



深圳市迈洛克实业有限公司
SHENZHEN M&LAK INDUSTRY CO., LTD.

VER: A1

地址: 深圳市宝安区西乡街道广深路 375 号金山工业园 5 楼
TEL: 0755-27863350 FAX: 0755-27863350

DATE: 20160408

Customer/客户:

Li-ion Polymer Battery Specification

圆柱锂离子电池说明书

MODEL/型号: LIR18650-2200mAh

Prepared By/Date 编制/日期	Checked By/Date 审核/日期	Approved By/Date 批准/日期
朱涛/20160408		

Customer Approval 客户验证	Signature/Date(签名/日期)
	Company Name(公司名称)
	Company Stamp(公司印章)



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1 Scope (适用范围)

This specification is applied to the reference battery in this Specification and manufactured by SHENZHEN M&LAK INDUSTRY CO., LTD.

本说明书适用于本书中所提及的深圳市迈洛克实业有限公司制造的电池。

2 Product Specification (产品技术规格)

Table 1 (表 1)

No. (序号)	Item (项目)	General Parameter (常规参数)		Remark (备注)
		Typical (标称容量)	2200mAh	
1	Rated Capacity (额定容量)	Minimum (最小容量)	2150mAh	Standard discharge (0.2C C ₅ A) after Standard charge (标准充电后 0.2C ₅ A 标准放电)
2	Nominal Voltage (正常电压)	3.7V		Mean Operation Voltage (即工作电压)
3	Voltage at end of Discharge (放电终止电压)	2.75V		Discharge Cut-off Voltage (放电截止电压)
4	Charging Voltage (充电电压)	4.2V		
5	Internal Impedance (内阻)	≤200m Ω		Internal resistance measured at AC 1KHz after 50% charge (半电态下用交流法测量内阻) The measure must uses the new batteries that within one week after shipment and cycles less than 5 times (使用出货后不到一个星期及循 环次数少于 5 次的新电池测量)
6	Standard charge (标准充电)	Constant Current 0.2C ₅ A Constant Voltage 4.2V 0.02 C ₅ A cut-off (持续电流: 0.2C ₅ A 持续电压: 4.2V 截止电流: 0.02 C ₅ A)		Charge time : Approx 6.0h (充电时间: 大约 6 个小时)
7	Standard discharge (标准放电)	Constant current 0.2 C ₅ A end voltage 2.75V (持续电流: 0.2C ₅ A 截止电压: 2.75V)		
8	Fast charge (快速充电)	Constant Current 0.5C ₅ A Constant Voltage 4.2V 0.02 C ₅ A cut-off (持续电流: 0.5C ₅ A 持续电压: 4.2V 截止电流: 0.02 C ₅ A)		Charge time : Approx 2.5h (充电时间: 大约 2.5 个小时)



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Continuous the table 1 (续表 1)

No. (序号)	Item (项目)	General Parameter (常规参数)	Remark (备注)
9	Fast discharge (快速放电)	Constant current 0.5 C ₅ A end voltage 2.75V (持续电流: 0.5 C ₅ A 截止电压: 2.75V)	
10	Maximum Continuous Charge Current (最大充电持续电流)	1 C ₅ A	
11	Maximum Continuous Discharge Current (最大放电持续电流)	1 C ₅ A	
12	Operation Temperature Range (工作温度范围)	Charge (充电): 0~45°C	60 ± 25% R.H. Bare Cell (单体电池储存湿度范围)
		Discharge (放电): -20~55°C	
13	Storage Temperature Range (储存温度范围)	Less than 1 year: -20~25°C (小于一年: -20~25°C)	60 ± 25% R.H. at the shipment state (出货状态时的湿度范围)
		less than 3 months: -20~40°C (小于 3 个月: -20~40°C)	
14	Pack Dimension (包装后尺寸)	Height: 69.0 ± 1mm (高度: 69.0 ± 1mm)	
		diameter: 19.0 ± 0.5mm (直径: 19.0 ± 0.5mm)	
		Line length: 100 ± 5mm (出线长度: 100 ± 5mm)	
15	Weight	25g(Approx)	



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3 Performance And Test Conditions (电池性能及测试条件)

3.1 Standard Test Conditions (标准测试条件)

Test should be conducted with new batteries within one week after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of $20 \pm 5^{\circ}\text{C}$ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30 $^{\circ}\text{C}$ and humidity 25~85%RH.

测试必须使用出厂时间不超过一个星期的新电池，且未进行过五次以上的充放电循环。除非特别说明，否则测试会在温度 $20 \pm 5^{\circ}\text{C}$ ，相对湿度 45~85%的条件下进行。如果经鉴定测试结果不受上述条件影响，测试也可以在温度 15~30 $^{\circ}\text{C}$ ，相对湿度 25~85%RH 的条件下进行。

3.2 Measuring Instrument or Apparatus (测量器具及设备)

3.2.1 Dimension Measuring Instrument (尺寸测量器具)

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

尺寸测量器具的精度等级应不小于 0.01 mm。

3.2.2 Voltmeter (伏特计)

Standard class specified in the national standard or more sensitive class having inner impedance more than $10\text{k}\Omega/V$

按照国家标准指定规格等级或采用灵敏度更高的，测量电压时内阻不应小于 $10\text{k}\Omega/V$ 。

3.2.3 Ammeter (安培计)

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω .

按照国家标准指定规格等级或采用灵敏度更高的，包括电流表及电线在内的总外阻应小于 0.01Ω 。

3.2.4 Impedance Meter (电阻计)

Impedance shall be measured by a sinusoidal alternating current method(1kHz LCR meter).

内阻测试仪测量原理应为交流阻抗法 (1kHz LCR)。

3.3 Standard Charge\Discharge (标准充放电)

3.3.1 Standard Charge : Test procedure and its criteria are referred as follows:

标准充电：测试过程及标准如下：

$0.2C_5A = 440\text{mA}$

Charging shall consist of charging at a $0.2C_5A$ constant current rate until the cell reaches 4.2V. The cell shall then be charged at constant voltage of 4.2 volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to $0.02 C_5A$. Charge time : Approx 6h, The cell shall demonstrate no permanent degradation when charged between 0°C and 45°C .

电池先 $0.2C_5A$ 恒流充至 4.2V, 当充电电流逐渐减小时再以 4.2V 恒压充至电流减小到 $0.02 C_5A$, 充电时间大约为 6 个小时。在 0°C - 45°C 内充电电池应没有永久损害。

3.3.2 Standard Discharge (标准放电)

$0.2C_5A = 440\text{mA}$

Cells shall be discharged at a constant current of $0.2 C_5A$ to 2.75 volts

电池以 $0.2 C_5A$ 恒流放电至 2.75V

3.3.3 If no otherwise specified, the rest time between Chare and Discharge amount to 30min.



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3.4 Appearance (外观)

There shall be no such defect as flaw, crack, rust, leakage, which may adversely affect commercial value of battery.

电池外观应没有划伤、破裂、污渍、生锈、漏液等影响市场价值的缺陷存在。

3.5 Initial Performance Test (初始性能测试)

Table 2 (表 2)

Item (项目)	Test Method and Condition (测试方法及条件)	Requirements (要求)
(1) Open-Circuit Voltage (开路电压)	The open-circuit voltage shall be measured within 24 hours after standard charge. (标准充电后 24 小时内测量开路电压)	$\geq 4.0V$
(2) Internal impedance (初始内阻)	Internal resistance measured at AC 1KHz after 50% charge. (半充电状态下, 测量其 AC 1KHz 下的交流阻抗)	$\leq 200 m\Omega$
(3) Minimal Rated Capacity (最小额定容量)	The capacity on 0.2C _{5A} discharge till the voltage tapered to 2.75V shall be measured after rested for 30min then finish standard charge. (标准充电后, 搁置 30min, 测量 0.2C 放电至 2.75V 截止电压所放出的容量)	Discharge Capacity (放电容量) $\geq 2200mAh$

3.6 Temperature Dependence of discharge capacity (放电温度特性)

Cells shall be charged per 3.3.1 and discharged @0.2 C_{5A} to 2.75 volts. Except to be discharged at temperatures per Table 3. Cells shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 °C and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 3.

电池按 3.3.1 规定充电。按表 3 的温度中放电, 电池必须先在该试验温度中放置 3 个小时。在每一个温度中的放电容量应不小于表 3 的要求。

Table 3 (表 3)

Discharge Temperature (放电温度)	-10°C	0°C	23°C	60°C
Discharge Capacity (0.2 C _{5A}) (放电容量/0.2 C _{5A})	50%	80%	100%	75%



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3.7 Cycle Life and Leakage-Proof (循环寿命及漏液试验)

Table 4 (表 4)

No. (序号)	Item (项目)	Criteria (标准)	Test Conditions (测试条件)
1	Cycle Life (循环寿命) (0.5 C ₅ A)	Higher than 70% of the Initial Capacities of the Cells (初始容量的 70%)	Carry out 300cycle Charging/Discharging in the below condition. ◆ Charge: Standard Charge, per 3.3.1 ◆ Discharge: 0.2 C ₅ A to 2.75 V ◆ Rest Time between charge/discharge: 30min. ◆ Temperature: 20±5°C 循环 300 次 充放电按以下条件： ◆ 充电：标准充电，按 3.3.1 规定 ◆ 放电：0.2 C ₅ A 放至 2.75V ◆ 搁置：10min. ◆ 温度：20±5°C
2	Leakage-Proof (漏液试验)	No leakage (visual inspection) (没有漏液/目测)	After full charge with standard charge, store at 50±3°C, 50±10%RH for 1 month. 标准充电条件下充满电后在温度 50±3°C， 湿度 50±10%RH 下储存一个月

4. Mechanical characteristics and Safety Test (安全测试及机械特性)

Table 5 (表 5)

(Mechanical characteristics)

No. (序号)	Items (项目)	Test Method and Condition (测试方法及条件)	Criteria (标准)
1	Vibration Test 振动测试	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes. 将标准充电后的电芯固定在振动台上，沿 X、Y、Z 三个方向各振动 30 分钟，振幅 1.6mm，振动频率为 10Hz~55Hz，每分钟变化 1Hz。	No leakage 无泄漏 No fire 不起火
2	Drop Test 跌落测试	The cell is to be dropped from a height of 1 meter twice onto concrete ground. 将标准充电后的电芯从 1 米高度跌落至混凝土地面 2 次	No explosion, No fire, no leakage. 无爆炸、无起火、 无泄漏



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Table 6 (表 6)

(Safety Test)

Item (项目)	Battery Condition (电池要求)	Test Method (测试方法)	Requirements (要求)
Crush (挤压试验)	Fresh, Fully charged (充满电的新电池)	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min. (电池放置在两块平面金属板间,施加 13KN (1.72Mpa) 的作用力,且持续保持 30 分钟)	No explosion, No fire (无起火无爆炸)
Short Circuit (短路试验 20℃)	Fresh, Fully charged (充满电的新电池)	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1 Ω. Tests are to be conducted at room temperature(20±2℃). (在常温下约 20±2℃ 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω)	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃ (无起火无爆炸 电池表面温度应低于 150℃)
Short Circuit (短路试验 60℃)	Fresh, Fully charged (充满电的新电池)	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1 Ω. Tests are to be conducted at temperature(20±2℃). (在常温下约 20±2℃ 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω)	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃ (无起火无爆炸 电池表面温度应低于 150℃)
Impact (冲击试验)	Fresh, Fully charged (充满电的新电池)	A 56mm diameter bar is inlaid into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample. (用一条直径为 56mm 的圆棒放置在电池中央,将一 10Kg 的重锤从 1m 的高度垂直落下在电池的中心位置)	No explosion, No fire (无起火无爆炸)
Forced Discharge (过放试验)	Fresh, Fully charged (充满电的新电池)	Discharge at a current of 1 C ₅ A for 2.5h. (以 1C ₅ A 的电流放电 2.5 小时)	No explosion, No fire (无起火无爆炸)
Nail Pricking (针刺试验) (3mm)	Fresh, Fully charged (充满电的新电池)	Prick through the sample battery with a nail having a diameter of 3mm and remain 2h. (用直径为 3mm 的钉子刺穿电池并保持 2 个小时)	No explosion, No fire (无起火无爆炸)



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5. 保护板资料

5. Handling of Cells (电池操作注意事项)

5.1 Prohibition short circuit (禁止电池短路)

Never make short circuit cell. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion that are very dangerous.

The LIP tabs may be easily short-circuited by putting them on conductive surface.

Such outer short circuit may lead to heat generation and damage of the cell.

避免电池短路。短路会产生很高的电流而使电池发热以及电解液泄漏, 产生有毒气体或爆炸是非常危险的。极片连接在导电物体表面很容易短路, 外部短路会导致发热及损害电池。

5.2 Prohibition of disassembly (禁止拆卸)

1) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing, explosion, or other problems.

2) Electrolyte is harmful

LIP battery should not have liquid from electrolyte flowing, but in case the electrolyte come into contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

1、不要拆卸电池。

拆卸电池会发生电池内部短路, 会引起起火、爆炸、有害气体或者其它问题。

2、电解液是有害的

万一电解液沾到皮肤、进入眼睛, 应立即用清水冲洗以及求助医生。

5.3 Prohibition of dumping of cells into fire (不要把电池倾倒入火中)

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, which is very dangerous and is prohibited.

不要焚毁电池, 否则会致电池爆炸, 这个很危险, 必须禁止。

5.4 Prohibition of cells immersion into liquid such as water (禁止浸泡电池)

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others.

请不要把电池浸泡在液体当中, 像清水、海水, 及非酒精饮料、果汁、咖啡或者其它的饮料。

5.5 Prohibition of use of damaged cells (禁止使用损坏的电池)

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as damages in a plastic envelop of the cell, deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more.

The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.

电池可能在运输过程中因碰撞而受损。如果发现电池有异常, 例如包装损坏、电池包变形、有



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6. Period of Warranty (保质期)

The period of warranty is a year from the date of shipment. MLK guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customer abuse and misuse.

电池的保质期从出货之日算起为一年,需证明电池的缺陷是在制造过程中形成的而不是由于用户滥用及错误使用造成, 本公司负责退换电池。

7. Storing the Batteries (电池的存放)

The batteries should be stored at room temperature, charged to about 30% to 50% of capacity. We recommend that batteries be charged about once per half a year to prevent over discharge.

电池应当在室温下存放, 应充到 30%至 50%的电量。如长时间储存, 建议每半年充一次电以防止电池过放电。

8. Other The Chemical Reaction (其它的化学反应)

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

由于电池是利用化学反应的原理, 所以随时间的增加电池的性能会降低, 即使是存放很长一段时间而不使用。如果使用条件如充电、放电及周围环境温度等情形不在指定的使用范围内, 会使缩短电池的使用寿命, 或者会产生漏液导致设备损坏。如果电池长周期不能充电, 即使充电方法正确, 这样需要更换电池了。

9.Note: (注释)

Any other items which are not covered in this specification shall be agreed by both parties.

本说明书未包括事项应由双方协议确定。



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