



中国认可
国际互认
检测
TES TING
CNAS L3187

检测报告

Test Report

No: UNWT(2022)02034

样品名称: 可充电锂离子电池组

Sample Name: LiFePO₄ rechargeable battery

委托单位: polynom ag

Client: polynom ag

检验类别: 委托检验

Test Type: Commissioned Test

枣庄市产品质量监督检验所

Zaozhuang Institute of Supervision and Inspection on Product Quality

国家锂电池产品质量检验检测中心

National Lithium Battery Product Quality Inspection and Testing Center

注意事项

Attentions

1. 报告无“检验报告专用章”无效。

The test report is invalid without the special seal for inspection report.

2. 报告无主检、审核、批准人签字（或等效标识）无效。

The test report is invalid without the signatures or equivalent identification of Approver, Checker and Tester.

3. 报告涂改无效。

The test report is invalid if altered.

4. 未经我公司批准，不得复制（全文复制除外）本报告。

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6. 委托送样检验，检验结果仅对来样负责。

For the commissioned test, the test results are only responsible for the samples.

7. 检验项目中注“※”者，为分包检验项目。

The item is subcontracted test if there's a mark of ※.

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产品名称 Sample Name	可充电锂离子电池组 LiFePO ₄ rechargeable battery		
样品标示商标 Sample Mark	ELUBAT	样品型号 Sample Model	275823
额定容量 Rated Capacity	4.5Ah	标称电压 Normal Voltage	3.2V
额定能量 Rated Energy	14.4Wh	锂金属含量 Metal Content	不适用 N/A
执行标准 Executive Standard	/	样品等级 Sample Grade	/
委托单位: - Commissioned by: polynom ag	委托单位地址: - Commissioner address: Stauseestrasse 73, CH-5314, Kleindöttingen, Switzerland / +41764315555		
生产单位: - Manufacturer: Sander Elektronik AG	生产单位地址: - Manufacturer address: Stauseestrasse 73, CH-5314, Kleindöttingen, Switzerland / +41764315555		
生产企业: 山东精工电源科技有限公司 Factory: Shandong Goldencell Power Technology Co., Ltd.	生产企业地址: 山东省枣庄高新区光明大道 X6699 号 Factory address: No. X6699 Guangming Boulevard Zaozhuang Hi-Tech District, Shandong Province China		
到样日期 Accepted Date	2022.01.17	测试日期 Test Date	2022.01.20-2022.02.11
样品状态 Sample Status	白色 White	送样人员 Sample Carrier	Erika Noé
样品数量 Quantity of Sample	8pcs (无保护装置)		
检测依据 Test method and criterion	《试验和标准手册》第 7 修订版修正 1, 38.3 Manual of Tests and Criteria ST/SG/AC.10/11/Rev.7/Amend1 UN38.3		
检测项目 Test items	高度模拟、温度试验、振动、冲击、外部短路、撞击、强制放电 Altitude simulation, Thermal test, Vibration, Shock, External Short-circuit, Impact, Forced discharge		
检测结论 Conclusion	经测试, 送检样品符合《试验和标准手册》第 7 修订版修正 1 第 38.3 节的测试要求。 After testing, the sample meets the requirements of Manual of Test and Criteria ST/SG/AC.10/11/Rev.7/Amend1 UN38.3 . (检测检测专用章) (Stamp) 签发日期(Issue date): 2022.2.18		
备注 Comments	委托送样检测, 检测结果仅对来样负责。 It is a entrusted sample test, the test results are only responsible for the samples.		

批准:

Approver:

审核:

Checker:

主检:

Tester:

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序号 No.	检测项目 Name of test	检测方法/标准要求 Test method and Standard requirement	子样编号 Sample number	检测结果 Test result	单项结论 Test conclusion
1	高度模拟 Altitude simulation	《试验和标准手册》试验 T.1 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.1	B01-B08	见附表 1 See Appendix 1	合格 Pass
2	温度试验 Thermal test	《试验和标准手册》试验 T.2 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.2	B01-B08	见附表 2 See Appendix 2	合格 Pass
3	振动 Vibration	《试验和标准手册》试验 T.3 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.3	B01-B08	见附表 3 See Appendix 3	合格 Pass
4	冲击 Shock	《试验和标准手册》试验 T.4 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.4	B01-B08	见附表 4 See Appendix 4	合格 Pass
5	外部短路 External Short-circuit	《试验和标准手册》试验 T.5 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.5	B01-B08	见附表 5 See Appendix 5	合格 Pass
6	撞击 Impact	《试验和标准手册》试验 T.6 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.6	C11-C20	见附表 6 See Appendix 6	合格 Pass
	挤压 Crush		N/A	N/A	N/A
7	过度充电 Overcharge	《试验和标准手册》试验 T.7 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.7	N/A	N/A	N/A
8	强制放电 Forced discharge	《试验和标准手册》试验 T.8 Manual of Tests and Criteria ST/SG/AC.10/11/ Rev.7/Amend1, 38.3, Test T.8	C21-C40	见附表 7 See Appendix 7	合格 Pass
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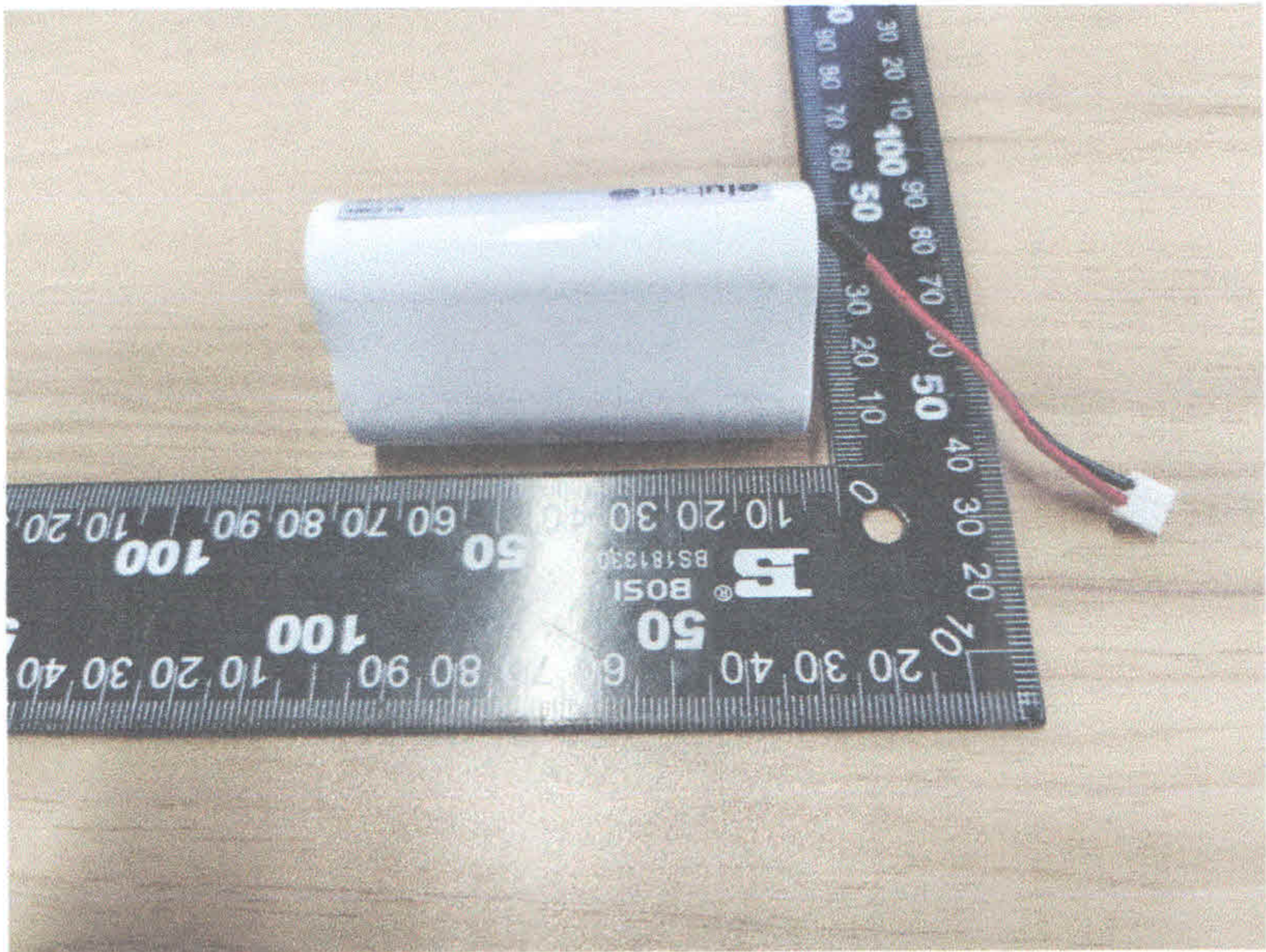
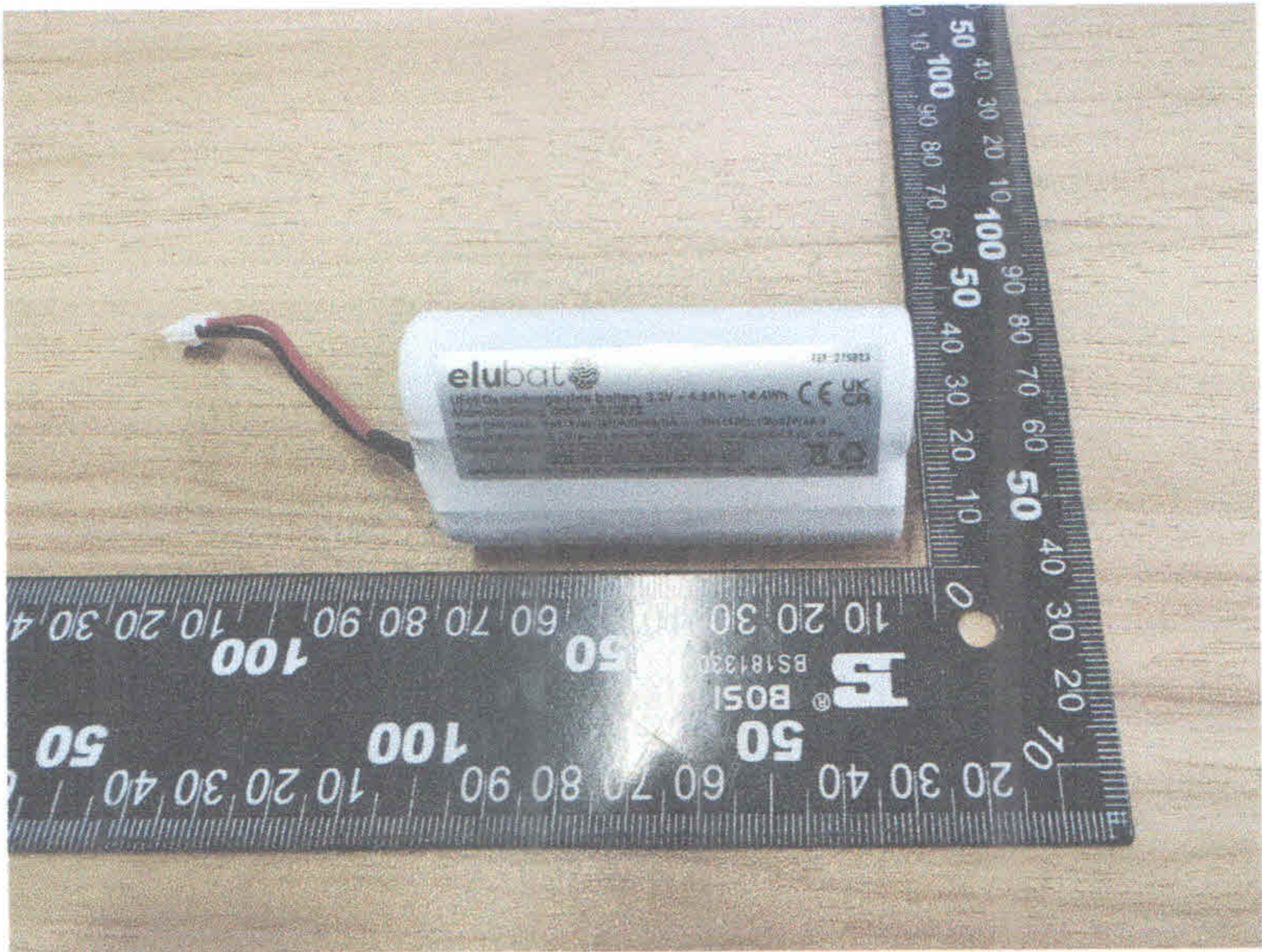
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样品及标识照片
Photos of samples and markings

Photos of Battery



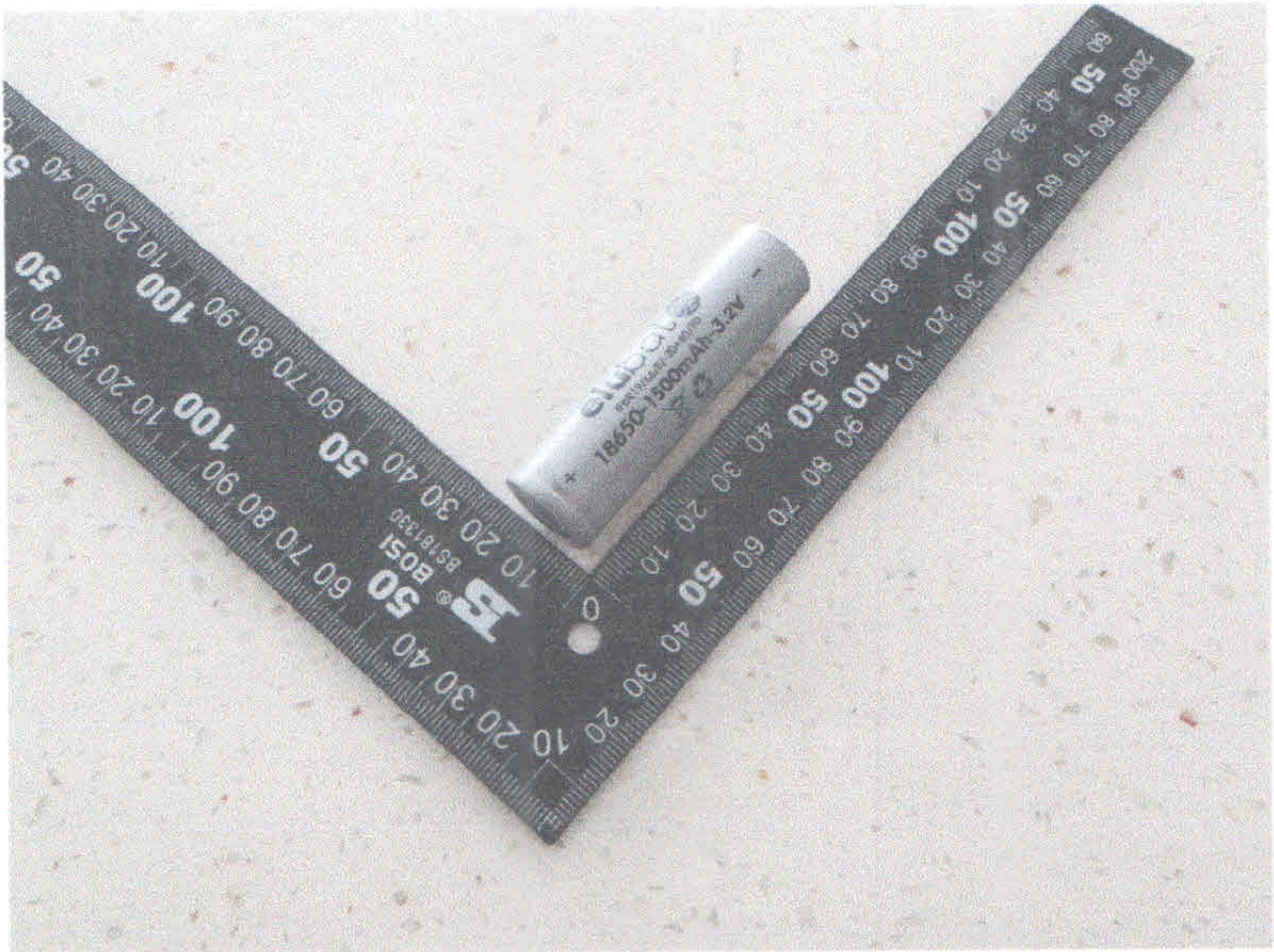
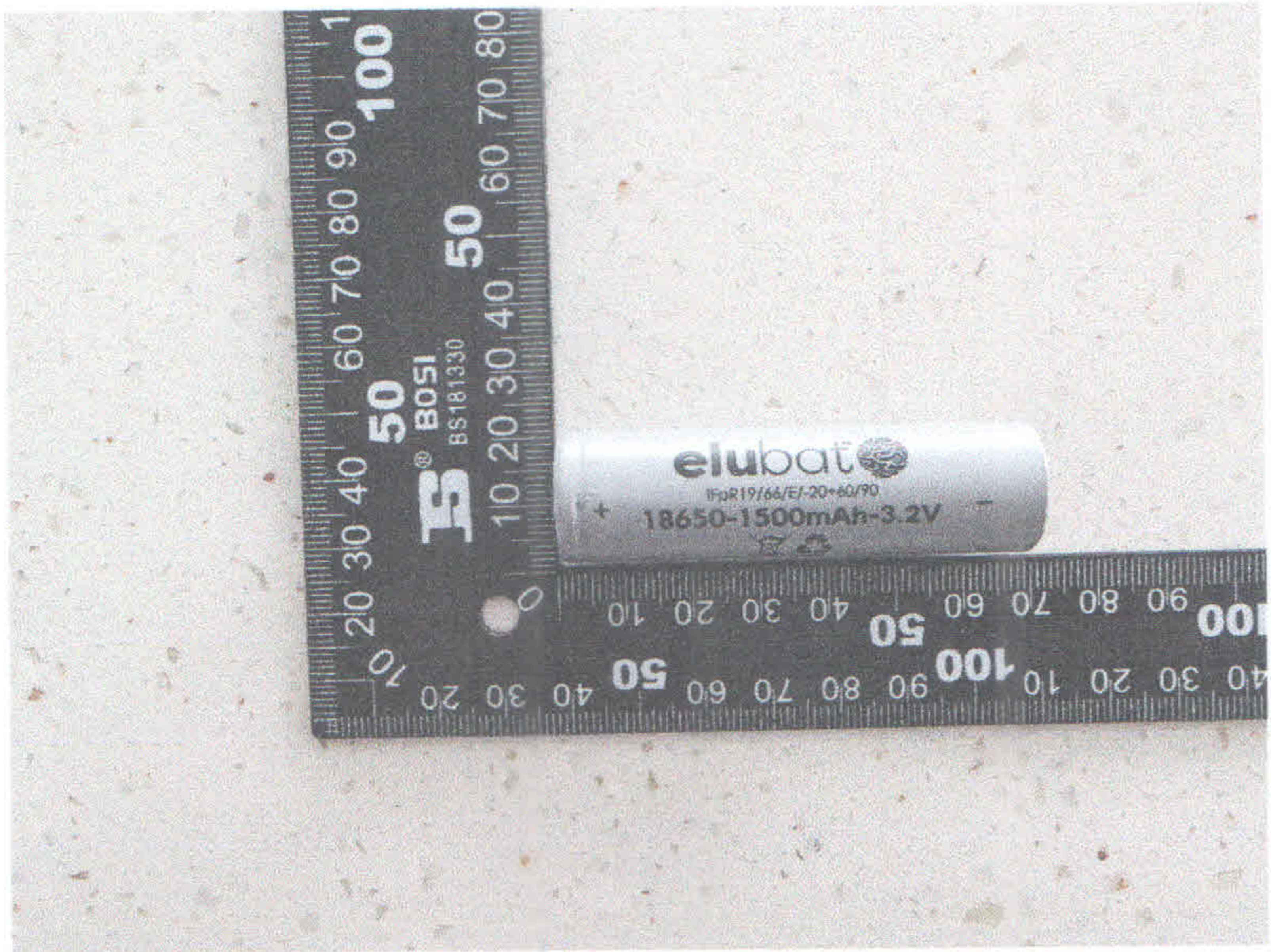
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样品及标识照片
Photos of samples and markings

Photos of Cell



附表 1

测试项目 Test Items	高度模拟 Altitude simulation						
1.1	测试步骤 Test procedure						
	试验电池和电池组在环境温度(20±5℃)下, 储存在小于等于 11.6kPa 的压力下至少六小时。 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℃).						
1.2	样品状态 Sample status						
	B01-B04: 第 1 个循环完全充电状态。 B01-B04: first cycle, fully charged state.						
	B05-B08: 25 个循环后完全充电状态。 B05-B08: 25th cycle, fully charged state.						
1.3	测试结果 Result						
样品编号 Sample No.	测试前/Before		测试后/After		质量损失 Mass Loss (%)	剩余电压 Residual OCV (%)	测试结果 Test Result
	质量/Mass (g)	开路电压/OCV (V)	质量/Mass (g)	开路电压/OCV (V)			
B01	124.481	3.348	124.480	3.347	0.001%	99.97%	O
B02	124.049	3.347	124.047	3.347	0.002%	100.00%	O
B03	124.268	3.346	124.267	3.345	0.001%	99.97%	O
B04	124.173	3.347	124.173	3.346	0.000%	99.97%	O
B05	124.389	3.356	124.387	3.355	0.002%	99.97%	O
B06	124.468	3.354	124.467	3.354	0.001%	100.00%	O
B07	124.335	3.355	124.335	3.354	0.000%	99.97%	O
B08	124.541	3.354	124.540	3.354	0.001%	100.00%	O
注: L-泄漏; V-排气; D-解体; R-破裂; F-起火; O-无泄漏、无排气、无解体、无破裂、无起火。 Note: L-Leakage, V-Venting, D -Disassembly, R -Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.							

附表 2

Appendix 2

测试项目 Test Items	温度试验 Thermal test						
1.1	测试步骤 Test procedure						
	将测试电池和电池组在温度为 $72\pm 2^{\circ}\text{C}$ 的条件下贮存不少于 6 个小时，然后在温度 $-40\pm 2^{\circ}\text{C}$ 条件下贮存不少于 6 个小时，两个温度间的间隔最长为 30min。重复操作上述步骤 10 次，然后将测试电池和电池组在环境温度为 $20\pm 5^{\circ}\text{C}$ 的条件下放置 24 个小时。 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 in 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 ($20\pm 5^{\circ}\text{C}$).						
1.2	样品状态 Sample status						
	B01-B04: 第 1 个循环完全充电状态。 B01-B04: first cycle, fully charged state.						
	B05-B08: 25 个循环后完全充电状态。 B05-B08: 25th cycle, fully charged state.						
1.3	测试结果 Result						
样品编号 Sample No.	测试前/Before		测试后/After		质量损失 Mass Loss (%)	剩余电压 Residual OCV (%)	测试结果 Test Result
	质量/Mass (g)	开路电压 /OCV (V)	质量/Mass (g)	开路电压 /OCV (V)			
B01	124.480	3.347	124.478	3.345	0.002%	99.94%	O
B02	124.047	3.347	124.047	3.346	0.000%	99.97%	O
B03	124.267	3.345	124.266	3.345	0.001%	100.00%	O
B04	124.173	3.346	124.171	3.345	0.002%	99.97%	O
B05	124.387	3.355	124.386	3.354	0.001%	99.97%	O
B06	124.467	3.354	124.467	3.354	0.000%	100.00%	O
B07	124.335	3.354	124.333	3.353	0.002%	99.97%	O
B08	124.540	3.354	124.538	3.353	0.002%	99.97%	O
注：L-泄漏；V-排气；D-解体；R-破裂；F-起火；O-无泄漏、无排气、无解体、无破裂、无起火。 Note: L-Leakage, V-Venting, D-Disassembly, R -Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.							

附表 3
Appendix 3

测试项目 Test Items	振动 Vibration						
1.1	测试步骤 Test procedure						
	将电池和电池组牢固地安装在振动台的台面上，同时确保电芯和电池没有变形，以此保证振动有效地传播。振动为正弦波形式，频率从 7Hz 增加至 200Hz，然后再回到 7Hz，持续 15 分钟，此为一个循环。每个电池和电池组需在三个互相垂直的安装方向上循环 12 次振动，且其中一个振动方向必须与端面垂直，整个测试共 3 个小时。 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.						
1.2	样品状态 Sample status						
	B01-B04: 第 1 个循环完全充电状态。 B01-B04: first cycle, fully charged state.						
	B05-B08: 25 个循环后完全充电状态。 B05-B08: 25th cycle, fully charged state.						
1.3	测试结果 Result						
样品编号 Sample No.	测试前/Before		测试后/After		质量损失 Mass Loss (%)	剩余电压 Residual OCV (%)	测试结果 Test Result
	质量/Mass (g)	开路电压 /OCV (V)	质量/Mass (g)	开路电压 /OCV (V)			
B01	124.478	3.345	124.477	3.345	0.001%	100.00%	O
B02	124.047	3.346	124.045	3.345	0.002%	99.96%	O
B03	124.266	3.345	124.265	3.344	0.001%	99.97%	O
B04	124.171	3.345	124.170	3.343	0.001%	99.94%	O
B05	124.386	3.354	124.384	3.352	0.002%	99.94%	O
B06	124.467	3.354	124.465	3.353	0.002%	99.97%	O
B07	124.333	3.353	124.332	3.352	0.001%	99.97%	O
B08	124.538	3.353	124.536	3.351	0.002%	99.94%	O
注：L-泄漏；V-排气；D-解体；R-破裂；F-起火；O-无泄漏、无排气、无解体、无破裂、无起火。 Note: L-Leakage, V-Venting, D -Disassembly, R -Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.							

Appendix 4

测试项目 Test Items	冲击 Shock						
1.1	测试步骤 Test procedure						
	将测试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样品的所有安装面。每个测试电池和电池组须经受最大加速度 150g_n 和脉冲持续时间 6 毫秒的半正弦波冲击。每个电池和电池组需在三个互相垂直的正方向经受三次冲击，然后在反方向经受三次冲击，总共 18 次。 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. Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.						
1.2	样品状态 Sample status						
	B01-B04: 第 1 个循环完全充电状态。 B01-B04: first cycle, fully charged state.						
	B05-B08: 25 个循环后完全充电状态。 B05-B08: 25th cycle, fully charged state.						
1.3	测试结果 Result						
样品编号 Sample No.	测试前/Before		测试后/After		质量损失 Mass Loss (%)	剩余电压 Residual OCV (%)	测试结果 Test Result
	质量/Mass (g)	开路电压 /OCV (V)	质量/Mass (g)	开路电压 /OCV (V)			
B01	124.477	3.345	124.476	3.344	0.001%	99.97%	O
B02	124.045	3.345	124.043	3.343	0.002%	99.94%	O
B03	124.265	3.344	124.264	3.344	0.001%	100.00%	O
B04	124.170	3.343	124.168	3.341	0.002%	99.94%	O
B05	124.384	3.352	124.383	3.351	0.001%	99.97%	O
B06	124.465	3.353	124.464	3.352	0.001%	99.97%	O
B07	124.332	3.352	124.330	3.351	0.002%	99.97%	O
B08	124.536	3.351	124.534	3.351	0.002%	100.00%	O
注：L-泄漏；V-排气；D-解体；R-破裂；F-起火；O-无泄漏、无排气、无解体、无破裂、无起火。 Note: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.							

附表 5
Appendix 5

测试项目 Test Items	外部短路 External short circuit	
1.1	测试步骤 Test procedure	
	测试电池和电池组应加热一段必要的时间，使得其外壳温度达到均匀稳定的 $57 \pm 4^{\circ}\text{C}$。这段加热时间的长短取决于电池和电池组的设计尺寸大小，同时这段加热时间应加以评估和记录。若无法评估加热时间，则小型电池和电池组需暴露至少 6 小时。然后，电池或电池组应在 $57 \pm 4^{\circ}\text{C}$ 条件下经受总外电阻小于 0.1 欧姆的外短路。当小型电池和电池组的外壳温度降到 $57 \pm 4^{\circ}\text{C}$ 后应继续维持外短路状态至少 1 个小时。短路和降温阶段的温度应至少相当于环境温度。 The cell or battery to be tested 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. 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. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $57 \pm 4^{\circ}\text{C}$. The short circuit and cooling down phase shall be conducted at least at ambient temperature.	
1.2	样品状态 Sample status	
	B01-B04: 第 1 个循环完全充电状态。 B01-B04: first cycle, fully charged state. B05-B08: 25 个循环后完全充电状态。 B05-B08: 25th cycle, fully charged state.	
1.3	测试结果 Result	
样品编号 Sample No.	样品表面最高温度($^{\circ}\text{C}$) Max. External Temperature	测试结果 Test Result
B01	81.5	O
B02	81.9	O
B03	81.3	O
B04	63.5	O
B05	80.7	O
B06	80.6	O
B07	86.4	O
B08	83.7	O
注： D- 解体； R- 破裂； F- 起火； O- 无泄漏、无排气、无解体、无破裂、无起火。 Note: D -Disassembly, R -Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.		

附表 6
Appendix 6

测试项目 Test Items	撞击 Impact				
1.1	测试步骤 Test procedure				
	试样电池和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 $15.8 \pm 0.1 \text{ mm}$，长度至少 6cm，或电池最长端的尺寸，取二者之长者。将一块 $9.1 \pm 0.1 \text{ kg}$ 的重锤从 $61 \pm 2.5 \text{ cm}$ 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。受撞击的试样，纵轴与平面平行并与横放在试样中心的直径 $15.8 \pm 0.1 \text{ mm}$ 弯曲表面的纵轴垂直。试验结束后继续观察 6h。 The test sample cell is to be placed on a flat smooth surface. A $15.8 \text{ mm} \pm 0.1 \text{ mm}$ 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 $9.1 \text{ kg} \pm 0.1 \text{ kg}$ mass is to be dropped from a height of 61cm 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 $15.8 \text{ mm} \pm 0.1 \text{ mm}$ diameter curved surface lying across the centre of the test sample. The test sample shall be observed for a further 6h.				
1.2	样品状态 Sample status				
	C11-C15: 第 1 个循环后 50%的额定容量。 C11-C15: first cycle, 50% charged state.				
	C16-C20: 25 个循环后 50%的额定容量。 C16-C20: 25th cycle, 50% charged state.				
1.3	测试结果 Result				
样品编号 Sample No.	样品表面最高温度(°C) Max. External Temperature	测试结果 Test Result	样品编号 Sample No.	样品表面最高温度(°C) Max. External Temperature	测试结果 Test Result
C11	120.1	O	C16	129.6	O
C12	124.1	O	C17	125.5	O
C13	116.8	O	C18	127.4	O
C14	118.1	O	C19	121.6	O
C15	122.2	O	C20	119.9	O
注: D- 解体; R- 破裂; F- 起火; O- 无泄漏、无排气、无解体、无破裂、无起火。 Note: D -Disassembly, R -Rupture, F-Fire, O-No leakage, no venting, no disassembly, no rupture & no fire.					

附表 7
Appendix 7

测试项目 Test Items	强制放电 Forced discharge		
1.1	测试步骤 Test procedure		
	在 20±5℃的环境温度下, 将单个电池连接在 12V 的直流电源上进行强制放电, 此直流电源提供每个电池初始电流为制造厂指定的最大放电电流, 放电时间 (h) 为额定容量除以初始电流 (A)。 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 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).		
1.2	样品状态 Sample status		
	C21-C30: 第 1 个循环完全放电状态。 C21-C30: first cycle, fully discharged state.		
	C31-C40: 25 个循环后完全放电状态。 C31-C40: 25th cycle, fully discharged state.		
1.3	测试结果 Result		
样品编号 Sample No.	测试结果 Test Result	样品编号 Sample No.	测试结果 Test Result
C21	O	C31	O
C22	O	C32	O
C23	O	C33	O
C24	O	C34	O
C25	O	C35	O
C26	O	C36	O
C27	O	C37	O
C28	O	C38	O
C29	O	C39	O
C30	O	C40	O
注: D-解体; F-起火; O-无解体、无起火。 Note: D -Disassembly, F-Fire, O-No disassembly, no fire.			

测试摘要
TEST SUMMARY

电池生产商信息/Manufacturer information			
电池生产商 Manufacturer	Sander Elektronik AG		
生产商地址 Address	Stauseestrasse73,CH-5314,Kleindöttingen,Switzerland		
联系电话 Tel	+41764315555	电子邮箱 E-mail	erika.noe@sanderelek.ch
网站地址 Website	https://www.sanderelek.ch/web/index.php		
电池信息/Battery information			
电池类型 Type	锂离子电池组 Lithium-ion battery	型号 Model	275823
额定容量 Rate Capacity	4.5Ah	电池质量 Mass	(120±20) g
物理形状说明 Physical description	白色 White		
测试机构信息/Test laboratory information			
测试机构 test laboratory	枣庄市产品质量监督检验所 Zaozhuang Institute of Supervision and Inspection on Product Quality		
机构地址 Address	山东省枣庄高新区复元三路 Fuyuan 3rd Road, High-tech District, Zaozhuang, Shandong, P. R. China.		
联系电话 Telephone	86-0632-8637868	电子邮箱 E-mail	gjldzjzx@163.com
网站地址 Website	www.guojialidianjiance.com		
测试报告信息/Test report information			
报告编号/Test report ID	UNWT(2022)02034		
接样日期 Receiving date	2022.01.17	测试日期 Test date	2022.01.20-2022.02.11
测试人员 Tester	王威、杨尚官 Wang Wei/ Yang Shangguan	批准人员 Approver	鞠群 Ju Qun
测试项目及结论/Test item and result			
T1.高度模拟 Altitude simulation	通过/Pass	T2.温度试验 Thermal test	通过/Pass
T3.振动 Vibration	通过/Pass	T4.冲击 Shock	通过/Pass
T5.外部短路 External short circuit	通过/Pass	T6.撞击 Impact	通过/Pass
T8.强制放电 Forced discharge	通过/Pass		
结论/Result: 样品满足《试验与标准手册》第7修订版修正1第38.3节的测试要求。 The sample meets the requirement of Manual of Test and Criteria ST/SG/AC.10/11/Rev.7/Amend1, section 38.3.			