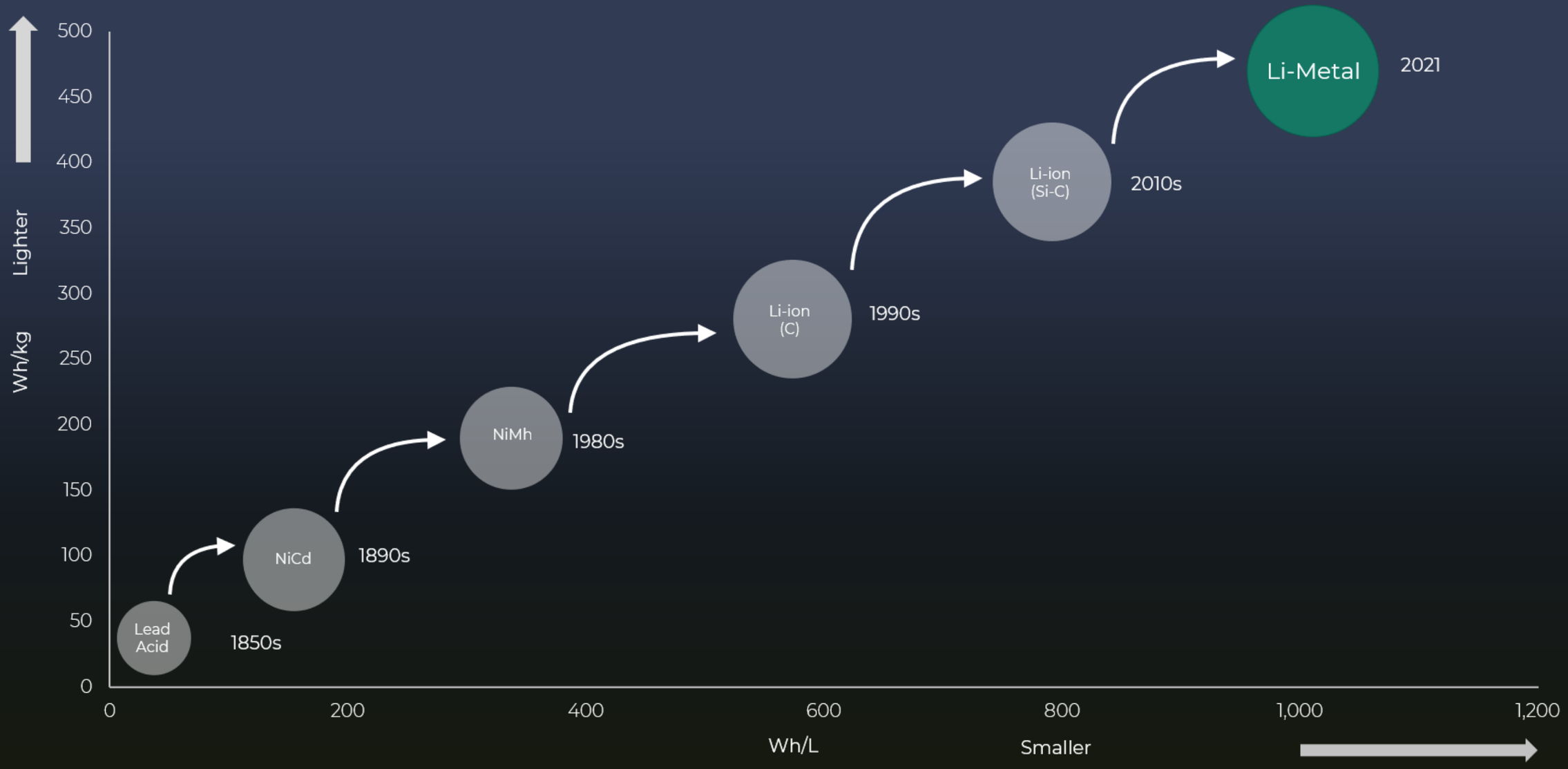
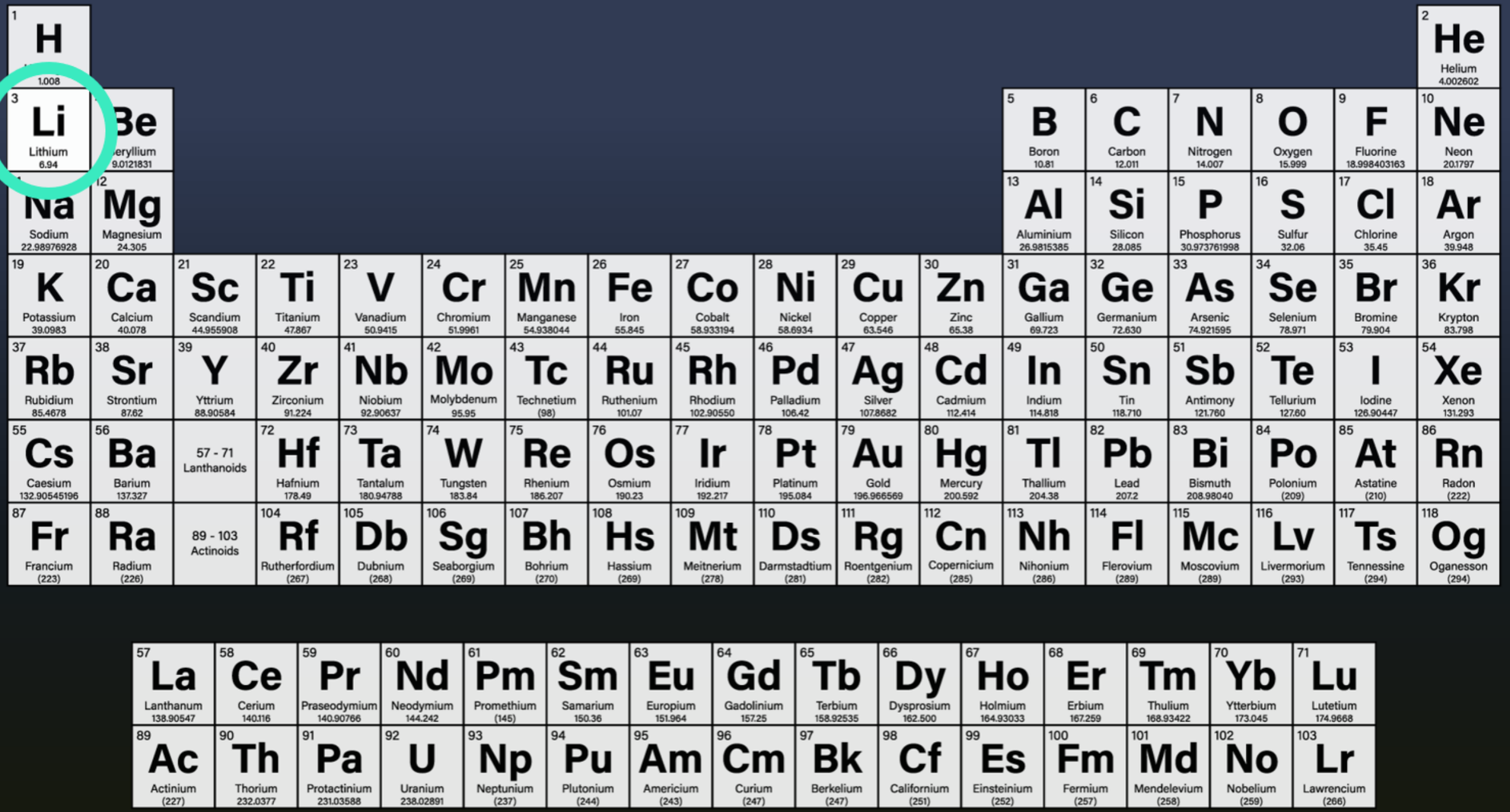
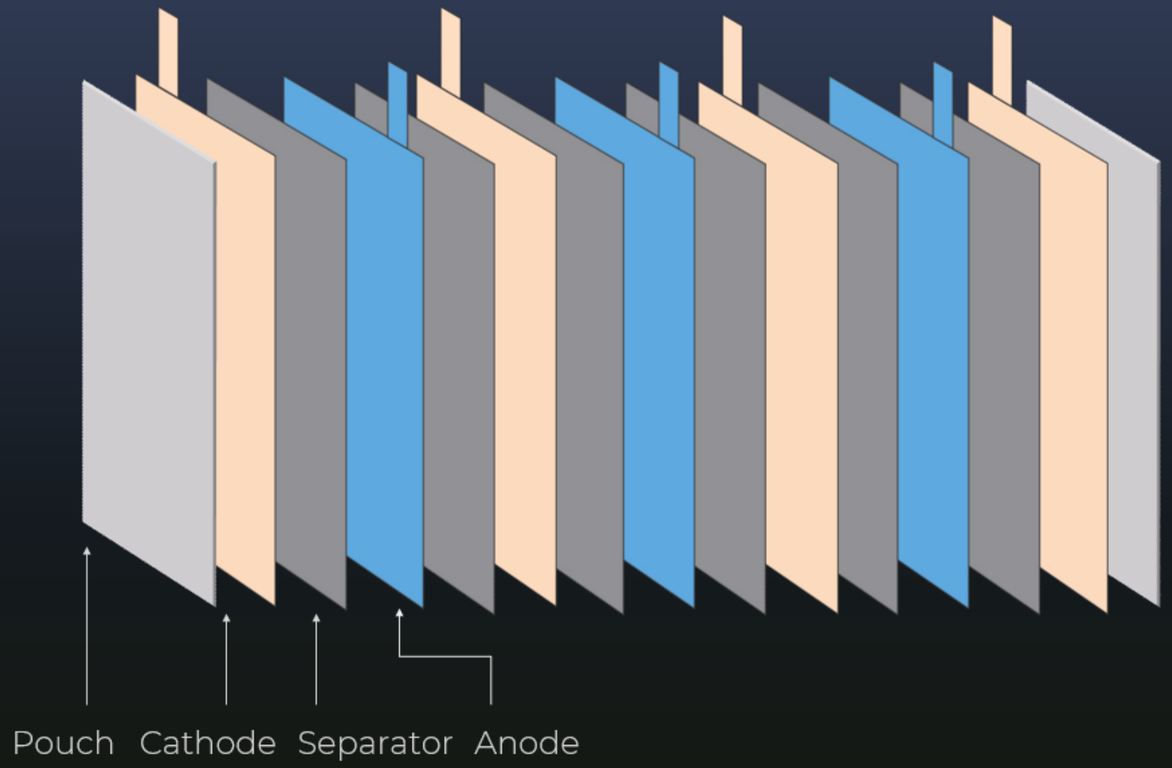

SES

The automotive industry is going through
its biggest transformation in 100 years


GM will only sell zero-emission vehicles by 2035
Ford will invest $29 Billion into EVs and AVs by 2025, aiming to be carbon neutral by 2050
Toyota aims for 70% of vehicle sales to be from EVs and invest $13 billion in EV batteries by 2030.
Hyundai plans to fully electrify its lineup in global markets by 2040


Wh/kg
Lighter
500
450
400
350
300
250
200
150
100
50
0
Lead Acid
1850s
NiCd
1890s
NiMh
1980s
Li-ion (C)
1990s
Li-ion (Si-C)
2010s
Li-Metal
2021
0
200
400
600
800
1,000
1,200
Wh/L
Smaller


1 H 1.008
2 He Helium 4.002602
3 Li Lithium 6.94
Be eryllium 9.0121831
5 B Boron 10.81
6 C Carbon 12.011
7 N Nitrogen 14.007
8 O Oxygen 15.999
9 F Fluorine 18.998403163
10 Ne Neon 20.1797
Na Sodium 22.98976928
12 Mg Magnesium 24.305
13 Al Aluminium 26.9815385
14 Si Silicon 28.085
15 P Phosphorus 30.973761998
16 S Sulfur 32.06
17 Cl Chlorine 35.45
18 Ar Argon 39.948
19 K Potassium 39.0983
20 Ca Calcium 40.078
21 Sc Scandium 44.955908
22 Ti Titanium 47.867
23 V Vanadium 50.9415
24 Cr Chromium 51.9961
25 Mn Manganese 54.938044
26 Fe Iron 55.845
27 Co Cobalt 58.933194
28 Ni Nickel 58.6934
29 Cu Copper 63.546
30 Zn Zinc 65.38
31 Ga Gallium 69.723
32 Ge Germanium 72.630
33 As Arsenic 74.921595
34 Se Selenium 78.971
35 Br Bromine 79.904
36 Kr Krypton 83.798
37 Rb Rubidium 85.4678
38 Sr Strontium 87.62
39 Y Yttrium 88.90584
40 Zr Zirconium 91.224
41 Nb Niobium 92.90637
42 Mo Molybdenum 95.95
43 Tc Technetium (98)
44 Ru Ruthenium 101.07
45 Rh Rhodium 102.90550
46 Pd Palladium 106.42
47 Ag Silver 107.8682
48 Cd Cadmium 112.414
49 In Indium 114.818
50 Sn Tin 118.710
51 Sb Antimony 121.760
52 Te Tellurium 127.60
53 I Iodine 126.90447
54 Xe Xenon 131.293
55 Cs Caesium 132.90545196
56 Ba Barium 137.327
57 - 71 Lanthanoids
72 Hf Hafnium 178.49
73 Ta Tantalum 180.94788
74 W Tungsten 183.84
75 Re Rhenium 186.207
76 Os Osmium 190.23
77 Ir Iridium 192.217
78 Pt Platinum 195.084
79 Au Gold 196.966569
80 Hg Mercury 200.592
81 Tl Thallium 204.38
82 Pb Lead 207.2
83 Bi Bismuth 208.98040
84 Po Polonium (209)
85 At Astatine (210)
86 Rn Radon (222)
87 Fr Francium (223)
88 Ra Radium (226)
89 - 103 Actinoids
104 Rf Rutherfordium (267)
105 Db Dubnium (268)
106 Sg Seaborgium (269)
107 Bh Bohrium (270)
108 Hs Hassium (269)
109 Mt Meitnerium (278)
110 Ds Darmstadtium (281)
111 Rg Roentgenium (282)
112 Cn Copernicium (285)
113 Nh Nihonium (286)
114 Fl Flerovium (289)
115 Mc Moscovium (289)
116 Lv Livermorium (293)
117 Ts Tennessine (294)
118 Og Oganesson (294)
57 La Lanthanum 138.90547
58 Ce Cerium 140.116
59 Pr Praseodymium 140.90766
60 Nd Neodymium 144.242
61 Pm Promethium (145)
62 Sm Samarium 150.36
63 Eu Europium 151.964
64 Gd Gadolinium 157.25
65 Tb Terbium 158.92535
66 Dy Dysprosium 162.500
67 Ho Holmium 164.93033
68 Er Erbium 167.259
69 Tm Thulium 168.93422
70 Yb Ytterbium 173.045
71 Lu Lutetium 174.9668
89 Ac Actinium (227)
90 Th Thorium 232.0377
91 Pa Protactinium 231.03588
92 U Uranium 238.02891
93 Np Neptunium (237)
94 Pu Plutonium (244)
95 Am Americium (243)
96 Cm Curium (247)
97 Bk Berkelium (247)
98 Cf Californium (251)
99 Es Einsteinium (252)
100 Fm Fermium (257)
101 Md Mendelevium (258)
102 No Nobelium (259)
103 Lr Lawrencium (266)

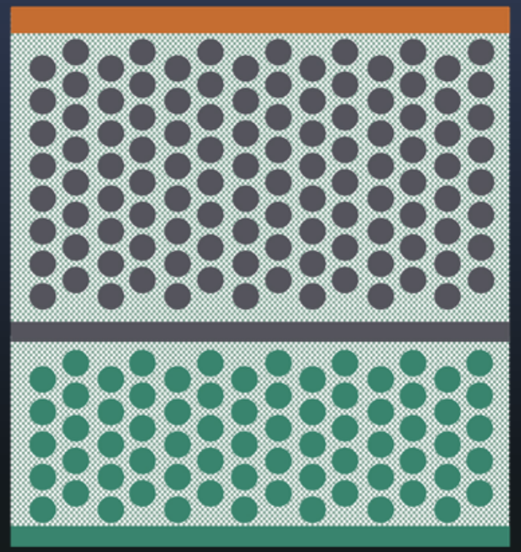

Pouch
Cathode
Separator
Anode

Conventional Li-ion

Anode

Separator

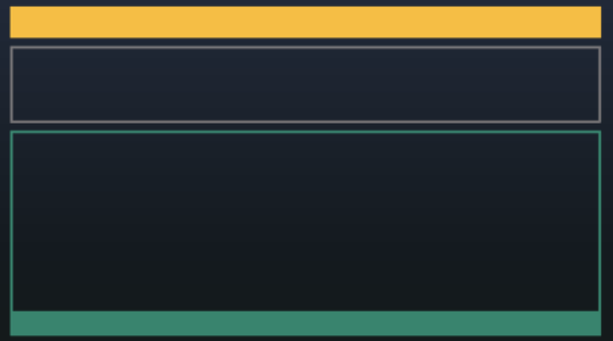
Cathode



✗ Energy Density

✓ Manufacturability

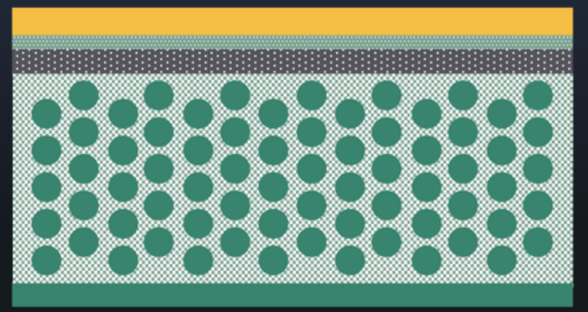
All-Solid-State Li-Metal



✓ Energy Density

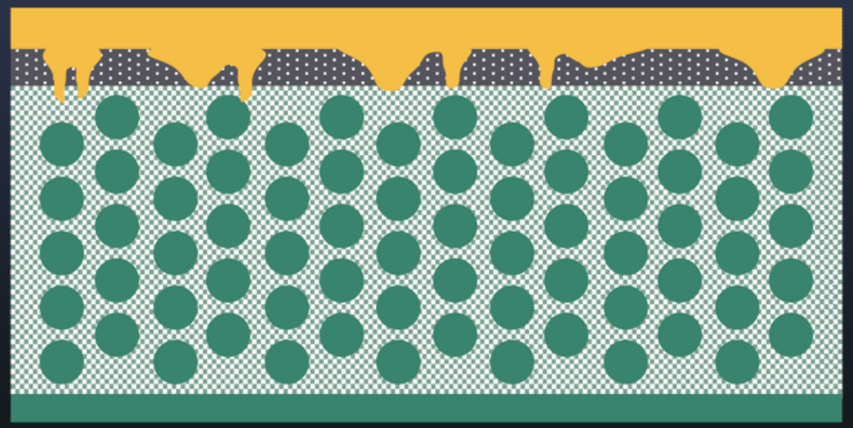
✗ Manufacturability

SES Hybrid Li-Metal



✓ Energy Density

✓ Manufacturability



0

Old liquid
Flammable dangerous

1

Solid state
Safe but poor performance, energy density and manufacturability

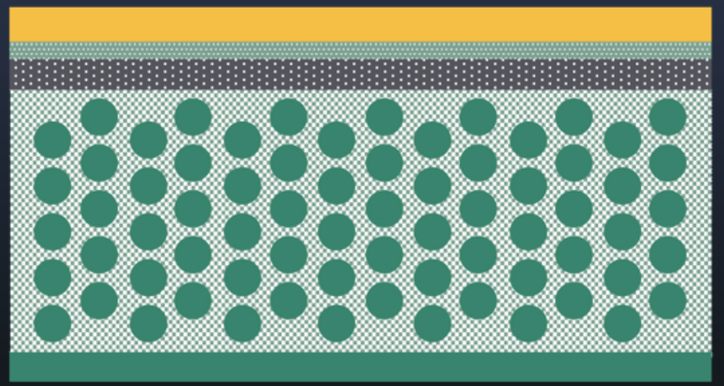
2

New liquid
High concentration, solvent-in-salt, safe and stable on lithium metal

3

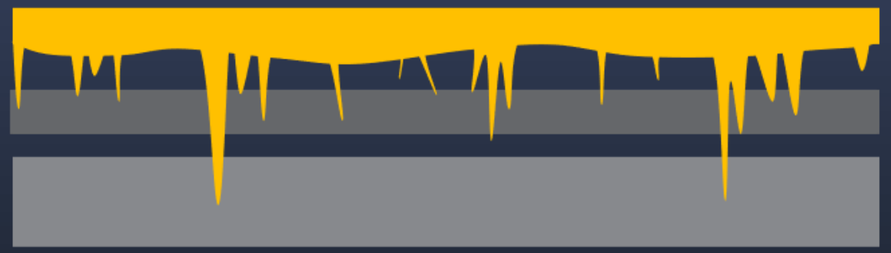
Safety software
Precisely monitor battery health

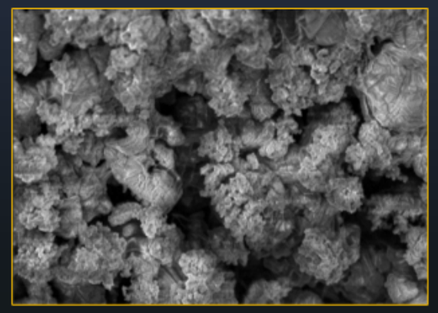
1980 1990 2000 2010 2020



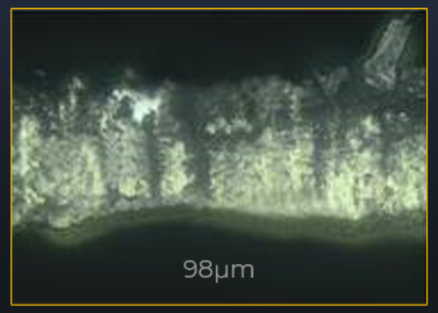
Safety software 3

Before



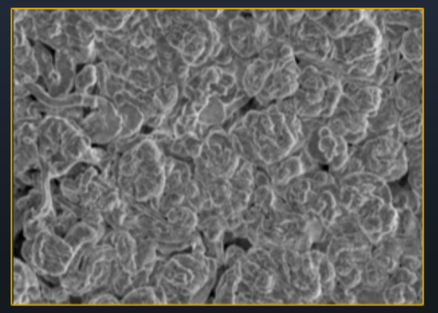


Top View

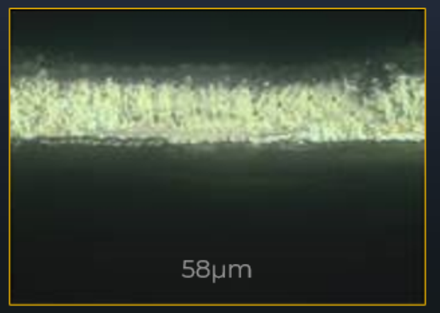


Cross-Section

After



Top View



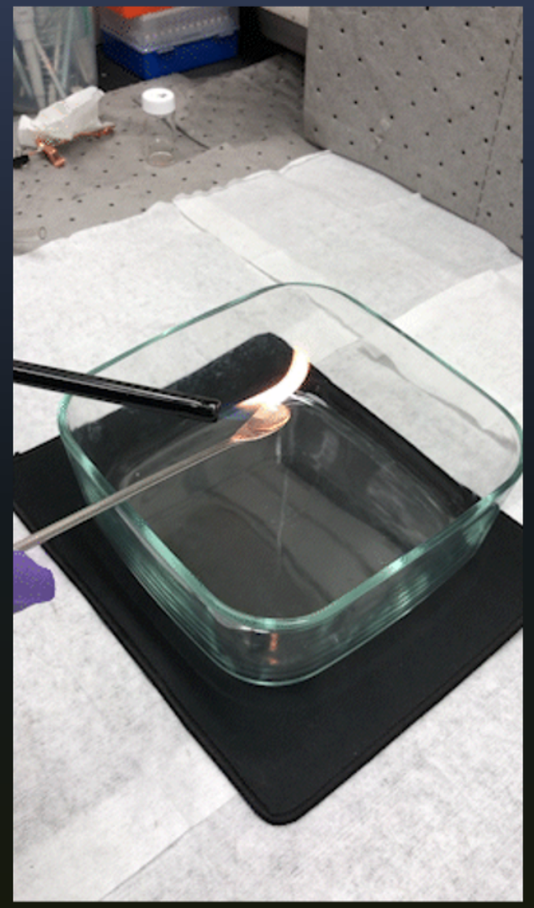
Cross-Section

Conventional Lithium-ion Electrolyte:

✗ Flammable

SES Proprietary High Concentration Solvent-in-Salt Electrolyte:

✓ Self Extinguishing



Hermes

Platform for
new material
development

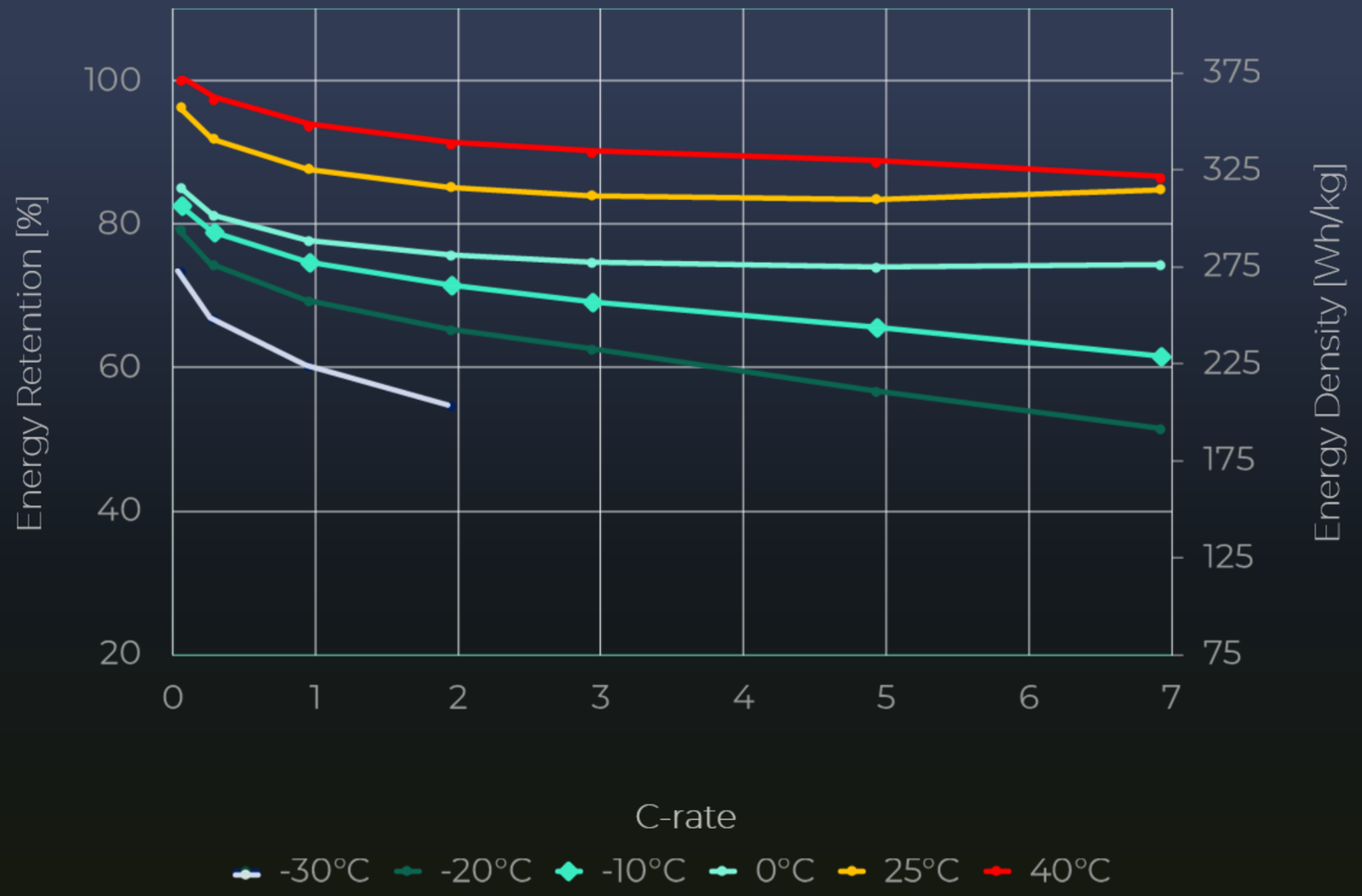
Apollo

Engineering
capability for large
automotive cells

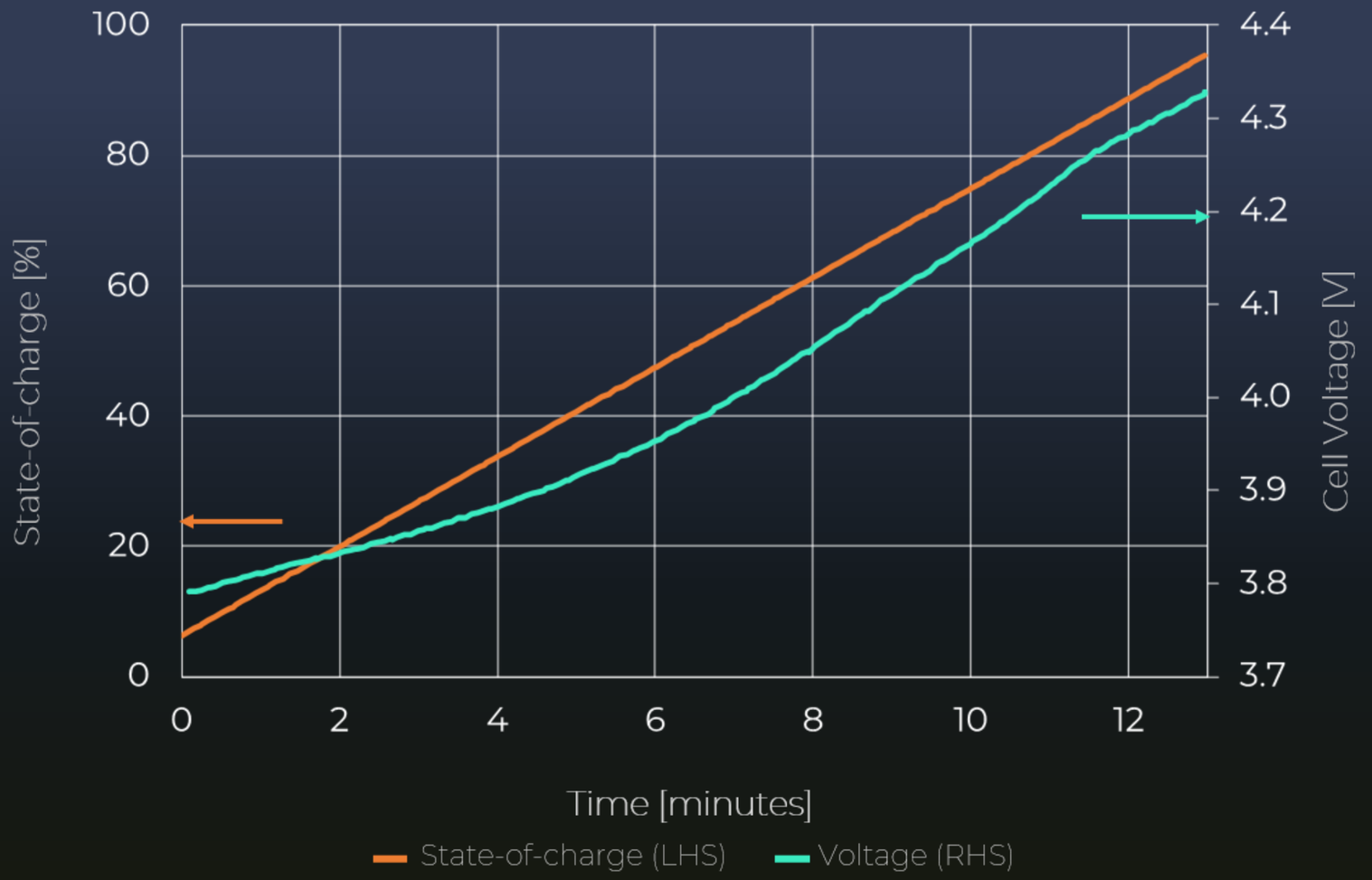
Avatar

AI-powered safety
software to monitor
battery health


S191201A032
SES-SH

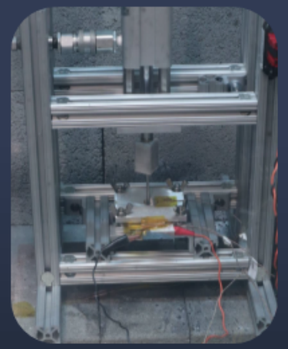


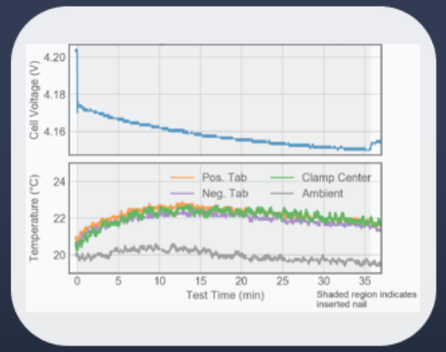
Note: all data from 3rd party testing



Note: all data from 3rd party testing

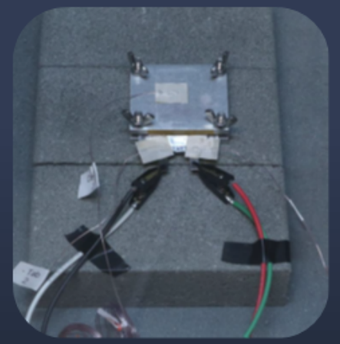
Nail Penetration: ✓ PASSED

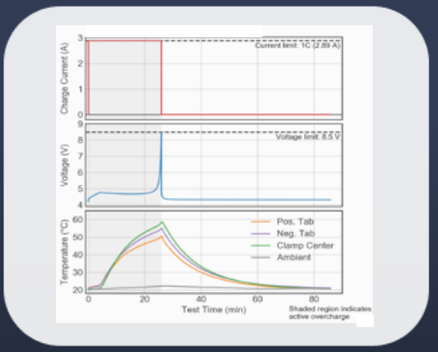




No thermal runaway even with complete nail penetration

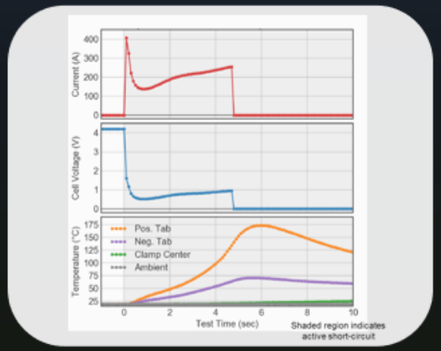
Overcharge: ✓ PASSED





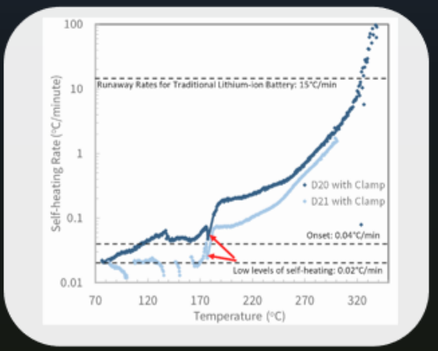
No thermal runaway even when charged to ~2x safe charge limit

External Short Circuit: ✓ PASSED



No thermal runaway even when cell is short circuited

Thermal Stability: ✓ PASSED

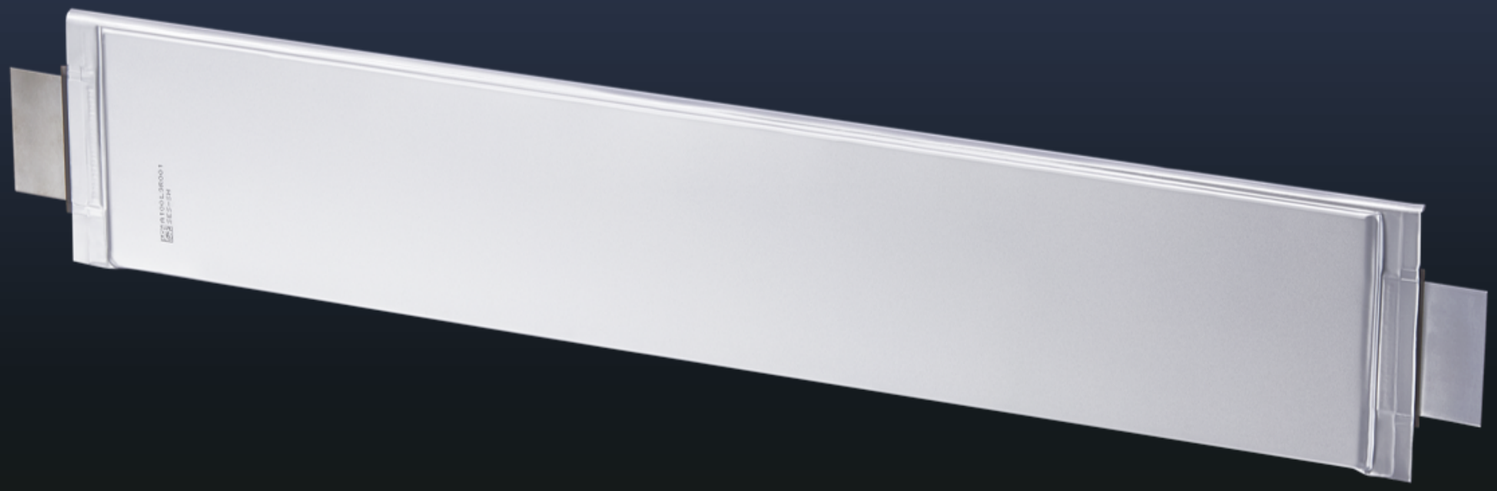


SES proprietary electrolyte is stable against molten lithium

Note: all data from 3rd party testing


S191201A032
SES-SH


SES

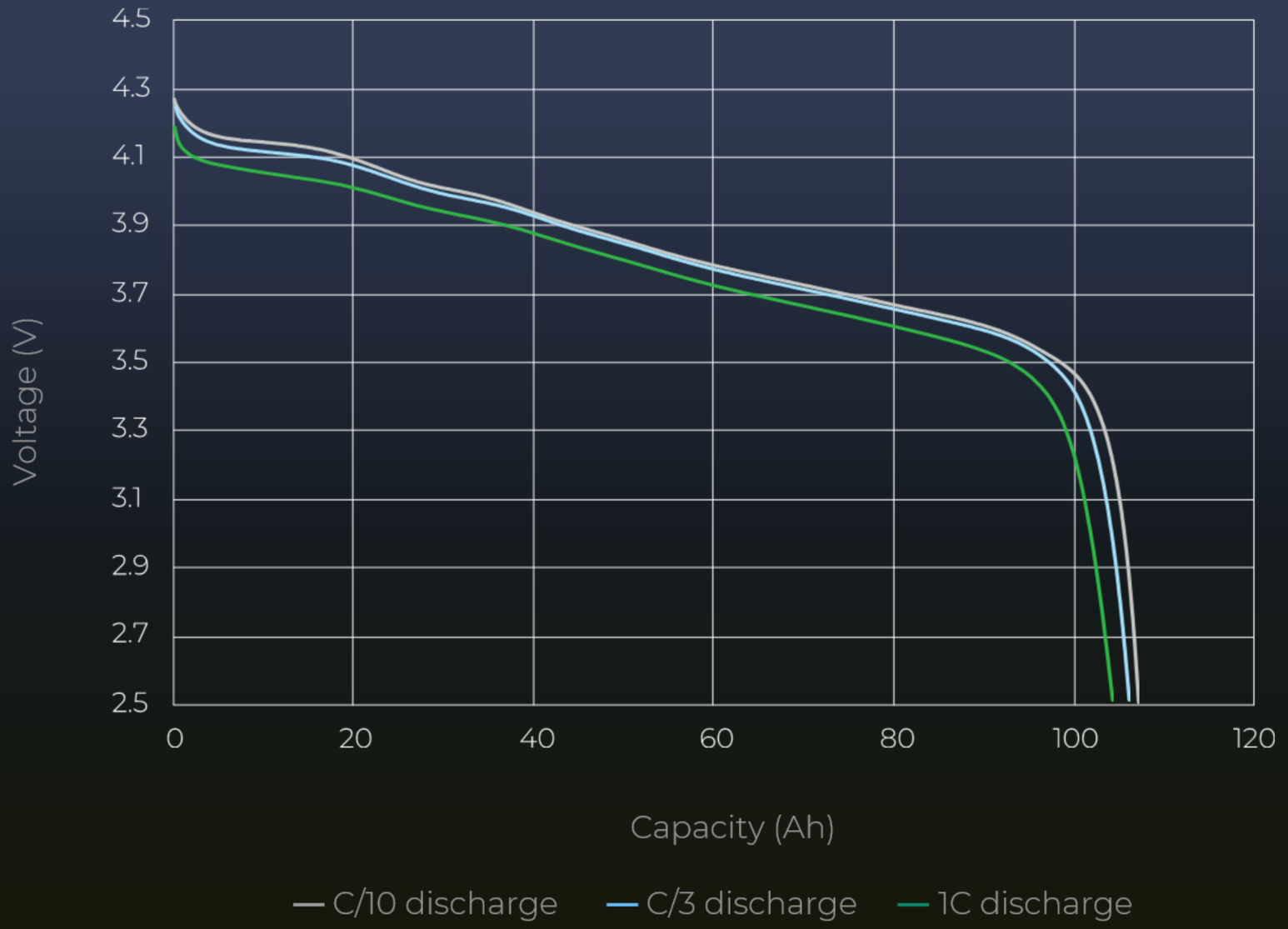


107 Ah

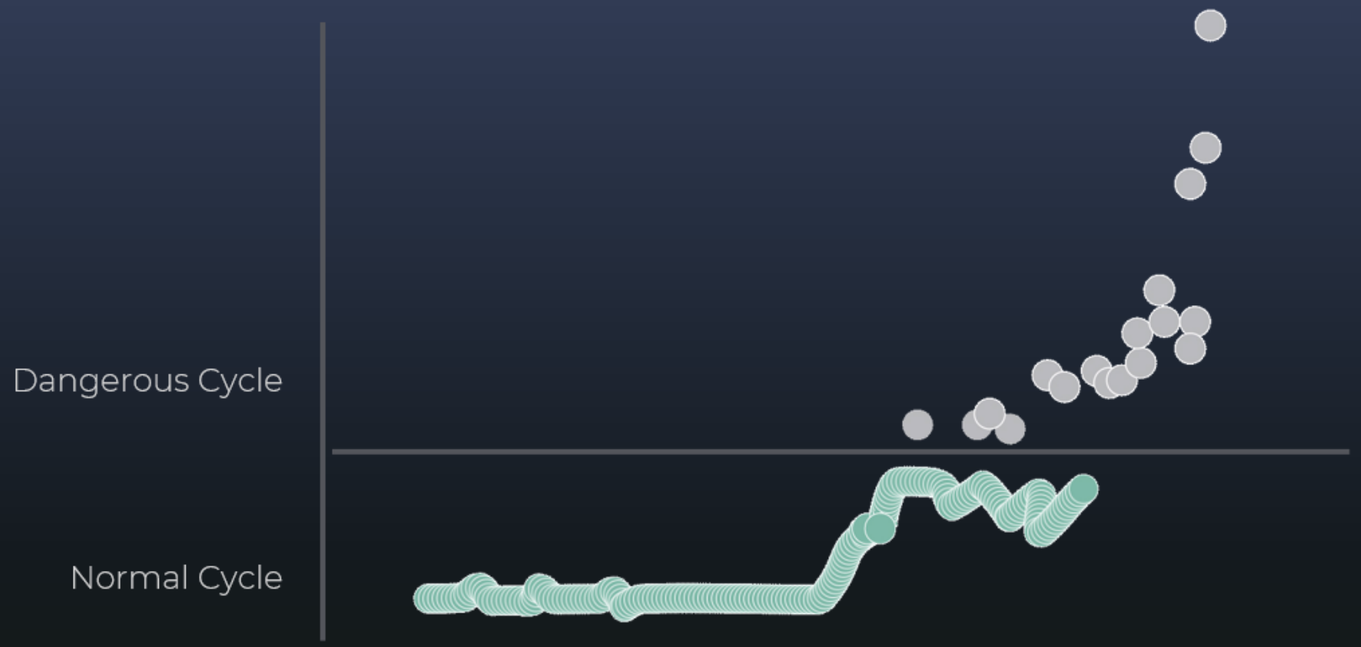
0.982 kg

417 Wh/kg

935 Wh/L



100Ah Cell Production


Dangerous Cycle
Normal Cycle

Hermes

Platform for
new material
development

Apollo

Engineering
capability for large
automotive cells

Avatar

AI-powered safety
software to monitor
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Hermes

Apollo

Avatar

Hybrid Li-Metal


A
B/C
SOP
SES
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
SES A123
3000 sqft
SES Boston
25,000 sqft
SES Shanghai
60,000 sqft
SES Shanghai Giga
300,000 sqft

SES Shanghai Giga


HYUNDAI
MOTOR GROUP
SAIC
上汽集团
SAIC MOTOR
gm
GEELY
SK
KIA
TIANQI LITHIUM
KOCH
FOXCONN
vertex
VENTURES
祥峰投资
LG
Technology Ventures
APPLIED
MATERIALS
TEMASEK

WE ARE NOT	WE ARE
Solid State Li-Metal	Hybrid Li-Metal
Single technology	System approach
Another “battery breakthrough”	Make it work