中国认可
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检测
TESTING
CNAS L5138

UN38.3 检测报告
UN38.3 Test Report

样品名称：	聚合物锂离子电芯
Sample name:	**Polymer Lithium ion Cell**
样品型号：	**GX 400909**
Sample model:	
委托单位：	
Applicant:	

深圳天溯计量检测股份有限公司

Shenzhen Tiansu Calibration and Testing Co., Ltd.

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通用信息 General information			
委托单位 Applicant	名称 Name		
	地址 Address		
制造单位 Manufacturer	名称 Name		
	地址 Address		
	电话 Phone number		
	网址 Website		
测试实验室 Testing laboratory	名称 Name	深圳天溯计量检测股份有限公司 Shenzhen Tiansu Calibration and Testing Co., Ltd.	
	地址 Address	深圳市龙岗区宝龙街道锦龙大道 2 号 1 栋、4 栋 B/1,4, NO.2 Jinlong Road, Longgang District, Shenzhen, China	
样品名称 Sample name	聚合物锂离子电芯 Polymer Lithium ion Cell	样品型号 Sample model	GX 400909
类别 Classification	锂离子电池 Li-ion Battery	商标 Trade mark	/
额定值 Ratings	3.7V/25mAh/0.0925Wh	样品形状 Shape of sample	近长方体 Approximate Cuboid
测试标准 Test standard	联合国《试验和标准手册》（第 7 版）38. 3 节 UN "Manual of Tests and Criteria" ST/SG/AC.10/11/Rev.7/Subsection 38.3		
签发日期 Date of issue	2023.02.02	测试日期 Test date	2023.01.14 to 2023.02.02

主 检 Tested by 李银飞　审 核 Reviewed by 邱伟超　批 准 Approved by 段江涛

SHENZHEN TIANSU CALIBRATION AND TESTING CO., LTD. 深圳天溯计量检测股份有限公司 报告专用章 Report Seal (01-03)

样品说明及描述 Sample description

	电芯 Cell
型号 Model	GX 400909
标称电压 Nominal voltage	3.7V
额定容量 Rated capacity	25mAh
充电限制电压 Limited charge voltage	4.2V
放电终止电压 Cut-off voltage	2.45V
标准充电电流 Standard charge current	12.5mA
标准放电电流 Standard discharge current	5mA
最大持续充电电流 Max continuous charge current	25mA
最大持续放电电流 Max continuous discharge current	37.5mA
尺寸 Dimension	10.64*8.85*4.05(mm)
重量 Weight	0.6g

检测结论
Test conclusion：

submitted samples are tested according to UN "Manual of Tests and Criteria" ST/SG/AC.10/11/Rev.7/Subsection 38.3. The test results comply with the relevant requirements of the standard.

修订说明：
Revision note ：
N/A

测试概要 Test summary

章节 Clause	测试项目 Test item	Sample No. 样品编号	结论 Conclusion
T.1	高度模拟 Altitude simulation	C01#-C10#	通过 Pass
T.2	温度试验 Thermal test		通过 Pass
T.3	振动 Vibration		通过 Pass
T.4	冲击 Shock		通过 Pass
T.5	外部短路 External short circuit		通过 Pass
T.6	撞击/挤压 Impact/Crush	C11#-C20#	通过 Pass
T.7	过度充电 Overcharge	---	不适用 N/A
T.8	强制放电 Forced Discharge	C21#-C40#	通过 Pass

说明 Notes：

C01#-C05#	为第一个充放电周期完全充电状态的电池 Cells at first cycle in fully charged states
C06#-C10#	为 25 次充放电周期后完全充电状态的电池 Cells after 25 cycles ending in fully charged states
C11#-C15#	为第一个充放电周期后 50%设计额外容量状态的电池 Cells at first cycle at 50% of the design rated capacity
C16#-C20#	为 25 充放电周期后 50%设计额外容量状态的电池 Cells after 25 cycle at 50% of the design rated capacity
C21#-C30#	为第一个充放电周期后完全放电状态的电池 Cells at first cycle in fully discharged states
C31#-C40#	为 25 个充放电周期后完全放电状态的电池 Cells after 25 cycles ending in fully discharged states

样品照片 Photos

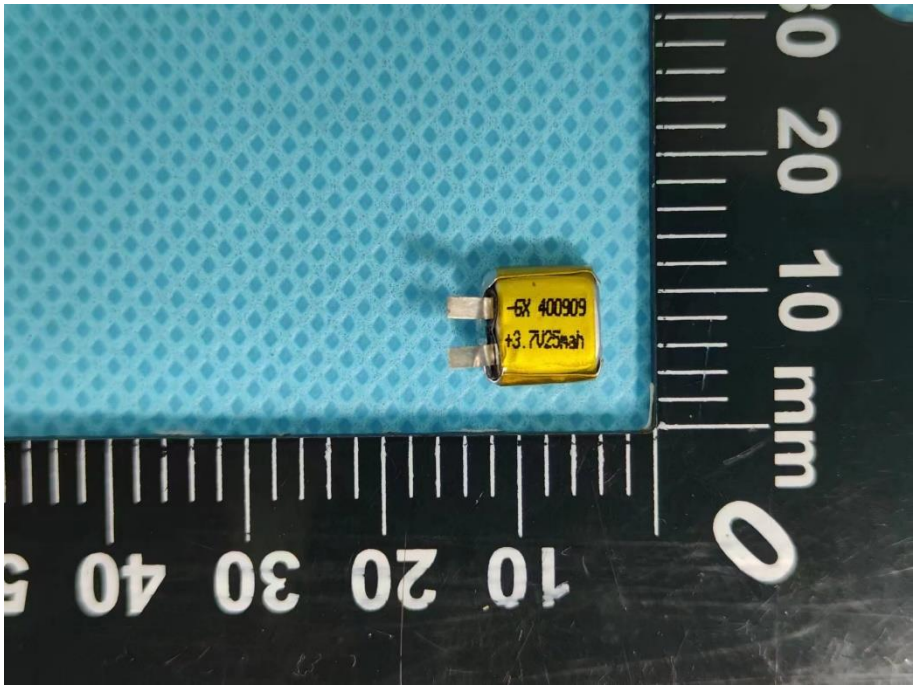

Photo 1 电池正面 Front view of Cell

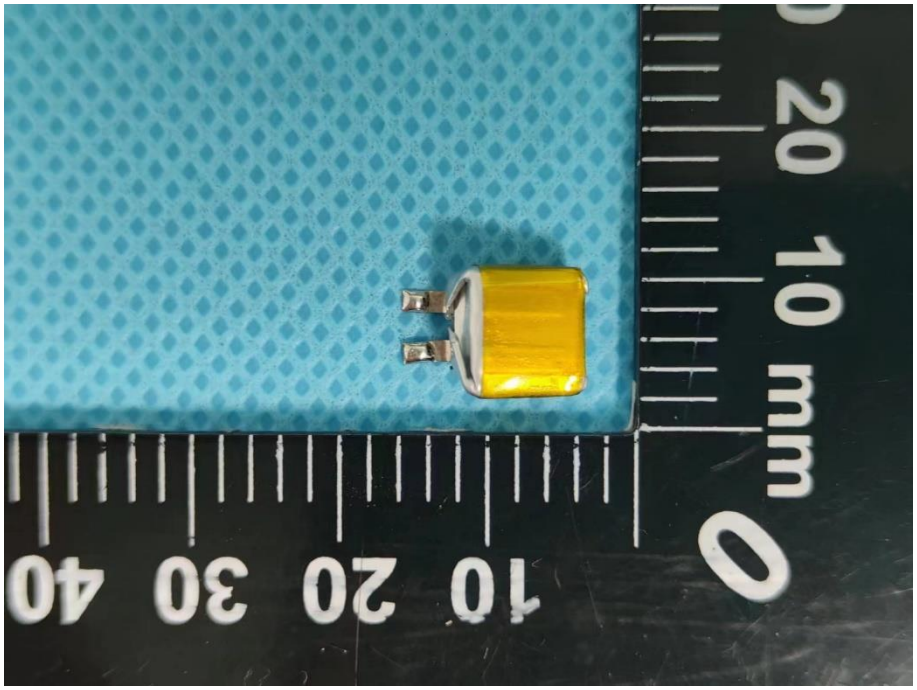

Photo 2 电池背面 Back view of Cell

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程序

小型电池或电池组必须按顺序进行试验 T1 至 T5。试验 T6 和 T8 应使用未试验过的电池或电池组。

Procedure

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries.

质量损失依照下式计算：

质量损失＝（M_1－M_2）/M_1×100%

式中 M_1 是试验前的质量，M_2 是试验后的质量。如质量损失不超过下表所列数值，即视为“无质量损失”。

In order to quantify the mass loss, the following procedure is provided.

mass loss＝（M_1－M_2）/M_1×100%

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 below, it shall be considered as “no mass loss”.

电池或电池组质量 M Mass M of cell or battery	质量损失限值 Mass lost limited
M＜1g	0.5%
1g≤M≤75g	0.2%
M＞75g	0.1%

T.1： 高度模拟：Altitude simulation

试验电池和电池组应在压力等于或低于 11.6 千帕和环境温度(20±5)℃下存放至少 6 小时。

如果无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电池或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%，电池和电池组即符合这一要求。有关电压的要求不适用于完全放电状态的试验电池和电池组。

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

Cells and 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 cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.2： 温度测试：Thermal test

试验电池和电池组应先在试验温度等于（72±2)℃的条件下存放至少 6 小时，接着再在试验温度等于-40±2℃的条件下存放至少 6 小时。两个极端试验温度之间的最大时间间隔为 30 分钟。此程序重复进行，共完成 10 次，接着将所有试验电池和电池组在环境温度(20±5)℃下存放 24 小时。对于大型电池和电池组，暴露于极端试验温度的时间至少应为 12 小时。

如果无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电池或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%，电池和电池组即符合这一要求。有关电压的要求不适用于完全放电状态的试验电池和电池组。

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

Cells and 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 cell or battery after testing is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

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T.3： 振动：Vibration

电池和电池组紧固于振动机平台，但紧固程度不能造成电池变形以致不能准确传递振动。振动应是正弦波形，对数频率扫描从 7 赫兹到 200 赫兹，再回到 7 赫兹，跨度为 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方向重复进行 12 次，总共为时 3 小时。其中一个振动方向必须与端面垂直。

作对数式频率扫描，对总质量不足 12 千克的电池和电池组(电池和小型电池组)，和对 12 千克及更大的电池组(大型电池组)应有所不同。

对电池和小型电池组：从 7 赫兹开始，保持 1 gn 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 8 gn(频率约为 50 赫兹)。将最大加速度保持在 8 gn 直到频率增加到 200 赫兹。

对大型电池组：从 7 赫兹开始，保持 1 gn 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 2 gn (频率约为 25 赫兹)。将最大加速度保持在 2 gn 直到频率增加到 200 赫兹。

如果试验中和试验后无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电池或电池组在第三个垂直安装方位上的试验后立即测得的开路电压不小于在进行这一试验前电压的 90%，电池和电池组即符合本项要求。有关电压的要求不适用于完全放电状态的试验电池和电池组。

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be 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 shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 gn 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 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 gn 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 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90 % of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.4：冲击：Shock

试验电池和电池组用坚固支架紧固在试验机上，支架支撑着每个试验电池组的所有安装面。

每个电池须经受最大加速度 150 gn 和脉冲持续时间 6 毫秒的半正弦波冲击。不过，大型电池须经受最大加速度 50 gn 和脉冲持续时间 11 毫秒的半正弦波冲击。

每个电池须经受的正弦波冲击的最大加速度取决于电池组的质量。小型电池组的脉冲持续时间 6 毫秒，大型电池组的脉冲持续时间 11 毫秒。以下公式用于计算合适的最低限度最大加速度。

每个电池或电池组须在三个互相垂直的电池或电池组安装方位的正极方向经受三次冲击，接着在负极方向经受三次冲击，总共经受 18 次冲击。

如果无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电池或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%，电池和电池组即符合这一要求。有关电压的要求不适用于完全放电状态的试验电池和电池组。

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of

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11 milliseconds.

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula Acceleration(g_n) $=\sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller	6 ms
Large batteries	50 g_n or result of formula Acceleration(g_n) $=\sqrt{\left(\frac{30000}{mass^*}\right)}$ whichever is smaller	11 ms

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure.

T.5：外部短路：External short circuit

对于待试电池或电池组，应加温一段必要的时间，使从外壳测量的温度达到均匀的稳定温度（57±4）℃。这段时间的长短取决于电池或电池组的大小和设计，对于这个持续时间应加以评估和记录。如无法进行这种评估，则小型电池和小型电池组的暴露时间应至少 6 小时，大型电池和小型电池组的暴露时间应至少 12 小时。然后，电池或电池组应在（57±4）℃条件下经受总外电阻小于 0.1 欧姆的短路条件。

这一短路条件应在电池或电池组外壳温度回到（57±4）℃后继续至少 1 小时，或在大型电池组的情况下外壳温度降幅达试验中所观察的最高温升幅的二分之一并保持低于该数值。短路和降温阶段的温度应至少相当于环境温度。

如果外壳温度不超过 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，电池和电池组即符合本项要求。

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to（57±4）°C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

The short circuit and cooling down phases shall be conducted at least at ambient temperature.

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

T.6: 撞击/挤压 Impact / Crush

撞击(适用于直径不小于 18.0 毫米的圆柱形电池) Impact (applicable to cylindrical cells not less than 18.0 mm in diameter：

试样电池或元件电池放在平坦光滑的表面上。一根 316 型不锈钢棒横放在试样中心，钢棒直径 15.8 毫米±0.1 毫米，长度至少 6 厘米，或电池最长端的尺寸，取二者之长者。将一块 9.1 千克±0.1 千克的重锤从 61±2.5 厘米高处跌落到钢棒和试样交叉处，使用一个几乎没有摩擦的、对落体重锤阻力最小的垂直轨道或管道加以控制。垂直轨道或管道用于引导落锤

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沿与水平支撑表面呈 90 度落下。

接受撞击的试样，纵轴应与平坦表面平行并与横放在试样中心的直径 15.8 毫米±0.1 毫米弯曲表面的纵轴垂直。每一试样只经受一次撞击。

The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1 mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1 mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

挤压(适用于棱柱形、袋装、硬币/纽扣电池和直径小于 18.0 毫米的圆柱形电池) Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)：

将电池或元件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。挤压持续进行，直到出现以下三种情况之一：

(a) 施加的力量达到 13 千牛顿±0.78 千牛顿；

例如：用一个活塞直径 32 毫米的液压顶施力，直到液压顶的压力达到 17 兆帕。

(b) 电池的电压下降至少 100 毫伏；或

(c) 电池变形达原始厚度的 50%或以上。

一旦达到最大压力、电压下降 100 毫伏或更多，或电池变形至少达原厚度的 50%，即可解除压力。

棱柱形或袋装电池应从最宽的一面施压。纽扣/硬币形电池应从其平坦表面施压。圆柱形电池应从与纵轴垂直的方向施压。

每个试样电池或元件电池只做一次挤压试验。试样应继续观察 6 小时。试验应使用之前未做过其他试验的电池或元件电池进行。

A cell or component cell 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) The applied force reaches 13 kN ± 0.78 kN;

Example: The force shall be applied by a hydraulic ram with a 32 mm diameter piston until a pressure of 17 MPa is reached on the hydraulic ram.

(b) The voltage of the cell drops by at least 100 mV; or

(c) The cell is deformed by 50 % or more of its original thickness

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50 % of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

如果外壳温度不超过 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，电池和电池组即符合本项要求。

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

T7：过度充电：Overcharge

充电电流必须是制造商建议的最大持续充电电流的两倍。试验的最小电压如下：

(a) 制造商建议的充电电压不大于 18 伏时，试验的最小电压应是电池组最大充电电压的两倍或 22 伏两者中的较小者。

(b) 制造商建议的充电电压大于 18 伏时，试验的最小电压应为最大充电电压的 1.2 倍。

试验应在环境温度下进行。进行试验的时间应为 24 小时。

可充电电池组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。

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The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) when the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V.

(b) when the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

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

T8：强制放电:Forced discharge

每个电池应在环境温度下与 12 伏直流电源串联在起始电流等于制造商给定的最大放电电流的条件下强制放电。

将适当大小和额定值的电阻负荷与试验电池串联，计算得出给定的放电电流。对每个电池进行强制放电，放电时间(小时)应等于其额定容量除以初始试验电流(安培)。

原电池或可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。

Each cell shall be 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.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

Primary or rechargeable 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：

38.3.4.1	T.1： 高度模拟：Altitude simulation						P
样品编号 Sample No.	测试前 Before test		测试后 After Test		质量损失 Mass loss (%)	剩余电压 Residual OCV (%)	测试结果 Test result
	样品质量 M_1 Mass	开路电压 Voltage	样品质量 M_2 Mass	开路电压 Voltage			
C1#	0.598g	4.18V	0.597g	4.17V	0.17	99.76	O
C2#	0.598g	4.18V	0.597g	4.17V	0.17	99.76	O
C3#	0.600g	4.17V	0.600g	4.15V	0.00	99.52	O
C4#	0.598g	4.18V	0.598g	4.17V	0.00	99.76	O
C5#	0.598g	4.18V	0.597g	4.16V	0.17	99.52	O
C6#	0.597g	4.18V	0.597g	4.16V	0.00	99.52	O
C7#	0.599g	4.17V	0.599g	4.16V	0.00	99.76	O
C8#	0.599g	4.18V	0.599g	4.18V	0.00	100.00	O
C9#	0.597g	4.18V	0.596g	4.17V	0.17	99.76	O
C10#	0.599g	4.18V	0.598g	4.17V	0.17	99.76	O
其他补充：测试结果“O”代表判定该测试无渗漏、无排气、无解体、无破裂、无起火。 Supplements：Test result "O" decides that the test no leakage, no venting, no disassembly, no rupture, no fire.							

38.3.4.2	T.2： 温度测试：Thermal test						P
样品编号 Sample No.	测试前 Before test		测试后 After Test		质量损失 Mass loss (%)	剩余电压 Residual OCV (%)	测试结果 Test result
	样品质量 M_1 Mass	开路电压 Voltage	样品质量 M_2 Mass	开路电压 Voltage			
C1#	0.597g	4.17V	0.596g	4.11V	0.17	98.56	O
C2#	0.597g	4.17V	0.596g	4.12V	0.17	98.80	O
C3#	0.600g	4.15V	0.598g	4.07V	0.33	98.07	O
C4#	0.598g	4.17V	0.598g	4.09V	0.00	98.08	O
C5#	0.597g	4.16V	0.597g	4.09V	0.00	98.32	O
C6#	0.597g	4.16V	0.596g	4.11V	0.17	98.80	O
C7#	0.599g	4.16V	0.599g	4.11V	0.00	98.80	O
C8#	0.599g	4.18V	0.597g	4.13V	0.33	98.80	O
C9#	0.596g	4.17V	0.596g	4.09V	0.00	98.08	O
C10#	0.598g	4.17V	0.597g	4.12V	0.17	98.80	O
其他补充：测试结果“O”代表判定该测试无渗漏、无排气、无解体、无破裂、无起火。 Supplements：Test result "O" decides that the test no leakage, no venting, no disassembly, no rupture, no fire.							

38.3.4.3	T.3： 振动：Vibration						P
样品编号 Sample No.	测试前 Before test		测试后 After Test		质量损失 Mass loss (%)	剩余电压 Residual OCV (%)	测试结果 Test result
	样品质量 M_1 Mass	开路电压 Voltage	样品质量 M_2 Mass	开路电压 Voltage			
C1#	0.596g	4.11V	0.595g	4.08V	0.17	99.27	O
C2#	0.596g	4.12V	0.595g	4.11V	0.17	99.76	O
C3#	0.598g	4.07V	0.598g	4.05V	0.00	99.51	O
C4#	0.598g	4.09V	0.598g	4.07V	0.00	99.51	O
C5#	0.597g	4.09V	0.596g	4.07V	0.17	99.51	O
C6#	0.596g	4.11V	0.595g	4.10V	0.17	99.76	O
C7#	0.599g	4.11V	0.598g	4.10V	0.17	99.76	O
C8#	0.597g	4.13V	0.596g	4.10V	0.17	99.27	O
C9#	0.596g	4.09V	0.596g	4.07V	0.00	99.51	O
C10#	0.597g	4.12V	0.596g	4.09V	0.17	99.27	O
其他补充：测试结果“O”代表判定该测试无渗漏、无排气、无解体、无破裂、无起火。 Supplements：Test result "O" decides that the test no leakage, no venting, no disassembly, no rupture, no fire.							

38.3.4.4	T.4：冲击：Shock						P
样品编号 Sample No.	测试前 Before test		测试后 After Test		质量损失 Mass loss (%)	剩余电压 Residual OCV (%)	测试结果 Test result
	样品质量 M_1 Mass	开路电压 Voltage	样品质量 M_2 Mass	开路电压 Voltage			
C1#	0.595g	4.08V	0.594g	4.07V	0.17	99.75	O
C2#	0.595g	4.11V	0.594g	4.09V	0.17	99.51	O
C3#	0.598g	4.05V	0.597g	4.05V	0.17	100.00	O
C4#	0.598g	4.07V	0.597g	4.07V	0.17	100.00	O
C5#	0.596g	4.07V	0.596g	4.05V	0.00	99.51	O
C6#	0.595g	4.10V	0.594g	4.08V	0.17	99.51	O
C7#	0.598g	4.10V	0.597g	4.09V	0.17	99.76	O
C8#	0.596g	4.10V	0.595g	4.09V	0.17	99.76	O
C9#	0.596g	4.07V	0.596g	4.06V	0.00	99.75	O
C10#	0.596g	4.09V	0.595g	4.09V	0.17	100.00	O
其他补充：测试结果“O”代表判定该测试无渗漏、无排气、无解体、无破裂、无起火。 Supplements：Test result "O" decides that the test no leakage, no venting, no disassembly, no rupture, no fire.							

38.3.4.5	T.5：外部短路：External short circuit	P
样品编号 Sample No.	样品表面最高温度 Max external temperature（℃）	Test result 测试结果
C1#	116.9	O
C2#	101.5	O
C3#	114.6	O
C4#	103.9	O
C5#	109.6	O
C6#	97.1	O
C7#	99.9	O
C8#	113.0	O
C9#	106.3	O
C10#	106.1	O
其他补充：测试结果“O”代表判定该测试无解体，无破裂，无起火。 Supplements：Test result "O" decides that the test no disassembly，no rupture，no fire.		

38.3.4.6	**T.6:挤压 Crush**	P
样品编号 Sample No.	样品表面最高温度 Max external temperature（℃）	测试结果 Test result
C11#	24.0	O
C12#	24.5	O
C13#	24.7	O
C14#	23.4	O
C15#	24.1	O
C16#	24.4	O
C17#	23.9	O
C18#	23.8	O
C19#	23.3	O
C20#	24.3	O
其他补充：测试结果“O”代表判定该测试无解体，无破裂，无起火。 Supplements：Test result "O" decides that the test no disassembly，no fire.		

38.3.4.7	T7：过度充电:Overcharge		N/A
样品编号 Sample No.	测试结果 Test result	样品编号 Sample No.	测试结果 Test result
--	N/A	--	N/A
--	N/A	--	N/A
--	N/A	--	N/A
--	N/A	--	N/A
其他补充：-- Supplements ：--			

38.3.4.8	T8：强制放电:Forced discharge		P
样品编号 Sample No.	测试结果 Test result	样品编号 Sample No.	测试结果 Test result
C21#	O	C31#	O
C22#	O	C32#	O
C23#	O	C33#	O
C24#	O	C34#	O
C25#	O	C35#	O
C26#	O	C36#	O
C27#	O	C37#	O
C28#	O	C38#	O
C29#	O	C39#	O
C30#	O	C40#	O
其他补充：测试结果“O”代表判定该测试无解体，无起火。 Supplements ：Test result "O" decides that the test no disassembly，no fire.			

声　　明

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UN38.3 检测报告

UN38.3 Test Report

Client 委托方	
Add. of Client 委托方地址	
Samples Description 样品名称	Li-ion Battery 锂离子电池
Model/Type 型号规格	APL 502030 3.7V 250mAh
Testing Laboratory 测试机构	Shenzhen NCT Testing Technology Co., Ltd. 深圳诺测检测技术有限公司 A101, 1/F., &2F., B2, Fuqiao 6th Area, Xintian, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China 广东省深圳市宝安区福海街道新田社区富桥六区 B2 一楼 A101, 二楼 Phone number 电话号码: +86-755-27790922 Email 邮箱: sales@nct-testing.com Website 网址: http://www.ncttesting.com
Report No. 报告编号	NCT23005180XB1-1
Issued Date 发行日期	2023.02.22
Test Conclusion 测试结论:Shown in the Conclusion of test report. 见检测报告结论页.	

Tested by主检人: Michael Lei — Michael Lei

Approved by批准人: Boris Lin — Boris Lin

Inspected by 审核人: Hely Wang — Hely Wang

Seal of NCT 检测单位（盖章）

Date of Issue 签发日期: 2023.02.22

Ⅰ、Sample Description 样品描述

Product Name 产品名称	Li-ion Battery 锂离子电池		**Sample Model** 样品型号	APL 502030 3.7V 250mAh	
Manufacturer 制造商					
Address 地址					
Factory 工厂					
Address 地址					
Manufacturer's contact information 制造商联系信息					
Trade Mark 商标	---	**Cell Shape** 电芯形状	Prismatic 棱柱形	**Battery Size** 电池尺寸 **(L×W×T)**	(30.0×20.0×5.0)mm
Nominal Voltage 标称电压	3.7V	**Rated Capacity** 额定容量	250mAh 0.925Wh	**Limited Charge Voltage** 充电限制电压	4.2V
Standard Charge Current 标准充电电流	50mA	**Maximum Continuous Charge Current** 最大持续充电电流	250mA	**End Charge Current** 结束充电电流	5mA
Cut-off Voltage 放电截止电压	3.0V	**Standard Discharge Current** 标准放电电流	50mA	**Maximum Discharge Current** 最大放电电流	250mA
Cell Number 组成电芯数量	1PC		**Cell Model** 电芯型号	APL 502030 3.7V 250mAh	
Sample Mass 样品重量	5.53g		**Sample Physical description** 样品物理形态	Approximate Silver Cuboid 银色近长方体	
Receiving Date 接收日期	2023.02.08		**Completing Date** 完成日期	2023.02.21	

Ⅱ、Standard 标准

UNITED NATIONS "Manual of Tests and Criteria" (ST/SG/AC.10/11/Rev.7+Amend.1 Section 38.3)
联合国《试验和标准手册》第七修订版及修正 1 第 38.3 节。

Ⅲ、Test Item 测试项目

T.1. ☒Altitude simulation 高度模拟
T.2. ☒Thermal test 温度试验
T.3. ☒Vibration 振动
T.4. ☒Shock 冲击
T.5. ☒External short circuit 外部短路
T.6. ☐Impact 撞击/ ☒Crush 挤压
T.7. ☒Overcharge 过充电
T.8. ☒Forced discharge 强制放电

Ⅳ、Test Method and Requirement 测试方法和要求

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.

用相同的电芯或电池按照顺序进行试验 T.1 至 T.5。试验 T.6 至 T.8 用没有进行其他试验的电芯。试验 T7 可以使用原先在试验 T1 至 T5 中使用过的未损坏的电池进行，以便测试交替充电放电的电池。

Single cell batteries of B1#~B5#, B11#~B14# are full charged after one cycle;
Single cell batteries of B6#~B10#, B15#~B18# are full charged after twenty-five cycles;
Rechargeable cells of C1#~C5# are 50% charged after one cycle;
Rechargeable cells of C6#~C10# are 50% charged after twenty-five cycles;
Rechargeable cells of C11#~C20# are full discharged after one cycle;
Rechargeable cells of C21#~C30# are full discharged after twenty-five cycles;
Test environment condition: ambient temperature: 15-25℃, ambient humidity: 40-70%
单电芯电池 B1#~B5#, B11#~B14#为 1 次循环满电状态；
单电芯电池 B6#~B10#, B15#~B18#为 25 次循环满电状态；
可充电电芯 C1#~C5#为 1 次循环后 50%充电状态；
可充电电芯 C6#~C10#为 25 次循环后 50%充电状态；
可充电电芯 C11#~C20#为 1 次循环完全放电状态；
可充电电芯 C21#~C30#为 25 次循环完全放电状态；
试验环境条件：环境温度：15-25℃，环境湿度：40-70%

In order to quantify the mass loss, the following procedure is provided:

Mass loss (%) = (M1-M2)/M1 x 100

质量损失的量化值，可用以下公式计算：

质量损失(%)=(M1-M2)/M1×100

Where M1 is the mass before the test and M2 is the mass after the test. When mass loss does not exceed the values in Table below, it shall be considered as "no mass loss".

式中：M1 是试验前的质量，M2 是试验后的质量。如果质量损失不超过下表所列的数值，应视为"无质量损失"。

Mass M of cell or battery 电芯或电池的质量	Mass loss limit 质量损失限值

M＜1g	0.5%
1g≤M≤75g	0.2%
M＞75g	0.1%

Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table above.

渗漏系指可以看到的电解液或者其他物质从电芯或者电池中漏出，或电芯或电池中的物质损失（不包括电池外壳、搬运装置、或标签），失去的质量超过上表所列的数值。

In test T.1 to T.4, cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

在测试 T.1 至 T.4 中，电芯和电池须满足无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯或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%。

T.1. Altitude simulation 高度模拟

Test method 测试方法

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

试验电芯和电池被放置在压力等于或低于 11.6 kPa 和环境温度(20±5℃)下存放至少 6 小时。

Requirement 要求

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯或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%。

T.2. Thermal test 温度试验

Test method 测试方法

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72±2℃, followed by storage for at least six hours at a test temperature equal to -40±2℃. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20±5℃). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

试验电芯和电池放置在试验温度等于 72±2℃的条件下存放至少 6 小时，接着再在试验温度等于-40±2℃的条件下存放至少 6 小时。两个极端试验温度之间的最大时间间隔为 30 分钟。此程序重复进行，共完成 10 次循环，接着将所有试验电芯和电池在环境温度(20±5℃)下存放 24 小时。对于大型电芯和电池，暴露于极端试验温度的时间至少应为 12 小时。

Requirement 要求

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯或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%。

T.3. Vibration 振动

Test method 测试方法

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be 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.

电芯和电池紧固于振动台台面，但不得造成电芯变形，并能准确可靠地传播振动。振动应是正弦波形，对数扫描频率在 7 Hz 和 200 Hz 之间，再回到 7 Hz，跨度为 15 分钟。这一振动过程须对三个互相垂直的电芯安装方位的每一方向重复进行 12 次，总共为时 3 小时。其中一个振动方向必须与端面垂直。

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

作对数式频率扫描，对电芯和总质量不超过 12 千克的电池（电芯和小型电池），和对质量超过 12 千克的电池（大型电池）有所不同。

For cells and small batteries : from 7 Hz a peak acceleration of 1 gn 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 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.

对电芯和小型电池：从 7 Hz 开始，保持 1 gn 的最大加速度，直到频率达到 18 Hz。然后将振幅保持在 0.8mm（总位移 1.6mm），并增加频率直到峰值加速度达到 8 gn（频率约为 50 Hz）。将峰值加速度保持在 8 gn 直到频率增加到 200 Hz。

For large batteries : from 7 Hz a peak acceleration of 1 gn 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 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.

对大型电池：从 7 Hz 开始，保持 1 gn 的最大加速度，直到频率达到 18 Hz。然后将振幅保持在 0.8mm（总位移 1.6mm），并增加频率直到峰值加速度达到 2 gn（频率约为 25Hz）。将峰值加速度保持在 2 gn 直到频率增加到 200 Hz。

Requirement 要求

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯或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%。

T.4. Shock 冲击

Test method 测试方法

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

试验电芯和电池用刚性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。

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjects to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 milliseconds.

每个电芯须经受峰值加速度 150 gn 和脉冲持续时间 6 ms 的半正弦波冲击。不过，大型电芯须经受峰值加速度 50 gn 和脉冲持续时间 11 ms 的半正弦波冲击。

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

每个电池须经受半正弦波冲击，峰值加速度需要根据电池的重量来决定。小型电池的脉冲持续时间为 6 ms，大型电池的脉冲持续时间为 11ms。下面的公式是用来计算合适的最小峰值加速度。

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller	6 ms
Large batteries	50 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass^*}\right)}$ whichever is smaller	11 ms

* Mass is expressed in kilograms.

电池	最小峰值加速度	脉冲持续时间
小型电池	150 gn 或计算结果中取最小的值 加速度（gn）= $\sqrt{(\frac{100850}{mass})}$	6ms
大型电池	50 gn 或计算结果中取最小的值 加速度（gn）= $\sqrt{(\frac{30000}{mass})}$	11 ms

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

每个电芯或电池须在三个互相垂直的电芯或电池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。

Requirement 要求

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯或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%。

T.5. External short circuit 外部短路

Test method 测试方法

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57±4℃, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57± 4℃ shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

试验电芯或电池需要加热一段时间，以使其外壳温度均匀稳定地达到 57±4℃。加热时间的长短是由电芯或电池的尺寸和设计来决定的，这个加热时间需要评估并记录。如果这个加热时间不好评估的话，对于小电芯和小电池需要在此温度下放置至少 6 个小时，对于大电芯和大电池至少放置 12 个小时。然后使电芯或电池在 57±4℃下经受总外电阻小于 0.1Ω 的短路条件。

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57±4℃, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

短路测试持续到电芯或电池外壳温度回到 57±4℃后至少持续 1 小时，针对大电池，外壳温度需要下降到

测试过程中监控到的最大温度的一半以下。

The short circuit and cooling down phases shall be conducted at least at ambient temperature.

短路测试和冷却阶段至少应该在环境温度下进行。

Requirement 要求

Cells and batteries 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.

电芯和电池外壳温度不超过 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。

T.6. Impact / Crush 撞击/挤压

Test procedure – Impact (applicable to cylindrical cells not less than 18.0 mm in diameter)

测试步骤 – 撞击（适用于直径大于等于 18.0 毫米以上的圆柱形电芯）

The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

试样电芯或电芯组件放在平坦光滑表面上，一根 316 型不锈钢棒横放在试样中心，钢棒直径 15.8 毫米±0.1 毫米，长度至少 6 厘米，或电芯最长端的尺度，取二者之长者。将一块 9.1 千克±0.1 千克的重锤从 61±2.5 厘米高度跌落到钢棒和试样交叉处，使用一个几乎没有摩擦的、对落体重锤阻力最小的垂直轨道或管道加以控制。垂直轨道或管道用于引导落锤沿与水平支撑表面呈 90 度落下。

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

受撞击的试样，纵轴应与平坦表面平行并与横放在试样中心的直径 15.8±0.1 毫米弯曲表面的纵轴垂直。每一试样只经受一次撞击。

Test procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)

测试步骤– 挤压（适用于棱柱形，袋状，硬币/纽扣电芯和圆柱形电芯直径小于 18.0 毫米）

A cell or component cell 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.

将电芯或电芯组件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 cm/s。挤压持续进行，直到出现以下三种情况之一：

(a) The applied force reaches 13 kN ± 0.78 kN;

(b) The voltage of the cell drops by at least 100 mV;

(c) The cell is deformed by 50% or more of its original thickness.

(a)施加的力达到 13 kN ± 0.78 kN；

(b)电芯的电压下降至少 100mV；

(c)电芯形变达到原始厚度的 50%或更多。

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

一旦达到最大压力、电压下降 100mV 或更多，或电芯形变至少达到原始厚度的 50%，即可解除压力。

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

棱柱形或袋装电芯须从最宽的面施压。纽扣/硬币形电芯应从其平坦表面施压。圆柱形电芯应从与纵轴垂

直的方向施压。

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

每个试样电芯或电芯组件只做一次挤压试验。试样须继续观察 6 小时。试验须使用之前未做过其他试验的试样电芯或电芯组件进行。

Requirement 要求

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

电芯和电芯组件外壳温度不超过 170℃，并且在试验过程中及试验后 6 小时内无解体，无起火。

T.7. Overcharge 过充电

Test method 测试方法

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

充电电流为制造商推荐的最大持续充电电流的两倍。试验的最小电压如下：

(a) When the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) When the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

(a) 制造商推荐的充电电压不大于 18 伏时，试验的最小电压应是电池最大充电电压的两倍或 22 伏两者中的较小者。

(b) 制造商推荐的充电电压大于 18 伏时，试验的最小电压应是电池最大充电电压的 1.2 倍。

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

试验应在环境温度下进行。进行试验的时间应为 24 小时。

Requirement 要求

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

充电电池应在试验过程中和试验后 7 天内无解体，无起火。

T.8. Forced discharge 强制放电

Test method 测试方法

Each cell shall be 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.

每个电芯在环境温度下与 12V 直流电电源串联在起始电流等于制造商给定的最大放电电流的条件下强制放电。

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell is forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

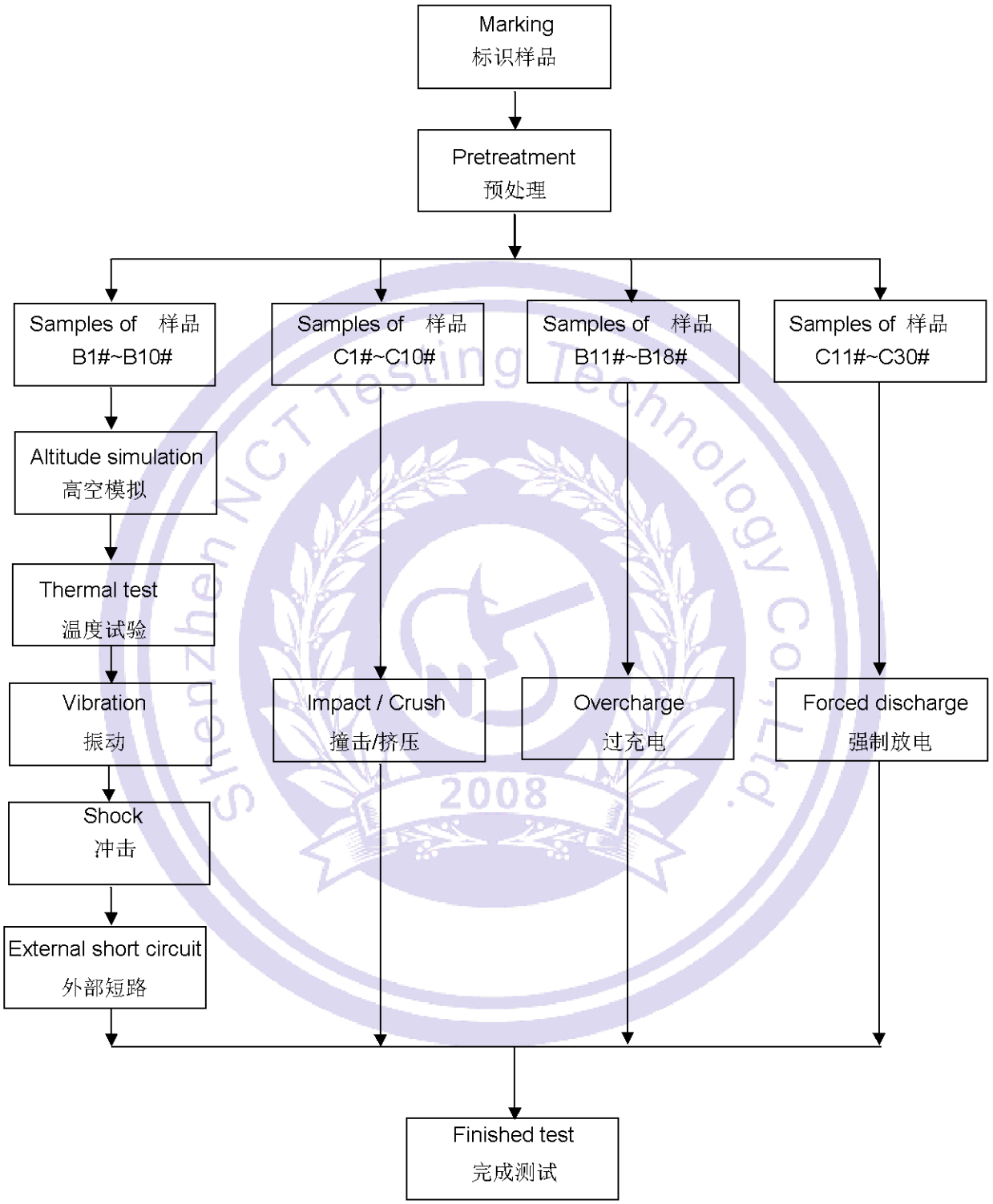
试样电芯与一个适当大小的电阻负载串联以调节到规定大小的放电电流。每个电芯的放电时间（单位为 h）等于电芯的额定容量除以试验初始放电电流（单位 A）。

Requirement 要求

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

原电芯或充电电芯应在试验过程中和试验后 7 天内无解体，无起火。

Ⅴ、Test Procedure 测试流程



Ⅵ、Test Data 测试数据

T.1. Altitude simulation 高度模拟

The state of cells 样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/Voltage pre-test 试验后电压/试验前电压(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 1 次循环后满电状态	B1#	5.530	4.184	5.530	4.181	0.000	99.928	Pass 合格
	B2#	5.516	4.177	5.515	4.173	0.018	99.904	Pass 合格
	B3#	5.521	4.179	5.521	4.176	0.000	99.928	Pass 合格
	B4#	5.532	4.186	5.532	4.183	0.000	99.928	Pass 合格
	B5#	5.515	4.183	5.514	4.179	0.018	99.904	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B6#	5.518	4.180	5.518	4.177	0.000	99.928	Pass 合格
	B7#	5.534	4.187	5.534	4.184	0.000	99.928	Pass 合格
	B8#	5.529	4.179	5.528	4.176	0.018	99.928	Pass 合格
	B9#	5.523	4.182	5.523	4.178	0.000	99.904	Pass 合格
	B10#	5.528	4.178	5.528	4.175	0.000	99.928	Pass 合格

Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.3℃
After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.
测试后，电池未渗漏、未泄气、未解体、未破裂和未起火。

T.2. Thermal test 温度试验

The state of cells 样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/Voltage pre-test 试验后电压/试验前电压(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 1 次循环后满电状态	B1#	5.530	4.181	5.528	4.143	0.036	99.091	Pass 合格
	B2#	5.515	4.173	5.514	4.138	0.018	99.161	Pass 合格
	B3#	5.521	4.176	5.519	4.141	0.036	99.162	Pass 合格
	B4#	5.532	4.183	5.530	4.145	0.036	99.092	Pass 合格
	B5#	5.514	4.179	5.513	4.141	0.018	99.091	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B6#	5.518	4.177	5.517	4.142	0.018	99.162	Pass 合格
	B7#	5.534	4.184	5.532	4.146	0.036	99.092	Pass 合格
	B8#	5.528	4.176	5.526	4.141	0.036	99.162	Pass 合格
	B9#	5.523	4.178	5.522	4.140	0.018	99.090	Pass 合格
	B10#	5.528	4.175	5.526	4.140	0.036	99.162	Pass 合格

Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.2℃
After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.
测试后，电池未渗漏、未泄气、未解体、未破裂和未起火。

T.3. Vibration 振动

The state of cells 样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/Voltage pre-test 试验后电压/试验前电压(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 1 次循环后满电状态	B1#	5.528	4.143	5.528	4.140	0.000	99.928	Pass 合格
	B2#	5.514	4.138	5.513	4.134	0.018	99.903	Pass 合格
	B3#	5.519	4.141	5.519	4.138	0.000	99.928	Pass 合格
	B4#	5.530	4.145	5.530	4.141	0.000	99.903	Pass 合格
	B5#	5.513	4.141	5.512	4.138	0.018	99.928	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B6#	5.517	4.142	5.517	4.139	0.000	99.928	Pass 合格
	B7#	5.532	4.146	5.531	4.142	0.018	99.904	Pass 合格
	B8#	5.526	4.141	5.526	4.138	0.000	99.928	Pass 合格
	B9#	5.522	4.140	5.522	4.136	0.000	99.903	Pass 合格
	B10#	5.526	4.140	5.525	4.137	0.018	99.928	Pass 合格

Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.3℃
After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.
测试后，电池未渗漏、未泄气、未解体、未破裂和未起火。

T.4. Shock 冲击

The state of cells 样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/Voltage pre-test 试验后电压/试验前电压(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 1 次循环后满电状态	B1#	5.528	4.140	5.528	4.136	0.000	99.903	Pass 合格
	B2#	5.513	4.134	5.513	4.131	0.000	99.927	Pass 合格
	B3#	5.519	4.138	5.518	4.135	0.018	99.928	Pass 合格
	B4#	5.530	4.141	5.530	4.137	0.000	99.903	Pass 合格
	B5#	5.512	4.138	5.511	4.135	0.018	99.928	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B6#	5.517	4.139	5.517	4.136	0.000	99.928	Pass 合格
	B7#	5.531	4.142	5.530	4.138	0.018	99.903	Pass 合格
	B8#	5.526	4.138	5.526	4.134	0.000	99.903	Pass 合格
	B9#	5.522	4.136	5.521	4.133	0.018	99.927	Pass 合格
	B10#	5.525	4.137	5.525	4.134	0.000	99.927	Pass 合格

Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.4℃
After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.
测试后，电池未渗漏、未泄气、未解体、未破裂和未起火。

T.5. External short circuit 外部短路

The state of cells 样品状态	No. 编号	External Peak temperature(℃) 电池表面最高温度(℃)	Status 结果
Full charged after one cycle 1 次循环后满电状态	B1#	57.9	Pass 合格
	B2#	58.1	Pass 合格
	B3#	57.6	Pass 合格
	B4#	57.8	Pass 合格
	B5#	58.4	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B6#	57.7	Pass 合格
	B7#	57.5	Pass 合格
	B8#	58.0	Pass 合格
	B9#	57.5	Pass 合格
	B10#	58.2	Pass 合格
Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.3℃ There is no disassembly, no rupture and no fire during the test and within six hours after test. 电池在测试中和测试后 6 小时内未解体、未破裂，未起火。			

T.6. Crush 挤压

The state of cells 样品状态	No. 编号	External Peak temperature(℃) 电池表面最高温度(℃)	Status 结果
50% charged after one cycle 1 次循环后 50%充电状态	C1#	23.6	Pass 合格
	C2#	24.1	Pass 合格
	C3#	23.8	Pass 合格
	C4#	23.4	Pass 合格
	C5#	24.2	Pass 合格
50% charged after twenty-five cycles 25 次循环后 50%充电状态	C6#	23.9	Pass 合格
	C7#	24.3	Pass 合格
	C8#	23.5	Pass 合格
	C9#	24.0	Pass 合格
	C10#	23.7	Pass 合格
Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.2℃ There is no disassembly and no fire during the test and within six hours after test. 电芯在测试中和测试后 6 小时内未解体、未起火。			

T.7. Overcharge 过充电

The state of cells 样品状态	No. 编号	Status 结果
Full charged after one cycle 1 次循环后满电状态	B11#	Pass 合格
	B12#	Pass 合格
	B13#	Pass 合格
	B14#	Pass 合格
Full charged after twenty-five cycles 25 次循环后满电状态	B15#	Pass 合格
	B16#	Pass 合格
	B17#	Pass 合格
	B18#	Pass 合格
Notes 注释: Atmospheric pressure 大气压强:1.013×10^5Pa, Ambient temperature 环境温度: 23.3℃ There is no disassembly and no fire during the test and within seven days after the test. 电池在测试中和测试后 7 天内未解体，未起火。		

T.8. Forced discharge 强制放电

The state of cells 样品状态	No. 编号	Status 结果
Full discharged after one cycle 1 次循环完全放电状态	C11#	Pass 合格
	C12#	Pass 合格
	C13#	Pass 合格
	C14#	Pass 合格
	C15#	Pass 合格
	C16#	Pass 合格
	C17#	Pass 合格
	C18#	Pass 合格
	C19#	Pass 合格
	C20#	Pass 合格
Full discharged after twenty-five cycles 25 次循环完全放电状态	C21#	Pass 合格
	C22#	Pass 合格
	C23#	Pass 合格
	C24#	Pass 合格
	C25#	Pass 合格
	C26#	Pass 合格
	C27#	Pass 合格
	C28#	Pass 合格

	C29#	Pass 合格
	C30#	Pass 合格

Notes 注释: Atmospheric pressure 大气压强:1.013×10^{5}Pa, Ambient temperature 环境温度: 23.4℃
There is no disassembly and no fire during the test and within seven days after the test.
电芯在测试中和测试后 7 天内未解体，未起火。

Ⅶ、Conclusion 结论

No. 编号	Test item 测试项目	Sample number 样品数量	Test reference 测试参考	Conclusion 结论
1	Altitude simulation 高空模拟	B1#~B10#	UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.1 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.1 节	Pass 合格
2	Thermal test 温度试验		UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.2 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.2 节	Pass 合格
3	Vibration 振动		UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.3 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.3 节	Pass 合格
4	Shock 冲击		UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.4 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.4 节	Pass 合格
5	External short circuit 外部短路		UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.5 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.5 节	Pass 合格
6	Impact/Crush 撞击/挤压	C1#~C10#	UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.6 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.6 节	Pass 合格
7	Overcharge 过度充电	B11#~B18#	UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.7 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.7 节	Pass 合格
8	Forced discharge 强制放电	C11#~C30#	UN Manual of Test and Criteria, part Ⅲ, subsection 38.3.4.8 UN 试验和标准手册,第Ⅲ部分,第 38.3.4.8 节	Pass 合格

The submitted samples were complied with the stated requirements of UN manual of test and criteria, part Ⅲ, subsection 38.3, the test result is qualified.

经检测，提交的测试样品均符合 UN38.3 的要求，测试结论为合格。

Ⅷ、Photo of The Sample 样品图片

Model 型号: APL 502030 3.7V 250mAh

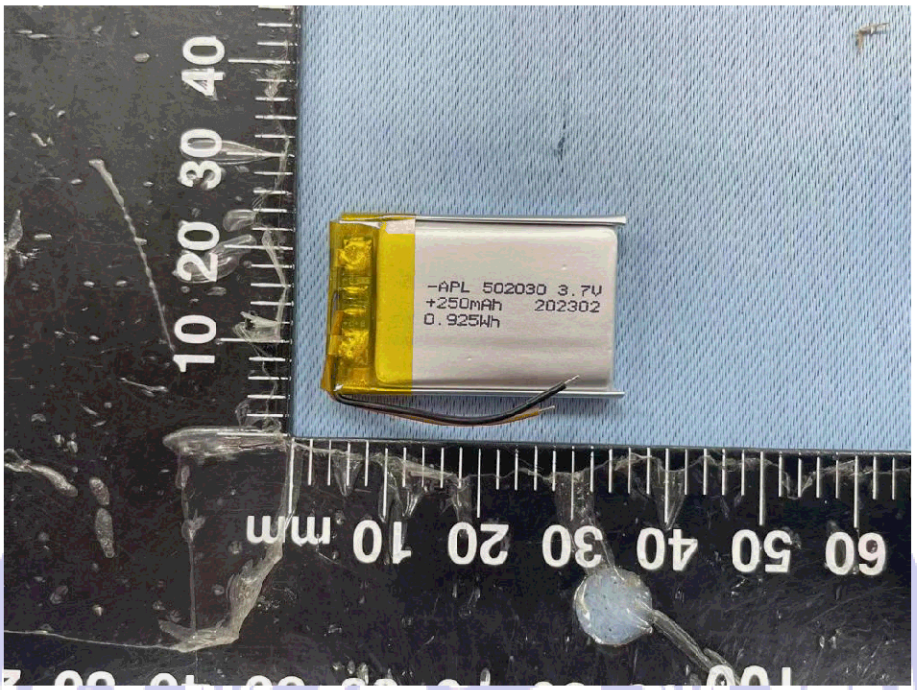


Photo 1 Front 正面

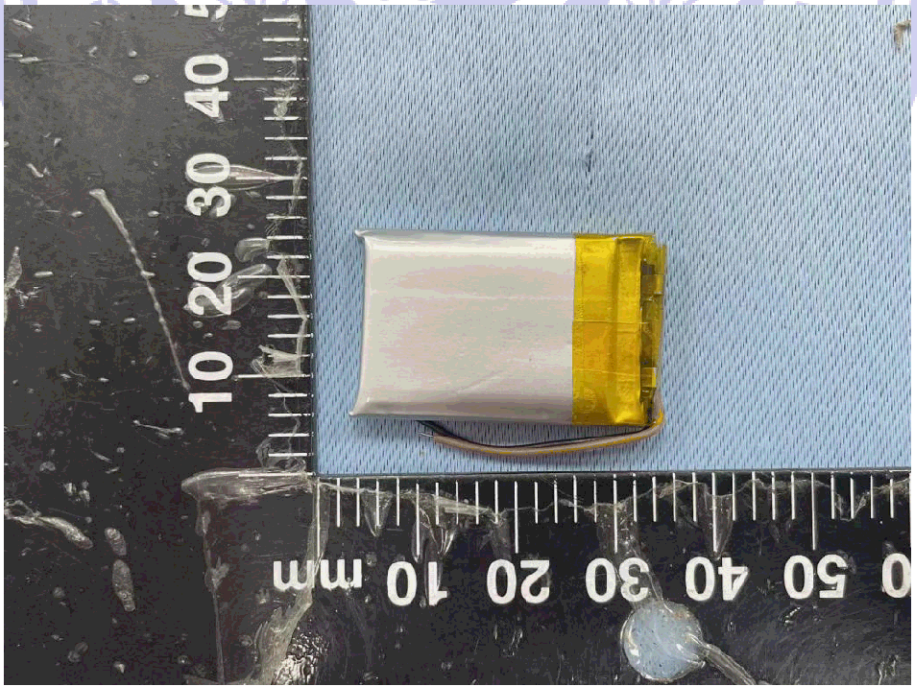


Photo 2 Rear 反面

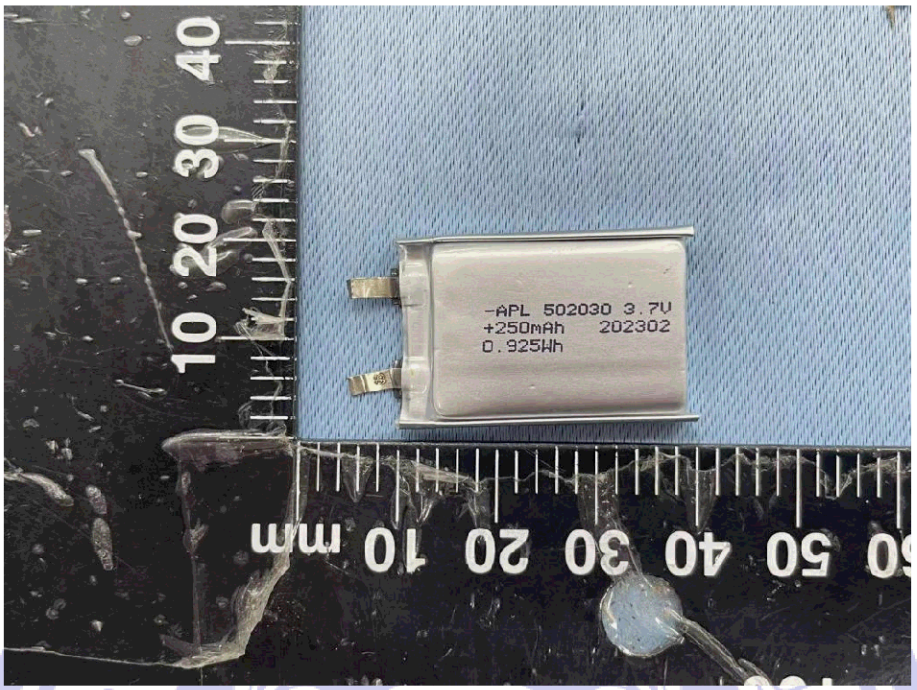


Photo 3 Internal Cell 内部电芯

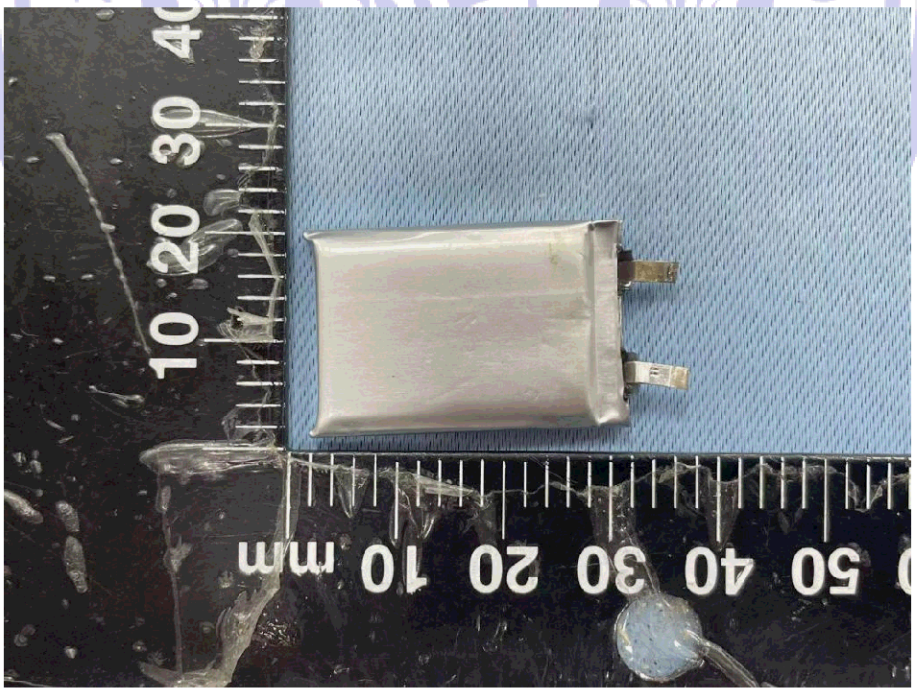


Photo 4 Internal Cell 内部电芯

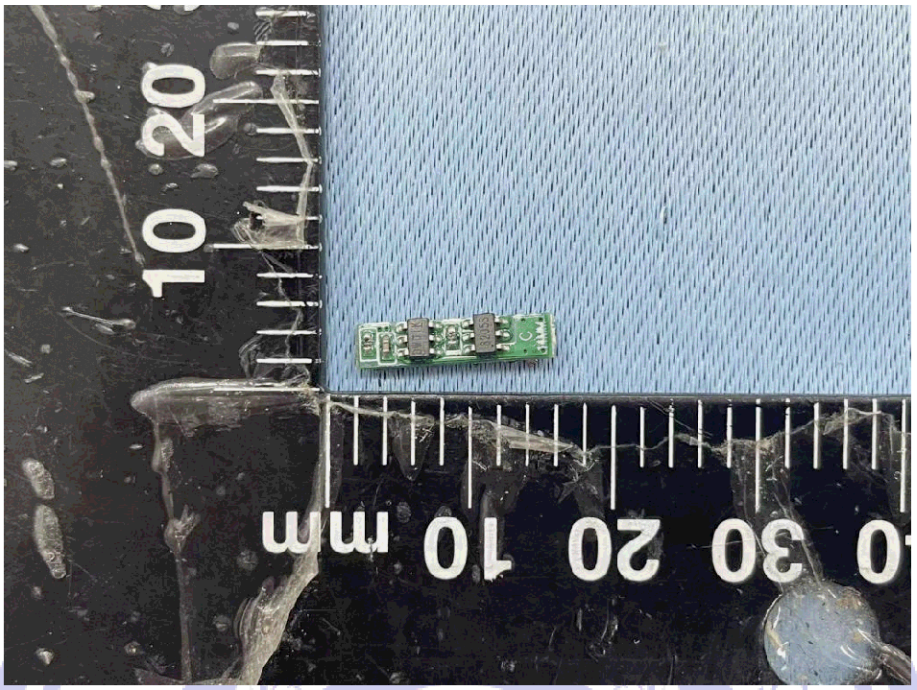


Photo 5 Protection board 保护板

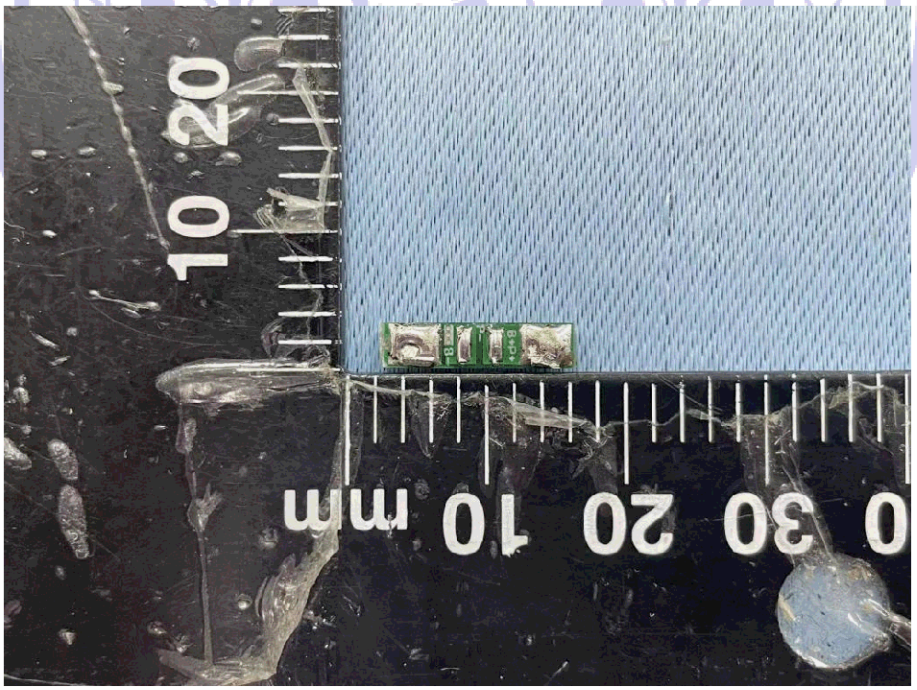


Photo 6 Protection board 保护板

注意事项

Important Notice

1. The test report is invalid without the official stamp of NCT.
   本报告书无 NCT 盖章无效.
2. Nobody is allowed to photocopy or partly photocopy this test report without written permission of NCT.
   未经 NCT 书面同意，不得复制或部分地复制本报告书。
3. The test report is invalid without the signatures of Ratifier, Reviewer and Testing engineer.
   本报告书无批准人、审核人、及主检人签名无效。
4. The report is invalid when anything of following happens – illegal transfer, reproduce, embezzlement, imposture, modification or tampering in any media form.
   私自转让、复制、盗用、冒用、涂改、或以任何媒体形式篡改的报告书无效。
5. Objections to the test report must be submitted to NCT within 15 days.
   对报告书若有异议，应于收到报告之日起 15 天内向本公司提出。
6. The test report is valid for the tested samples only.
   本报告仅对测试样品有效。
7. The Chinese contents in this report are only for reference.
   本报告中的中文内容仅供参考。

********End of Report 报告结束********