



中国认可
国际互认
检测
TESTING
CNAS L0357

检测报告

Test Report

报告编号 (Report No.) : S19-B0140-1

产品名称(Product Name): 锂离子可充电电芯

Lithium-ion Rechargeable Cell

型号 (Model/Type) : FST 18650-2500mAh

委托方(Client) : 远东福斯特新能源有限公司

Far East First New Energy 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

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产品名称 Product Name	锂离子可充电电芯 Lithium-ion Rechargeable Cell	委托方 Client	远东福斯特新能源有限公司 Far East First New Energy Co.,Ltd.
型号规格 Model/Type	FST 18650-2500mAh, 3.6V, 2500mAh, 9.0Wh	委托方地址 Client Address	江西省宜春市袁州区经济开发区经发大道 39 号 No.39, Jingfa Road, Economic and Technological Development Zone, 336000 Yichun City, Jiangxi Province, China
样品数量 Sample Quantity	电池 35 35 cells	制造商 Manufacturer	远东福斯特新能源有限公司 Far East First New Energy Co.,Ltd.
样品来源 Sample Source	送样 Submitted by Manufacturer	制造商地址 Manufacturer Address	江西省宜春市袁州区经济开发区经发大道 39 号 No.39, Jingfa Road, Economic and Technological Development Zone, 336000 Yichun City, Jiangxi Province, China
收样日期 Receipt Sample Date	2019.02.18	生产厂 Factory	远东福斯特新能源有限公司 Far East First New Energy Co.,Ltd.
试验类别 Testing Kind	委托试验 Entrusted Test	生产厂地址 Factory Address	江西省宜春市袁州区经济开发区经发大道 39 号 No.39, Jingfa Road, Economic and Technological Development Zone, 336000 Yichun City, Jiangxi Province, China
检验日期 Testing Date	开始时间 (Start Date) : 2019.02.25 结束时间 (Complete Date) : 2019.03.13		
试验环境 Testing Environment	温度(Temperature): (19.9~24.2) °C; 湿度(Humidity): (44~67) %R.H.; 大气压力(Atmospheric Pressure): 101kPa		
试验标准/ 方法 Testing Standard /Method	UN 38.3, Rcv.6 《关于危险货物运输的建议书—试验和标准手册》第三部分 38.3 节《金属锂电池和锂离子电池组》 "Recommendations on the TRANSPORT OF DANGEROUS GOODS-Manual of Tests and Criteria", Sixth 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 《关于危险货物运输的建议书—试验和标准手册》第三部分 38.3 节《金属锂电池和锂离子电池组》，对电池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、撞击试验以及强制放电试验。 According to UN 38.3, batteries are subjected to Altitude simulation, Thermal test, Vibration, Shock, External short circuit, Impact and Forced discharge test.		
试验结论 Verdict	符合要求 Qualified		
试验 Tested by		日期 (Date) : 2019.03.18	
审核 Checked by		日期 (Date) : 2019.03.19	
批准 Approved by		日期 (Date) : 2019.03.19	
	王莹 Wang Ying: 技术负责人 Technical Manager 郭建宇 Guo Jianyu: 质量负责人 Quality Manager 何鹏林 He Penglin: 副主任 Vice Director		
注: 判定栏中“P”表示合格, “N”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” means no application, “F” means fail, “—” means no Verdict.			

样品描述及说明 General product information

样品类型 (Sample Type):

是否可充电 Rechargeable or not	是 Yes
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<input checked="" type="checkbox"/> 电池 Cell	用途 Use	电子产品 Electrical Products	化学组分 Electrochemistry System	钴酸锂 LiCoO ₂
<input type="checkbox"/> 电池组 Battery	用途 Use	—	型号 Battery Model	—
	组成方式 Composing Mode	—	电芯化学组分 Electrochemistry System	—
	电芯生产厂 Manufacturer Of Cell	—		
	电芯型号 Cell model	—	电芯容量 Cell Capacity	—

样品参数:

标称电压 Nominal Voltage	3.6V	额定容量 Rated Capacity	2500mAh	额定能量 Rated Energy	9.0Wh
充电限制电压 Max. Charging Voltage	4.2V	最大连续充电电流 Max. Charging Current	2500mA	充电电流 Charging Current	1250mA
放电终止电压 Discharge Cut-off Voltage	2.75V	最大放电电流 Max. Discharging Current	7500mA	充电截止电流 Charge Cut-off Current	50mA

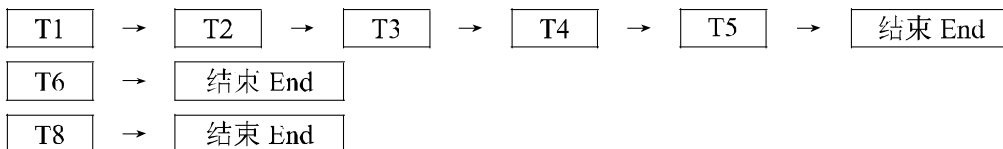
测试项目、样品及顺序 Test items, sample and Order

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~A10	P
T2	温度试验 Thermal test	A1~A10	P
T3	振动 Vibration	A1~A10	P
T4	冲击 Shock	A1~A10	P
T5	外短路 External short circuit	A1~A10	P
T6	撞击/挤压 Impact / Crush	C1~C5	P
T7	过度充电 Overcharge	—	N
T8	强制放电 Forced discharge	D1~D10, E1~E10	P

样品的预处理: A1~A10 为 1 次循环完全充电状态; C1~C5 为 1 次循环 50% 额定容量; D1~D10: 1 次循环完全放电状态; E1~E10: 50 次循环完全放电状态。

Pretreatment of the samples: A1~A10: at first cycle in fully charged states; C1~C5: at first cycle at 50% of the design rated capacity; D1~D10: at first cycle in fully discharged states; E1~E10: at 50 cycle in fully discharged states.

试验顺序:



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) °C 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 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	44.939	4.196	44.939	4.193	0.00	0.07	P
A2	44.978	4.188	44.978	4.185	0.00	0.07	P
A3	45.088	4.192	45.087	4.189	0.00	0.07	P
A4	44.968	4.195	44.967	4.192	0.00	0.07	P
A5	44.901	4.191	44.901	4.188	0.00	0.07	P
A6	45.153	4.190	45.153	4.187	0.00	0.07	P
A7	44.705	4.191	44.705	4.188	0.00	0.07	P
A8	44.953	4.191	44.953	4.189	0.00	0.05	P
A9	44.562	4.192	44.562	4.189	0.00	0.07	P
A10	44.712	4.193	44.712	4.190	0.00	0.07	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 $(72 \pm 2)^\circ\text{C}$ 下存放至少 6 小时,接着再在试验温度等于 $(-40 \pm 2)^\circ\text{C}$ 下存放至少 6 小时。两个极端试验温度之间的最大时间间隔为 30 分钟。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 $(20 \pm 5)^\circ\text{C}$ 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 $(72 \pm 2)^\circ\text{C}$, followed by storage for at least six hours at a test temperature equal to $(-40 \pm 2)^\circ\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature $(20 \pm 5)^\circ\text{C}$. 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 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	44.939	4.193	44.938	4.138	0.00	1.31	P
A2	44.978	4.185	44.975	4.139	0.01	1.10	P
A3	45.087	4.189	45.082	4.142	0.01	1.12	P
A4	44.967	4.192	44.965	4.145	0.00	1.12	P
A5	44.901	4.188	44.898	4.143	0.01	1.07	P
A6	45.153	4.187	45.149	4.143	0.01	1.05	P
A7	44.705	4.188	44.701	4.142	0.01	1.10	P
A8	44.953	4.189	44.949	4.139	0.01	1.19	P
A9	44.562	4.189	44.560	4.141	0.00	1.15	P
A10	44.712	4.190	44.711	4.146	0.00	1.05	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																																																																																											
<p>38.3.4.3.1 目的 本试验模拟运输过程中的振动。</p> <p>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。</p> <p>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。</p> <p>38.3.4.3.1 Purpose This test simulates vibration during transport.</p> <p>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 $1g_n$ is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (16 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.</p> <p>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.</p>																																																																																												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 10%;">样品 编号 Sample No.</th> <th colspan="2" style="width: 20%;">试验前 Before test</th> <th colspan="2" style="width: 20%;">试验后 After test</th> <th rowspan="2" style="width: 10%;">质量亏损 Mass loss (%)</th> <th rowspan="2" style="width: 10%;">电压亏损 Voltage loss (%)</th> <th rowspan="2" style="width: 20%;">判定: 是否符合要求 Verdict</th> </tr> <tr> <th style="width: 10%;">质量(g) Mass</th> <th style="width: 10%;">电压(V) Voltage</th> <th style="width: 10%;">质量(g) Mass</th> <th style="width: 10%;">电压(V) Voltage</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">A1</td><td style="text-align: center;">44.938</td><td style="text-align: center;">4.138</td><td style="text-align: center;">44.938</td><td style="text-align: center;">4.138</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A2</td><td style="text-align: center;">44.975</td><td style="text-align: center;">4.139</td><td style="text-align: center;">44.975</td><td style="text-align: center;">4.138</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.02</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A3</td><td style="text-align: center;">45.082</td><td style="text-align: center;">4.142</td><td style="text-align: center;">45.082</td><td style="text-align: center;">4.142</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A4</td><td style="text-align: center;">44.965</td><td style="text-align: center;">4.145</td><td style="text-align: center;">44.965</td><td style="text-align: center;">4.145</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A5</td><td style="text-align: center;">44.898</td><td style="text-align: center;">4.143</td><td style="text-align: center;">44.897</td><td style="text-align: center;">4.143</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A6</td><td style="text-align: center;">45.149</td><td style="text-align: center;">4.143</td><td style="text-align: center;">45.149</td><td style="text-align: center;">4.143</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A7</td><td style="text-align: center;">44.701</td><td style="text-align: center;">4.142</td><td style="text-align: center;">44.701</td><td style="text-align: center;">4.141</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.02</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A8</td><td style="text-align: center;">44.949</td><td style="text-align: center;">4.139</td><td style="text-align: center;">44.948</td><td style="text-align: center;">4.138</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.02</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A9</td><td style="text-align: center;">44.560</td><td style="text-align: center;">4.141</td><td style="text-align: center;">44.559</td><td style="text-align: center;">4.141</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.00</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A10</td><td style="text-align: center;">44.711</td><td style="text-align: center;">4.146</td><td style="text-align: center;">44.711</td><td style="text-align: center;">4.145</td><td style="text-align: center;">0.00</td><td style="text-align: center;">0.02</td><td style="text-align: center;">P</td></tr> </tbody> </table>	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	44.938	4.138	44.938	4.138	0.00	0.00	P	A2	44.975	4.139	44.975	4.138	0.00	0.02	P	A3	45.082	4.142	45.082	4.142	0.00	0.00	P	A4	44.965	4.145	44.965	4.145	0.00	0.00	P	A5	44.898	4.143	44.897	4.143	0.00	0.00	P	A6	45.149	4.143	45.149	4.143	0.00	0.00	P	A7	44.701	4.142	44.701	4.141	0.00	0.02	P	A8	44.949	4.139	44.948	4.138	0.00	0.02	P	A9	44.560	4.141	44.559	4.141	0.00	0.00	P	A10	44.711	4.146	44.711	4.145	0.00	0.02	P
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A10	44.711	4.146	44.711	4.145	0.00	0.02	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
本试验模拟运输过程中可能发生的撞击。

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_r 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_r 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 _r 或加速度 (g _r) = $\sqrt{\frac{100850}{\text{质量}}}$ 中的较小者	6ms
大型电池组	50g _r 或加速度 (g _r) = $\sqrt{\frac{30000}{\text{质量}}}$ 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 simulates possible impacts during transport.

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_r and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_r 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 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	44.938	4.138	44.938	4.138	0.00	0.00	P
A2	44.975	4.138	44.975	4.138	0.00	0.00	P
A3	45.082	4.142	45.082	4.142	0.00	0.00	P
A4	44.965	4.145	44.965	4.145	0.00	0.00	P
A5	44.897	4.143	44.897	4.143	0.00	0.00	P
A6	45.149	4.143	45.149	4.143	0.00	0.00	P
A7	44.701	4.141	44.701	4.141	0.00	0.00	P
A8	44.948	4.138	44.948	4.138	0.00	0.00	P
A9	44.559	4.141	44.559	4.141	0.00	0.00	P
A10	44.711	4.145	44.711	4.145	0.00	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																																	
<p>38.3.4.5.1 目的</p> <p>本试验模拟外部短路。</p> <p>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 $57 \pm 4^\circ\text{C}$。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 $57 \pm 4^\circ\text{C}$ 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 $57 \pm 4^\circ\text{C}$ 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。</p> <p>短路和温度下降过程应在试验环境温度条件下进行。</p> <p>38.3.4.5.3 要求</p> <p>如果外壳温度不超过 170°C,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。</p> <p>38.3.4.5.1 Purpose</p> <p>This test simulates an external short circuit.</p> <p>38.3.4.5.2 Test procedure</p> <p>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 $57 \pm 4^\circ\text{C}$, 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 $57 \pm 4^\circ\text{C}$ shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.</p> <p>This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $57 \pm 4^\circ\text{C}$, 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.</p> <p>The short circuit and cooling down phases shall be conducted at least at ambient temperature.</p> <p>38.3.4.5.3 Requirement</p> <p>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 within six hours of this test.</p>																																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">样品编号 Sample No.</th> <th style="width: 40%;">最高温度 ($^\circ\text{C}$) Maximum Temperature</th> <th style="width: 40%;">判定: 是否符合要求 Verdict</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">A1</td><td style="text-align: center;">122.1</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A2</td><td style="text-align: center;">112.0</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A3</td><td style="text-align: center;">121.2</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A4</td><td style="text-align: center;">119.1</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A5</td><td style="text-align: center;">121.8</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A6</td><td style="text-align: center;">116.1</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A7</td><td style="text-align: center;">124.9</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A8</td><td style="text-align: center;">132.2</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A9</td><td style="text-align: center;">123.6</td><td style="text-align: center;">P</td></tr> <tr><td style="text-align: center;">A10</td><td style="text-align: center;">117.4</td><td style="text-align: center;">P</td></tr> </tbody> </table>	样品编号 Sample No.	最高温度 ($^\circ\text{C}$) Maximum Temperature	判定: 是否符合要求 Verdict	A1	122.1	P	A2	112.0	P	A3	121.2	P	A4	119.1	P	A5	121.8	P	A6	116.1	P	A7	124.9	P	A8	132.2	P	A9	123.6	P	A10	117.4	P	
样品编号 Sample No.	最高温度 ($^\circ\text{C}$) Maximum Temperature	判定: 是否符合要求 Verdict																																
A1	122.1	P																																
A2	112.0	P																																
A3	121.2	P																																
A4	119.1	P																																
A5	121.8	P																																
A6	116.1	P																																
A7	124.9	P																																
A8	132.2	P																																
A9	123.6	P																																
A10	117.4	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
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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、无破裂，无起火，电池和电池组即符合本项要求。

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

38.3.4.6.2 Test 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 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.
 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 (°C) Maximum Temperature	判定: 是否符合要求 Verdict
C1	142.5	p
C2	131.2	p
C3	130.4	p
C4	142.1	p
C5	130.0	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 Tcst T.6 B: Crush N

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、无破裂, 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.

38.3.4.6.3 Test 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 18 650 cells 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 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 (°C) 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

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

38.3.4.8.3 Requirement
 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.

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
D1	P	E1	P
D2	P	E2	P
D3	P	E3	P
D4	P	E4	P
D5	P	E5	P
D6	P	E6	P
D7	P	E7	P
D8	P	E8	P
D9	P	E9	P
D10	P	E10	P

样品照片 Photos of the sample



电池外观
Cell appearance



电池外观
Cell appearance

样品照片 Photos of the sample



电池铭牌
Cell 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	2019.04.18	√
2.	冲击试验台 Shock Platform	CL-50/KCL-2000	CIS1559-002	2019.04.18	√
3.	电池低气压试验箱 Low Pressure Chamber	BE-8104	CIS1737-007	2019.04.18	√
4.	数据采集仪 Data Collector	DL820	CIS1559-019	2019.04.18	√
5.	多通道短路器 Multi channel short circuit	6×32A	CIS165M-028	2019.04.18	√
6.	数字万用表 Digital multimeter	34461A	CIS165M-031	2019.04.18	√
7.	电子天平 Electronic Scale	JJ224BC	CIS1737-033	2019.04.18	√
8.	电池温控短路试验机 Battery short circuit by	BE-8102	CIS1737-034	2019.04.18	√
9.	电池重物冲击试验机 Shock Testing Machine	BE-8106	CIS1559-036	2019.04.18	√
10.	高低温试验箱 High-Low Temperature	KWGD61	CIS1737-042	2019.04.18	√
11.	电池充放电测试仪 Battery Charge And	HYNN-BP-2020A	CIS1737-047	2019.04.18	√
12.	数据采集仪 Data Collector	GL840	CIS1737-053	2019.04.18	√
13.	多通道短路器 Multi channel short circuit	6×32A	CIS1737-068	2019.04.18	√

注 意 事 项

NOTES

1. 本报告未加盖“试验报告专用章”无效；

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2. 本报告未经本实验室批准不得部分复印；

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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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