

Superior Lithium Polymer Battery (SLPB)

KOKAM Li-ion/Polymer Cell

Kokam's SLPB cell has proven its outstanding power, high energy density, longer cycle life and safety. Kokam is a pioneer in supplying small to large format SLPB cells ranging from 2 Ah to 240 Ah.



"Superior Performance, Proven Quality, Greater Reliability, Increased Safety"

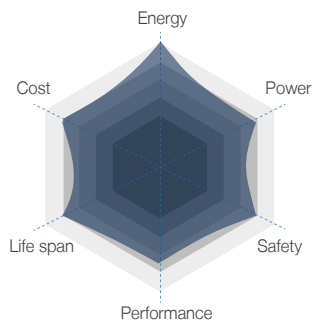
Kokam sets about to solve the limitations associated with conventional lithium-ion technologies, including cycle and calendar life, safety, recharge time, power delivery and ability to operate in extreme temperatures. The technology's performance features surpass other existing battery capabilities in the market place today.

Pouch type has more surface area compared to Prismatic type (High Capacity Cell), therefore more effective in letting out heat



- Exceptionally High Power Performance
- High Energy Density (~ 260 Wh/kg)
- High Gravimetric and Volumetric Power Density.
- Excellent Power-to-Energy Balance (up to 50C)
- Longer Cycle and Calendar Life
- Low Impedance and Heat Generation
- Light Weight
- No Memory Effect
- High Charge / Discharge Energy Efficiency
- Low Self-Discharge Rates

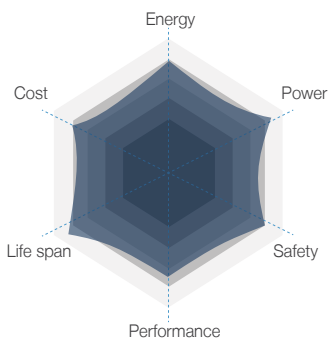
Cell chemistry



High Energy NMC (Nickel Manganese Cobalt)

Advantages

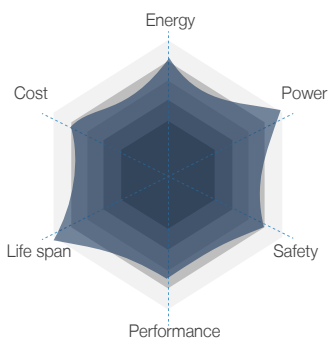
- High energy density (~ 260Wh/kg): Up to 3.2MWh of batteries can be stored in a 40ft container
- More than 96% of high efficiency at 0.5C
- Competitive Price: The NMC cells have a comparative advantage in terms of price, considering it's superior performance, reliability and safety features.



High Power NMC

Advantages

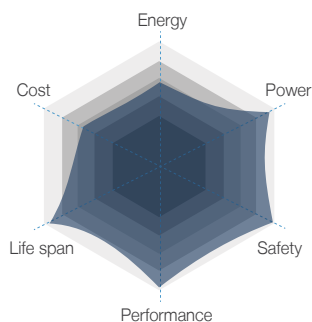
- High C-rate up to 50C-rate level
- High C-rate discharge performance for uses in frequency regulation, UPS, etc.
- Improved performance without safety or cycle life trade off



Ultra High Power NMC

Advantages

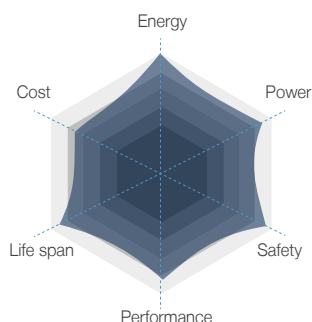
- Improved performance with 4C charge
- Improved high power cycle life up to 10,000 cycles
- Decreased 50% of internal resistance against standard NMC
- Special coating applied to cathode to improve high power performance



Lithium titanate (LTO)

Advantages

- Wide Range of Operation: -30 ~ 60degC.
- High specific power: 4C-rate continuous and 8 C-rate peak charge & discharge operation
- High round trip efficiency (RTE): >95%.
- Long cycle life: 20,000 cycles @ 80% DoD, 1C charge & discharge operating conditions.
- Extremely Safe: A thermal runaway event is significantly less likely to occur in LTO cells. LTO cells can also be re-operated after an event of an over-discharge, unlike conventional graphite based Li-Ion cells. This feature enables the user to operate the battery cells under extreme environmental and operational conditions.
- The advantages of the LTO cells: Originates from the Anode side of the battery cell. Whereas the Anode side of ordinary Li-Ion cells are made up of Graphite, the Anode side of the LTO cell is composed of LTO.



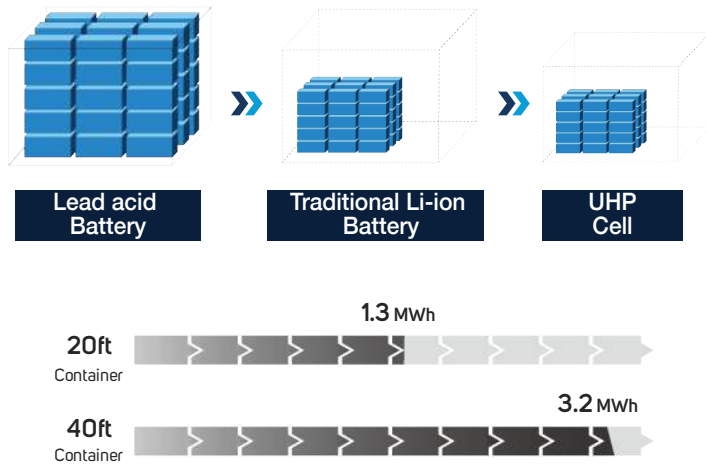
NMC + LFP+LTO (NANO)

Advantages

- Specially designed for defense & aerospace application
- This hybrid type cell has incorporated the advantages of NMC, LFP and LTO cells in one cell. It is suitable for extremely volatile and dynamic operational conditions. The high power, energy and safety features allow the NANO cells to be flexibly applied in various applications.

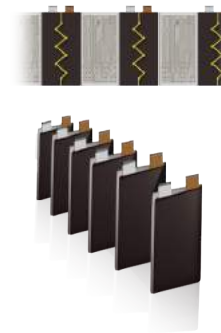
Ultra High Power NMC Characteristic

[HIGH ENERGY]



[Z-FOLDING Technology]

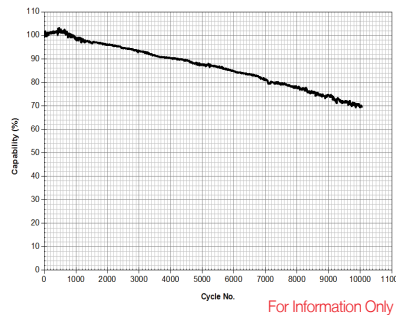
Low Internal Resistance, High Efficiency



- Internal Resistance
Kokam UHP: 0.3~0.35mΩ
 (Competitor NMC : 0.5~0.7mΩ)
 50% lower Internal Resistance compared to other battery manufacturers
- Z-fold stacking and special coating method significantly **reduces internal resistance** and **increases efficiency, power, and cycle life.**

[Increased cycle life]

- 90% DOD, 1C/1C **10,000 cycle**
- 100% DOD, 4C/4C **over 4,000 cycle**



[Tab fuse]

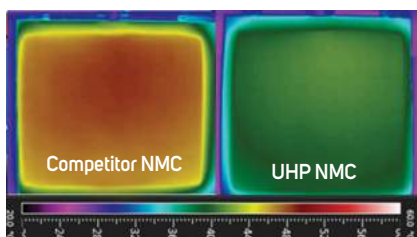
- In order to prevent the cell from being shorted, the cathode tab is fused



[Increased cycle life]



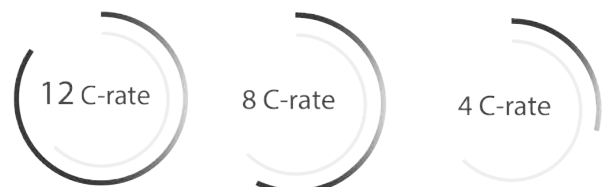
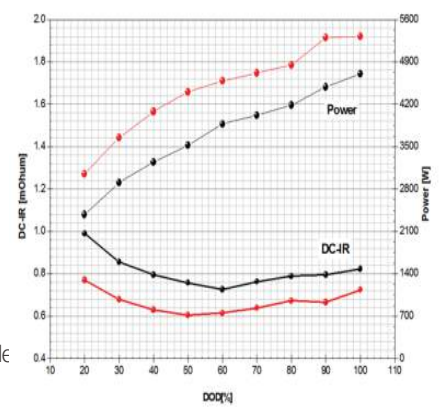
- Pouch type has more surface area compared to Prismatic type (High Capacity Cell), therefore more effective in letting out heat.
- 1.6x of heat dissipation** → 19.1cm²/Ah:11.6 cm²/Ah
- 3.5x of dissipation surface** → 650 mm²/6.5t:216 mm²/22.5t



- UHP Cell creates less heat than standard NMC cells, allowing for more vigorous operations

[Tab fuse]

- 4C-rate Continuous Charge**
- 8C-rate Continuous Discharge**
- 15C-rate Instant discharge possible**





Technology Specifications

Ultra High Energy NMC Cell (UHE) _ For UAV & other unmanned vehicles with high energy density

| Type | Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|------|---------------|---------------|---------------|-----|-----|------------|-------------|----------------|-------|------------------------|
| | | | W | L | T | | | C-rate(C) | | |
| | | | | | | | | Continuous | Pulse | |
| UHE | SLPB065070180 | 12 | 80 | 181 | 6.3 | 2.8 | 0.17 | 2 | 4 | 257 |
| | SLPB080085270 | 27 | 95 | 272 | 7.6 | 1.6 | 0.38 | 2 | 4 | 260 |

SLPB Small Cell

| Type | Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (g) | Discharge Rate | | Energy Density (Wh/kg) | Chemistry |
|---------|----------------|---------------|---------------|-------|------|------------|------------|----------------|-------|------------------------|-----------|
| | | | W | L | T | | | C-rate(C) | | | |
| | | | | | | | | Continuous | Pulse | | |
| 3~5Ah | SLPB8043128H | 3.2 | 43 | 128 | 7.8 | 5 | 84 | 20 | 40 | 141 | HP NMC |
| | SLPB526495 | 3.3 | 64.5 | 95.5 | 5.4 | 15 | 67 | 2 | 3 | 182 | HE NMC |
| | SLPB8643128H5 | 3.6 | 43 | 129 | 8.8 | 3 | 101 | 30 | 50 | 132 | HP NMC |
| | SLPB11543140H5 | 5 | 43 | 142.5 | 11.7 | 3 | 132 | 30 | 50 | 140 | HP NMC |
| | SLPB050106100 | 5 | 107 | 102 | 5.9 | 5 | 120 | 2 | 5 | 154 | HE NMC |
| | SLPB50106100 | 5 | 107 | 102 | 5.9 | 5 | 140 | 5 | 8 | 151 | HE NMC |
| 5~10 Ah | SLPB776495 | 5.3 | 64.5 | 95.5 | 7.8 | 8 | 102 | 2 | 3 | 192 | HE NMC |
| | SLPB75106100 | 7.5 | 107 | 102 | 7.9 | 4 | 165 | 5 | 8 | 173 | HE NMC |
| | SLPB68106100 | 8 | 107 | 102 | 7.25 | 3.6 | 160 | 2 | 3 | 185 | HE NMC |
| | SLPB7570180 | 9.6 | 82 | 183 | 7.6 | 3.5 | 215 | 2 | 3 | 165 | HE NMC |
| 10~20Ah | SLPB98106100 | 10 | 107 | 102 | 10 | 4 | 210 | 2 | 3 | 176 | HE NMC |
| | SLPB55205130H | 11 | 207 | 137 | 5.6 | 1.6 | 280 | 8 | 10 | 145 | HP NMC |
| | SLPB7570270 | 15 | 82 | 272 | 7.7 | 2.5 | 317 | 2 | 3 | 175 | HE NMC |
| | SLPB75106205 | 16 | 107 | 209 | 7.8 | 3.8 | 340 | 5 | 8 | 174 | HE NMC |
| | SLPB78205130H | 16 | 207 | 137 | 7.8 | 1.1 | 406 | 8 | 15 | 146 | HP NMC |

SLPB Large Cell

| Type | Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) | Chemistry |
|-----------|--------------------|---------------|---------------|-----|------|------------|-------------|----------------|-------|------------------------|-----------|
| | | | W | L | T | | | C-rate(C) | | | |
| | | | | | | | | Continuous | Pulse | | |
| 20~50Ah | SLPB60216216 | 25 | 226 | 227 | 6.3 | 1.20 | 0.600 | 5 | 8 | 154 | HE NMC |
| | SLPB98188216P | 30 | 198 | 220 | 9.9 | 1.00 | 0.870 | 20 | 30 | 128 | UHP NMC |
| | SLPB78216216H | 31 | 226 | 227 | 7.8 | 0.90 | 0.720 | 8 | 15 | 158 | HP NMC |
| | SLPB100216216H | 40 | 226 | 227 | 10.0 | 0.80 | 0.990 | 8 | 15 | 160 | HP NMC |
| | SLPB120216216HR2 | 46 | 226 | 227 | 12.5 | 0.80 | 1.270 | 12 | 15 | 135 | NANO |
| 50~100 Ah | SLPB120216216 | 53 | 226 | 227 | 12.0 | 0.90 | 1.160 | 5 | 8 | 169 | HE NMC |
| | SLPB110255255H | 63 | 268 | 265 | 11.0 | 0.60 | 1.520 | 8 | 15 | 153 | HP NMC |
| | SLPB130255255N_X60 | 60 | 266 | 263 | 12.8 | 0.40 | 1.760 | 6 | 10 | 76 | LTO |
| | SLPB60460330H | 70 | 462 | 327 | 5.7 | 0.60 | 1.740 | 5 | 6 | 149 | HP NMC |
| | SLPB120255255 | 75 | 268 | 265 | 11.6 | 0.60 | 1.580 | 3 | 5 | 175 | HE NMC |
| | SLPB125255255H | 75 | 268 | 265 | 13.0 | 0.55 | 1.780 | 8 | 15 | 156 | HP NMC |
| | SLPB130255255P | 75 | 268 | 265 | 13.5 | 0.40 | 1.810 | 4 | 8 | 153 | UHP NMC |
| | SLPB70460330H | 80 | 462 | 327 | 6.3 | 0.60 | 1.920 | 5 | 6 | 154 | HP NMC |
| | SLPB125255255 | 87 | 268 | 265 | 13.0 | 0.65 | 1.780 | 2 | 3 | 181 | HE NMC |
| 100Ah~ | SLPB70460330 | 100 | 462 | 327 | 7.0 | 0.65 | 2.070 | 2 | 3 | 179 | HE NMC |
| | SLPB80460330H | 100 | 462 | 327 | 7.8 | 0.55 | 2.380 | 5 | 6 | 155 | HP NMC |
| | SLPB140460330 | 200 | 462 | 327 | 13.9 | 0.50 | 4.180 | 2 | 3 | 177 | HE NMC |
| | SLPB160460330H | 200 | 462 | 327 | 14.8 | 0.50 | 4.580 | 2 | 3 | 162 | HP NMC |
| | SLPB160460330 | 240 | 462 | 327 | 15.8 | 0.50 | 4.780 | 2 | 3 | 186 | HE NMC |



Chemistry Category Summary

Ultra High Energy NMC Cell (UHE) _ For UAV & other unmanned vehicles with high energy density

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|---------------|---------------|---------------|-----|-----|------------|-------------|----------------|------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Max | Peak | |
| SLPB065070180 | 12 | 80 | 181 | 6.3 | 2.8 | 0.17 | 2 | 4 | 257 |
| SLPB080085270 | 27 | 95 | 272 | 7.6 | 1.6 | 0.38 | 2 | 4 | 260 |

High Energy NMC Cell

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|---------------|---------------|---------------|------|------|------------|-------------|----------------|-------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Continuous | Pulse | |
| SLPB50106100 | 5 | 107 | 102 | 5.9 | 5 | 0.14 | 5 | 8 | 151 |
| SLPB776495 | 5.3 | 64.5 | 95.5 | 7.8 | 8 | 0.10 | 2 | 3 | 192 |
| SLPB68106100 | 8 | 107 | 102 | 7.25 | 3.6 | 0.16 | 2 | 3 | 185 |
| SLPB7570180 | 9.6 | 82 | 183 | 7.6 | 3.5 | 0.21 | 2 | 3 | 165 |
| SLPB75106205 | 16 | 107 | 209 | 7.8 | 3.8 | 0.34 | 5 | 8 | 174 |
| SLPB125255255 | 87 | 268 | 265 | 13.0 | 0.65 | 1.78 | 2 | 3 | 181 |
| SLPB160460330 | 240 | 462 | 327 | 15.8 | 0.50 | 4.78 | 2 | 3 | 186 |

Ultra High Power NMC Cell (UHP) _ For laser weapon, torpedo, etc. with high power and improved cycle life

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|----------------|---------------|---------------|-------|------|------------|-------------|----------------|-------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Continuous | Pulse | |
| SLPB8043128H | 3.2 | 43 | 128 | 7.8 | 5 | 0.08 | 20 | 40 | 141 |
| SLPB8643128H5 | 3.6 | 43 | 129 | 8.8 | 3 | 0.10 | 30 | 50 | 132 |
| SLPB11543140H5 | 5 | 43 | 142.5 | 11.7 | 3 | 0.13 | 30 | 50 | 140 |
| SLPB98188216P | 30 | 198 | 220 | 9.9 | 1 | 0.87 | 20 | 30 | 128 |

High Power NMC Cell

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|----------------|---------------|---------------|-----|------|------------|-------------|----------------|-------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Continuous | Pulse | |
| SLPB55205130H | 11 | 207 | 137 | 5.6 | 1.6 | 0.28 | 8 | 10 | 145 |
| SLPB78205130H | 16 | 207 | 137 | 7.8 | 1.1 | 0.40 | 8 | 15 | 146 |
| SLPB100216216H | 40 | 226 | 227 | 10.0 | 0.80 | 0.99 | 8 | 15 | 160 |
| SLPB125255255H | 75 | 268 | 265 | 13.0 | 0.55 | 1.78 | 8 | 15 | 156 |
| SLPB80460330H | 100 | 462 | 327 | 7.8 | 0.55 | 2.38 | 5 | 6 | 155 |

NANO Cell (NMC+LFP+LTO) _ For aerospace and special applications with improved safety, and low temperature performance

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|------------------|---------------|---------------|-----|------|------------|-------------|----------------|-------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Continuous | Pulse | |
| SLPB120216216HR2 | 46 | 226 | 227 | 12.5 | 0.80 | 1.27 | 12 | 15 | 135 |
| SLPB135255255PR2 | 70 | 268 | 265 | 13.5 | 0.40 | 1.90 | 10 | 15 | 136 |

LTO Cell _ Able to withstand temperatures ranging from -40 to 60 degrees Celsius

| Model | Capacity (Ah) | Dimension(mm) | | | AC-IR (mΩ) | Weight (kg) | Discharge Rate | | Energy Density (Wh/kg) |
|--------------------|---------------|---------------|-----|------|------------|-------------|----------------|-------|------------------------|
| | | W | L | T | | | C-rate(C) | | |
| | | | | | | | Continuous | Pulse | |
| SLPB130255255N_X60 | 60 | 266 | 263 | 12.8 | 0.40 | 1.76 | 6 | 10 | 76 |



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