

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"

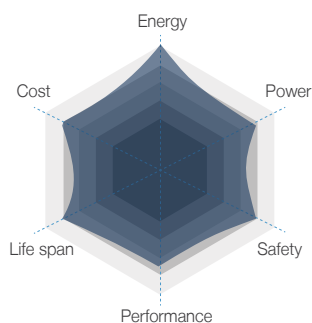
Kokam sets about to solve the limitations associated with conventional lithium-ion technologies, including cycle and calendar life, safety, recharge time, power delivery and ability to operate in extreme temperatures. The technology's performance features surpass other existing battery capabilities in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

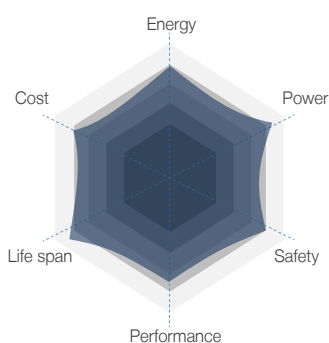
## Cell chemistry



### High Energy NMC (Nickel Manganese Cobalt)

#### Advantages

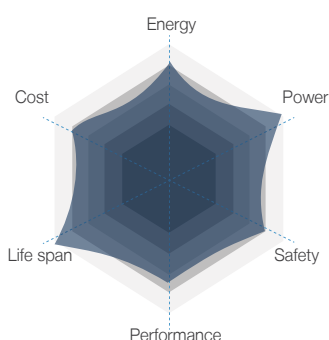
- High energy density (~ 260Wh/kg): Up to 3.2MWh of batteries can be stored in a 40ft container
- More than 96% of high efficiency at 0.5C
- Competitive Price: The NMC cells have a comparative advantage in terms of price, considering it's superior performance, reliability and safety features.



### High Power NMC

#### Advantages

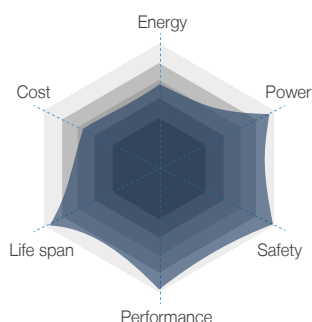
- High C-rate up to 50C-rate level
- High C-rate discharge performance for uses in frequency regulation, UPS, etc.
- Improved performance without safety or cycle life trade off



### Ultra High Power NMC

#### Advantages

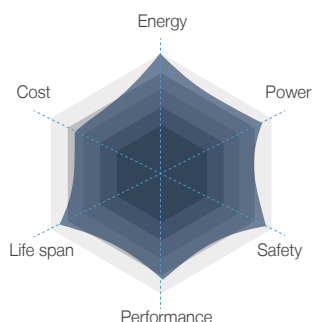
- Improved performance with 4C charge
- Improved high power cycle life up to 10,000 cycles
- Decreased 50% of internal resistance against standard NMC
- Special coating applied to cathode to improve high power performance



### 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.



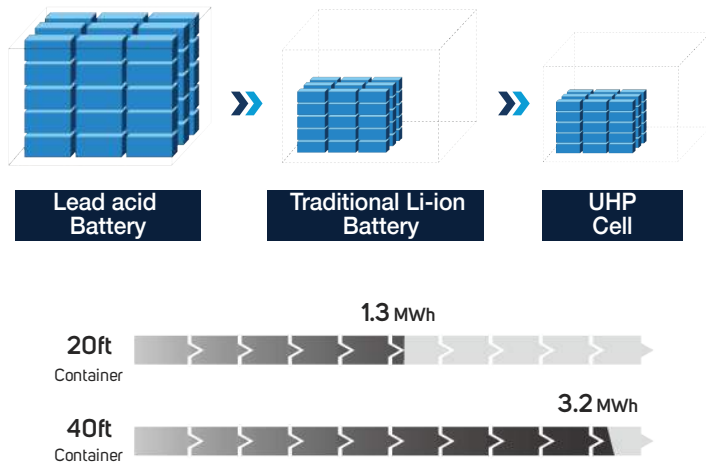
### NMC + LFP+LTO (NANO)

#### 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.

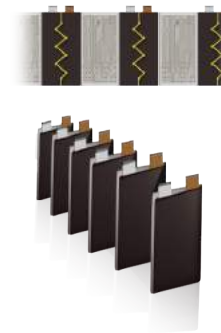
# Ultra High Power NMC Characteristic

## [HIGH ENERGY]



## [Z-FOLDING Technology]

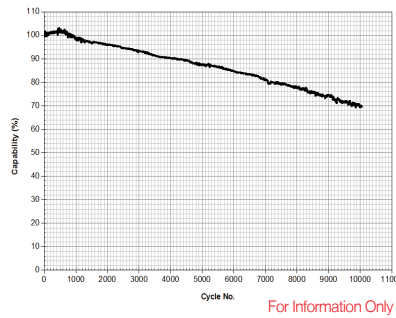
### Low Internal Resistance, High Efficiency



- 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]

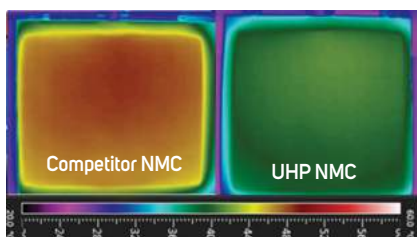
- In order to prevent the cell from being shorted, the cathode tab is fused



## [Increased cycle life]



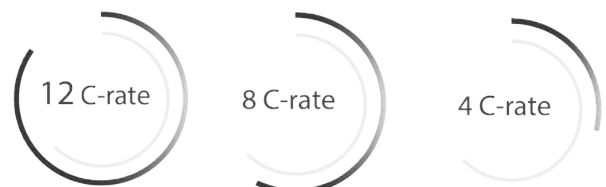
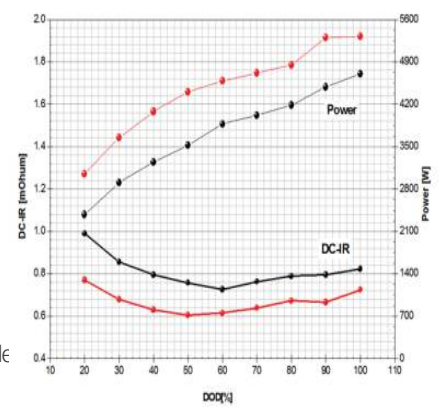
- Pouch type has more surface area compared to Prismatic type (High Capacity Cell), therefore more effective in letting out heat.
- 1.6x of heat dissipation** → 19.1cm<sup>2</sup>/Ah:11.6 cm<sup>2</sup>/Ah
- 3.5x of dissipation surface** → 650 mm<sup>2</sup>/6.5t:216 mm<sup>2</sup>/22.5t



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

## [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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