

# KOKAM Lithium Ion 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 11.6 Ah to 240 Ah.

**Kokam**

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

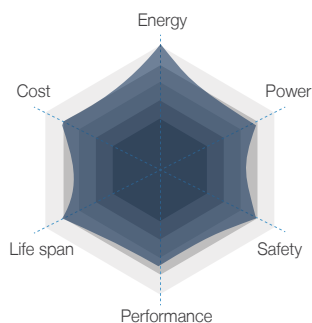
Kokam sets about to solve the limitations associated with conventional lithium-ion technologies, including cycle and calendar life, safety, recharge time, power delivery and ability to operate in extreme temperatures. The technology's performance features surpass other existing battery capabilities in 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
- High Gravimetric and Volumetric Power Density.
- Excellent Power-to-Energy Balance (up to 20C)
- Longer Cycle and Calendar Life
- Low Impedance and Heat Generation
- Light Weight
- No Memory Effect
- High Charge / Discharge Energy Efficiency
- Low Self-Discharge Rates

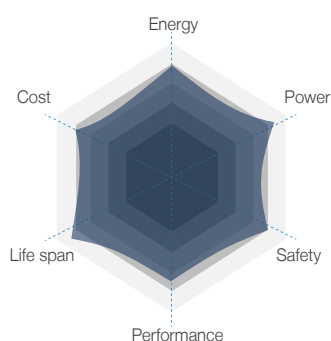
## Cell Chemistry



### High Energy NMC (Nickel Manganese Cobalt)

#### Advantages

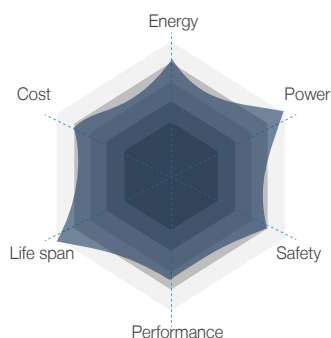
- High energy density (ESS: ~203Wh/kg, UHE NMC: ~248Wh/kg):  
Up to 5MWh of batteries can be stored in a 40ft container
- More than 96% of high efficiency at 0.5C
- Competitive Price: The NMC cells have a comparative advantage in terms of price, considering it's superior performance, reliability and safety features.



### High Power NMC

#### Advantages

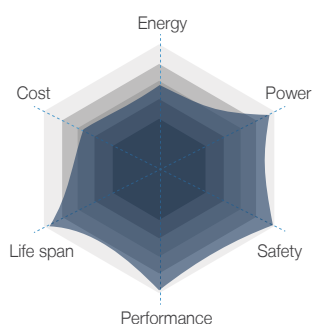
- Improved performance with 8C discharge
- Improved performance with 3C charge
- Improved high power cycle life
- Up to 3MWh of batteries can be stored in a 40ft container
- Special coating applied to cathode to improve high power performance



### Ultra High Power NMC

#### Advantages

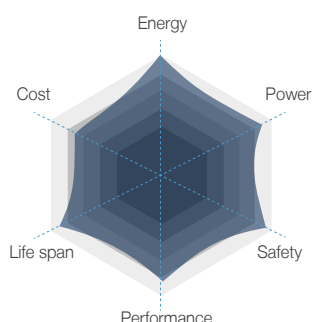
- High C-rate up to 20C-rate level
- High C-rate discharge performance for uses in frequency regulation, UPS, etc.
- Improved performance without safety or cycle life trade off



### Lithium Titanate (LTO)

#### Advantages

- Wide Range of Operation: -30 ~ 60degC.
- High specific power: 5C-rate continuous and 8 C-rate peak charge & discharge operation
- High round trip efficiency (RTE): >95%.
- Long cycle life: 8,000 cycles @ 80% DoD, 4C 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.



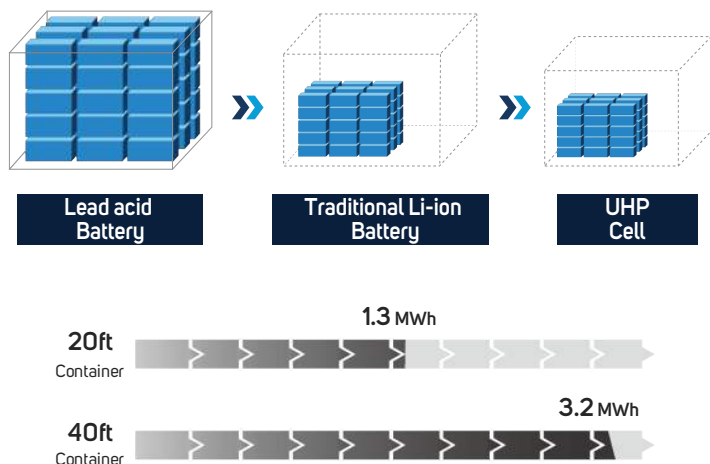
### NMC + LFP + LTO (NANO)

#### 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]

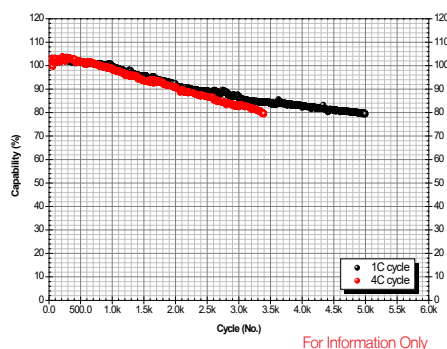
#### Low Internal Resistance, High Efficiency



- 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 **over 4,500 cycle**
- 90% DOD, 4C/4C **over 3,000 cycle**



### [Tab fuse]

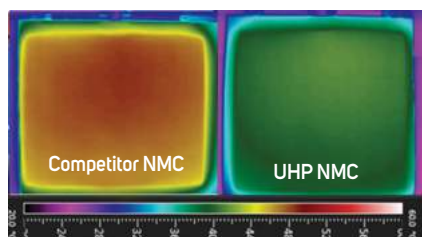
- In order to prevent the cell from being shorted, the cathode tab is fused



### [Heat Dissipation]



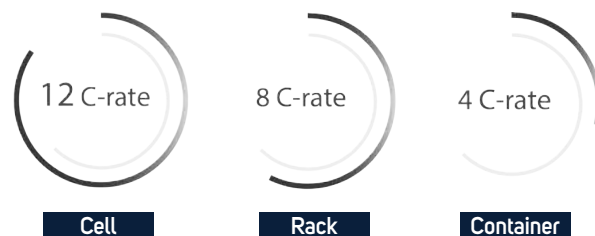
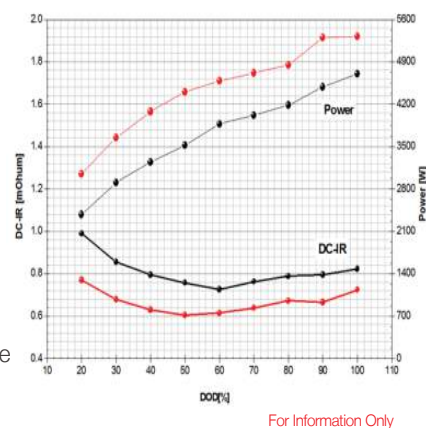
- Pouch type has more surface area compared to Prismatic type (High Capacity Cell), therefore more effective in letting out heat.
- 1.6x of heat dissipation** → 19.1cm<sup>2</sup>/Ah:11.6 cm<sup>2</sup>/Ah
- 3.5x of dissipation surface** → 650mm<sup>2</sup>/6.5t:216 mm<sup>2</sup>/22.5t

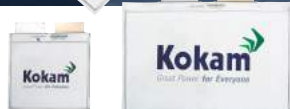


- UHP Cell creates less heat than standard NMC cells, allowing for more vigorous operations

### [High Power]

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





## Chemistry Category Summary

### Ultra 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	
SLPB065070180	11.6	84	185	6.6	2.8	0.17	2	4	246
SLPB080085270	26	99	275	7.9	1.6	0.38	2	4	248

### 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	
SLPB60216216	25	226	227	6.3	1.2	0.55	5	8	167
SLPB72216216	31	226	227	7.5	1.1	0.66	5	8	172
SLPB90216216	40	226	227	9.3	0.9	0.84	5	8	176
SLPB120216216	53	226	227	12.0	0.9	1.09	5	8	179
SLPB120216216G2	70	226	227	12.3	0.7	1.15	2	3	225
SLPB120255255	75	268	265	11.8	0.65	1.53	3	5	181
SLPB130255255G1	100	268	265	13.3	0.55	1.81	2	3	204
SLPB120460330	150	462	327	10.5	0.5	3.02	2	3	184
SLPB140460330	200	462	327	13.6	0.5	3.95	2	3	187
SLPB160460330	240	462	327	15.8	0.5	4.51	2	3	197

### 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	
SLPB98188216P	30	199	224	9.4	0.7	0.78	20	30	142
SLPB130255255P	75	268	265	13.7	0.4	1.83	8	15	152

### 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	
SLPB78205130H	16	217	137	7.8	1.2	0.39	8	12	150
SLPB100216216H	40	226	227	10.3	0.8	0.94	8	12	157
SLPB125255255H	75	268	265	13.0	0.55	1.66	8	12	167
SLPB160460330H	200	462	327	14.8	0.5	4.58	2	3	162

### 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	0.6	1.18	8	12	144

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