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检测
TESTING
CNAS L0357

检 测 报 告

Test Report

报告编号（Report No.）：S23-B1116-1

产品名称(Product Name): 锂离子可充电电池

Li-ion Rechargeable Battery

型号 (Model/Type) : LF ICR21700

委托方(Client) : 宁波海曙力孚电池科技有限公司

NINGBO HAISHU LIFU BATTERY TECHNOLOGY CO., LTD.

中国电子技术标准化研究院赛西实验室

China Electronics Standardization Institute CESI Laboratory

检测报告 Test Report

产品名称 Product Name	锂离子可充电电池 Li-ion Rechargeable Battery	委托方 Client	宁波海曙力孚电池科技有限公司 NINGBO HAISHU LIFU BATTERY TECHNOLOGY CO., LTD.
型号规格 Model/Type	LF ICR21700，4000mAh，14.8V，59.2Wh，4S1P	委托方地址 Client Address	海曙区姚丰南路 18 号 2 幢 301 室 Room 301, NO.2 building, No. 18,South Road Yaofeng, Haishu District
样品数量 Sample Quantity	电池组 16，电池 30 16 batteries, 30 cells	制造商 Manufacturer	同委托方 Same as Client
样品来源 Sample Source	送样 Submitted by Manufacturer	制造商地址 Manufacturer Address	同委托方地址 Same as Client Address
收样日期 Receipt Sample Date	2023.07.10	生产厂 Factory	同委托方 Same as Client
试验类别 Testing Kind	委托试验 Entrusted Test	生产厂地址 Factory Address	同委托方地址 Same as Client Address
检验日期 Testing Date	开始时间（Start Date）：2023.08.02		结束时间（Complete Date）：2023.11.02
试验环境 Testing Environment	温度(Temperature)：（21.3~24.7）℃； 大气压力(Atmospheric Pressure)：101kPa		湿度(Humidity)：（28~51）%R.H.；
试验标准/方法 Testing Standard /Method	UN 38.3, Rev.7, Amd1《试验和标准手册》第三部分 38.3 节《金属锂和锂离子电池组》 "*Manual of Tests and Criteria*", Amendment 1, *seventh* revised edition, Part III, 38.3"Lithium metal and lithium ion batteries"(UN 38.3).		
试验概况与分析 Testing Description	根据 UN 38.3, Rev.7,Amd1《试验和标准手册》第三部分 38.3 节《金属锂和锂离子电池组》，对电池组进行了高度模拟试验、温度试验、振动试验、冲击试验、外部短路试验以及过度充电试验，对其元件电池进行了撞击试验以及强制放电试验。 According to UN 38.3,Rev.7,Amd1,batteries are subjected to Altitude simulation, Thermal test, Vibration, Shock, External short circuit and the Overcharge test, its component cells are subjected to Impact and Forced discharge test.		
试验结论 Verdict	符合要求 Qualified		
试 验 Tested by	杨春兴	日期（Date）：2023.11.14	中国电子技术标准化研究院 赛西实验室 China Electronics Standardization Institute CESI Laboratory (签章 Stamp)
审 核 Checked by	麻林太	日期（Date）：2023.11.14	
批 准 Approved by	王莹	日期（Date）：2023.11.14	
	郭建宇 Guo Jianyu: 质量负责人 Quality Manager 王莹 Wang Ying: 技术负责人 Technical Manager 何鹏林 He Penglin:副主任 Vice Director		

注：判定栏中"P"表示合格，"N/A"表示不适用或未进行，"F"表示不合格，"—"表示不做判定。
Notes：In verdict column ,"P" means pass, "N/A" means no application, "F" means fail, "—"means no Verdict.

样品描述及说明 General product information

样品信息(Sample information)：

是否可充电 Rechargeable or not		是 Yes	用途 Use	工作灯及手电筒 Working light and flashlight
运输时是否安装在设备中 Contained In Equipment during transportation		—	化学组分 Electrochemistry System	三元 Li（NiCoMn）O_2
☐ 电池 Cell ☐ 单一电池电池组 Single cell battery ☑ 电池组 Battery	组成方式 Composing Mode	4 串 1 并 4S1P	电池容量 Cell Capacity	4000mAh
	电池型号 Cell model	21700	电池生产厂 Manufacturer Of Cell	湖南兆科动力新能源有限公司 Hunan Zhaoke Power New Energy Co., Ltd.

样品参数(Sample parameters)：

标称电压 Nominal Voltage	14.8V	额定容量 Rated Capacity	4000mAh	额定能量 Rated Energy	59.20Wh
充电限制电压 Max. Charging Voltage	16.8V	最大连续充电电流 Max. Charging Current	4000mA	充电电流 Charging Current	800mA
放电终止电压 Discharge Cut-off Voltage	10V	最大放电电流 Max. Discharging Current	4000mA	充电截止电流 Charge Cut-off Current	11mA

测试项目、样品及顺序 Test items, sample and Order

测试编号 Test No.	测试项目 Test Items	样品编号 Sample No.	结论 Verdict
T1	高度模拟 Altitude simulation	A1~A4，B1~B4	P
T2	温度试验 Thermal test	A1~A4，B1~B4	P
T3	振动 Vibration	A1~A4，B1~B4	P
T4	冲击 Shock	A1~A4，B1~B4	P
T5	外短路 External short circuit	A1~A4，B1~B4	P
T6	撞击 Impact	C1~C5，D1~D5	P
T7	过度充电 Overcharge	A5~A8，B5~B8	P
T8	强制放电 Forced discharge	E1~E10，F1~F10	P

样品的预处理：A1~A8 为 1 次循环完全充电状态：B1~B8 为 25 次循环完全充电状态：C1~C5 为 1 次循环 50%额定容量：D1~D5 为 25 次循环 50%额定容量；E1~E10：1 次循环完全放电状态；F1~F10：25 次循环完全放电状态。其中：A1~A8、B1~B8 为电池组，C1~C5、D1~D5、E1~E10、F1~F10 为其元件电池。

Pretreatment of the samples: A1~A8 in first cycle in fully charged states; B1~B8: in after 25 cycles ending in fully charged states;C1~C5: in first cycle at 50% of the design rated capacity; D1~D5: in after 25 cycle at 50% of the design rated capacity; E1~E10: in first cycle in fully discharged states; F1~F10: in after 25 cycles in fully discharged states.

NOTES: A1~A8, B1~B8 are batteries, C1~C5, D1~D5, E1~E10, F1~F10 are component cells.

试验顺序 Test order：

T1 → T2 → T3 → T4 → T5 → 结束 End

T6 → 结束 End

T7 → 结束 End

T8 → 结束 End

UN 38.3 测试方法、数据及结果 Test method and data

电池或锂离子电池组质量 Mass of cell or battery（M）	质量损失限值 Mass loss limit
M＜1g	0.5%
1 g≤M≤75g	0.2%
M＞75g	0.1%

38.3.4.1 试验 T.1：高度模拟 Test T.1: Altitude simulation	P

38.3.4.1.1 目的
本试验模拟在低压条件下的空运。
38.3.4.1.2 试验程序
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。
38.3.4.1.3 要求
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。
38.3.4.1.1 Purpose
This test simulates air transport under low-pressure conditions.
38.3.4.1.2 Test procedure
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.
38.3.4.1.3 Requirement
Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no dis assembly, 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.

样品编号 Sample No.	试验前 Before test		试验后 After test		质量亏损 Mass loss（%）	电压亏损 Voltage loss（%）	判定：是否符合要求 Verdict
	质量(g) Mass	电压(V) Voltage	质量(g) Mass	电压(V) Voltage			
A1	294.69	16.726	294.69	16.702	0.00	0.14	P
A2	294.16	16.728	294.15	16.703	0.00	0.15	P
A3	294.17	16.730	294.17	16.706	0.00	0.14	P
A4	294.82	16.712	294.82	16.702	0.00	0.06	P
B1	294.79	16.710	294.76	16.706	0.01	0.02	P
B2	295.41	16.704	295.41	16.698	0.00	0.04	P
B3	293.87	16.688	293.87	16.681	0.00	0.04	P
B4	295.33	16.700	295.33	16.696	0.00	0.02	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.2 试验 T.2：温度试验 Test T.2: Thermal test	P

38.3.4.2.1 目的

本试验评估电池和锂离子电池组的密封完善性和内部电连接。试验是利用迅速和极端的温度变化进行的。

38.3.4.2.2 试验程序

试验电池和电池组应先在试验温度等于（72±2）℃下存放至少 6 小时，接着再在试验温度等于（-40±2)℃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。此一程序重复进行，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。

38.3.4.2.3 要求

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。

38.3.4.2.1 Purpose

This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

38.3.4.2.2 Test procedure

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 10 times, 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.

38.3.4.2.3 Requirement

Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no dis assembly, 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.

样品编号 Sample No.	试验前 Before test		试验后 After test		质量亏损 Mass loss（%）	电压亏损 Voltage loss（%）	判定：是否符合要求 Verdict
	质量(g) Mass	电压(V) Voltage	质量(g) Mass	电压(V) Voltage			
A1	294.69	16.702	294.60	16.423	0.03	1.67	P
A2	294.15	16.703	294.14	16.422	0.00	1.68	P
A3	294.17	16.706	294.05	16.429	0.04	1.66	P
A4	294.82	16.702	294.70	16.428	0.04	1.64	P
B1	294.76	16.706	294.69	16.436	0.02	1.62	P
B2	295.41	16.698	295.33	16.450	0.03	1.49	P
B3	293.87	16.681	293.70	16.431	0.06	1.50	P
B4	295.33	16.696	295.23	16.487	0.03	1.25	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.3 试验 T.3：振动 Test T.3: Vibration	P

38.3.4.3.1 目的
本试验模拟运输过程中的振动。
38.3.4.3.2 试验程序
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，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个方向都重复进行 12 次，总共为时 3 小时。其中一个振动方向必须与端面垂直。
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。
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。
38.3.4.3.3 要求
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的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。
38.3.4.3.1 Purpose
This test simulates vibration during transport.
38.3.4.3.2 Test procedure
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 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.
38.3.4.3.3 Requirement
Cells and batteries meet this requirement if there is no mass loss, 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.

样品编号 Sample No.	试验前 Before test		试验后 After test		质量亏损 Mass loss (%)	电压亏损 Voltage loss (%)	判定：是否符合要求 Verdict
	质量(g) Mass	电压(V) Voltage	质量(g) Mass	电压(V) Voltage			
A1	294.60	16.423	294.64	16.417	-0.01	0.04	P
A2	294.14	16.422	294.12	16.416	0.01	0.04	P
A3	294.05	16.429	294.19	16.423	-0.05	0.04	P
A4	294.70	16.428	294.59	16.420	0.04	0.05	P
B1	294.69	16.436	294.74	16.430	-0.02	0.04	P
B2	295.33	16.450	295.39	16.443	-0.02	0.04	P
B3	293.70	16.431	293.93	16.425	-0.08	0.04	P
B4	295.23	16.487	295.16	16.480	0.02	0.04	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.4 试验 T.4：冲击 T.4: Shock	P

38.3.4.4.1 目的

本试验评估电池和电池组对累积冲击效应的耐受程度。

38.3.4.4.2 试验程序

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。每个电池须经受最大加速度 150g_n和脉冲持续时间 6 毫秒的半正弦波冲击。另外，每个大型电池须经受最大加速度 50g_n和脉冲持续时间 11 毫秒的半正弦波冲击。每个电池组应根据电池组的质量而经受不同最大加速度的半正弦波冲击。

电池组	最大加速度	脉冲持续时间
小型电池组	150g_n或加速度（g_n）= $\sqrt{\frac{100850}{质量}}$中的较小者	6ms
大型电池组	50g_n或加速度（g_n）= $\sqrt{\frac{30000}{质量}}$中的较小者	11ms
注：质量以公斤表示。		

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

38.3.4.4.3 要求

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。

38.3.4.4.1 Purpose

This test assesses the robustness of cells and batteries against cumulative shocks.

38.3.4.4.2 Test procedure

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 g_n and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 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.

38.3.4.4.3 Requirement

Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no dis assembly, 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.

样品编号 Sample No.	试验前 Before test		试验后 After test		质量亏损 Mass loss（%）	电压亏损 Voltage loss（%）	判定：是否符合要求 Verdict
	质量(g) Mass	电压(V) Voltage	质量(g) Mass	电压(V) Voltage			
A1	294.64	16.417	294.61	16.416	0.01	0.01	P
A2	294.12	16.416	294.11	16.416	0.00	0.00	P
A3	294.19	16.423	294.19	16.422	0.00	0.01	P
A4	294.59	16.420	294.59	16.418	0.00	0.01	P
B1	294.74	16.430	294.69	16.429	0.02	0.01	P
B2	295.39	16.443	295.42	16.443	-0.01	0.00	P
B3	293.93	16.425	293.98	16.425	-0.02	0.00	P
B4	295.16	16.480	295.22	16.480	-0.02	0.00	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.5 试验 T.5：外部短路 T.5: External short circuit	P

38.3.4.5.1 目的
本试验模拟外部短路。
38.3.4.5.2 试验程序
对于待试验电池或电池组经一段时间的加热后，使其外壳温度稳定到 57±4℃。加热时间取决于电池或电池组的大小和设计，并进行评估和记录。如果无法评估，小型电池和电池组应至少为 6h，大型电池和电池组应至少为 12h。然后使电池或电池组在 57±4℃下经受总外部电阻小于 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，对大型电池组，温度下降到最高温升值的一半，并要低于该值。
短路和温度下降过程应在试验环境温度条件下进行。
38.3.4.5.3 要求
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。
38.3.4.5.1 Purpose
This test simulates an external short circuit.
38.3.4.5.2 Test procedure
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 °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, and12 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.
38.3.4.5.3 Requirement
Cells and batteries meet this requirement if their external temperature does not exceed 170°C and there is no dis assembly, no rupture and no fire within six hours of this test.

样品编号 Sample No.	最高温度（℃） Maximum Temperature	判定：是否符合要求 Verdict
A1	57.1	P
A2	57.5	P
A3	58.2	P
A4	57.8	P
B1	57.5	P
B2	57.8	P
B3	58.2	P
B4	58.2	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.6 试验 T.6 A：撞击 Test T.6 A: Impact	P

38.3.4.6.1 目的

本节的试验模拟撞击或挤压等可能造成内部短路的机械性破坏。

38.3.4.6.2 试验程序—撞击（适用于直径不小于 18 毫米的圆柱电池）

试样电池或元件电池放在平坦表面上。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。

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。

38.3.4.6.4 要求

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，无起火，电池和元件电池即符合本项要求。

38.3.4.6.1 Purpose

These tests simulate mechanical abuse from an impact or crush that may result in an in tern al short circuit.

38.3.4.6.2Test procedure – Impact (applicable to cylindrical cells not less than 18 mm in diameter)

The 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 316stainless 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.

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.

38.3.4.6.4 Requirement

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.

样品编号 Sample No.	最高温度（℃） Maximum Temperature	判定：是否符合要求 Verdict	样品编号 Sample No.	最高温度（℃） Maximum Temperature	判定：是否符合要求 Verdict
C1	29.0	P	D1	30.5	P
C2	37.3	P	D2	42.2	P
C3	27.7	P	D3	29.8	P
C4	51.9	P	D4	43.1	P
C5	27.4	P	D5	31.3	P

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.6 试验 T.6 B：挤压 Test T.6 B: Crush	N/A

38.3.4.6.1 目的

本节的试验模拟撞击或挤压等可能造成内部短路的机械性破坏。

38.3.4.6.3 试验程序—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）

注：此处直径指设计参数(例如，18650 电池的直径为 18. 0 毫米)。

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±0.78 千牛；

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

（b） 电池电压下降至少 100 毫伏；或

（c） 电池变形达到原始厚度的 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/硬币形电池应从平坦表面施压。圆柱形电池应从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。

38.3.4.6.4 要求

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、无起火，电池和元件电池即符合本项要求。

38.3.4.6.1 Purpose

These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit.

38.3.4.6.3Test Procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18 mm in diameter)

NOTE: Diameter here refers to the design parameter (for example the diameter of 18 650cells is 18.0 mm).

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.

38.3.4.6.4 Requirement

Cells and component cells meet this requirement if their external temperature does no t exceed 170 °C and there is no dis assembly and no fire during the test and within six hours after this test.

样品编号 Sample No.	最高温度（℃） Maximum Temperature	判定：是否符合要求 Verdict
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.7 试验 T.7：过度充电 Test T.7: Overcharge	P

38.3.4.7.1 目的
本试验评估可再充电电池组或可再充电单一电池电池组承受过度充电状况的能力。
38.3.4.7.2 试验程序
充电电流必须是制造商建议的最大连续充电电流的两倍。试验的最小电压应为如下：
(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。
38.3.4.7.3 要求
充电电池组如在进行过程中和试验后 7 天内无解体，无起火，即符合本项要求。
38.3.4.7.1 Purpose
This test evaluates the ability of a rechargeable battery or a single cell rechargeable battery to withstand an overcharge condition.
38.3.4.7.2 Test procedure
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.
38.3.4.7.3 Requirement
Rechargeable batteries meet this requirement if there is no dis assembly and no fire within seven days of the test.

样品编号 Sample No.	判定：是否符合要求 Verdict
A5	P
A6	P
A7	P
A8	P
B5	P
B6	P
B7	P
B8	P

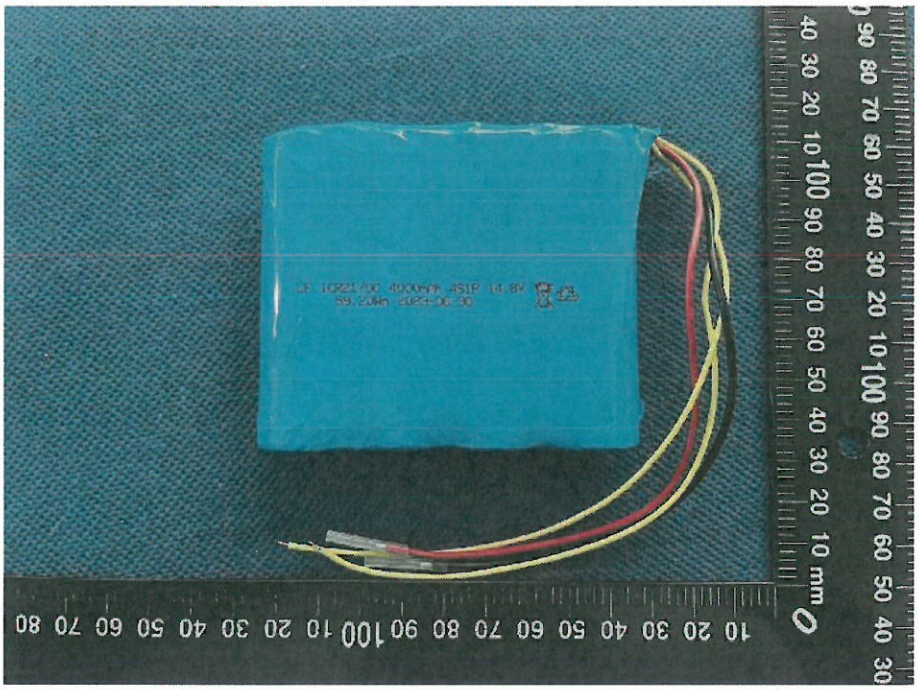
UN 38.3 测试方法、数据及结果 Test method and data

38.3.4.8 试验 T.8：强制放电 Test T.8: Forced discharge	P

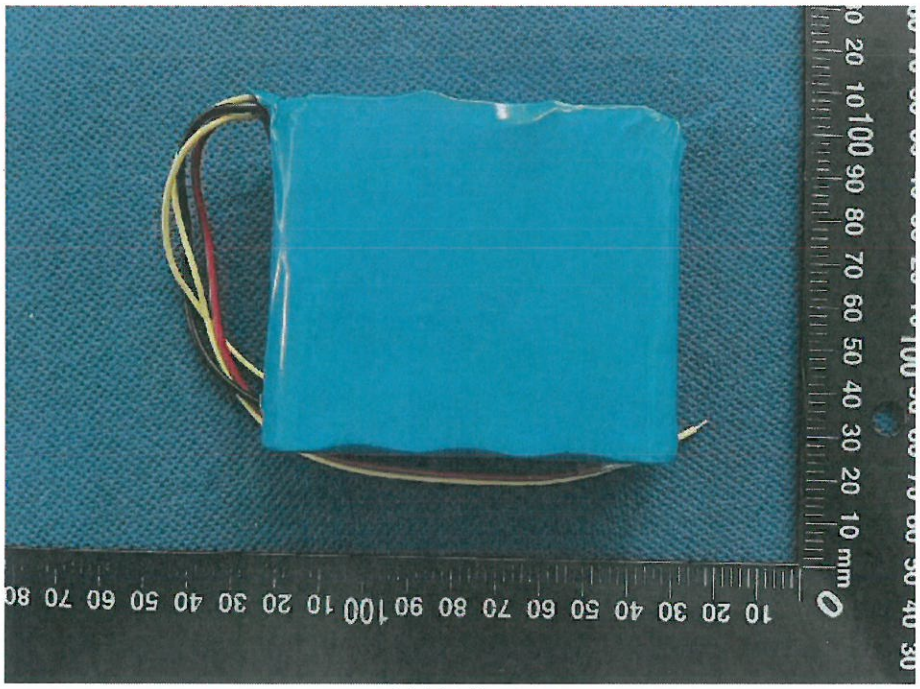
38.3.4.8.1 目的
本试验评估原电池或充电电池承受强制放电状况的能力。
38.3.4.8.2 试验程序
每个电池必须在环境温度下与 12 伏的直流电电源串联在起始电流等于制造商给定的最大放电电流的条件下强制放电。
将适当大小和额定值的电阻负荷与试验电池串联，计算得出给定的放电电流。对每个电池进行强制放电，放电的时间（小时）应等于其额定容量除以初始试验电流（安培）。
38.3.4.8.3 要求
原电池或充电电池如在试验过程中和试验后 7 天内无解体，无起火，即符合本项要求。
38.3.4.8.1 Purpose
This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.
38.3.4.8.2 Test procedure
Each cell shall be forced discharged at ambient temperature by connecting it in series with a12V 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).
38.3.4.8.3 Requirement
Primary or rechargeable cells meet this requirement if there is no dis assembly and no fire during the test and within seven days after the test.

样品编号 Sample No.	判定：是否符合要求 Verdict	样品编号 Sample No.	判定：是否符合要求 Verdict
E1	P	F1	P
E2	P	F2	P
E3	P	F3	P
E4	P	F4	P
E5	P	F5	P
E6	P	F6	P
E7	P	F7	P
E8	P	F8	P
E9	P	F9	P
E10	P	F10	P

样品照片 Photos of the sample

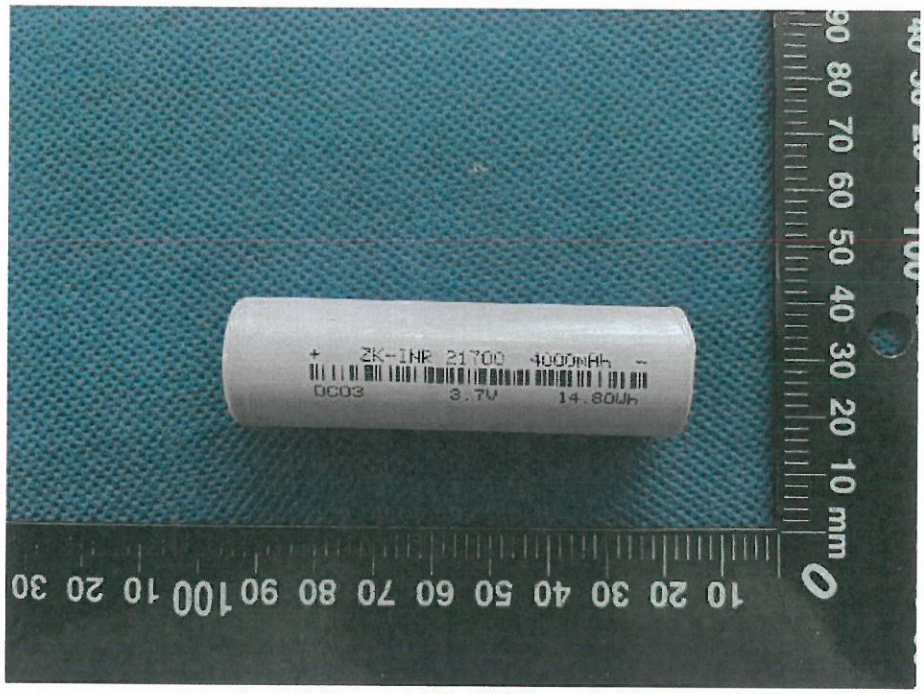


电池组外观 1
View of the battery 1

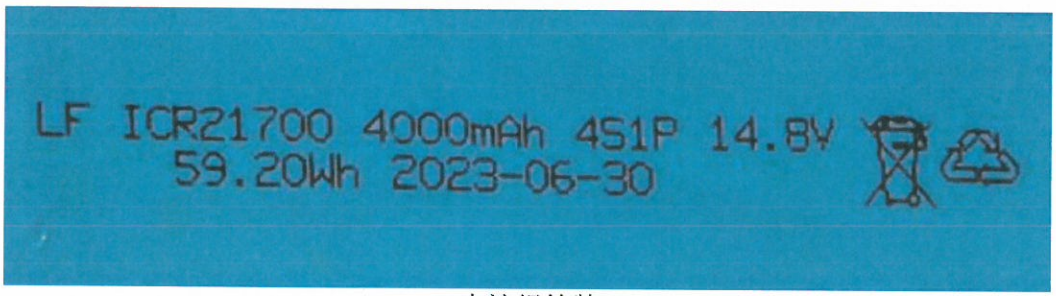


电池组外观 2
View of the battery 2

样品照片 Photos of the sample



元件电池
View of the component cell



电池组铭牌
View of the battery nameplate

试验仪器设备清单
Test equipment list

序号 No.	名称 Name	型号 Type	编号 Equipment No.	校准有效期至 Calibration Date	本次使用 Used (√)
1.	振动试验台 Vibration Platform	DC-300-3	CIS1559-001	2024.03.16	√
2.	冲击试验台 Shock Platform	CL-50/KCL-2000	CIS1559-002	2024.03.23	√
3.	电池重物冲击试验箱 Battery heavy impact test chamber	BE-8106	CIS1737-036	2023.03.16	√
4.	电池低气压试验箱 Low Pressure Chamber	BE-8104	CIS1559-007	2024.03.16	√
5.	数字万用表 Digital multi meter	34461A	CIS165M-031	2024.03.20	√
6.	数据采集仪 Data Collector	GL820	CIS1559-020	2024.03.20	√
7.	数据采集仪 Data Collector	GL840	CIS1559-053	2024.03.20	√
8.	快速温变试验箱 High-low Temperature Test Chamber	KWGD61	CIS1737-042	2024.03.16	√
9.	电池充放电测试仪 Battery Charge And Discharging Tester	HYNN-BP-2020A	CIS1737-047	2024.03.20	√
10.	多通道短路器 Multi channel short circuit	6×32A	CIS165M-028	2024.03.20	√
11.	电池温型控短路试验机 Battery short circuit by Temperature Test Machine	BE-8102	CIS1559-005	2024.03.16	√
12.	电子天平 Electronic balance	BL-1200F	CIS1559-023	2024.03.16	√
13.	多通道短路器 Multi channel short circuit	6×32A	CIS165M-068	2024.03.20	√
14.	充放电测试仪 Battery Charge And Discharging Tester	CDS-60V40A-T	CIS2068-092	2024.03.20	√
15.	充放电测试仪 Battery Charge And Discharging Tester	CDS-60V40A-T	CIS2068-091	2024.03.20	√

注意事项

NOTES

1. 本报告未加盖“检验检测专用章”无效；

   This test report is invalid without testing stamp.

2. 本报告未经本实验室批准不得部分复印；

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

3. 本报告试验结果只对受试样品有效；

   The test results presented in this report is only valid to the samples tested.

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