shortcomings:

- Capped energy density
- Capped total capacity
- Unflexible cell design
- Unflexible pack design

The metal can tries to get around shortcomings of volatile, unstable electrolyte!

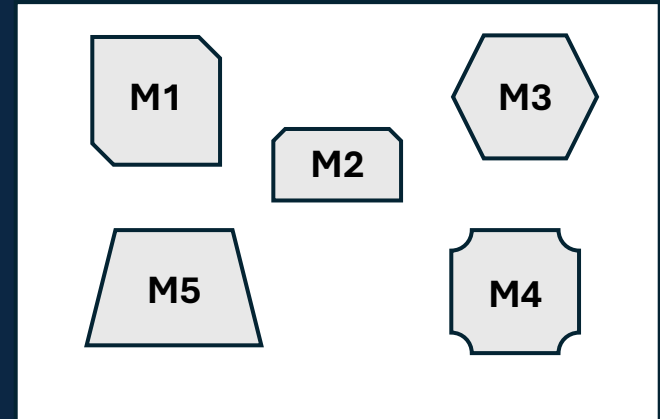
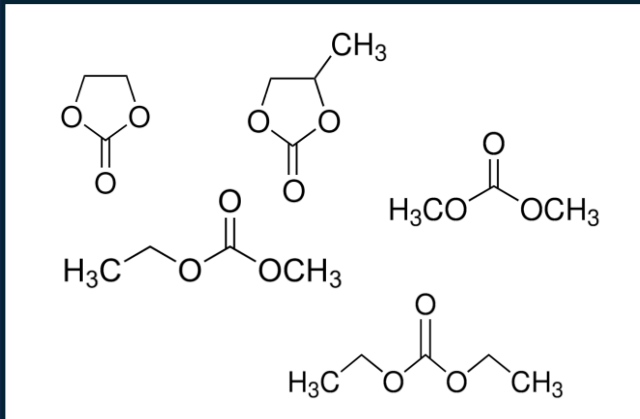
But what if we could design electrolytes that can sustain extreme operations in large cells?



Elementium's “scalability” and “universality” approach

Principles

- Limited number of new molecules facilitates regulatory approval and enables economies of scale
- Simple and cost-effective synthesis
- Drop-in capabilities (same physicochemical properties as carbonates)
- Non-volatile and ideally non-flammable molecules with distinct functionality
- Universal applicability across any cell chemistry
- Functional across all operating conditions



- Same set of “universal” carbonates address all cell chemistries
- Each molecule brings unique functionality
- None work optimally independently

- Molecules provide complementary functionality
- When combine, they provide universal functionality
- Molecules can still leverage carbonate learnings



Leveraging carbonate infrastructure through strategic partnerships

Scaling through strategic partnerships

- ✓ Leveraging toll manufacturing titans and their carbonate electrolyte footprint
- ✓ Proven & reliable production capabilities
- ✓ ISO Certified facilities & pre-qualified with customers
- ✓ Global footprint with non-FEOC supply chain
- ✓ Competitive pricing



Up to 25 GWh of annual production capacity – today

- Fully drop-in, similar physicochemical properties, zero retooling or formation changes
- No supply chain bottlenecks
- HSE GLP-compliant testing completed
- Non-PFAS, non-PBT, future-proofed

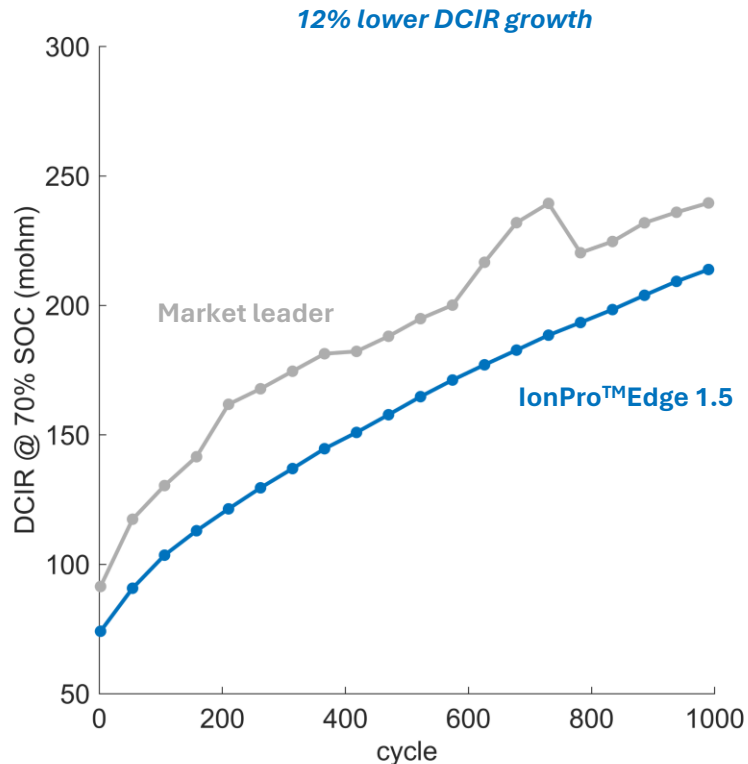
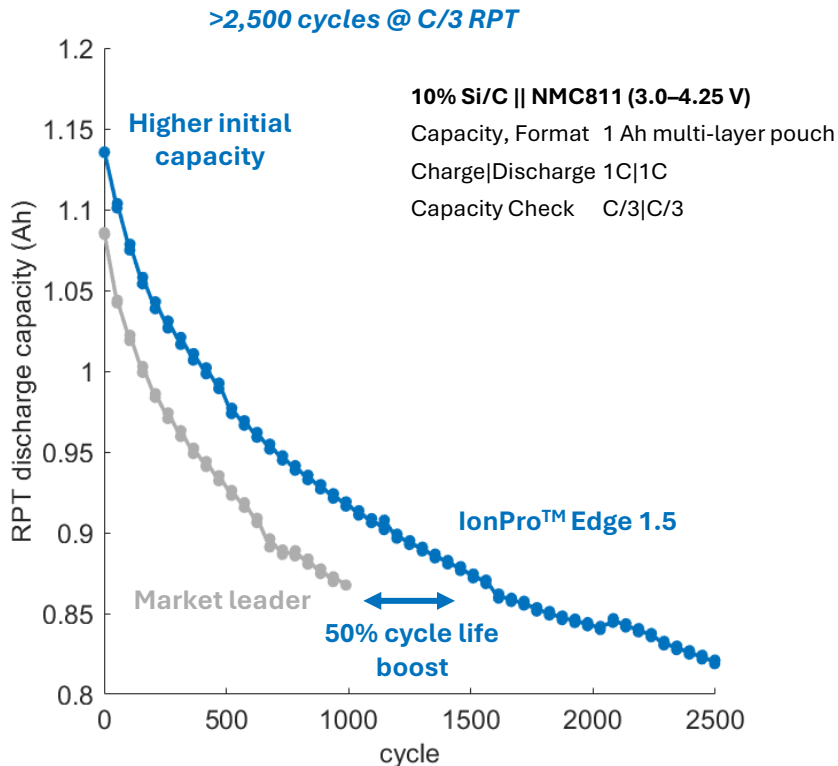
Elementium's IonPro™ line

	IonPro™ Edge	IonPro™ Energy	IonPro™ Synergy	IonPro™ Ultra	IonPro™ Arctic	IonPro™ Titan
Applicable anodes	Si/C, Si, SiOx, Gr, LMB, NMB	Gr	Si/C, Gr	Si/C, Si, SiOx, Gr	Si/C, Si, SiOx, Gr, LMB, NMB	Gr
Applicable cathodes	NMC, NFPP, NFM	LMFP, LFP, NMC	NMC	HV LCO	NMC, LCO	LMR, HV NMC
Cycle life	10-100% typical improvement over market leader electrolytes					
Operational Temperature	-25°C – 60°C	-10°C – 60°C	-50°C – 60°C	-10°C – 60°C	-50°C – 60°C	-50°C – 60°C
Rate performance	>6C, up to 18C	>3C, up to 6C	>3C, up to 10C	>3C, up to 10C	>3C, up to 6C	>3C, up to 6C
Voltage Window	4.3 V	4.3 V	4.3 V	4.53 V	4.45 V	4.6 V
Safety	Best*	Improved	Improved	Standard	Best*	Improved

A case study:

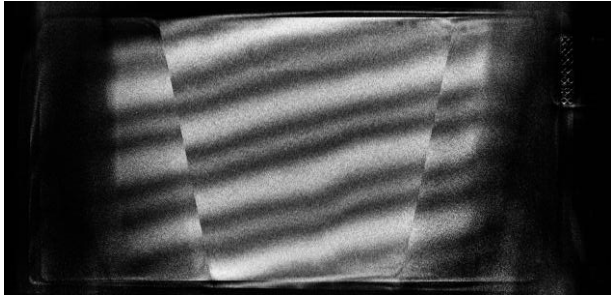
**Next-gen drone-type pouch cell chemistries
IonPro™ Edge 1.5 in Si-C/NMC**

Exceptional performance in low Si cells: 10% Si/C-NMC811



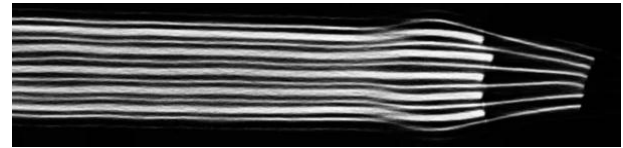
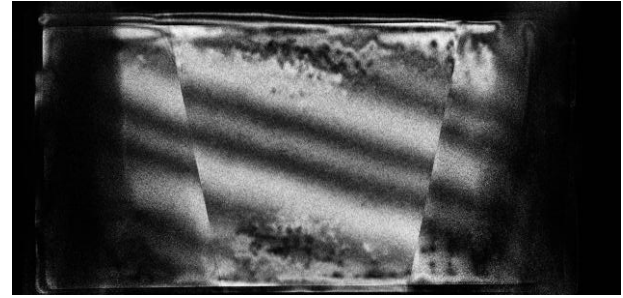
Reduced swelling / gassing at 4C|1C 10% Si/C

IonPro™ Edge



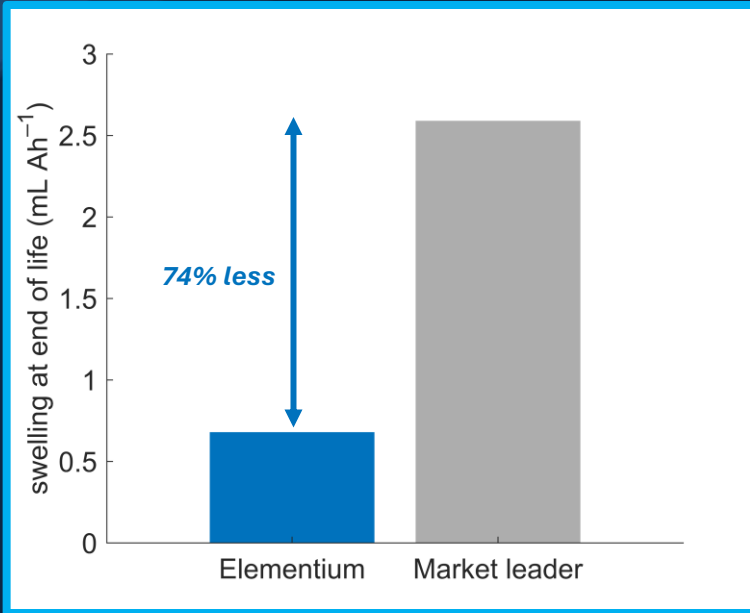
Stays pristine during 4C/1C cycling

Market leader

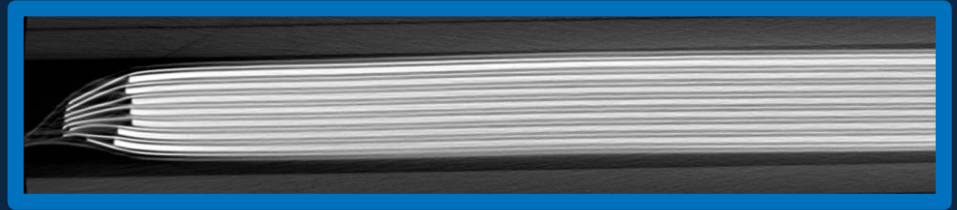


Gas generation/plating, Electrode buckling & delamination

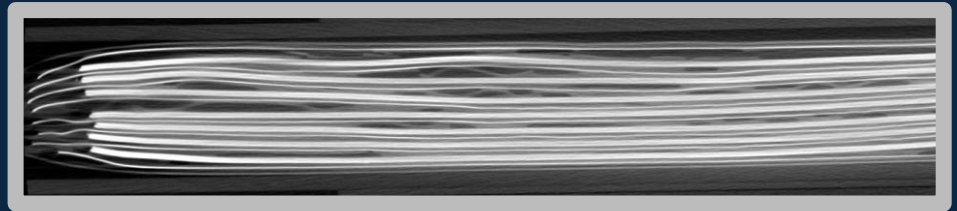
Markedly reduces cell swelling in silicon cells



Elementium in 40%SiC+AG || NMC9 (2.5–4.5 V) at end of life



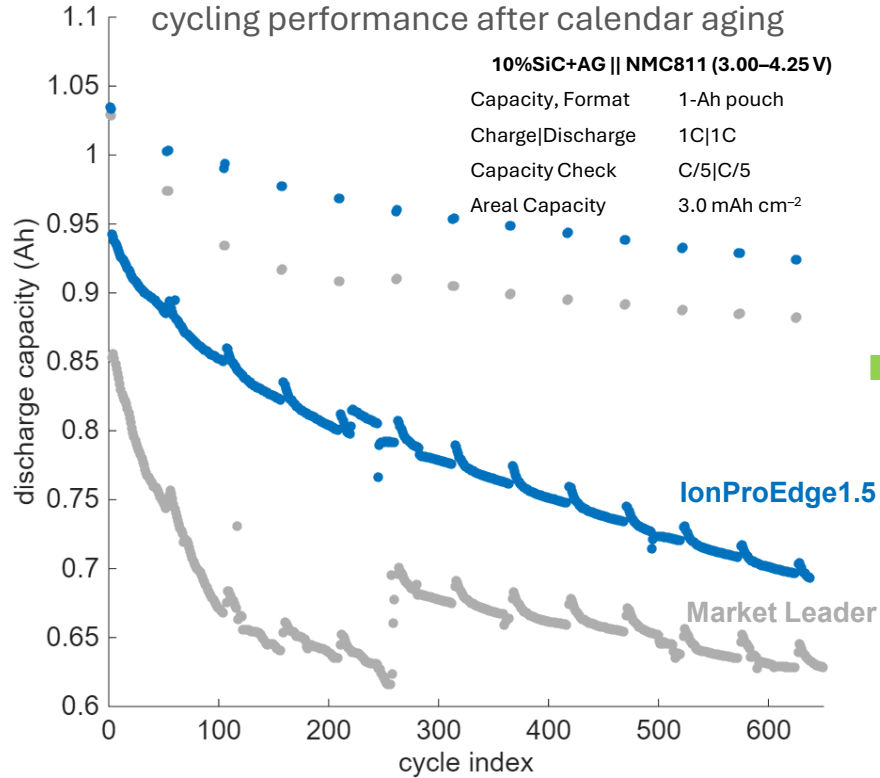
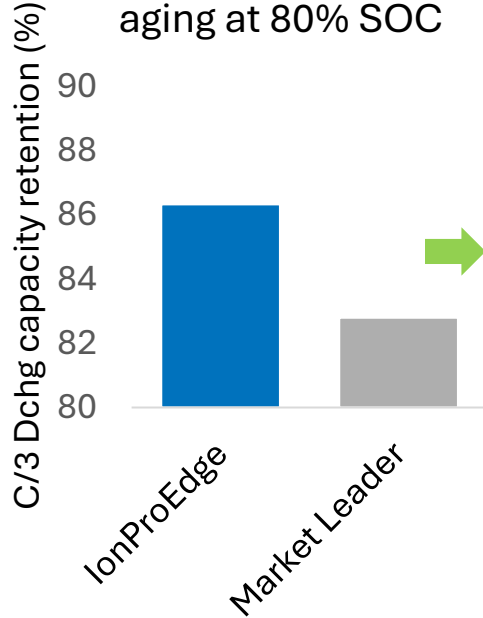
Industry leader in 40%SiC+AG || NMC9 (2.5–4.5 V) at end of life



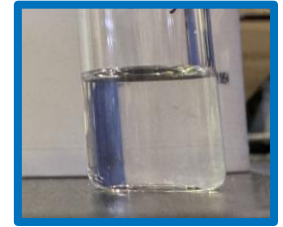
No pressure applied during cycling, cycled to wide voltage range to accelerate degradation

High stability cycling after calendar aging in Si anode cells

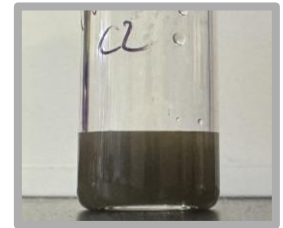
capacity retention
after 10 weeks of 60C
aging at 80% SOC



Post-mortem electrolyte
comparison



IonProEdge1.5
after aging and cycling



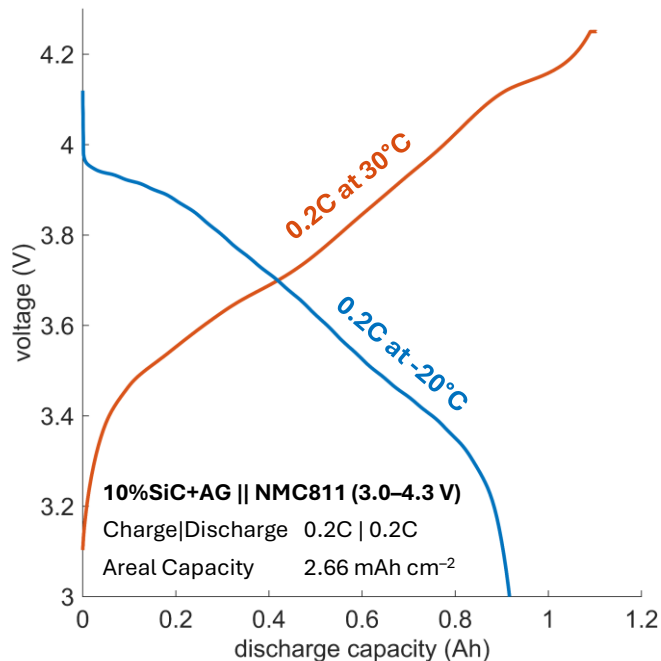
Market leader after aging
and cycling (was initially
clear)

*IonProEdge1.5 has superior cycling performance and stability after 2.5 months of
calendar aging*

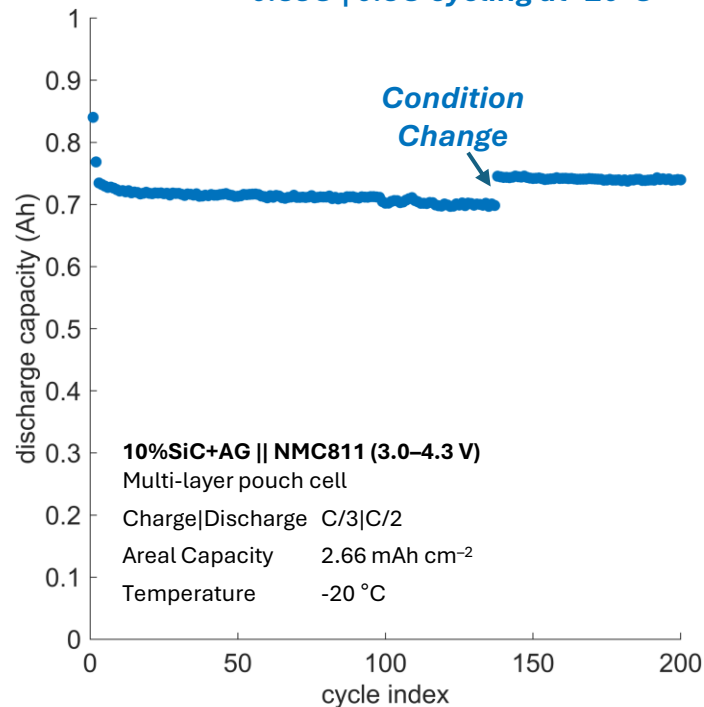
No transition metal dissolution

Near 100% coulombic efficiency at -20°C in IonPro™ Edge 1.5

91.7% capacity retention at -20°C after a room temp charge

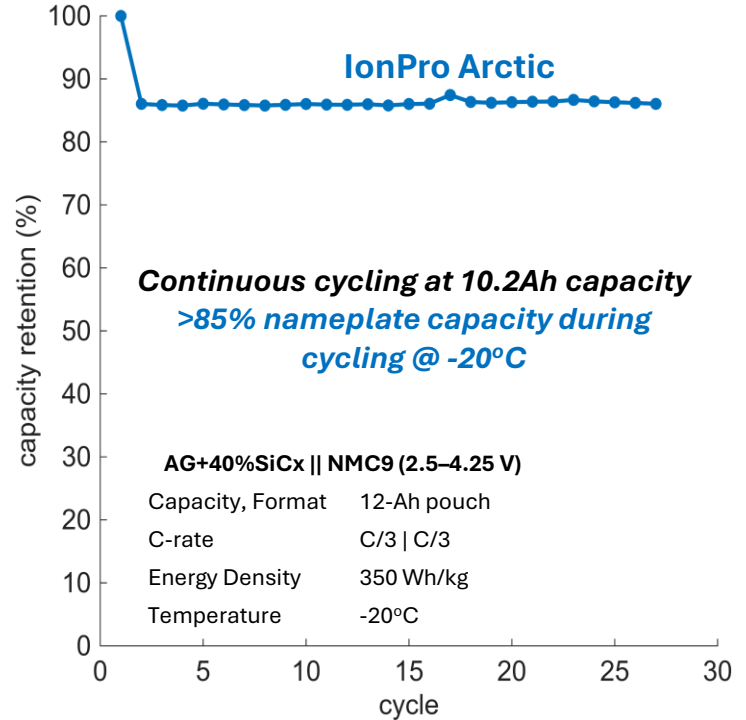
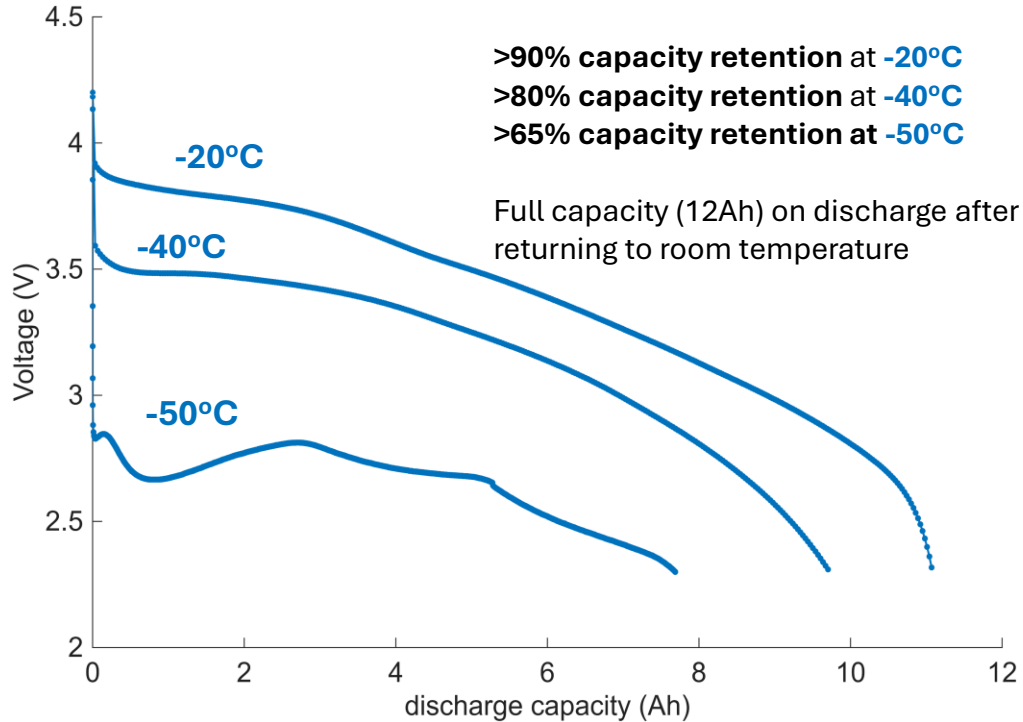


~80% capacity retention during charging at 0.33C | 0.5C cycling at -20°C

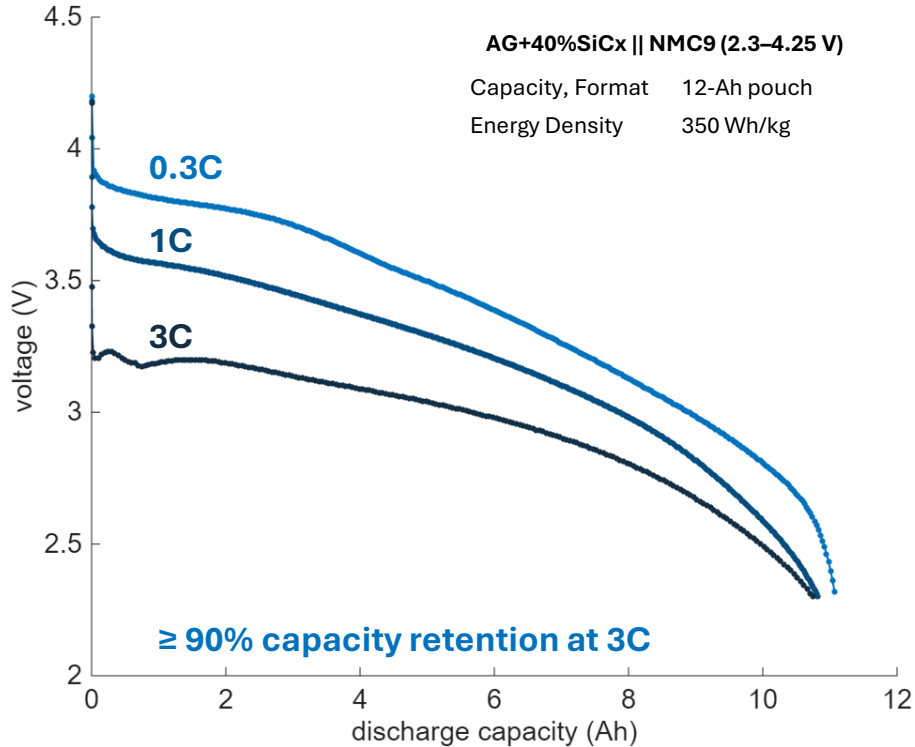


**Breaking the temperature barrier with IonPro™ Arctic:
A non-volatile, non-flammable drop-in liquid electrolyte**

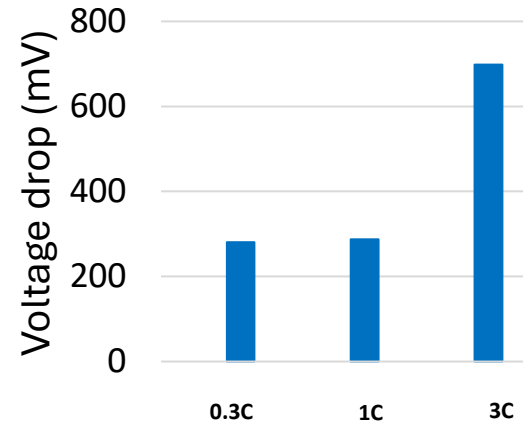
Unprecedented low temperature >10 Ah POUCH performance



90% capacity retention at 3C discharge rate at -20°C

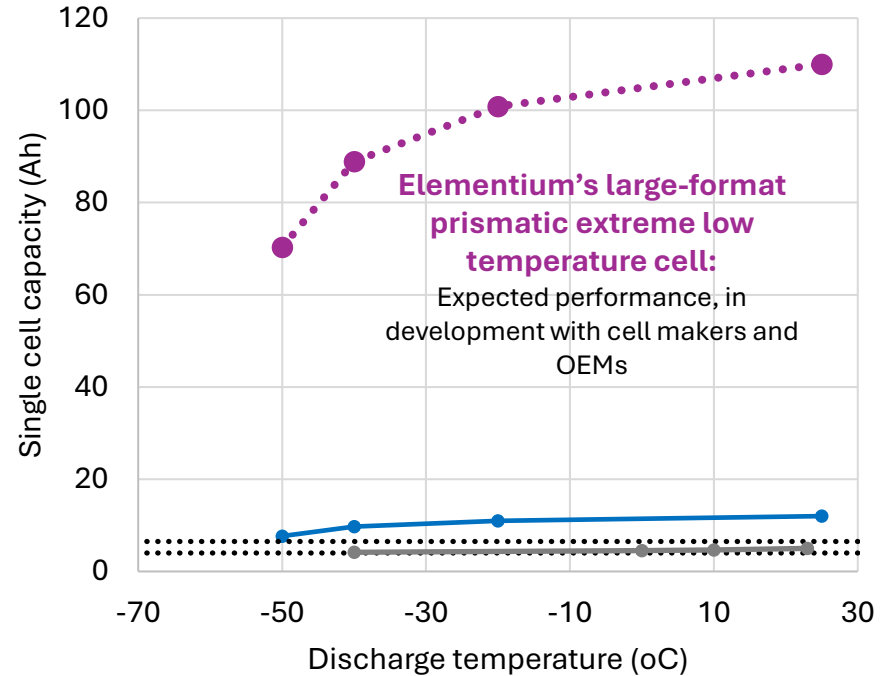
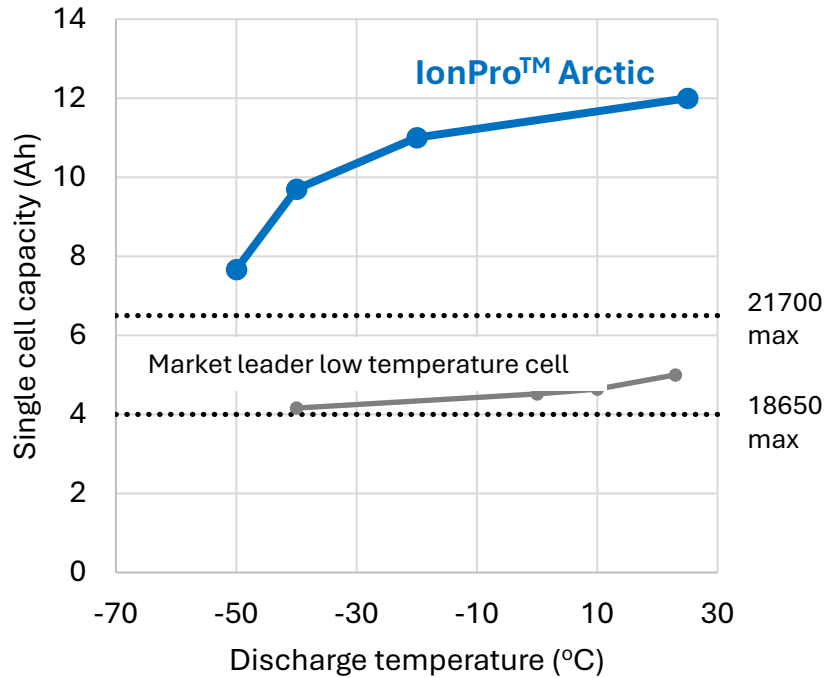


- ≥90% capacity retention at 1C & 3C
- Full capacity (12Ah) retained on discharge after returning to room temperature



Voltage maintained >3V despite higher rates

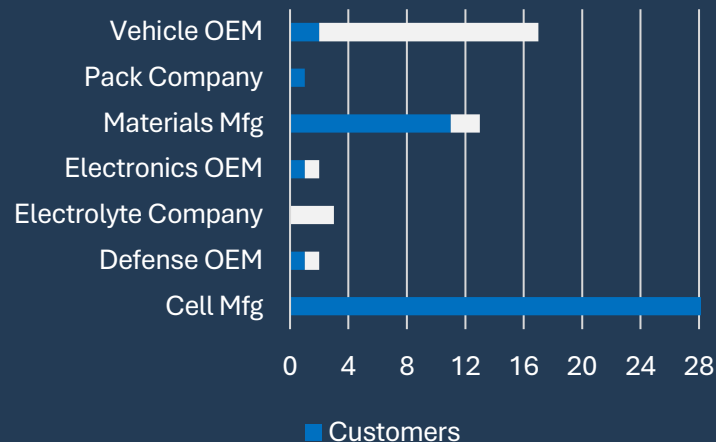
The value of unlocking large low temperature cells



Supporting the **entire battery ecosystem**

>75 customer pilots / collaborations

- ✓ 26 Fortune 500 Partners
- ✓ 13 Electrode chemistries



Company A, B, C, D (Si materials/cell maker): **Si-type anode**

- Increased **cycle life** by >60%, **lowered impedance**
- **Zero gassing**, minimal swelling
- Higher discharge energy, superior rate capability

Company E, F (Si materials/cell maker): **Si-C/HV LCO or NMC9**

- Increased cycle life, enabled **fast charge/discharge**
- **Zero gassing**, minimal swelling
- Scheduled for several >10,000 cell pilots

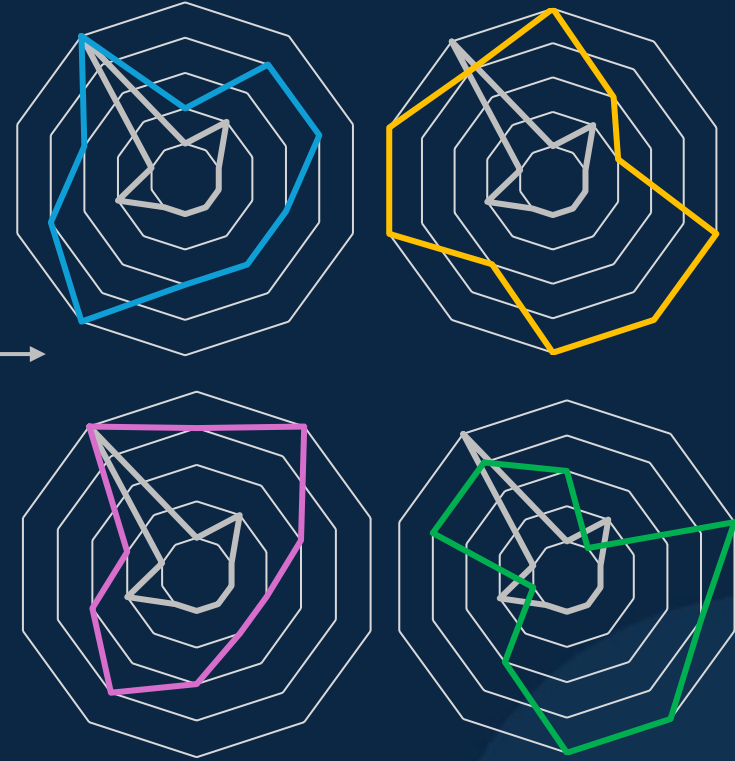
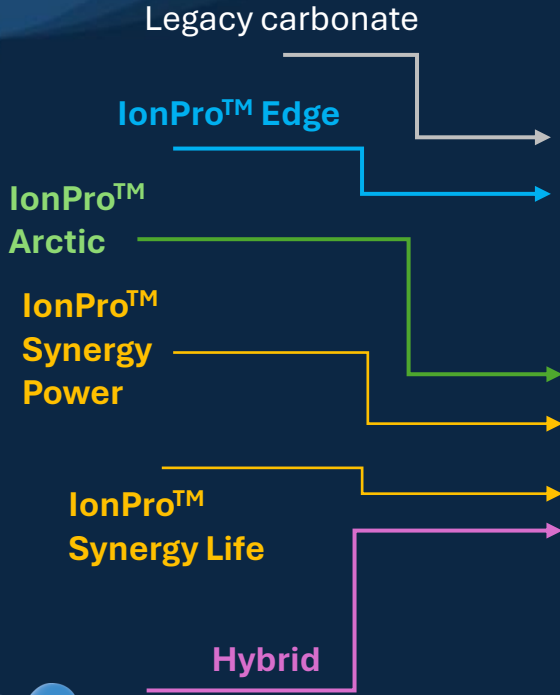
Company F, G, H (**major Auto OEM**): **Gr/Mn-rich**

- **Improved storage calendar life** over baseline
- **Zero gassing**, non-flammable electrolyte
- Ranked #1 in 3rd party benchmark

Customizing battery performance using electrolytes

Electrolyte (“liquid”ware):

Cell (commodity hardware):
“Drone-type” Si-C/NMC



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Thank you!

There's a lot more to show.... Let's talk!

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