



检测报告

TEST REPORT

委托单位名称

Client Name

深圳市比苛电池有限公司

Shenzhen PKCELL Battery Co.,Ltd

产品名称

Name of product

锂离子电池

Lithium-ion Battery

制造厂商

Manufacturer

深圳市比苛电池有限公司

Shenzhen PKCELL Battery Co.,Ltd

商标型号

Trade mark & model

PKCELL/ICR18650

检测类别

Test sort

Safety Entrust Test



中检集团南方电子产品测试（深圳）有限公司

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

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中检集团南方电子产品测试(深圳)有限公司
CCIC Southern Electronic Product Testing (Shenzhen) CO., Ltd.

检 测 报 告
TEST REPORT

样品名称 Name of sample	锂离子电池 Lithium-ion Battery		商 标 Trade mark	PKCELL	
制造厂商 Manufacturer	深圳市比苛电池有限公司 Shenzhen PKCELL Battery Co.,Ltd		型号规格 Model/Type	ICR18650	
委托单位 Client	深圳市比苛电池有限公司 Shenzhen PKCELL Battery Co.,Ltd		取样方式 Sampling method	Sent by client	
送检日期 Application data	2015/03/03		完成日期 Completing Date	2015/03/27	
样品数量 Quantity of samples	43PCS		检验环境 Environment condition	15~35℃ 45~75%RH	
标称电压 Nominal voltage	3.7V	充电限制电压 Limited Charge Voltage	4.20V	额定能量 Rate Energy	8.14Wh/2200mAh
标准充电电流 Standard charge current (Battery/Power Bank)	440mA	最大充电电流 Max. Charge Current (Battery/Power Bank)	2200mA	充电截止电流 End Charge Current (Cell)	44mA
放电终止电压 Cut-off Voltage	2.75V	最大放电电流 Max. Discharge Current	2200mA	电池数量 Component cells Number	1PCS

检验项目 (Test item):

- Test1: 高度模拟 Altitude simulation
- Test2: 温度试验 Thermal Test
- Test3: 振动 Vibration
- Test4: 冲击 Shock
- Test5: 外短路 External short circuit
- Test6: 挤压 Crush
- Test7: 过充电 Overcharge
- Test8: 强制放电 Forced discharge

检测依据 (Reference documents):

《关于危险货物运输的建议书 试验和标准手册》(第五次修订版本) 38.3 节: 金属锂电池和锂离子电池组。

Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria, section 38.3 lithium batteries (ST/SG/AC.10/11/Rev.5/Amend.1 section 38.3).

检验概况 (Summary):

对电池或电池组进行了 T1 至 T8 项试验, 试验 T1 至 T5 按顺序进行, 使用相同电池或电池组, 试验 T6 和 T8 使用未另外试验过的电池或电池组, 试验 T7 使用原先试验 T1 至 T5 中使用过的未损坏的电池组进行试验。

Each Cell/battery type is subjected to tests 1 to 8, Tests 1 to 5 are conducted in sequence on the same Cells/batteries, Tests 6 and 8 are conducted using not otherwise tested Cells/batteries, Test 7 using undamaged batteries previously used in Tests 1 to 5.

$$\text{质量损失 Mass loss\%} = (M_1 - M_2) / M_1 \times 100$$

式中: M1 是实验前的质量, M2 是试验后的质量, 如果质量损失不超过表 3.8.3.1 所列的数值, 视为



“无质量损失”。

Where M_1 is the mass before the test and M_2 is the mass after the test. When mass loss does not exceed the values in Table 38.3.2.2, it shall be considered as “no mass loss”.

Mass M of cell or battery	Mass loss limit
$M < 1g$	0.5%
$1g \leq M \leq 75g$	0.2%
$M > 75g$	0.1%

试验 T1 至 T4 如果电池组无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电池组在试验后的开路电压不小于其在进行这一试验前电压的 90%则认为符合要求。

In test 1 to 4 batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test battery after testing is not less than 90% of its voltage immediately prior to this procedure.

制造商提供的锂离子电池为单电芯电池，根据标准规定，单电芯电池应作为电池来评估，按照电池的测试要求进行测试。

The Lithium-ion Batteries submitted by manufacturer are single cell batteries, According to the standard, a single cell Battery is considered a “Cell” and shall be tested according to the testing requirements for “cell”.

备注 (Remark) :

编号 B01#-B10#、B16#-B19#是在第一个充放电周期完全充电的可充电电芯；

Rechargeable cells of B01#-B10#、B16#-B19# are fully charge at first cycle;

编号 C11#-C15#是在第一个充放电周期 50%设计额定容量状态的可充电电芯；

Rechargeable cells of C11#-C15# at 50% of the design rated capacity at first cycle;

编号 B20#-B23#是在 50 个充放电周期后完全充电的可充电电芯；

Rechargeable cells of B20#-B23# are fully charged after 50 cycles;

编号 C24#-C33#是在第一个充放电周期完全放电的可充电电芯；

Rechargeable Cells of B24#-B33# are in fully Discharged at first cycle;

编号 C34#-C43#是在 50 个充放电周期后完全放电的可充电电芯；

Rechargeable cells of B34#-B43# are in fully discharged after 50 cycles;

检验结论 (Test conclusion):

测试样品符合联合国《关于危险货物运输的建议书 试验和标准手册》38.3 要求。

The test samples comply with section 38.3 of Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria.

(检验单位盖章 stamp)

检测:
Tested by

审核:
Reviewed by

批准:
Approved by

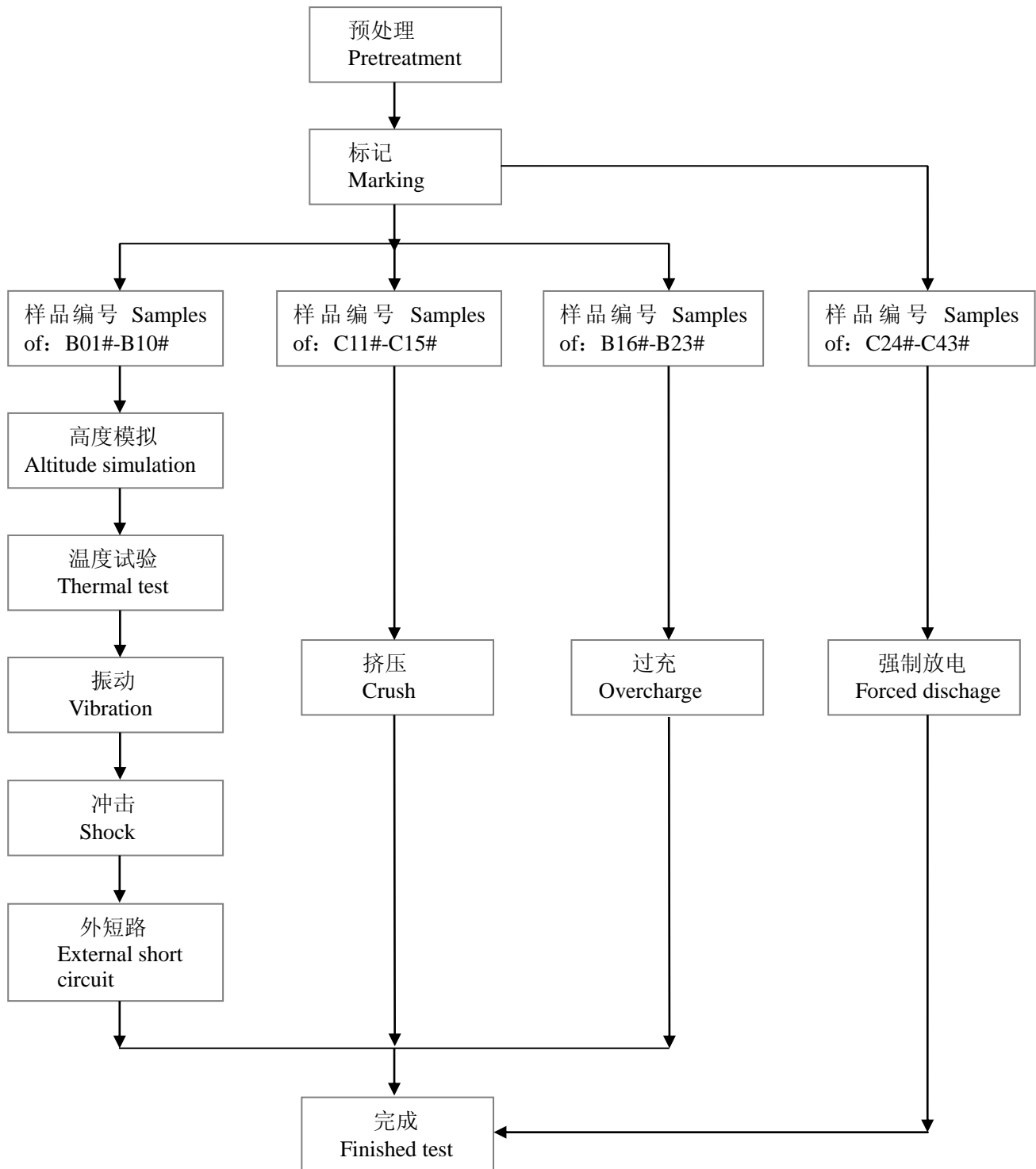
2015 年 03 月 27 日

2015 年 03 月 27 日

2015 年 03 月 27 日



测试流程 Test Procedure





测试结果 Test results:

Test T.1 高度模拟 Altitude situation

测试方法 Test method;

电池在压力等于或低于 11.6 千帕和环境温度 (20±5℃) 下存放至少 6 小时。

Cells are stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20±5℃).

要求 Requirement;

电池如无渗漏、无排气、无解体、无破裂和无燃烧，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的 90%，电池即符合这一要求。

Cells meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cells after testing is not less than 90% of its voltage immediately prior to this procedure.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	试验前 Pre-test		试验后 After test		质量损 失 Mass loss (%)	电压比 Voltage after test/Voltage pre-test (%)	判定 Status
		质量 Mass (g)	电压 Voltage (V)	质量 Mass (g)	电压 Voltage (V)			
第一个充放电周 期完全充电 At first cycle, in fully charged states	B01#	46.819	4.19	46.812	4.18	0.02	99.76	PASS
	B02#	46.566	4.18	46.560	4.18	0.01	100.0	PASS
	B03#	46.397	4.18	46.392	4.18	0.01	100.0	PASS
	B04#	46.475	4.19	46.468	4.19	0.02	100.0	PASS
	B05#	46.681	4.20	46.676	4.19	0.01	99.76	PASS
	B06#	46.723	4.18	46.717	4.18	0.0	100.0	PASS
	B07#	46.664	4.17	46.656	4.17	0.02	100.0	PASS
	B08#	46.428	4.18	46.422	4.18	0.01	100.0	PASS
	B09#	46.866	4.19	46.859	4.19	0.02	100.0	PASS
	B10#	46.749	4.18	46.743	4.18	0.01	100.0	PASS

备注 Notes:

试验后电池无渗漏、无排气、无解体、无破裂和无燃烧，环境温度 22.5℃。

After the test, the cells are no leakage, no venting, no disassembly, no rupture and no fire. Ambient temperature: 22.5℃.



Test T.2: 温度试验 Thermal test

测试方法 Test method;

电池在试验温度等于 $75 \pm 2^\circ\text{C}$ 下存放至少 6 小时，接着在试验温度等于 $-40 \pm 2^\circ\text{C}$ 下存放至少 6 小时。两个极端试验温度之间的最大时间间隔为 30 分钟。这一程序重复 10 次，接着将所有试验电池在环境温度 ($20 \pm 5^\circ\text{C}$) 下存放 24 小时。

Cells are to be stored for at least six hours at a test temperature equal to $75 \pm 2^\circ\text{C}$, followed by storage for at least six hours at a test temperature equal to $-40 \pm 2^\circ\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells are to be stored for 24 hours at ambient temperature ($20 \pm 5^\circ\text{C}$).

要求 Requirement;

电池如无渗漏、无排气、无解体、无破裂和无燃烧，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的 90%，电池即符合这一要求。

Cells meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cells after testing is not less than 90% of its voltage immediately prior to this procedure.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	试验前 Pre-test		试验后 After test		质量损失 Mass loss (%)	电压比 Voltage after test/Voltage pre-test (%)	判定 Status
		质量 Mass (g)	电压 Voltage (V)	质量 Mass (g)	电压 Voltage (V)			
第一个充放电周期完全充电 At first cycle, in fully charged states	B01#	46.812	4.18	46.801	4.13	0.02	98.80	PASS
	B02#	46.560	4.18	46.548	4.14	0.03	99.04	PASS
	B03#	46.392	4.18	46.383	4.13	0.02	98.80	PASS
	B04#	46.468	4.19	46.457	4.15	0.02	99.04	PASS
	B05#	46.676	4.19	46.659	4.15	0.03	99.04	PASS
	B06#	46.717	4.18	46.708	4.14	0.02	99.04	PASS
	B07#	46.656	4.17	46.642	4.13	0.03	99.04	PASS
	B08#	46.422	4.18	46.413	4.14	0.02	99.04	PASS
	B09#	46.859	4.19	46.847	4.15	0.03	99.04	PASS
	B10#	46.743	4.18	46.738	4.14	0.01	99.04	PASS

备注 Notes:

试验后电池无渗漏、无排气、无解体、无破裂和无燃烧，环境温度 22.7°C 。

After the test, the cells are no leakage, no venting, no disassembly, no rupture and no fire. Ambient temperature: 22.7°C .



Test T.3: 振动 Vibration

测试方法 Test method;

电池紧固在振动机平面上，正弦波形振动，频率在 7 和 200 赫兹之间摆动再回到 7 赫兹的对数扫频为时 15 分钟。这一振动过程须对三个互相垂直的电池安装方位的每一个方向都重复进行 12 次，总共为时 3 小时。其中一个振动方向必须与端面垂直。

对数扫频为：从 7 赫兹开始保持 1gn 的最大加速度直到频率达到 18 赫兹。然后将振幅保持在 0.8 毫米(总偏移 1.6 毫米)并增加频率直到最大加速度达到 8gn(频率约为 50 赫兹)。将最大加速度保持在 8gn 直到频率增加到 200 赫兹。

Cells are firmly secured to the platform of the vibration machine ,The vibration is a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

要求 Requirement;

电池如无渗漏、无排气、无解体、无破裂和无燃烧，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的 90%，电池即符合这一要求。

Cells meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cells after testing is not less than 90% of its voltage immediately prior to this procedure.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	试验前 Pre-test		试验后 After test		质量损失 Mass loss (%)	电压比 Voltage after test/Voltage pre-test (%)	判定 Stat us
		质量 Mass (g)	电压 Voltage (V)	质量 Mass (g)	电压 Voltage (V)			
第一个充放电周期完全充电 At first cycle, in fully charged states	B01#	46.801	4.13	46.801	4.13	0.00	100.0	PASS
	B02#	46.548	4.14	46.548	4.14	0.00	100.0	PASS
	B03#	46.383	4.13	46.383	4.13	0.00	100.0	PASS
	B04#	46.457	4.15	46.457	4.15	0.00	100.0	PASS
	B05#	46.659	4.15	46.659	4.15	0.00	100.0	PASS
	B06#	46.708	4.14	46.708	4.14	0.00	100.0	PASS
	B07#	46.642	4.13	46.642	4.13	0.00	100.0	PASS
	B08#	46.413	4.14	46.413	4.14	0.00	100.0	PASS
	B09#	46.847	4.15	46.847	4.15	0.00	100.0	PASS
	B10#	46.738	4.14	46.738	4.14	0.00	100.0	PASS

备注 Notes:

试验后电池无渗漏、无排气、无解体、无破裂和无燃烧，环境温度 22.6℃。

After the test, the cells are no leakage, no venting, no disassembly, no rupture and no fire. Ambient temperature: 22.6℃.



Test T.4:冲击 Shock

测试方法 Test method;

电池用坚硬支架紧固在试验装置上，支架支撑着每个试验电池的所有安装面。每个电池经受最大加速度 150gn 和脉冲持续时间 6 毫秒的半正弦波冲击。每个电池在三个互相垂直的电池组安装方位的正方向经受三次冲击，接着在反方向经受三次冲击，总共经受 18 次冲击。

cells are secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test cell. Each cell is subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Each battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the battery for a total of 18 shocks.

要求 Requirement;

电池如无渗漏、无排气、无解体、无破裂和无燃烧，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的 90%，电池即符合这一要求。

Cells meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cells after testing is not less than 90% of its voltage immediately prior to this procedure.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	试验前 Pre-test		试验后 After test		质量损失 Mass loss (%)	电压比 Voltage after test/Voltage pre-test (%)	判定 Stat us
		质量 Mass (g)	电压 Voltage (V)	质量 Mass (g)	电压 Voltage (V)			
第一个充放电周期完全充电 At first cycle, in fully charged states	B01#	46.801	4.13	46.801	4.13	0.00	100.0	PASS
	B02#	46.548	4.14	46.548	4.14	0.00	100.0	PASS
	B03#	46.383	4.13	46.383	4.13	0.00	100.0	PASS
	B04#	46.457	4.15	46.457	4.15	0.00	100.0	PASS
	B05#	46.659	4.15	46.659	4.15	0.00	100.0	PASS
	B06#	46.708	4.14	46.708	4.14	0.00	100.0	PASS
	B07#	46.642	4.13	46.642	4.13	0.00	100.0	PASS
	B08#	46.413	4.14	46.413	4.14	0.00	100.0	PASS
	B09#	46.847	4.15	46.847	4.15	0.00	100.0	PASS
	B10#	46.738	4.14	46.738	4.14	0.00	100.0	PASS

备注 Notes:

试验后电池无渗漏、无排气、无解体、无破裂和无燃烧，环境温度 24.3℃。

After the test, the cells are no leakage, no venting, no disassembly, no rupture and no fire. Ambient temperature: 24.3℃.



Test T.5:外部短路 External short circuit

测试方法 Test method;

电池的温度稳定后使其外壳温度达到 55±2℃，然后电池组在 55±2℃下经受总外阻小于 0.1 欧姆的短路条件。短路条件持续到电池外壳温度回到 55±2℃后继续至少 1 小时，再观察 6 小时结束试验。

Cells be tested are temperature stabilized so that its external case temperature reaches 55±2℃ and then the cell are subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 55±2℃. This short circuit condition is continued for at least one hour after the cell external case temperature has returned to 55±2℃. The cells are observed for a further six hours for the test to concluded.

要求 Requirement;

外壳温度如不超过 170℃，并且在试验过程后 6 小时内无解体、无破裂、无起火，电池即符合这一要求。

Cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassembly, no rupture and no fire within six hours after test.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	最高温度 Highest temperature (℃)	判定 Status
第一个充放电周期完全充电 At first cycle, in fully charged states	B01#	55.9	PASS
	B02#	54.7	PASS
	B03#	55.3	PASS
	B04#	55.1	PASS
	B05#	55.6	PASS
	B06#	55.8	PASS
	B07#	54.6	PASS
	B08#	55.2	PASS
	B09#	55.7	PASS
	B10#	55.3	PASS

备注 Notes:

试验后电池 6 小时内无解体、无破裂、无起火，环境温度 24.6℃。

After the test, the cells are no disassembly ,no rupture and no fire within six hours.

Ambient temperature:24.6℃.



Test T.6: 挤压 Crush

测试方法 Test method;

将电池放在两个平面之间挤压，挤压力度逐渐加大，在第一个接触点上的速度大约为 1.5 厘米/秒，直到出现下列的情况之一；

Cells is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact, The crushing is to be continued until the first of the three options below is reached.

- (a) 施加的力量达到 13 千牛±0.78 千牛；
The applied force reaches 13 kN ± 0.78 kN;
- (b) 电池的电压下降至少 100mV；或
The voltage of the cell drops by at least 100 mV; or
- (c) 电池变形达原始高度的 50%或以上。
The cell is deformed by 50% or more of its original thickness.

要求 Requirement;

外壳温度如不超过 170℃，并且在试验过程中及试验后 6 小时内无解体、无破裂、无起火，电池即符合这一要求。

Cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassembly, no rupture and no fire during the test and within six hours after test.

测试数据如下表 Test Date showed in table below;

样品状态 State of sample	序号 No.	判定 Status
一个充放电周期 50%设计额定容量状态 At first cycle at 50% of the design rated capacity	C11#	PASS
	C12#	PASS
	C13#	PASS
	C14#	PASS
	C15#	PASS

备注 Notes:

电池在试验过程中和试验后 6 小时内无解体、无破裂、无起火，环境温度 24.6℃。

Cells are no disassembly and no fire during the test and within six hours after test.

Ambient temperature:24.6℃.



Test T.7:过充电 Overcharge

测试方法 Test method;

充电电流为制造商建议的最大持续充电电流的两倍，试验电压为电池最大充电电压的两倍，试验在环境温度下进行，进行试验时间为 24 小时。

The charge current is twice the manufacturer's recommended maximum continuous charge current. The voltage of the test is the lesser of two times the maximum charge voltage of the battery ,Tests are to be conducted at ambient temperature. The duration of the test is 24 hours.

要求 Requirement;

电池如在试验过程中和试验后 7 天内无解体，无起火，即符合本项要求。

Cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test

测试数据如下 Test Date showed in table below;

过充电流 Overcharge current: 2×2200=4400mA	过充电压 Overcharge voltage : 2×3.7=7.4V	充电总时间 Total time of charging: 24hours
样品状态 State of sample	序号 No.	判定 Status
第一个充放电周期后完全 充电 At first cycle in fully charged states	B16#	PASS
	B17#	PASS
	B18#	PASS
	B19#	PASS
五十个充放电周期后，完 全充电 After 50 cycles ending in fully charged states	B20#	PASS
	B21#	PASS
	B22#	PASS
	B23#	PASS

备注 Notes:

电池在试验过程中和试验后 7 天内无解体、无起火，环境温度 24.5℃。

Cells are no disassembly and no fire during the test and within seven days after the test
Ambient temperature:24.5℃.



Test T.8:强制放电 Forced discharge

测试方法 Test method;

电池在环境温度下与 12V 直流电电源串联在起始电流等于制造商给的最大放电电流条件下强制放电 Each cells is forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

要求 Requirement;

充电电池如在试验过程中和试验后 7 天内无解体, 无起火, 即符合本项要求。

Recharged cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

测试数据如下表 Test Date showed in table below;

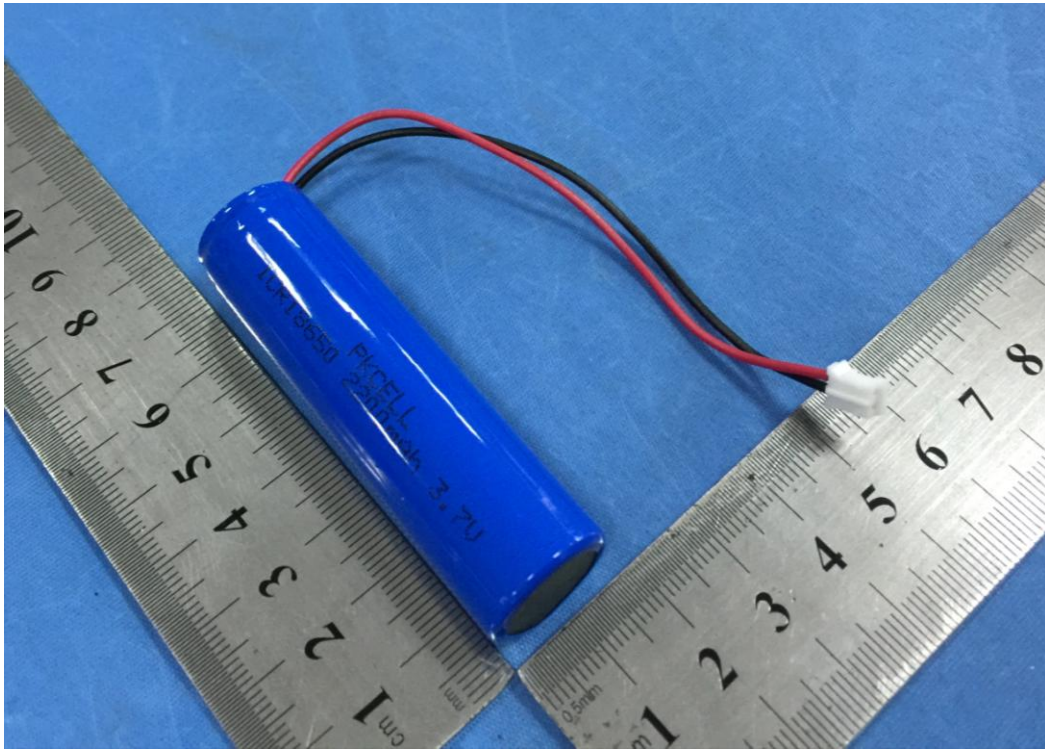
样品状态 State of sample	序号 No.	判定 Status
第一个充放电周期后完全 放电 At first cycle in fully discharged states	C24#	PASS
	C25#	PASS
	C26#	PASS
	C27#	PASS
	C28#	PASS
	C29#	PASS
	C30#	PASS
	C31#	PASS
	C32#	PASS
	C33#	PASS
五十个充放电周期后, 完 全放电 After 50 cycles ending in fully discharged states	C34#	PASS
	C35#	PASS
	C36#	PASS
	C37#	PASS
	C38#	PASS
	C39#	PASS
	C40#	PASS
	C41#	PASS
	C42#	PASS
	C43#	PASS

备注 Notes:

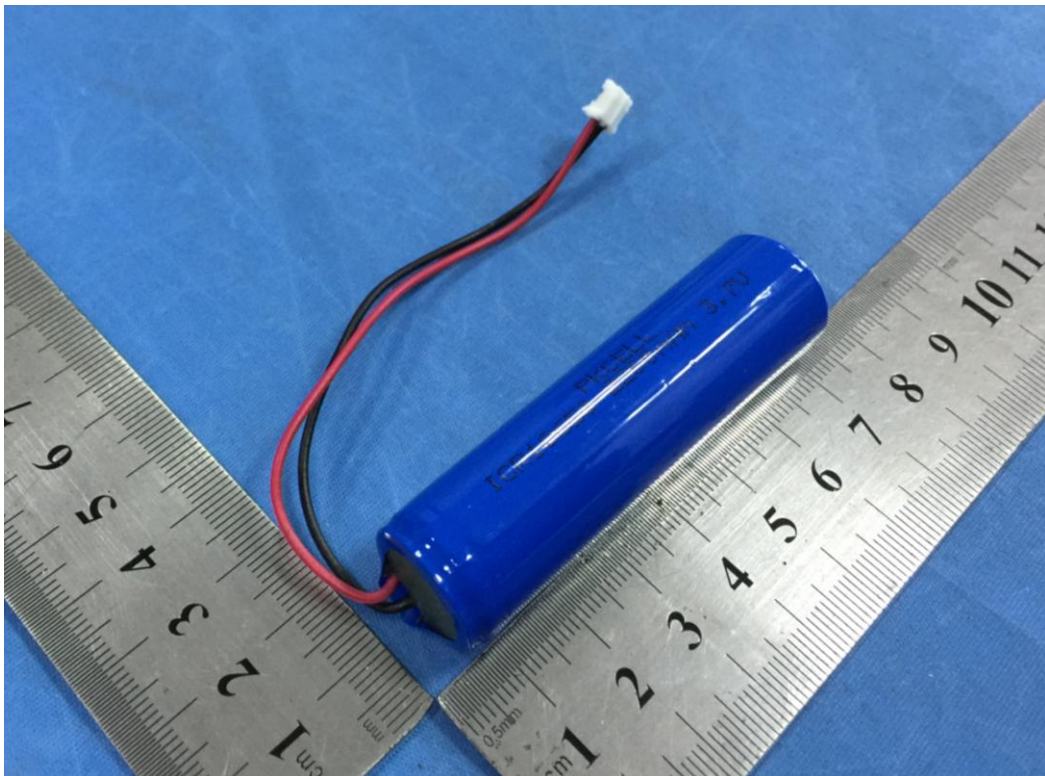
试验后充电电池在试验过程中和试验后 7 天内无解体、无起火, 环境温度 24.3℃

After the test, the recharged cells are no disassembly and no fire during the test and within seven days Ambient temperature:24.3℃.

样品照片 Photo document



图片 Photo 1



图片 Photo 2



声 明

STATEMENT

1. 本实验室是经过中国合格评定国家认可委员会认可的检测实验室，证书号：L1659。

This test laboratory is accredited by CNAS, Accreditation Certificate No. L1659.

2. 报告未加盖“检测专用章”无效。

The test report is invalid without stamp of laboratory.

3. 报告无检测、批准人员签字无效。

The test report is invalid without signature of person(s) testing and authorizing.

4. 报告涂改无效。

The test report is invalid if erased and corrected.

5. 自送样品的检测结论仅对送检样品有效。

Test results of the report is valid to the test samples if sampling by client.

6. CNAS 未涉及“☆”的项目。

“☆” item cannot be Accredited by CNAS.

7. 未经本实验室书面同意，不得部分地复制本报告。

The test report shall not be reproduced except in full, without written approval of the laboratory.

8. 如对本报告有异议，可在收到报告后 15 天内向本单位申诉，逾期不予受理。

If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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