锂电池 UN38.3 测试报告
Lithium Battery UN38.3 Test Report

报告编号： Report No.：	LA2023B1417028U

样品名称 Sample	聚合物锂离子电池 Polymer Li-ion Battery
样品型号 Model	502025
委托单位 Applicant	
签发日期 Issue Date	2023-10-27

深圳市莱恩瑞斯科技有限公司
Shenzhen Lionaces Technology Co., Ltd.

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1. 样品描述 Sample Description			
样品名称 Sample Name	聚合物锂离子电池 Polymer Li-ion Battery	样品型号 Model Name	502025
电池规格 Battery specification	3.7V, 200mAh, 0.74Wh	商标 Trade mark	N/A
组成方式 Composing mode	1S1P	电池重量 Mass of battery	4.23g
电池外观 Battery appearance	银色近长方体 Approximate Silver Cuboid	电池尺寸 Battery Size	24.2mm*20.2mm*4.7mm
电池类型 Battery Type	可充电单芯锂离子电池 Rechargeable Single Cell Lithium-ion Battery		
测试实验室 Testing laboratory	深圳市莱恩瑞斯科技有限公司 Shenzhen Lionaces Technology Co., Ltd.		
测试地址 Testing Address	深圳市宝安区福海街道和平社区永和路骏丰工业区 B6 栋 301 301, Building B6, Junfeng Industrial Zone, Yonghe Road, Heping Community, Fuhai Street, Baoan, Shenzhen, Guangdong, China		
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委托单位地址 Applicant address			
生产单位 Manufacturer			
生产单位地址 Manufacturer address			
电话 Telephone			
网址 website			

2、测试标准 Standard

联合国《试验和标准手册》（第 7 版修订 1）38.3 节
UN "Manual of Tests and Criteria" ST/SG/AC.10/11/Rev.7/Amend1/Subsection 38.3

3、测试项目及结论 Test Item And Conclusion

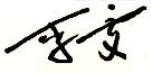
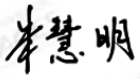
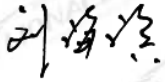
测试项目 Item	测试样品编号 Samples Number	结论 Conclusion
38.3.4.1 高度模拟 Altitude simulation	Z1~Z5, X1~X5	通过 Pass
38.3.4.2 温度试验 Thermal test		通过 Pass
38.3.4.3 振动 Vibration		通过 Pass
38.3.4.4 冲击 Shock		通过 Pass
38.3.4.5 外部短路 External Short Circuit		通过 Pass
38.3.4.6 挤压 Crush	Z6~Z10, X6~X10	通过 Pass
38.3.4.7过度充电Overcharge	Z11~Z14, X11~X14	通过 Pass
38.3.4.8 强制放电 Forced discharge	Z15~Z24, X15~X24	通过 Pass

参考组装电池测试要求，如果适用(38.3.3(f)和 38.3.3(g):不适用
Reference to assembled battery testing requirements, if applicable (i.e., 38.3.3(f) and 38.3.3(g)): Not applicable

说明 Notes: P--Pass; N/A--不适用 not applicable; Y--Yes; N--No;
Z1~Z5、Z11~Z14：第一个充放电周期完全充电状态的电池；Batteries at first cycle in fully charged states;
Z6~Z10：第一个充放电周期 50%设计额定容量状态的电池芯；Cells at first cycle at 50% of the design rated capacity;
Z15~Z24：第一个充放电周期完全放电状态的电池芯； Cells at first cycle in fully discharged states;
X1~X5、X11~X14：25 个充放电周期后完全充电状态的电池芯；Batteries after 25 cycles ending in fully charged states;
X6~X10：25 个充放电周期 50%设计额定容量状态的电池芯；Cells at after 25 cycles at 50% of the design rated capacity;
X15~X24：25 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.

送检样品符合《联合国关于危险货物运输的建议书：试验和标准手册》38.3 章的要求。
The submitted samples complied with UN Manual of Tests and Criteria, Part III, sub-section 38.3.

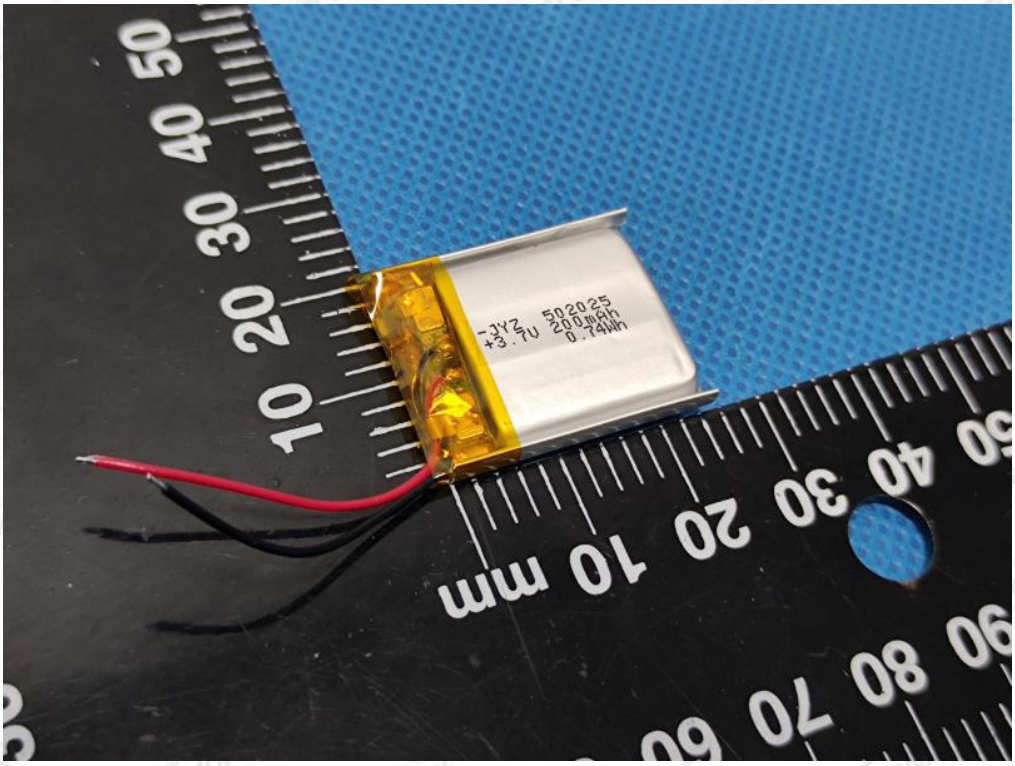
版本号：V1.0

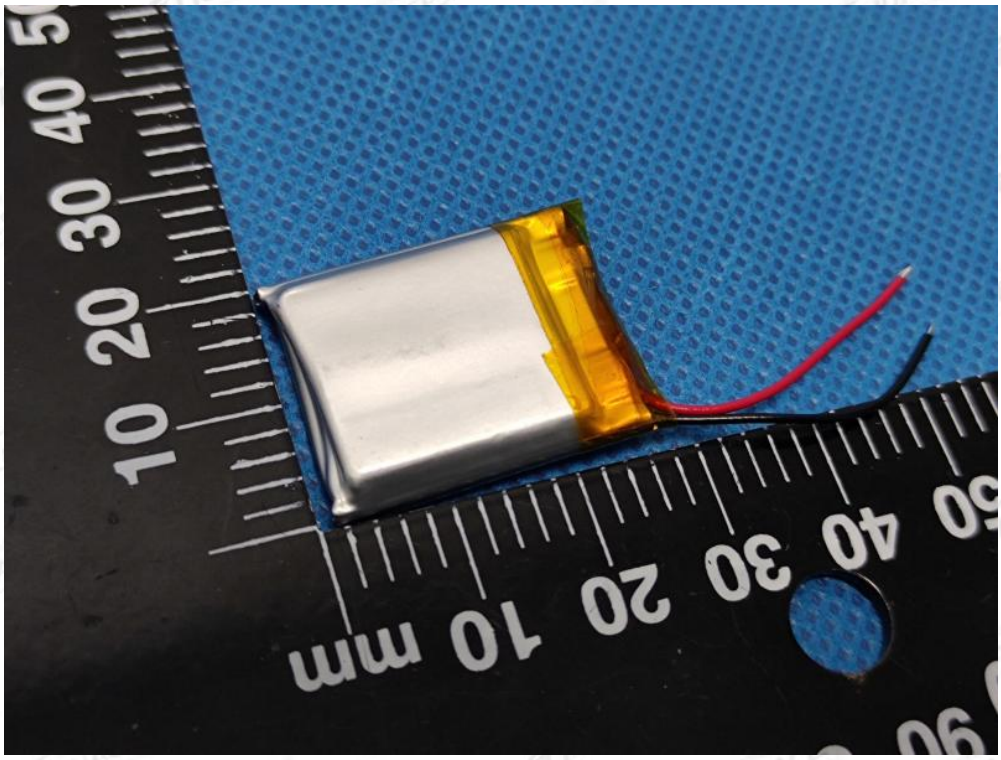
收样日期 Receiving Date	2023-10-13	完成日期 Completing Date	2023-10-27	签发日期 Issue Date	2023-10-27
主检人： Prepared by		审核人： Checked by		批准人： Approved by	

李雯 Wen Li：测试工程师 Quality Testing Engineer
朱慧明 Huiming Zhu：实验室经理 Lab Manager
刘海滨 Rick Liu：授权签字人 Authorized Signatory

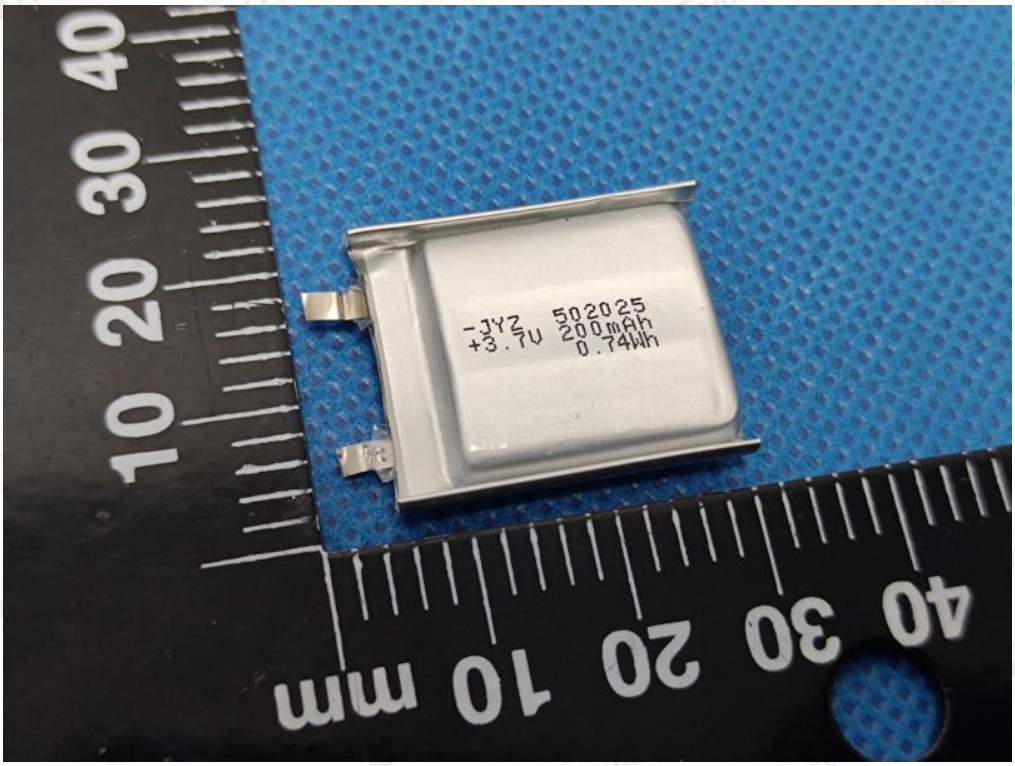
4、样品图片 Sample Photos

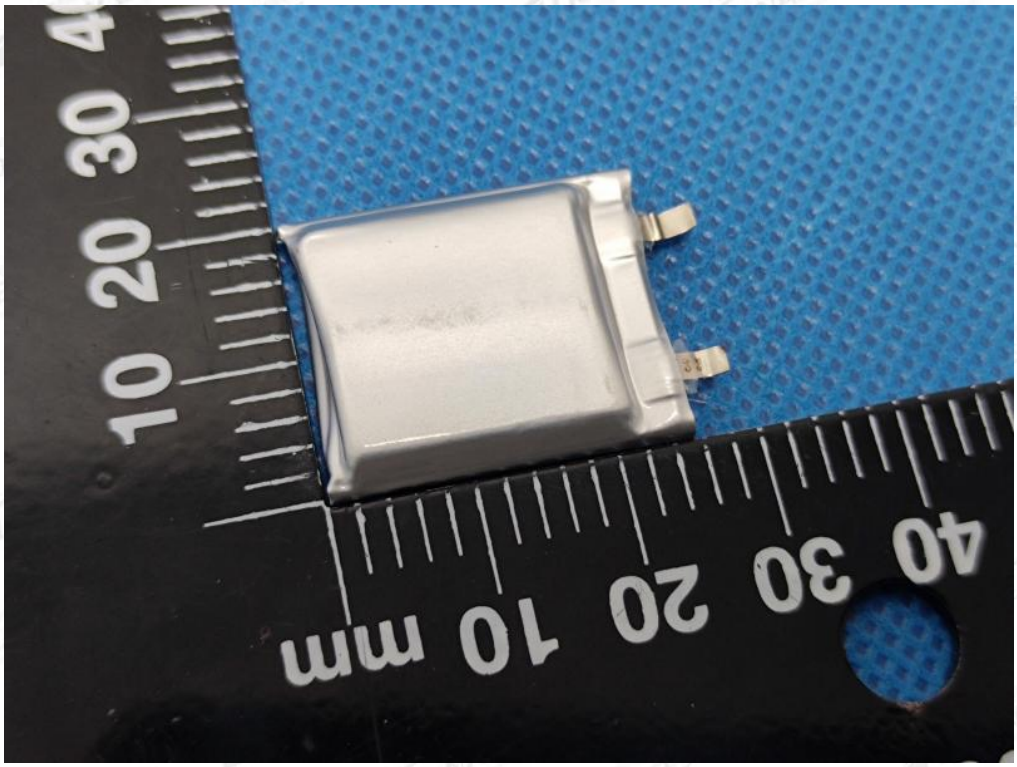
电池/Battery（502025 3.7V, 200mAh, 0.74Wh）





电芯/Cell（502025　　3.7V, 200mAh, 0.74Wh）





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5、测试方法及判定 Test Method And Verdict

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
38.3.4.1	**测试 1：高度模拟** **Test 1: Altitude simulation**	见表 1 See Table 1	P
	试验电池和电池组应压力不大于11.6kpa和环境温度为20±5℃的条件下贮存不少于6个小时。 Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hour at ambient temperature (20±5℃)	无渗漏，无排气，无解体，无破裂和无起火。 No leakage, no venting, no disassemble, no rupture and no fire.	P
	要求电池和电池组无渗漏、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%。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 meet this requirement if there is no leakage, no venting, no disassemble, 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.		
38.3.4.2	**测试 2：温度试验** **Test 2: Thermal test**	见表 2 See Table 2	P
	试验电池和电池组先在试验温度等于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。 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.	无渗漏，无排气，无解体，无破裂和无起火。 No leakage, no venting, no disassemble, no rupture and no fire.	P
	要求电池和电池组无渗漏、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%。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 meet this requirement if there is no leakage, no venting, no disassemble, 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.		

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
38.3.4.3	**测试3：振动** **Test 3: Vibration**	见表 3 See Table 3	P
	电池和电池组紧固于振动机平台，但不得造成电池变形，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 赫兹和 200 赫兹之间，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。 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. 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）有所不同。 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). 对电池和小型电池组：从 7 赫兹开始，保持 1g_n 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 8g_n（频率约为 50 赫兹）。将最大加速度保持在 8g_n 直到频率增加到 200 赫兹。 For cells and small batteries: 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 8g_n occurs (approximately 50 Hz). A peak acceleration of 8g_n is then maintained until the frequency is increased to 200 Hz. 对大型电池组：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 2g_n（频率约为 25 赫兹）。将最大加速度保持在 2g_n 直到频率增加到 200 赫兹。 For large batteries: from 7 Hz to 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 2gn occurs (approximately 25 Hz). A peak acceleration of 2g_n is then maintained until the frequency is increased to 200 Hz.	无渗漏，无排气，无解体，无破裂和无起火。 No leakage, no venting, no disassemble, no rupture and no fire.	P
	要求电池和电池组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		

<table>
<tr><th>章节
Clause</th><th>标准要求
Requirements</th><th>测试结果
Result</th><th>判定
Verdict</th></tr>
<tr><td></td><td>90%。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 meet this requirement if there is no leakage, no venting, no disassemble, 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.</td><td></td><td></td></tr>
<tr><td>38.3.4.4</td><td>测试4：冲击
Test 4: Shock</td><td>见表 4
See Table 4</td><td>P</td></tr>
<tr><td></td><td>试验电池和电池组用坚硬支架紧固在试验装置上，支架支撑着每个试验电池组的所有安装面。
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.
每个电池需经受最大加速度150g_n和脉冲持续时间6毫秒的半正弦波冲击。针对大型电池需经受最大加速度50g_n和脉冲持续时间11毫秒的半正弦波冲击。
Each cell shall be subjected to a half-sine shock of peak acceleration of 150g_n and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50g_n and pulse duration of 11 milliseconds.
每个电池组应根据电池组的质量而受到峰值加速度的半正弦波冲击。对于小型电池组的脉冲持续时间应6毫秒，对于大型电池组的脉冲持续时间应为11毫秒，下面的公式用于计算适当的最小峰值加速度。
<table>
<tr><th>电池
Battery</th><th>最小峰值加速度
Minimum peak acceleration</th><th>脉冲持续时间
Pulse duration</th></tr>
<tr><td>小型电池
Small batteries</td><td>150g_n 或公式结果中的较小值
150g_n or result of formula
$\text{Acceleration } (g_n) = \sqrt{\left(\frac{100850}{\text{mass}^*}\right)}$
whichever is smaller</td><td>6毫秒
6ms</td></tr>
<tr><td>大型电池
Large batteries</td><td>50g_n 或公式结果中的较小值
50g_n or result of formula
$\text{Acceleration } (g_n) = \sqrt{\left(\frac{3000}{\text{mass}^*}\right)}$
whichever is smaller</td><td>11毫秒
11ms</td></tr>
<tr><td colspan="3">* 质量单位用千克计算 Mass is expressed in kilograms.</td></tr>
</table>
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</td><td>无渗漏，无排气，无解体，无破裂和无起火。
No leakage, no venting, no disassemble, no rupture and no fire.</td><td>P</td></tr>
</table>

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
	milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations. 每个电池或电池组需在三个互相垂直的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。 Each cell or battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.		
	要求电池和电池组无渗漏、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%。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 meet this requirement if there is no leakage, no venting, no disassemble, 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.		
38.3.4.5	**测试 5：外部短路** **Test 5: External Short Circuit**	见表 5 See Table 5	P
	待测试的电池或电池组应加热一段时间，以使其外表面温度达到均匀稳定的 57±4℃的温度。加热时间取决于电池或电池组的大小和设计，并应进行评估和记录。如果这种评估是不可行的，对于小型电池和小型电池组至少在 57±4℃的环境下存放 6 小时，对于大型电池和大型电池组至少在 57±4℃的环境下存放 12 小时。然后电池或电池组在 57±4℃的环境中，应接受一个外部总阻值小于 0.1 欧姆的短路条件。 The cell or battery to be tested shall be 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. 这一短路条件应在电池或电池组的外壳温度回到 57±4℃后继续短路 1 小时，或对于大型电池组其外壳温度已下降了一半的最大升温，并保持低于该值。短路和冷却过程至少在环境温度中进行。 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	无解体，无破裂，无起火。No disassemble，no rupture and no fire.	P

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
	phases shall be conducted at least at ambient temperature. 要求电池和电池组外壳温度不超过 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。 Cells and batteries meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble, no rupture and no fire within six hours of this test.		
38.3.4.6	**测试 6：撞击/挤压** **Test 6: Impact / Crush**	见表 6 See Table 6	P
	撞击（适用于直径大于等于 18 毫米的圆柱形电池） Impact (applicable to cylindrical cells not less than 18mm 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沿与水平支撑表面呈 90 度落下。 The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8mm±0.1mm diameter, at least 6cm 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 friction less, 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. 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±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 samples is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm±0.1mm diameter curved surface lying across the centre of the test samples. Each sample is to be subjected to only a single impact. 要求电池和电池组外壳温度不超过 170℃，并且在试验过程中及试验后 6 小时内无解体，无起火。 Cells and component cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble and no fire during the test and within six hours after this test.	N/A	N/A

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
	挤压（适用于棱柱形、袋装、硬币/纽扣电池和直径小于 18 毫米的圆柱形电池） Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18mm 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±0.78千牛； (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。 A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5cm/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 13kN±0.78kN; (b) The voltage of the cell drops by at least 100mV; or (c) The cell is deformed by 50% or more of its original thickness. 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。 Once the maximum pressure has been obtained, the voltage drops by 100mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released. 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。 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. 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。 Each test cell or component cell is to be subjected to one crush only. The test Samples 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.	无解体，无破裂，无起火。No disassemble，no rupture and no fire.	P
	要求电池和电池组外壳温度不超过170℃，并且在试验过程中及试验后6小时内无解体，无起火。 Cells and component cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassemble and no fire during the test and within six hours after this test.		
38.3.4.7	**测试 7：过充电** **Test 7: Overcharge**	见表 7 See Table 7	P

章节 Clause	标准要求 Requirements	测试结果 Result	判定 Verdict
	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。 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 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. Tests are to be conducted at ambient temperature; the duration of the test shall be 24 hours.	无分解，无起火。No disassemble and no fire.	P
	要求充电电池组在试验过程中和试验后 7 天内无解体，无起火。 Rechargeable batteries meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		
38.3.4.8	**测试 8：强制放电** **Test 8: Forced discharge**	见表 8 See Table 8	P
	每个电池应在环境温度下与 12V 直流电源上进行强制放电，此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条件下强制放电。 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. 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）。 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).	无分解，无起火。No disassemble and no fire.	P
	要求原电池或充电电池在试验过程中和试验后 7 天内无解体，无起火。Primary or rechargeable cells meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		

6、测试数据 Test Data

表 1 Table 1	高度模拟 Altitude simulation						P
样品编号 Sample No.	电压 Voltage (V)			质量 Mass(g)			有无渗漏，排气，解体，破裂和起火 Whether leakage, venting, disassemble, rupture, fire (Y/N)
	测试前 Before test	测试后 After test	剩余 residual （%）	测试前 Before test	测试后 After test	损失 loss （%）	
Z1	4.184	4.182	99.952	4.2389	4.2386	0.007	N
Z2	4.179	4.179	100.000	4.2272	4.2272	0.000	N
Z3	4.181	4.181	100.000	4.2179	4.2179	0.000	N
Z4	4.183	4.183	100.000	4.2217	4.2217	0.000	N
Z5	4.182	4.182	100.000	4.2056	4.2056	0.000	N
X1	4.182	4.182	100.000	4.2143	4.2143	0.000	N
X2	4.183	4.182	99.976	4.2275	4.2275	0.000	N
X3	4.179	4.179	100.000	4.2246	4.2245	0.002	N
X4	4.182	4.182	100.000	4.2357	4.2355	0.005	N
X5	4.179	4.179	100.000	4.2216	4.2216	0.000	N

表 2 Table 2	温度试验 Thermal test						P
样品编号 Sample No.	电压 Voltage (V)			质量 Mass(g)			有无渗漏，排气，解体，破裂和起火 Whether leakage, venting, disassemble, rupture, fire (Y/N)
	测试前 Before test	测试后 After test	剩余 residual （%）	测试前 Before test	测试后 After test	损失 loss （%）	
Z1	4.182	4.145	99.115	4.2386	4.2348	0.090	N
Z2	4.179	4.143	99.139	4.2272	4.2235	0.088	N
Z3	4.181	4.142	99.067	4.2179	4.2137	0.100	N
Z4	4.183	4.139	98.948	4.2217	4.2182	0.083	N
Z5	4.182	4.135	98.876	4.2056	4.2018	0.090	N
X1	4.182	4.137	98.924	4.2143	4.2106	0.088	N
X2	4.182	4.141	99.020	4.2275	4.2237	0.090	N
X3	4.179	4.138	99.019	4.2245	4.2206	0.092	N
X4	4.182	4.139	98.972	4.2355	4.2316	0.092	N
X5	4.179	4.137	98.995	4.2216	4.2176	0.095	N

表 3 Table 3	振动 Vibration						P
样品编号 Sample No.	电压 Voltage (V)			质量 Mass(g)			有无渗漏，排气，解体，破裂和起火 Whether leakage, venting, disassemble, rupture, fire (Y/N)
	测试前 Before test	测试后 After test	剩余 residual （%）	测试前 Before test	测试后 After test	损失 loss （%）	
Z1	4.145	4.143	99.952	4.2348	4.2346	0.005	N
Z2	4.143	4.143	100.000	4.2235	4.2235	0.000	N
Z3	4.142	4.142	100.000	4.2137	4.2137	0.000	N
Z4	4.139	4.139	100.000	4.2182	4.2182	0.000	N
Z5	4.135	4.135	100.000	4.2018	4.2018	0.000	N
X1	4.137	4.137	100.000	4.2106	4.2106	0.000	N
X2	4.141	4.140	99.976	4.2237	4.2235	0.005	N
X3	4.138	4.138	100.000	4.2206	4.2206	0.000	N
X4	4.139	4.137	99.952	4.2316	4.2313	0.007	N
X5	4.137	4.137	100.000	4.2176	4.2176	0.000	N

表 4 Table 4	冲击 Shock						P
样品编号 Sample No.	电压 Voltage (V)			质量 Mass(g)			有无渗漏，排气，解体，破裂和起火 Whether leakage, venting, disassemble, rupture, fire (Y/N)
	测试前 Before test	测试后 After test	剩余 residual （%）	测试前 Before test	测试后 After test	损失 loss （%）	
Z1	4.143	4.143	100.000	4.2346	4.2346	0.000	N
Z2	4.143	4.141	99.952	4.2235	4.2235	0.000	N
Z3	4.142	4.142	100.000	4.2137	4.2137	0.000	N
Z4	4.139	4.139	100.000	4.2182	4.2182	0.000	N
Z5	4.135	4.135	100.000	4.2018	4.2015	0.007	N
X1	4.137	4.135	99.952	4.2106	4.2106	0.000	N
X2	4.140	4.140	100.000	4.2235	4.2235	0.000	N
X3	4.138	4.138	100.000	4.2206	4.2204	0.005	N
X4	4.137	4.137	100.000	4.2313	4.2313	0.000	N
X5	4.137	4.137	100.000	4.2176	4.2175	0.002	N

表 5 Table 5	外短路 External short circuit	P
样品编号 Sample No.	最高温度 Peak temperature (˚C)	有无解体，破裂，起火 Whether disassemble, rupture, fire (Y/N)
Z1	57.6	N
Z2	57.6	N
Z3	57.5	N
Z4	57.5	N
Z5	57.3	N
X1	57.6	N
X2	57.3	N
X3	57.8	N
X4	57.3	N
X5	57.6	N

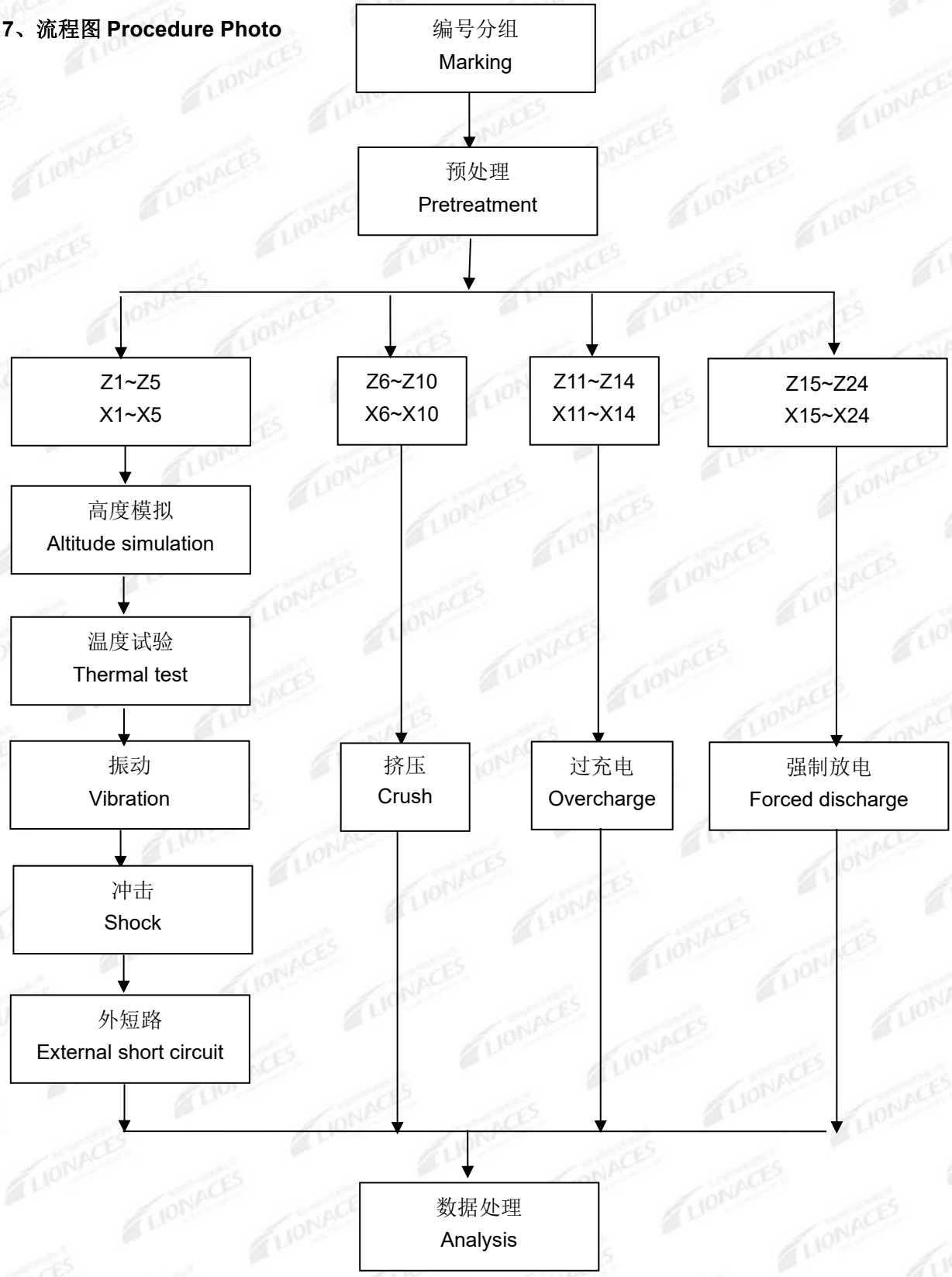
表 6 Table 6	挤压 Crush	P
样品编号 Sample No.	最高温度 Peak temperature (˚C)	有无解体，起火 Whether disassemble, fire (Y/N)
Z6	23.5	N
Z7	23.4	N
Z8	23.7	N
Z9	23.7	N
Z10	23.4	N
X6	23.6	N
X7	23.4	N
X8	23.6	N
X9	23.7	N
X10	23.6	N

表 7 Table 7	过度充电 Overcharge	P
样品编号 Sample No.	有无解体，起火 Whether disassemble, fire (Y/N)	
Z11	N	
Z12	N	

Z13	N
Z14	N
X11	N
X12	N
X13	N
X14	N

表 8 Table 8	强制放电 Forced discharge	P
样品编号 Sample No.	有无解体，起火 Whether disassemble, fire (Y/N)	
Z15	N	
Z16	N	
Z17	N	
Z18	N	
Z19	N	
Z20	N	
Z21	N	
Z22	N	
Z23	N	
Z24	N	
X15	N	
X16	N	
X17	N	
X18	N	
X19	N	
X20	N	
X21	N	
X22	N	
X23	N	
X24	N	

7、流程图 Procedure Photo



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8、测试设备 Test equipment

LA-BT-E078	电子天平秤 Electronic balance
LA-BT-E004	电池低气压高空模拟试验箱 Battery pressure simulation test tank
LA-BT-E014	高低温(交变)湿热试验箱 High and low temperature (alternating) hot and heat test box
LA-BT-E013	电磁式振动试验机 Electromagnetic vibration testing machine
LA-BT-E086	机械式冲击试验机 Mechanical impact tester
LA-BT-E096	数字式温度记录仪 Digital temperature recorder
LA-BT-E097	电池短路实验机 Battery short circuit tester
LA-BT-E084	电池挤压试验机 Battery crush test instrument
LA-BT-E027	温度记录仪 Temperature recorder
LA-BT-E079 LA-BT-E080 LA-BT-E081 LA-BT-E082 LA-BT-E083	直流稳压电源 DC power supply

----报告结束----
----End of report----

UN38.3 TEST REPORT

UN38.3 检测报告

Report No.: 报告编号：	CMC220412005
Name of Goods: 物品名称：	Polymer Li-ion Cell 聚合物锂离子电芯
Model: 型号：	401012
Type: 规格：	3.7V, 30mAh, 0.111Wh
Client: 委托单位：	
Classification of test: 检测类别：	Commission Test 委托检测

Tested by: 主检人： Roken Sun 孙陆猛

Approved by: 批准人： Dylan Dou 窦明波

Inspected by: 审核人： Meiko Ma 马方威

Date of Issue: 签发日期： 2022.04.26

Seal of CMC: CMC 印章：

CMC Testing International (Shenzhen) Co., Ltd.

CMC Testing International (Shenzhen) Co., Ltd.

众检检验认证（深圳）有限公司

TEST REPORT
检测报告

Name of Goods 物品名称	Polymer Li-ion Cell 聚合物锂离子电芯		Model 型号	401012	
Commissioner 委托单位					
Commissioner's Address 委托单位地址					
Manufacturer 制造商					
Manufacturer's Address 制造商地址					
Manufacturer's Contact Telephone 制造商联系电话					
Trade Mark/ identification 商标/识别码	--	Shape 形状	Cuboid 长方体	Size 尺寸 (L×W×T)	(12.8×10.0×4.0) mm
Nominal Voltage 标称电压	3.7V	Charge Voltage 充电电压	4.2V	Rated Capacity 额定容量	30mAh
Nominal Charge Current 标称充电电流	15mA	Maximum Charge Current 最大充电电流	30mA	End of Charge Current 结束充电电流	0.6mA
Nominal Discharge Current 标称放电电流	15mA	Maximum Discharge Current 最大放电电流	30mA	Discharge Cut-off Voltage 放电截止电压	3.0V
Cell Model 电池型号	401012	Cell Nominal Voltage 电池标称电压	3.7V	Cell Rated Capacity 电池额定容量	30mAh
Cells Number 电池数量	1PC	Sample Receiving Date 样品接收日期	2022.04.12	Testing Date 测试日期	2022.04.12 — 2022.04.26
Test conclusion 检测结论	The test results are qualified. 检测结果为合格。				

Test Standard 检测标准

UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS Manual of Tests and Criteria" Seventh revised edition (ST/SG/AC.10/11/Rev.7).

联合国《关于危险货物运输的建议书 试验和标准手册》第七修订版 (ST/SG/AC.10/11/Rev.7)。

Description and illustration of the sample: The sample's status is good.

样品说明及描述：样品状况良好。

Test item 检测项目	Sample No. 样品编号	State 状态	Remark 备注
Test 1 ~ Test 5	C001~C005	First cycle fully charged 第一个充电周期，完全充电	--
	C006~C010	25 cycles fully charged 第25个充电周期，完全充电	
Test 6	C011~C015	First cycle 50% Capacity 第一个充电周期，50%容量	--
	C016~C020	25 cycle 50% Capacity 第25个充电周期，50%容量	
Test 7	--	--	--
	--	--	
Test 8	C021~C030	First cycle fully charged 第一个充电周期，完全放电	--
	C031~C040	25 cycles fully charged 第25个充电周期，完全放电	
CXXX is used as the sample number of cells SN220412005CXXX, "X" is 0~9. CXXX 代表电芯样板编号 SN220412005CXXX，X=0~9。			

Description of the deviation from the standard, if any: --

检测结果不符合标准项的说明：

Test environment conditions: 20±5°C

检测环境条件：

Remarks: --

备注：

ST/SG/AC.10/11/Rev.7/Section 38.3			
Clause **章节**	**Requirements** **标准要求**	**Result** **测试结果**	**Verdict** **判定**
38.3.4	**Procedure** **检测步骤**		--
38.3.4.1	**Test 1: Altitude simulation** **检测 1：高度模拟**		Pass 合格
	Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hours at ambient temperature (20±5°C). 将电池和电池组在温度为 20±5°C，大气压力为不大于 11.6kPa 的环境中贮存不少于 6 小时。		
	Requirements 标准要求： 1) Cells and batteries Mass loss limit reference: Table 38.3.1 样品质量损失限值参考：表 38.3.1 2) Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states. 样品试验后开路电压应不低于试验前开路电压的 90％,此要求不适用于完全放完电的电池或电池组。 3) No leakage, no venting, no disassembly, no rupture and no fire. 样品（电池）应无渗漏、无排气、无解体、无破裂以及无起火现象的发生。	The samples C001~C010: No leakage, no venting, no disassembly, no rupture and no fire. 编号为 C001~C010 的样品：无渗漏、无排气、无解体、无破裂以及无起火现象。 The data is shown in Test T.1 数据见表 T.1	
38.3.4.2	**Test 2: Thermal test** **检测 2: 温度试验**		Pass 合格
	Test cells and batteries are to be stored for 电池和电池组存储条件如下： 1) For small cells and batteries: one temperature cycle: 72±2°C (6h) ~ -40±2°C (6h) 对于小型电池和电池组：一次温度循环为 72±2°C (6h) ~ -40±2°C (6h) For large cells and batteries: one temperature cycle: 72±2°C (12h) ~ -40±2°C (12h) 对于大型电池和电池组：一次温度循环为 72±2°C (12h) ~ -40±2°C (12h) 2) The maximum time interval between test temperature extremes is 30minutes. 温度转换最大间隔时间为 30min。 3) This procedure is to be repeated 10 times. 重复 10 次循环。 4) after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20±5°C). 循环结束后，电池和电池组在 20±5°C 的条件下搁置 24 小时。		
	Requirement 标准要求： 1) Cells and batteries Mass loss limit reference: Table 38.3.1 样品质量损失限值参考：表 38.3.1 2) Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states. 样品试验后开路电压应不低于试验前开路电压的 90％,此要求不适用于完全放完电的电池和电池组。 3) No leakage, no venting, no disassembly, no rupture and no fire. 样品（电池）应无渗漏、无排气、无解体、无破裂以及无起火现象的发生。	The samples C001~C010: No leakage, no venting, no disassembly, no rupture and no fire. 编号为 C001~C010 的样品：无渗漏、无排气、无解体、无破裂以及无起火现象。 The data is shown in Table T.2 数据见表 T.2	

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Clause **章节**	**Requirements** **标准要求**	**Result** **测试结果**	**Verdict** **判定**
38.3.4.3	**Test 3: Vibration** **检测 3: 振动**		Pass 合格
	1) Cells and batteries are firmly secured to the platform of the vibration machine. 电池和电池组牢固地安装在振动台（的台面）上。 2) The vibration: a sinusoidal waveform with a logarithmic sweep between 7Hz and 200Hz and back to 7Hz traversed in 15 minutes. 振动以正弦波形式，以 7Hz 增加至 200Hz，然后在减少回到 7Hz 为一个循环，一个循环持续 15 分钟的对数前移传送。 3) For cells and small batteries: from 7Hz a peak acceleration of $1g_n$ is maintained until 18Hz is reached. The amplitude is then maintained at 0.8mm (1.6mm total excursion) and the frequency increased until a peak acceleration of $8g_n$ occurs (approximately 50Hz). A peak acceleration of $8g_n$ is then maintained until the frequency is increased to 200Hz. 对于电池和小型电池：从 7Hz 开始，以 $1g_n$ 的峰值加速度保持不变，直到达到 18Hz。然后将振幅保持在 0.8mm（总偏移 1.6mm）并且频率增加直到出现 $8g_n$ 的峰值加速度（大约 50Hz）。然后保持 $8g_n$ 的峰值加速度，直到频率增加到 200Hz。 For large batteries: from 7Hz a peak acceleration of $1g_n$ is maintained until 18Hz is reached. The amplitude is then maintained at 0.8mm (1.6mm total excursion) and the frequency increased until a peak acceleration of $2g_n$ occurs (approximately 25Hz). A peak acceleration of $2g_n$ is then maintained until the frequency is increased to 200Hz. 对于大型电池：从 7Hz 开始，以 $1g_n$ 的峰值加速度保持不变，直到达到 18Hz。然后将振幅保持在 0.8mm（总偏移 1.6mm）并且频率增加直到出现 $2g_n$ 的峰值加速度（大约 25Hz）。然后保持 $2g_n$ 的峰值加速度，直到频率增加到 200Hz。 4) This cycle repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting position of the cell. One of the directions of vibration must be perpendicular to the terminal face. 以振动的其中一个方向必须是垂直样品极性，对每个电池从三个互相垂直的方向上循环 12 次，每个方向 3 个小时，共 9 小时。		
	Requirements 标准要求： 1) Cells and batteries Mass loss limit reference: Table 38.3.1 样品质量损失限值参考：表 38.3.1 2) Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states. 样品试验后开路电压应不低于试验前开路电压的 90％,此要求不适用于完全放完电的电池和电池组。 3) No leakage, no venting, no disassembly, no rupture and no fire. 样品（电池）应无渗漏、无排气、无解体、无破裂以及无起火现象的发生。	The samples C001~C010: No leakage, no venting, no disassembly, no rupture and no fire. 编号为 C001~C010 的样品：无渗漏、无排气、无解体、无破裂以及无起火现象。 The data is shown in Table T.3 数据见表 T.3	

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Clause 章节	**Requirements 标准要求**	**Result 测试结果**	**Verdict 判定**
38.3.4.4	**Test 4: Shock** **检测 4: 冲击**		Pass 合格
	1) Test cells and batteries shall be secured to the testing machine. 以稳固的托架固定住每个电池和电池组样品的全部配件表面。 2) Each cell shall be subjected to a half-sine shock of peak acceleration of 150g_n and pulse duration of 6 milliseconds. Large cells may be subjected to a half-sine shock of peak acceleration of 50g_n and pulse duration of 11 milliseconds. 对每个电池以峰值为 150g_n 的半正弦的加速度撞击，脉冲持续 6ms，大型电池须经受最大加速度 50g_n 和脉冲持续时间 11ms 的半正弦波冲击。 Small batteries shall be subjected to a half-sine shock of peak acceleration of 150g_n (or Acceleration (g_n)=$\sqrt{\left(\frac{100850}{\text{mass}}\right)}$, which is smaller) aneration of 50g_n (or Acceleration(g_n)=$\sqrt{\left(\frac{30000}{\text{mass}}\right)}$, which is smaller) and pulse dud pulse duration of 6 milliseconds, large batteries shall be subjected to a half-sine of peak accelration of 11 milliseconds. 对每个电池以峰值为 150g_n（或与$\sqrt{\left(\frac{100850}{\text{mass}}\right)}$中的较小值）的半正弦的加速度撞击，脉冲持续 6ms，大型电池须经受最大加速度 50g_n（或与$\sqrt{\left(\frac{30000}{\text{mass}}\right)}$中的较小值）和脉冲持续时间 11ms 的半正弦波冲击。 3) Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks. 每个电池或电池组须在三个互相垂直的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。		
	Requirements 标准要求： 1) Cells and batteries Mass loss limit: ≤0.2%. 样品质量损失≤0.2% 2) Open circuit voltage not less than 90%, The requirement relating to voltage is not applicable to test cells and batteries at full discharged states. 样品试验后开路电压应不低于试验前开路电压的 90％,此要求不适用于完全放完电的电池或电池组。 3) No leakage, no venting, no disassembly, no rupture and no fire. 样品（电池）应无渗漏、无排气、无解体、无破裂以及无起火现象的发生。	The samples C001~C010: No leakage, no venting, no disassembly, no rupture and no fire. 编号为 C001~C010 的样品：无渗漏、无排气、无解体、无破裂以及无起火现象。 The data is shown in Table T.4 数据见表 T.4	

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Clause **章节**	**Requirements** **标准要求**	**Result** **测试结果**	**Verdict** **判定**
38.3.4.5	**Test 5: External Short Circuit** **检测 5: 外部短路**		Pass 合格
	1) The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature 57±4°C. 加热电池或电池组样品直到温度稳定在 57±4°C 2) The cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 57±4°C, 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. 将样品正负极用小于 0.1Ω 的总电阻回路进行短路，样品的外表温度恢复到 57±4°C 之后保持短路状态 1 小时以上。 3) The cell or battery must be observed for a further six hours for the test to be concluded. 对电池或电池组必须进一步观察 6 个小时才能下结论。		
	Requirements 标准要求： 1) Cells external temperature not exceed 170°C. 电池的最高表面温度应不超过 170°C。 2) No disassembly, no rupture and no fire during the test and within six hours after the test. 测试中与测试后 6 小时内无解体、无破裂、无起火。	The samples C001~C010: No disassembly, no rupture and no fire. 编号为 C001~C010 的样品：无解体、无破裂以及无起火现象。 The data is shown in Table T.5 数据见表 T.5	
38.3.4.6	**Test 6: Impact / Crush** **检测 6: 撞击/挤压**		Pass 合格
	Impact (applicable to cylindrical cells not less than 18mm in diameter) 撞击（适用于直径不小于 18 毫米的圆柱形电池）		N/A 不适用
	1) This test sample cell or component cell is to be placed on a flat smooth surface. 将试验样品用的电池或元件电池放在一个平坦光滑的平面上 2) A 15.8 mm diameter bar is to be placed across the center of the sample, A 9.1kg mass is to be dropped from a height of 61±2.5cm onto the sample. 将一直径为 15.8mm 的不锈钢圆棒横过电池中部放置后，将一质量为 9.1kg 的物体从 61±2.5cm 的高度落向样品。 3) The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm ± 0.1mm diameter curved surface lying across the center of the test sample. Each sample is to be subjected to only a single impact. 接受撞击的试样，纵轴应与平坦的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。每一个试样只经受一次撞击。		
	Requirements 标准要求： 1) Cells external temperature not exceed 170°C. 电池的最高表面温度应不超过 170°C。 2) No disassembly, no rupture and no fire during the test and within six hours after the test. 测试中与测试后 6 小时内无解体、无破裂、无起火。	--	

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Clause 章节	**Requirements 标准要求**	**Result 测试结果**	**Verdict 判定**
	Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18mm in diameter). 挤压（适用于棱柱形、袋装、硬币/纽扣电池和直径小于 18 毫米的圆柱形电池）。		Pass 合格
	1) A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5cm/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) The applied force reaches 13kN ± 0.78kN. 施加的力达到 13 千牛顿±0.78 千牛顿。 (b) The voltage of the cell drops by at least 100mV. 电池的电压下降至少 100 毫伏。 (c) The cell is deformed by 50% or more of its original thickness. 电池变形达原始厚度的 50%或以上。 2). 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。		
	Requirements 标准要求： 1) Cells external temperature not exceed 170°C. 电池的最高表面温度应不超过 170°C。 2) No disassembly, no rupture and no fire during the test and within six hours after the test. 测试中与测试后 6 小时内无解体、无破裂、无起火。	The samples C011~C020: No leakage, no venting, no disassembly, no rupture and no fire. 编号为 C011~C020 的样品：无解体、无破裂、无起火现象。 The data is shown in Table T.6 数据见表 T.6	

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Clause 章节	**Requirements 标准要求**	**Result 测试结果**	**Verdict 判定**
38.3.4.7	**Test 7: Overcharge** **检测 7: 过度充电**		N/A 不适用
	1) The charge current shall be twice the manufacturer's recommended maximum continuous charge current. 以制造商建议的最大持续充电电流的两倍对样品充电。 2) The minimum voltage of the test shall be as follows: 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. 制造商建议的充电电压不大于 18V 时，试验的最小电压应是电池组最大充电电压的两倍或 22V 两者中的较小者。 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. 制造商建议的充电电压大于 18V 时，试验的最小电压应为最大充电电压的 1.2 倍。 3) Tests are to be conducted at ambient temperature 20±5°C, The duration of the test shall be 24 hours. 试验应在环境温度（20±5°C）下进行。进行试验的时间应为 24 小时。		
	Requirements 标准要求: No disassembly and no fire during the test and within seven days after the test. 试验过程中和试验后 7 天内无解体，无起火。	--	
38.3.4.8	**Test 8: Forced discharge** **检测 8: 强制放电**		Pass 合格
	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. 每个电池应在环境温度（20±5°C）下与 12V 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。		
	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). 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)。		
	Requirements 标准要求: No disassembly and no fire during the test and within seven days after the test. 试验过程中和试验后 7 天内无解体，无起火。	The samples C021~C040: no disassembly and no fire. 编号为 C021~C040 的样品：无解体、无起火现象。 The data is shown in Table T.8 数据见表 T.8	

Table 38.3.1:Mass loss limit

表 38.3.1:质量损失限值

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

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

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

质量损失的量化值，可用以下公式计算：

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

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 38.3.1, 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表 38.3.1 所列的数值，应视为“无质量损失”。

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 38.3.1.

渗漏是指可以看到的电解液或者其他物质从电池或电池组中漏出，或电池或电池组中的物质损失（不包括电池外壳、搬运装置、或标签），质量损失超过表 38.3.1 所列的数值。

Venting means the release of excessive internal pressure from a cell or battery in a manner intended by design to preclude rupture or disassembly.

排气是指按设计方式释放电池或电池组内部过高的压力，防止其破裂或解体。

Disassembly means a vent or rupture where solid matter from any part of a cell or battery penetrates a wire mesh screen (annealed aluminium wire with a diameter of 0.25 mm and grid density of 6 to 7 wires per cm) placed 25 cm away from the cell or battery.

解体是指排气或破裂使电池或电池组任何部分的固体物质穿过放在离电池或电池 25 cm 处的丝网筛（直径 0.25 mm 的软铝丝，网格密度每厘米 6 至 7 条铝丝）。

Rupture means the mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of solid materials.

破裂是指内部或外部原因引起的电池容器或电池组外壳机械损坏，造成内装物暴露或溢出，但无固体喷射。

Fire means that flames are emitted from the test cell or battery.

起火是指试验电池或电池组有火焰冒出。

Test Data 检测数据

Table T.1 Altitude simulation (表 T.1) 高度模拟

Test sample status 检测样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
First cycle, fully charged state 首次循环满电状态	C001	0.649	4.18	0.649	4.18	0.000	100.00	Pass 合格
	C002	0.641	4.18	0.641	4.17	0.000	99.76	Pass 合格
	C003	0.642	4.18	0.642	4.18	0.000	100.00	Pass 合格
	C004	0.639	4.17	0.638	4.17	0.156	100.00	Pass 合格
	C005	0.644	4.18	0.644	4.18	0.000	100.00	Pass 合格
25th cycle, fully charged state 25 次循环满电状态	C006	0.635	4.18	0.635	4.18	0.000	100.00	Pass 合格
	C007	0.648	4.18	0.648	4.18	0.000	100.00	Pass 合格
	C008	0.647	4.17	0.646	4.17	0.155	100.00	Pass 合格
	C009	0.644	4.18	0.644	4.18	0.000	100.00	Pass 合格
	C010	0.641	4.18	0.641	4.17	0.000	99.76	Pass 合格

Notes 注释: Ambient temperature 环境温度: 22.3°C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 检测后，样品无渗漏、无排气、无解体、无破裂和无起火。电压比不小于 90 %。

Table T.2 Thermal test (表 T.2) 温度试验

Test sample status 检测样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
First cycle, fully charged state 首次循环满电状态	C001	0.649	4.18	0.646	4.13	0.462	98.80	Pass 合格
	C002	0.641	4.17	0.639	4.14	0.312	99.28	Pass 合格
	C003	0.642	4.18	0.641	4.14	0.156	99.04	Pass 合格
	C004	0.638	4.17	0.636	4.14	0.313	99.28	Pass 合格
	C005	0.644	4.18	0.642	4.14	0.311	99.04	Pass 合格
25th cycle, fully charged state 25 次循环满电状态	C006	0.635	4.18	0.633	4.13	0.315	98.80	Pass 合格
	C007	0.648	4.18	0.646	4.14	0.309	99.04	Pass 合格
	C008	0.646	4.17	0.644	4.14	0.310	99.28	Pass 合格
	C009	0.644	4.18	0.642	4.14	0.311	99.04	Pass 合格
	C010	0.641	4.17	0.638	4.13	0.468	99.04	Pass 合格

Notes 注释: Ambient temperature 环境温度: 22.2°C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 检测后，样品无渗漏、无排气、无解体、无破裂和无起火。电压比不小于 90 %。

Table T.3 Vibration (表 T.3) 振动

Test sample status 检测样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
First cycle, fully charged state 首次循环满电状态	C001	0.646	4.13	0.646	4.13	0.000	100.00	Pass 合格
	C002	0.639	4.14	0.638	4.14	0.156	100.00	Pass 合格
	C003	0.641	4.14	0.641	4.13	0.000	99.76	Pass 合格
	C004	0.636	4.14	0.636	4.14	0.000	100.00	Pass 合格
	C005	0.642	4.14	0.642	4.14	0.000	100.00	Pass 合格
25th cycle, fully charged state 25 次循环满电状态	C006	0.633	4.13	0.633	4.13	0.000	100.00	Pass 合格
	C007	0.646	4.14	0.646	4.13	0.000	99.76	Pass 合格
	C008	0.644	4.14	0.643	4.14	0.155	100.00	Pass 合格
	C009	0.642	4.14	0.642	4.14	0.000	100.00	Pass 合格
	C010	0.638	4.13	0.638	4.13	0.000	100.00	Pass 合格

Notes 注释: Ambient temperature 环境温度: 22.8°C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 检测后，样品无渗漏、无排气、无解体、无破裂和无起火。电压比不小于 90 %。

Table T.4 Shock (表 T.4) 冲击

Test sample status 检测样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
First cycle, fully charged state 首次循环满电状态	C001	0.646	4.13	0.646	4.13	0.000	100.00	Pass 合格
	C002	0.638	4.14	0.638	4.14	0.000	100.00	Pass 合格
	C003	0.641	4.13	0.641	4.13	0.000	100.00	Pass 合格
	C004	0.636	4.14	0.635	4.13	0.157	99.76	Pass 合格
	C005	0.642	4.14	0.642	4.14	0.000	100.00	Pass 合格
25th cycle, fully charged state 25 次循环满电状态	C006	0.633	4.13	0.633	4.13	0.000	100.00	Pass 合格
	C007	0.646	4.13	0.646	4.13	0.000	100.00	Pass 合格
	C008	0.643	4.14	0.643	4.14	0.000	100.00	Pass 合格
	C009	0.642	4.14	0.642	4.14	0.000	100.00	Pass 合格
	C010	0.638	4.13	0.638	4.12	0.000	99.76	Pass 合格

Notes 注释: Ambient temperature 环境温度: 22.7°C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 检测后，样品无渗漏、无排气、无解体、无破裂和无起火。电压比不小于 90 %。

Table T.5 External short circuit (表 T.5) 外部短路

Test sample status 检测样品状态	No. 编号	Maximum external temperature (°C) 表面最高温度(°C)	Status 结果
First cycle, fully charged state 首次循环满电状态	C001	108.5	Pass 合格
	C002	104.2	Pass 合格
	C003	101.4	Pass 合格
	C004	105.3	Pass 合格
	C005	104.2	Pass 合格
25th cycle, fully charged state 25 次循环满电状态	C006	103.8	Pass 合格
	C007	105.7	Pass 合格
	C008	102.5	Pass 合格
	C009	103.6	Pass 合格
	C010	106.7	Pass 合格

Notes 注释: Ambient temperature 环境温度: 57.2°C。

Test sample 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.

检测样品表面温度不超过 170 °C，检测中与检测后 6 小时内无解体、无破裂、无起火。

Table T.6 Crush (表 T.6) 挤压

Test sample status 检测样品状态	No. 编号	Maximum external temperature (°C) 表面最高温度(°C)	Status 结果
First cycle, 50% charged state 首次循环 50%充电状态	C011	23.5	Pass 合格
	C012	23.7	Pass 合格
	C013	23.6	Pass 合格
	C014	23.4	Pass 合格
	C015	23.5	Pass 合格
25th cycle, 50% charged state 25 次循环 50%充电状态	C016	23.6	Pass 合格
	C017	23.8	Pass 合格
	C018	23.4	Pass 合格
	C019	23.6	Pass 合格
	C020	23.8	Pass 合格

Notes 注释: Ambient temperature 环境温度: 22.9°C。

Test sample 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.

检测样品表面温度不超过 170°C，检测中与检测后 6 小时内无解体、无破裂、无起火。

Table T.7 Overcharge (表 T.7) 过充电

Not applicable 不适用

Table T.8 Forced discharge (表 T.8) 强制放电

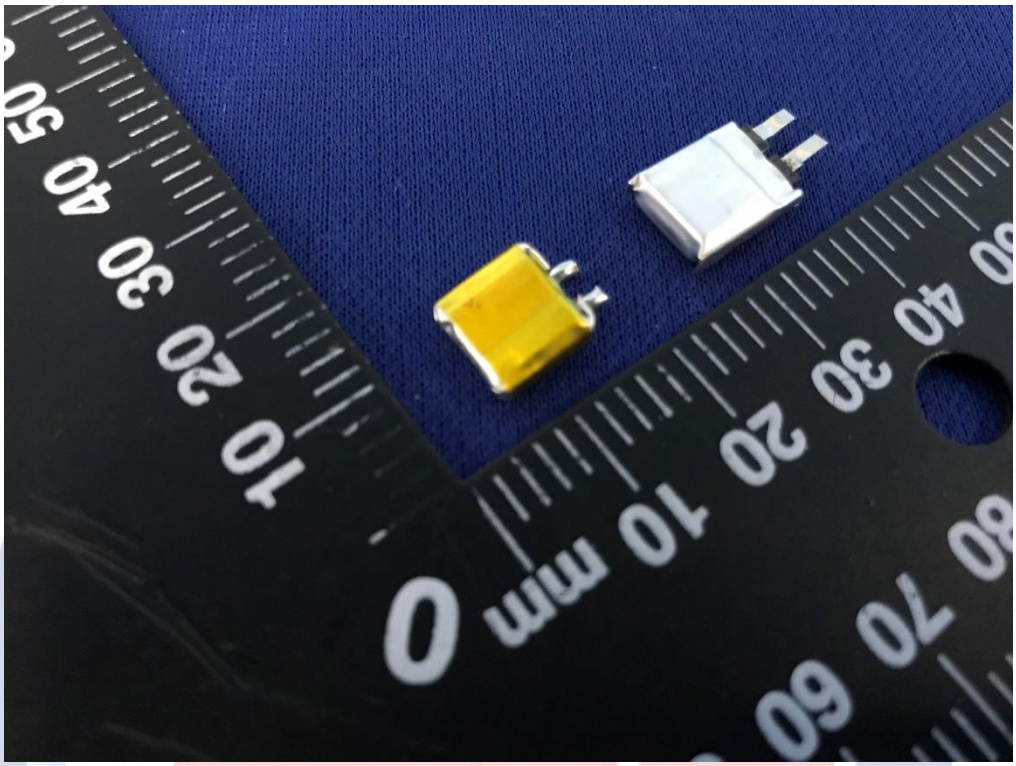
Test sample status 检测样品状态	No. 编号	Status 结果
First cycle, fully discharged state 首次循环完全放电状态	C021	Pass 合格
	C022	Pass 合格
	C023	Pass 合格
	C024	Pass 合格
	C025	Pass 合格
	C026	Pass 合格
	C027	Pass 合格
	C028	Pass 合格
	C029	Pass 合格
	C030	Pass 合格
25th cycle, fully discharged state 25 次循环完全放电状态	C031	Pass 合格
	C032	Pass 合格
	C033	Pass 合格
	C034	Pass 合格
	C035	Pass 合格
	C036	Pass 合格
	C037	Pass 合格
	C038	Pass 合格
	C039	Pass 合格
	C040	Pass 合格
Notes 注释: Ambient temperature 环境温度: 22.9°C。 There is no disassembly and no fire during the test and within seven days after the test. 样品在检测中和检测后 7 天内无解体、无起火。		

Main Test Apparatus 主要试验仪器设备清单

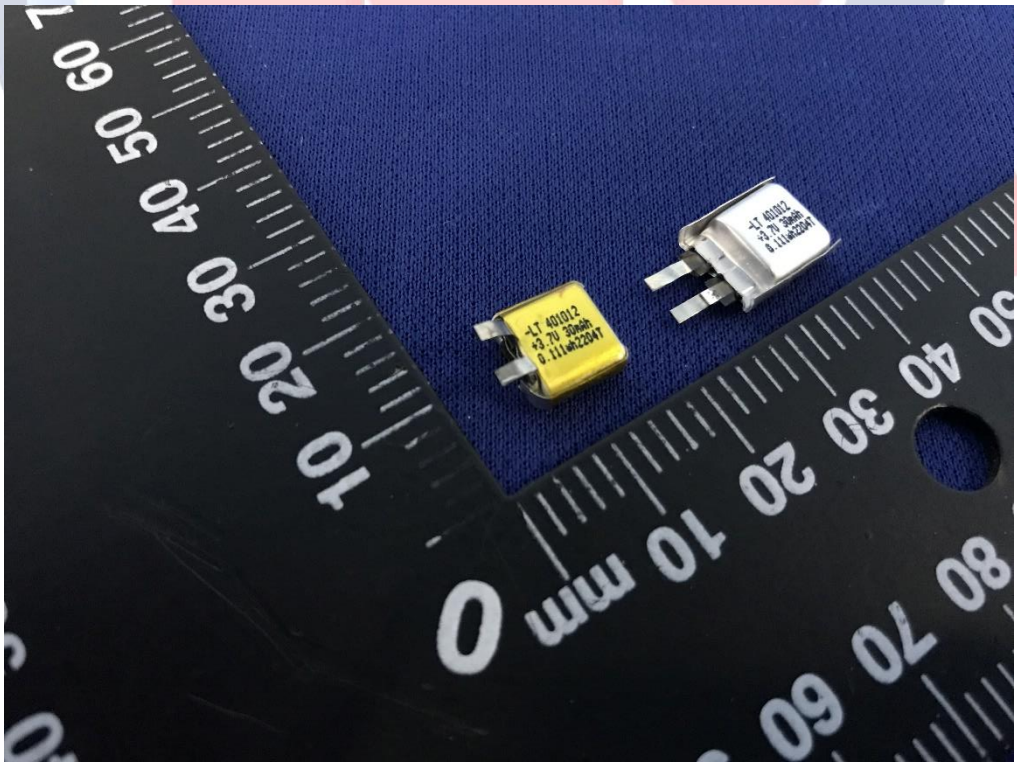
	Item 编号	Equipment name 设备名称	Model 型号	Cal. date 校准日期	Due. date 有效期至
☒	CMC-YQ-001	Programmable Temp.& Humi Chamber 可程式恒温恒湿试验箱	ZZ-K01B	2022-04-13	2023-04-12
☒	CMC-YQ-005	Battery Test System 电池测试系统	ACTS-20V10A	2022-04-13	2023-04-12
☒	CMC-YQ-006	Battery Extrusion Testing machine 温控型电池挤压试验机	GX-5067-TSM	2022-04-13	2023-04-12
☒	CMC-YQ-010	Battery short-circuit tester 温控型电池短路试验机	GX-6055-B5HL	2022-04-13	2023-04-12
☐	CMC-YQ-011	Battery weight impact testing machine 电池重物冲击试验机	ZZ-A11	2022-04-13	2023-04-12
☒	CMC-YQ-012	Low Altitude Simulation Tester 电池低压高空模拟试验机	GX-3020-ZC80	2022-04-13	2023-04-12
☒	CMC-YQ-014	Vibration test instrument 电磁式振动试验机	EV206VT650	2022-03-24	2023-03-23
☒	CMC-YQ-015	Vertical Shock Test Instrument 机械式冲击试验机	SKT50	2022-03-24	2023-03-23
☒	CMC-YQ-016-1	Data Collector 数据采集器	34970A	2022-04-13	2023-04-12
☒	CMC-YQ-019-1	DC POWER 直流电源	PSW80-40.5	2022-04-13	2023-04-12
☒	CMC-YQ-044-1	温度&湿度智能监控终端 Temperature & humidity monitoring intelligent terminal	ZL-TH10TP	2022-04-13	2023-04-12
☐	CMC-YQ-021	Electronic platform scale 电子台秤	TCS-200KG	2022-04-13	2023-04-12
☒	CMC-YQ-022	Electronic Balance 电子天平	JCS-6=5103W	2022-04-13	2023-04-12
☒	CMC-YQ-023	Digital caliper 数显卡尺	MNT-150	2022-04-13	2023-04-12
☒	CMC-YQ-025	Digital Multimeter 数字万用表	FLUKE-17B+	2022-04-13	2023-04-12
☒	CMC-YQ-028	Programmed DC Electronic Load 程控直流电子负载	SJ8512B	2022-04-13	2023-04-12
☒	CMC-YQ-029	Timer 秒表	XL-009A	2022-04-13	2023-04-12
☐	CMC-YQ-079-1	Battery Test equipment 电池测试设备	CE-7002-500V300A-R28GC	2022-02-24	2023-02-23
☒	CMC-YQ-037	Temperature and humidity barometer 温湿度气压表	(980-1050)kPa	2022-04-13	2023-04-12
☐	CMC-YQ-080	Battery Test equipment 电池测试设备	CE-7002-500V600A-R28GC	2022-02-24	2023-02-23

☒: Used equipment 使用设备
☐: Unused equipment 未使用设备

Photos of Samples
样品照片



Picture 1. Front view of cell
图片 1. 电池前视图



Picture 2. Back view of cell
图片 2. 电池后视图

Important
注意事项

1. The test report is invalid if it is not affixed the official seal of the laboratory to it.
   检测报告无本实验室公章（或检验检测专用章）无效。
2. Copies of the test report without the official seal of the laboratory are invalid.
   复制检测报告未重新加盖本实验室公章(或检验检测专用章)无效。
3. It is forbidden to copy the test report partially without the written approval of the laboratory.
   未经本实验室书面批准不得部分复制检测报告。
4. The test report is invalid without the signatures of Approver, Reviewer and Testing engineer.
   检测报告无检测、审核、批准人签名无效。
5. The test report is invalid if it is blotted out.
   检测报告涂改无效。
6. Objections to the test report must be submitted to CMC Testing International (Shenzhen) Co., Ltd. within 15 days.
   对检测报告若有异议，应于收到报告之日起十五天内向众检检验认证（深圳）有限公司提出。
7. The test report is valid for the tested samples only.
   本检测报告仅对检测样品负责。
8. As for the Verdict, “--” means “no need for judgment”, “P” means “pass”, “F” means “fail” and “N/A” means “not applicable”.
   判定栏中“--”表示“不需要判定”，“P”表示“通过”，“F”表示“不通过”，“N/A”表示“不适用”。

*** End of Report ***
*** 报告结束 ***