



CTC Laboratories, Inc.



中国认可  
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检测  
TESTING  
CNAS L5365

# TEST REPORT

## UN38.3

Name of sample.....: Rechargeable Li-ion Battery

样品名称 可充电锂离子电池

Model no.....: 5016

型号

Applicant.....: SHENZHEN GOTRON ELECTRONIC CO., LTD

申请商 深圳市冠群电子有限公司

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**TEST REPORT****ST/SG/AC.10/11/Rev.7/Amend.1/Section 38.3****AMENDMENTS TO THE Seventh REVISED EDITION OF THE RECOMMENDATIONS ON THE  
TRANSPORT OF DANGEROUS GOODS, MANUAL OF TEST AND CRITERIA****《关于危险品货物运输的建议书试验和标准手册》第七版修订一  
(Section 38.3: Lithium batteries)**

|                                                                                                                                                                      |                                                                                                                                                                                                                  |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Tested by (+ signature) .....<br>测试(签名)                                                                                                                              | 何世鹏                                                                                                                                                                                                              | 何世鹏 |
| Checked by (+ signature) .....<br>审核(签名)                                                                                                                             | 陈万波                                                                                                                                                                                                              | 陈万波 |
| Approved by (+ signature) .....<br>批准(签名)                                                                                                                            | 赵嵩煦                                                                                                                                                                                                              | 赵嵩煦 |
| Date of issue.....<br>签发日期                                                                                                                                           | 2025-05-09                                                                                                                                                                                                       |     |
| Applicant.....<br>申请商                                                                                                                                                | SHENZHEN GOTRON ELECTRONIC CO., LTD<br>深圳市冠群电子有限公司                                                                                                                                                               |     |
| Address .....<br>地址                                                                                                                                                  | 7B01, Building A, Block 1, Anhongji Tianyao Plaza, Longhua District, Shenzhen, China<br>深圳市龙华区民治街道大岭社区安宏基天曜广场 1 栋 A 座 7B01                                                                                       |     |
| Manufacturer.....<br>制造商                                                                                                                                             | Shenzhen Huatiantong Technology Co., Ltd.<br>深圳市华天通科技有限公司                                                                                                                                                        |     |
| Address.....<br>地址                                                                                                                                                   | Floor 1st, 2nd, 3rd, Building 3, Kaijieda Industrial District, No.97 Huaxing Road, Shuiwei Community, Dalang Street, Longhua District, Shenzhen City, P.R. China<br>深圳市龙华区大浪街道水围社区华兴路 97 号凯杰达工业区 3 栋 1 层、2 层、3 层 |     |
| Standard.....<br>标准                                                                                                                                                  | ST/SG/AC.10/11/Rev.7/Amend.1/Section 38.3                                                                                                                                                                        |     |
| Procedure deviation .....<br>过程偏差                                                                                                                                    | N/A                                                                                                                                                                                                              |     |
| Test result .....<br>检验结果                                                                                                                                            | Pass                                                                                                                                                                                                             |     |
| Test Report Form No.....                                                                                                                                             | CTC-TR-013_A1                                                                                                                                                                                                    |     |
| Master TRF.....                                                                                                                                                      | Dated 2024-09-20                                                                                                                                                                                                 |     |
| <b>This test report is specially limited to the above client company and product model only, It may not be duplicated without prior written consent of CTC Test.</b> |                                                                                                                                                                                                                  |     |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------|
| Samples Type .....<br>样品类型                                                                                                                                                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> Large battery <input type="checkbox"/> Large cell <input type="checkbox"/> Small battery<br><input type="checkbox"/> Small cell <input checked="" type="checkbox"/> Small battery (4 cells in parallel) |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Model I.....<br>型号                                                                                                                                                                                                                                                                                                                                                                                                                               | 5016                                                                                                                                                                                                                             |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Ratings .....<br>额定值                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.87V, 25500mAh, 98.685Wh                                                                                                                                                                                                        |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Trade mark .....<br>商标                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                 |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Dimension.....<br>尺寸                                                                                                                                                                                                                                                                                                                                                                                                                             | L: 94.5mm, W: 63.3mm, H: 24.8mm                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Shapen of cell .....<br>电芯形状                                                                                                                                                                                                                                                                                                                                                                                                                     | Prismatic                                                                                                                                                                                                                        |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Model<br>型号                                                                                                                                                                                                                                                                                                                                                                                                                                      | Rated capacity<br>额定容量                                                                                                                                                                                                           | Nominal voltage<br>标称电压 | Nominal Charge Current<br>标准充电电流 | Nominal Discharge Current<br>标准放电电流 | Maximum Charge Current<br>最大充电电流 | Maximum Discharge Current<br>最大放电电流 | Maximum Charge Voltage<br>最大充电电压 | Final Voltage<br>放电截止电压 |
| Battery 电池                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |
| 5016                                                                                                                                                                                                                                                                                                                                                                                                                                             | 25500mAh                                                                                                                                                                                                                         | 3.87V                   | 5100mA                           | 5100mA                              | 13000mA                          | 10000mA                             | 4.45V                            | 3.0V                    |
| Cell 电芯                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |
| 586391                                                                                                                                                                                                                                                                                                                                                                                                                                           | 6375mAh                                                                                                                                                                                                                          | 3.87V                   | 3187.5 mA                        | 1275mA                              | 7650mA                           | 6375mA                              | 4.45V                            | 3.0V                    |
| <b>Possible test case verdicts:</b><br>报告中可能用到的结论标识:                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |
| Test case does not apply to the test object<br>测试项目不适用于该产品                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                  |                         | N/A<br>不适用                       |                                     |                                  |                                     |                                  |                         |
| Test item does meet the requirement<br>测试项目符合标准的要求                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                  |                         | P(ass)<br>合格                     |                                     |                                  |                                     |                                  |                         |
| Test item does not meet the requirement<br>测试项目不符合标准的要求                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                  |                         | F(ail)<br>不合格                    |                                     |                                  |                                     |                                  |                         |
| <b>Test conclusion 检验结论:</b><br>The Rechargeable Li-ion Battery submitted by Shenzhen Huatiantong Technology Co., Ltd. are tested according to Section 38.3 of Seventh revised edition of Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria ( ST/SG/AC.10/11/Rev.7/Amend.1/Section 38.3).<br>由申请商深圳市华天通科技有限公司送检的电池名称可充电锂离子电池, 依据《关于危险品货物运输的建议书试验和标准手册》第七版修订一第 38.3 节进行检测。<br><b>Test result: Pass</b><br>检验结果: 通过 |                                                                                                                                                                                                                                  |                         |                                  |                                     |                                  |                                     |                                  |                         |



## Report version 报告版本:

| Revised No.<br>版次 | Report No.<br>报告号 | Date of issue<br>发布日期 | Description<br>描述 |
|-------------------|-------------------|-----------------------|-------------------|
| 01                | CTC2025218202     | 2025-05-09            | Original 首次发布     |

## I、CONCLUSION 结论

| ITEM 项目                        | SAMPLENUMBER 样品号                                                  | STANDARD 标准                                                                                                                                                                                                       | CONCLUSION 结论 |
|--------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Altitude simulation<br>高空模拟    | CTC250313-013-S031~S038(Hereinafter referred to as 以下简称为 B1-B8)   | Section 38.3 of Seventh revised edition of Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria (ST/SG/AC.10/11/Rev.7/Amend. 1/Section 38.3)<br>《关于危险品货物运输的建议书 试验和标准手册》第七版修订一第 38.3 节 | P             |
| Thermal test<br>热测试            |                                                                   |                                                                                                                                                                                                                   | P             |
| Vibration<br>振动                |                                                                   |                                                                                                                                                                                                                   | P             |
| Shock<br>冲击                    |                                                                   |                                                                                                                                                                                                                   | P             |
| External short circuit<br>外部短路 |                                                                   |                                                                                                                                                                                                                   | P             |
| Impact/Crush<br>撞击/挤压          | CTC250313-013-S001~S010(Hereinafter referred to as 以下简称为 C1-C10)  |                                                                                                                                                                                                                   | P             |
| Overcharge<br>过度充电             | CTC250313-013-S039~S046(Hereinafter referred to as 以下简称为 B9-B16)  |                                                                                                                                                                                                                   | P             |
| Forced discharge<br>强制放电       | CTC250313-013-S011~S030(Hereinafter referred to as 以下简称为 C11-C30) |                                                                                                                                                                                                                   | P             |

## Notes 备注:

| ITEM 项目 | SAMPLE NUMBER 样品号                                               | STATE 状态                                                             |
|---------|-----------------------------------------------------------------|----------------------------------------------------------------------|
| T.1-T.5 | CTC250313-013-S031~S034(Hereinafter referred to as 以下简称为 B1-B4) | at first cycle, in fully charged state<br>第一个交替充电放电周期完全充电状态          |
|         | CTC250313-013-S035~S038(Hereinafter referred to as 以下简称为 B5-B8) | after 25 cycles ending in fully charged state<br>第二十五个交替充电放电周期完全充电状态 |

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|     |                                                                   |                                                                                    |
|-----|-------------------------------------------------------------------|------------------------------------------------------------------------------------|
| T.6 | CTC250313-013-S001~S005(Hereinafter referred to as 以下简称为 C1-C5)   | at first cycle at 50% of the design rated capacity<br>第一个交替充电放电周期充电到设计额定容量的 50%    |
|     | CTC250313-013-S006~S010(Hereinafter referred to as 以下简称为 C6-C10)  | after 25 cycles at 50% of the design rated capacity<br>第二十五个交替充电放电周期充电到设计额定容量的 50% |
| T.7 | CTC250313-013-S039~S042(Hereinafter referred to as 以下简称为 B9-B12)  | at first cycle, in fully charged state<br>第一个交替充电放电周期完全充电状态                        |
|     | CTC250313-013-S043~S046(Hereinafter referred to as 以下简称为 B13-B16) | after 25 cycles ending in fully charged state<br>第二十五个交替充电放电周期完全充电状态               |
| T.8 | CTC250313-013-S011~S020(Hereinafter referred to as 以下简称为 C11-C20) | at first cycle, in fully discharged state<br>第一个交替充电放电周期完全放电状态                     |
|     | CTC250313-013-S021~S030(Hereinafter referred to as 以下简称为 C21-C30) | after 25 cycles ending in fully discharged state<br>第二十五个交替充电放电周期完全放电状态            |

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## II、MAIN TEST EQUIPMENT 主要测试设备

| NO.编号 | Instrument Name 仪器名称                                                         |
|-------|------------------------------------------------------------------------------|
| BA001 | Simulated high altitude and low pressure test chamber<br>模拟高空低压试验箱           |
| BA003 | Battery impact tester<br>电池冲击试验机                                             |
| BA008 | CTS 20V5A Charge and discharge tester<br>CTS 20V5A 充放电测试仪                    |
| BA009 | CTS 20V10A Charge and discharge tester<br>CTS 20V10A 充放电测试仪                  |
| BA010 | Programmable high and low temperature test box<br>程式高低温试验箱                   |
| BA011 | Temperature control type battery short circuit testing machine<br>温控型电池短路试验机 |
| BA013 | Electrical vibration testing system<br>电动振动试验系统                              |
| BA014 | Drop style shock testing machine<br>加速度机械式冲击试验机                              |
| BA029 | Digital multimeter<br>数字万用表                                                  |
| BA038 | Battery test system<br>电池测试系统                                                |
| BA039 | Battery test system<br>电池测试系统                                                |
| BA042 | Desk thermometer<br>台式温湿度计                                                   |
| BA051 | Battery extrusion needle testing machine<br>电池挤压针刺试验机                        |
| SA002 | DC source<br>DC 直流源                                                          |
| SA039 | Electric Load<br>电子负载                                                        |
| SA078 | Data Acquisition<br>温升数据采集仪                                                  |
| SA092 | Digital caliper<br>数字游标卡尺                                                    |
| SA137 | Desk thermometer<br>台式温湿度计                                                   |
| SA237 | electronic scales<br>电子天平                                                    |

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### III、TEST METHOD AND RESULT 测试方法和结果

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

小型电芯或电池必须按顺序进行试验 T1 至 T5。试验 T6 至 T8 应使用未另外试验过的电芯或电池。试验 T7 可以使用原先在试验 T1 至 T5 中使用过的未损坏的电池进行，以便测试交替充电放电的电池。

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

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

Where  $M_1$  is the mass before the test and  $M_2$  is the mass after the test, When mass loss does not exceed the values in Table blow, it shall be considered as “no mass loss”.

质量损失量化数值可用下式计算：

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

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

| Mass M of cell or battery<br>电芯或电池质量 M | Mass lost limite<br>质量损失限值 |
|----------------------------------------|----------------------------|
| $M < 1\text{g}$                        | 0.5%                       |
| $1\text{g} \leq M \leq 75\text{g}$     | 0.2%                       |
| $M > 75\text{g}$                       | 0.1%                       |

#### Test T.1: Altitude simulation 高空模拟

##### Test procedure 试验程序：

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ( $20 \pm 5^\circ\text{C}$ ).

试验电芯和电池在压力不大于 11.6kPa 和环境温度 ( $20^\circ\text{C} \pm 5^\circ\text{C}$ ) 下存放至少 6 小时。

##### Requirement 要求：

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

如果无漏液、无排气、无解体、无破裂和无着火，且每个试验电芯或电池在试验后的开路电压不低于其在进行这项试验前开路电压的 90%，电芯和电池即符合这一要求。有关电压的要求不适用于完全放完电状态的试验电芯和电池。

##### Result 结果：

The samples B1-B8: No leakage, no venting, no disassembly, no rupture and no fire. The data see table 1.

编号为 B1-B8 的样品：无漏液、无排气、无解体、无破裂和无着火现象，数据见表 1。

#### Test T.2: Thermal test 热测试

##### Test procedure 测试程序：

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 until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ( $20 \pm 5^\circ\text{C}$ ). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

试验电芯和电池在试验温度等于  $72^\circ\text{C} \pm 2^\circ\text{C}$  下存放至少 6 小时，接着在试验温度等于  $-40^\circ\text{C} \pm 2^\circ\text{C}$



下存放至少 6 小时。两个极端温度之间的最大时间间隔为 30 分钟。这一过程须重复 10 次，接着将所有电池在环境温度  $20^{\circ}\text{C}\pm 5^{\circ}\text{C}$  下存放 24 小时。对于大型电芯和电池，暴露于极端试验温度的时间至少应为 12 小时。

#### Requirement 要求:

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

如果无漏液、无排气、无解体、无破裂和无着火，且每个试验电芯或电池在试验后的开路电压不低于其在进行这项试验前开路电压的 90%，电芯和电池即符合这一要求。有关电压的要求不适用于完全放完电状态的试验电芯和电池。

#### Result 结果:

The samples B1-B8: No leakage, no venting, no disassembly, no rupture and no fire. The data see table 2.

编号为 B1-B8 的样品：无漏液、无排气、无解体、无破裂和无着火现象，数据见表 2。

### Test T.3: Vibration 振动

#### Test procedure 测试程序:

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 12Kg (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.

For large 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  $2 g_n$  occurs (approximately 25 Hz). A peak acceleration of  $2 g_n$  is then maintained until the frequency is increased to 200 Hz.

电芯和电池紧固于振动机平台，但不得造成电芯变形，并能准确可靠地传播振动。振动应是正弦波形，对数扫描频率在 7 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重复进行 12 次，总共为时 3 小时。

做对数频率扫描，对总质量不足 12 千克的电芯和电池（电芯和小型电池），和对 12 千克及更大的电池（大型电池）有所不同。

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

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

#### Requirement 要求:

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



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

#### Result 结果:

The samples B1-B8: No leakage, no venting, no disassembly, no rupture and no fire. The data see table 3.

编号为 B1-B8 的样品：无漏液、无排气、无解体、无破裂和无着火现象，数据见表 3。

#### Test T.4: Shock 冲击

##### Test procedure 测试程序:

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<sub>n</sub> and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g<sub>n</sub> 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.

| Battery         | Minimum peak acceleration                                                                                                                     | Pulse duration |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Small batteries | 150 g <sub>n</sub> or result of formula<br>$\text{Acceleration}(g_n) = \sqrt{\left(\frac{100850}{\text{mass}^*}\right)}$ whichever is smaller | 6ms            |
| Large batteries | 50 g <sub>n</sub> or result of formula<br>$\text{Acceleration}(g_n) = \sqrt{\left(\frac{30000}{\text{mass}^*}\right)}$ whichever is smaller   | 11ms           |

\* Mass is expressed in kilograms

Each cell or battery is 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.

试验电芯和电池用坚硬支架紧固在试验装置上，支架支撑着每个试验电池的所有安装面。

每个电芯须经受峰值加速度 150g<sub>n</sub> 和脉冲持续时间 6 毫秒的半正弦波冲击。另外，大型电芯须经受峰值加速度 50g<sub>n</sub> 和脉冲持续时间 11 毫秒的半正弦波冲击。

每个电池需经受半正弦波冲击的峰值加速度取决于电池的质量。小型电池的脉冲持续时间为 6 毫秒，大型电池为 11 毫秒。下面提供的公式用来计算适当的最小峰值加速度。

| 电池   | 最小峰值加速度                                                                                               | 脉冲持续时间 |
|------|-------------------------------------------------------------------------------------------------------|--------|
| 小型电池 | 150 g <sub>n</sub> 或公式的结果，取其较小值<br>$\text{加速度}(g_n) = \sqrt{\left(\frac{100850}{\text{质量}^*}\right)}$ | 6 毫秒   |
| 大型电池 | 50 g <sub>n</sub> 或公式的结果，取其较小值<br>$\text{加速度}(g_n) = \sqrt{\left(\frac{30000}{\text{质量}^*}\right)}$   | 11 毫秒  |

\* 质量以公斤为单位表示



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

**Requirement 要求:**

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

如果无漏液、无排气、无解体、无破裂和无着火，且每个试验电芯或电池在试验后的开路电压不低于其在进行这项试验前开路电压的 90%，电芯和电池即符合这一要求。有关电压的要求不适用于完全放完电状态的试验电芯和电池。

**Result 结果:**

The samples B1-B8: No leakage, no venting, no disassembly, no rupture and no fire. The data see table 4.

编号为 B1-B8 的样品：无漏液、无排气、无解体、无破裂和无着火现象，数据见表 4。

**Test T.5: External short circuit 外部短路****Test procedure 测试程序:**

The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches  $57 \pm 4^\circ\text{C}$  and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at  $57 \pm 4^\circ\text{C}$ . This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to  $57 \pm 4^\circ\text{C}$ .

试验电芯和电池在  $57 \pm 4^\circ\text{C}$  的环境温度下，经受外电阻小于 0.1 欧姆的短路试验，短路时间持续到电芯或电池壳温度恢复到  $57 \pm 4^\circ\text{C}$  后继续至少 1 小时。

**Requirement 要求:**

Cells and batteries meet this requirement if their external temperature does not exceed  $170^\circ\text{C}$  and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

如果电芯和电池外表面温度不超过  $170^\circ\text{C}$ ，6 小时内无解体、无破裂和无着火，那么电芯和电池适合这要求。

**Result 结果:**

The samples B1-B8: No disassembly, no rupture and no fire. The data see table 5.

编号为 B1-B8 的样品：无解体、无破裂和无着火现象，数据见表 5。

**Test T.6: Impact/Crush 撞击/挤压****Test procedure 测试程序:****Impact (applicable to cylindrical cells not less than 18mm in diameter)**

**Note: Diameter here refers to the design parameter (for example the diameter of 18650 cells is 18.0mm)**

This test sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm diameter bar is to be placed across the center of the sample. A 9.1 kg mass is to be dropped from a height of  $61 \pm 2.5\text{cm}$  onto the sample.

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. Each sample is to be subjected to only a single impact.

撞击（适用于直径不小于 18 毫米的圆柱形电池）

注：此处直径指设计参数（例如：18650 电芯的直径为 18 毫米）

将试验样品用的电芯或元件电芯放在一个平坦光滑的平面上，将一直径为 15.8 毫米的横木横过电池中部放置后，将一质量为 9.1 千克的物体从  $61 \pm 2.5$  厘米的高度落向样品。

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  $15.8 \pm 0.1$  毫米弯曲表面的纵轴垂直，每一个试样只经受一次撞击。

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



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  $13 \text{ kN} \pm 0.78 \text{ kN}$ ;

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

**挤压（适用于棱柱形、袋装、硬币/纽扣电芯和直径小于 18 毫米的圆柱形电芯）**

将电芯或元件电芯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  $13 \text{ 千牛} \pm 0.78 \text{ 千牛}$ ；

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

(b) 电芯的电压下降至少 100 毫伏；

(c) 电芯变形达原始厚度的 50% 或以上。

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

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

每个试样电芯或元件电芯只做一次挤压试验。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芯或元件电芯进行。

**Requirement 要求:**

Cells and component cells meet this requirement if their external temperature does not exceed  $170^\circ\text{C}$  and there is no disassembly and no fire during the test and within six hours after this test.

如果电芯或元件电芯外部最高温度应不过  $170^\circ\text{C}$ ，并且在试验过程中及试验结束后 6 个小时之内无解体和无着火，电芯和元件电芯即符合本项要求。

**Result 结果:** The samples C1-C10: No disassembly and no fire. The data see table 6.

C1-C10 的样品：无解体和无着火现象，数据见表 6。

### Test T.7: Overcharge 过度充电

**Test procedure 测试程序:**

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.

以 2 倍制造厂推荐的最大持续充电电流对样品充电，本测试最小电压为：

(a) 如果厂家推荐的充电电压不超过 18V，本测试的最小充电电压应该是 2 倍的厂家标定最大充电电压或者 22V 两者中的较小者

(b) 如果厂家推荐的充电电压超过 18V，本测试的最小充电电压应该 1.2 倍的厂家标定最大充电电压  $20 \pm 5^\circ\text{C}$  的环境温度下，试验持续 24 小时。

**Requirement 要求:**



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

试验样品在试验中和试验后 7 天内，应无解体和无着火现象发生。

**Result 结果:**

The samples B9-B16: No disassembly and no fire. The data see table 7.

编号为 B9-B16 的样品：无解体和无着火现象，数据见表 7。

**Test T.8: Forced discharge 强制放电**

**Test procedure 测试程序:**

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).

在环境温度下，将电芯连接在 12V 的直流电源上进行强制放电，此直流电源提供给每个电芯初始电流为制造厂指定的最大放电电流。

指定的放电电流通过串联在测试电芯上的合适大小和功率的负载来获得，每个电芯的强制放电时间（小时）为额定容量除以初始电流（安培）。

**Requirement 要求:**

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

试验样品在试验中和试验后 7 天内，应无解体和无着火现象发生。

**Result 结果:**

The samples C11-C30: No disassembly and no fire. The data see table 8.

编号为 C11-C30 的样品：无解体和无着火现象，数据见表 8。

**IV、TEST DATE 测试数据**

| Table 1: Altitude simulation / 表 1: 高空模拟 |                         |                           |                          |                           |                             |               |               |
|------------------------------------------|-------------------------|---------------------------|--------------------------|---------------------------|-----------------------------|---------------|---------------|
| No.编号                                    | Mass(g)<br>质量(g)        |                           |                          | Voltage(V)<br>电压(V)       |                             |               | Verdict<br>判定 |
|                                          | M1<br>(Pre-test<br>测试前) | M2<br>(After test<br>测试后) | Mass loss<br>质量损失<br>(%) | OCV1<br>(Pre-test<br>测试前) | OCV2<br>(After test<br>测试后) | OCV<br>(≥90%) |               |
| B1                                       | 340.148                 | 340.148                   | 0.000%                   | 4.42                      | 4.42                        | 100.00%       | P             |
| B2                                       | 339.911                 | 339.911                   | 0.000%                   | 4.43                      | 4.42                        | 99.77%        | P             |
| B3                                       | 339.650                 | 339.647                   | 0.001%                   | 4.41                      | 4.41                        | 100.00%       | P             |
| B4                                       | 340.370                 | 340.370                   | 0.000%                   | 4.43                      | 4.41                        | 99.55%        | P             |
| B5                                       | 339.693                 | 339.690                   | 0.001%                   | 4.42                      | 4.42                        | 100.00%       | P             |
| B6                                       | 340.386                 | 340.386                   | 0.000%                   | 4.42                      | 4.42                        | 100.00%       | P             |
| B7                                       | 339.973                 | 339.973                   | 0.000%                   | 4.43                      | 4.43                        | 100.00%       | P             |
| B8                                       | 339.865                 | 339.865                   | 0.000%                   | 4.43                      | 4.43                        | 100.00%       | P             |



Table 2: Thermal test / 表 2: 热测试

| No.编号 | Mass(g)<br>质量(g)        |                           |                          | Voltage(V)<br>电压(V)       |                             |               | Verdict<br>判定 |
|-------|-------------------------|---------------------------|--------------------------|---------------------------|-----------------------------|---------------|---------------|
|       | M1<br>(Pre-test<br>测试前) | M2<br>(After test<br>测试后) | Mass loss<br>质量损失<br>(%) | OCV1<br>(Pre-test<br>测试前) | OCV2<br>(After test<br>测试后) | OCV<br>(≥90%) |               |
| B1    | 340.148                 | 340.035                   | 0.033%                   | 4.42                      | 4.36                        | 98.64%        | P             |
| B2    | 339.911                 | 339.804                   | 0.031%                   | 4.42                      | 4.35                        | 98.42%        | P             |
| B3    | 339.650                 | 339.532                   | 0.035%                   | 4.41                      | 4.34                        | 98.41%        | P             |
| B4    | 340.370                 | 340.258                   | 0.033%                   | 4.41                      | 4.36                        | 98.87%        | P             |
| B5    | 339.693                 | 339.574                   | 0.035%                   | 4.42                      | 4.36                        | 98.64%        | P             |
| B6    | 340.386                 | 340.254                   | 0.039%                   | 4.42                      | 4.35                        | 98.42%        | P             |
| B7    | 339.973                 | 339.839                   | 0.034%                   | 4.43                      | 4.35                        | 98.19%        | P             |
| B8    | 339.865                 | 339.753                   | 0.033%                   | 4.43                      | 4.36                        | 98.42%        | P             |

Table 3: Vibration / 表 3: 振动

| No.编号 | Mass(g)<br>质量(g)        |                           |                          | Voltage(V)<br>电压(V)       |                             |               | Verdict<br>判定 |
|-------|-------------------------|---------------------------|--------------------------|---------------------------|-----------------------------|---------------|---------------|
|       | M1<br>(Pre-test<br>测试前) | M2<br>(After test<br>测试后) | Mass loss<br>质量损失<br>(%) | OCV1<br>(Pre-test<br>测试前) | OCV2<br>(After test<br>测试后) | OCV<br>(≥90%) |               |
| B1    | 340.035                 | 340.029                   | 0.002%                   | 4.36                      | 4.34                        | 99.54%        | P             |
| B2    | 339.804                 | 339.804                   | 0.000%                   | 4.35                      | 4.35                        | 100.00%       | P             |
| B3    | 339.532                 | 339.532                   | 0.000%                   | 4.34                      | 4.34                        | 100.00%       | P             |
| B4    | 340.258                 | 340.247                   | 0.003%                   | 4.36                      | 4.36                        | 100.00%       | P             |
| B5    | 339.574                 | 339.574                   | 0.000%                   | 4.36                      | 4.36                        | 100.00%       | P             |
| B6    | 340.254                 | 340.254                   | 0.000%                   | 4.35                      | 4.35                        | 100.00%       | P             |
| B7    | 339.839                 | 339.839                   | 0.000%                   | 4.35                      | 4.34                        | 99.77%        | P             |
| B8    | 339.753                 | 339.753                   | 0.000%                   | 4.36                      | 4.36                        | 100.00%       | P             |



Table 4: Shock / 表 4: 冲击

| No.编号 | Mass(g)<br>质量(g)        |                           |                          | Voltage(V)<br>电压(V)       |                             |               | Verdict<br>判定 |
|-------|-------------------------|---------------------------|--------------------------|---------------------------|-----------------------------|---------------|---------------|
|       | M1<br>(Pre-test<br>测试前) | M2<br>(After test<br>测试后) | Mass loss<br>质量损失<br>(%) | OCV1<br>(Pre-test<br>测试前) | OCV2<br>(After test<br>测试后) | OCV<br>(≥90%) |               |
| B1    | 340.029                 | 340.029                   | 0.000%                   | 4.34                      | 4.34                        | 100.00%       | P             |
| B2    | 339.804                 | 339.801                   | 0.001%                   | 4.35                      | 4.34                        | 99.77%        | P             |
| B3    | 339.532                 | 339.532                   | 0.000%                   | 4.34                      | 4.34                        | 100.00%       | P             |
| B4    | 340.247                 | 340.247                   | 0.000%                   | 4.36                      | 4.36                        | 100.00%       | P             |
| B5    | 339.574                 | 339.574                   | 0.000%                   | 4.36                      | 4.36                        | 100.00%       | P             |
| B6    | 340.254                 | 340.245                   | 0.003%                   | 4.35                      | 4.33                        | 99.54%        | P             |
| B7    | 339.839                 | 339.827                   | 0.003%                   | 4.34                      | 4.34                        | 100.00%       | P             |
| B8    | 339.753                 | 339.753                   | 0.000%                   | 4.36                      | 4.35                        | 99.77%        | P             |

Table 5: External short circuit / 表 5: 外部短路

| No.编号                           | B1   | B2   | B3   | B4   | B5   | B6   | B7   | B8   |
|---------------------------------|------|------|------|------|------|------|------|------|
| Peak<br>temperature 最<br>高温度(℃) | 57.6 | 57.6 | 57.5 | 57.7 | 57.5 | 57.8 | 57.5 | 57.8 |
| Verdict 判定                      | P    | P    | P    | P    | P    | P    | P    | P    |

Table 6 / 表 6: ☒ Crush / 挤压 ☐ Impact / 撞击

| No.编号                           | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  |
|---------------------------------|------|------|------|------|------|------|------|------|------|------|
| Peak<br>temperature 最<br>高温度(℃) | 23.4 | 23.5 | 23.5 | 23.4 | 23.4 | 23.3 | 23.4 | 23.5 | 23.3 | 23.4 |
| Verdict 判定                      | P    | P    | P    | P    | P    | P    | P    | P    | P    | P    |

Table 7: Overcharge / 表 7: 过度充电

| No.编号      | B9 | B10 | B11 | B12 | B13 | B14 | B15 | B16 |
|------------|----|-----|-----|-----|-----|-----|-----|-----|
| Verdict 判定 | P  | P   | P   | P   | P   | P   | P   | P   |

Table 8: Forced discharge / 表 8: 强制放电

| No.编号      | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Verdict 判定 | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   |
| No.编号      | C21 | C22 | C23 | C24 | C25 | C26 | C27 | C28 | C29 | C30 |
| Verdict 判定 | P   | P   | P   | P   | P   | P   | P   | P   | P   | P   |



## V、THE PHOTO OF SAMPLE 样品图片

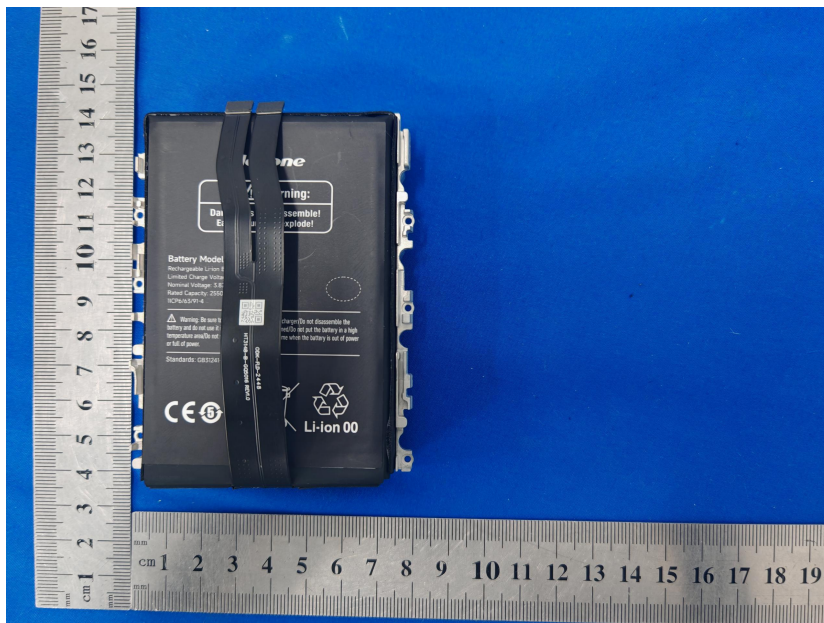


Fig. 1

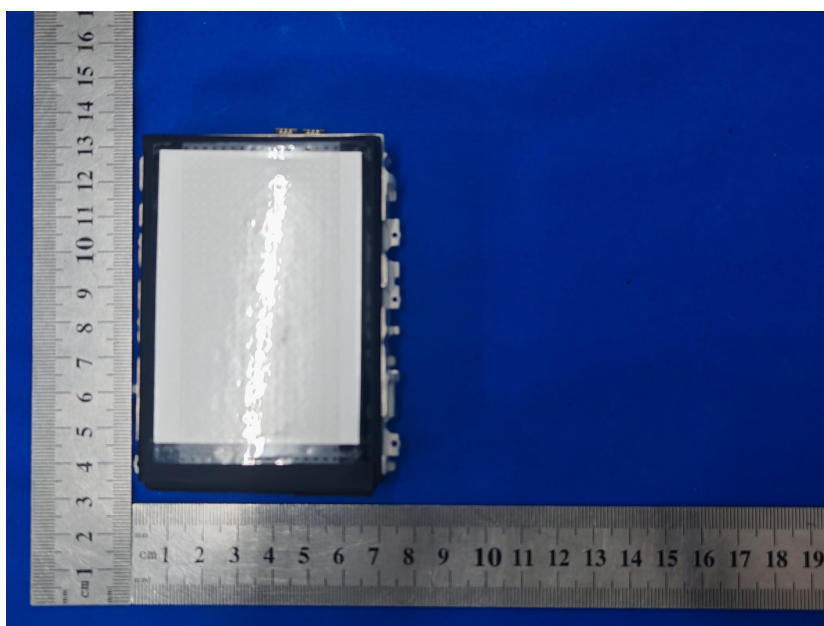


Fig. 2

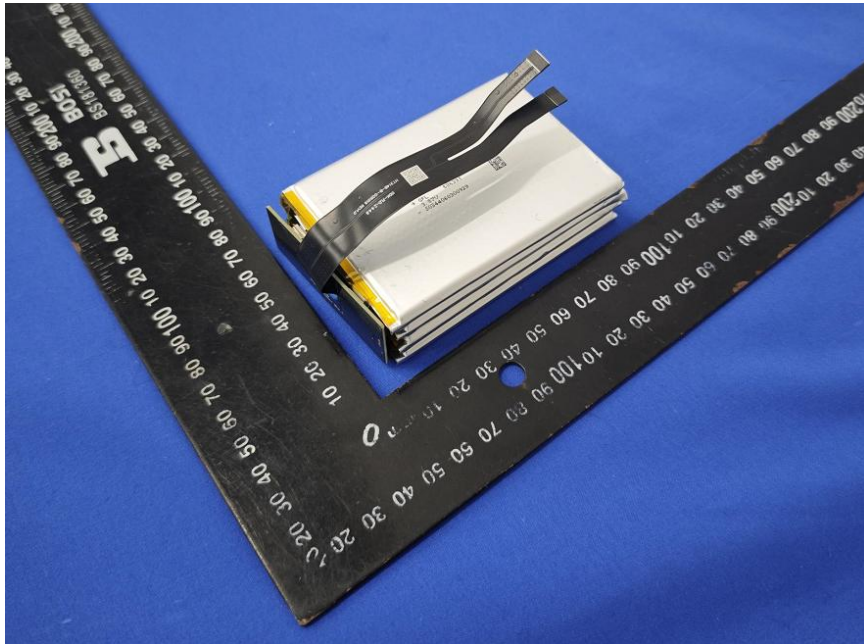


Fig. 3

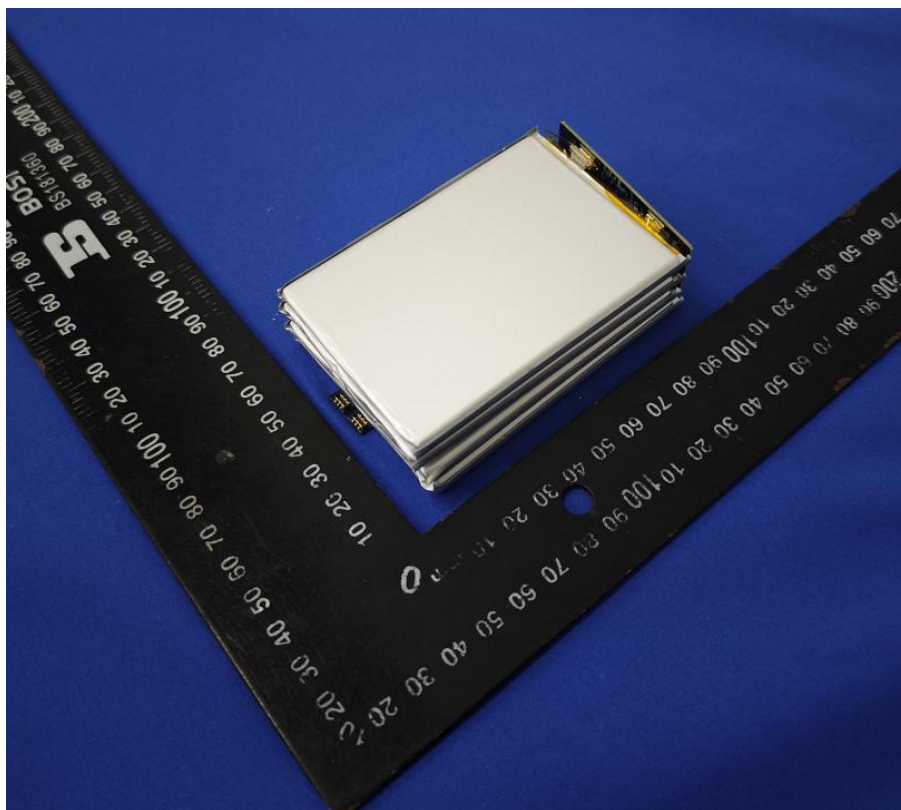


Fig. 4

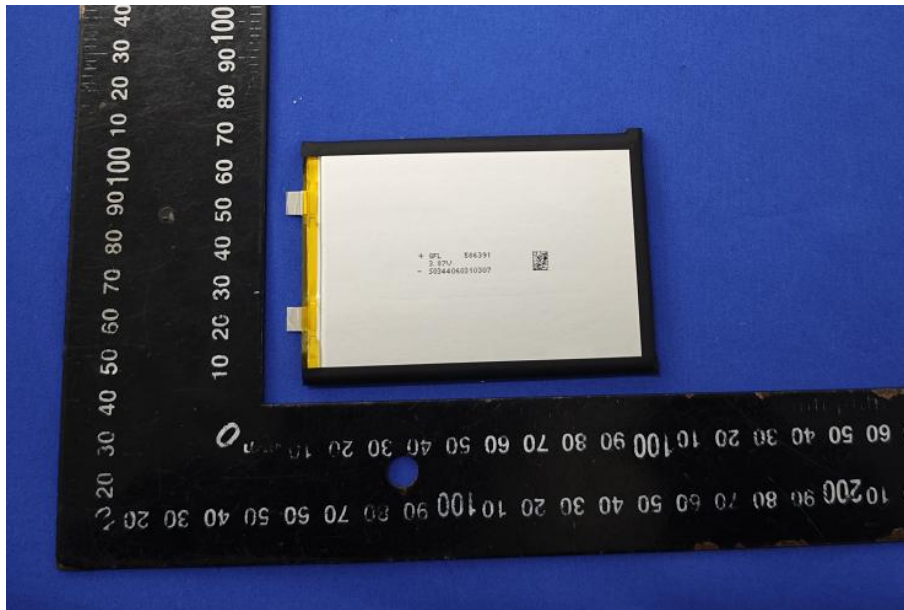


Fig.5

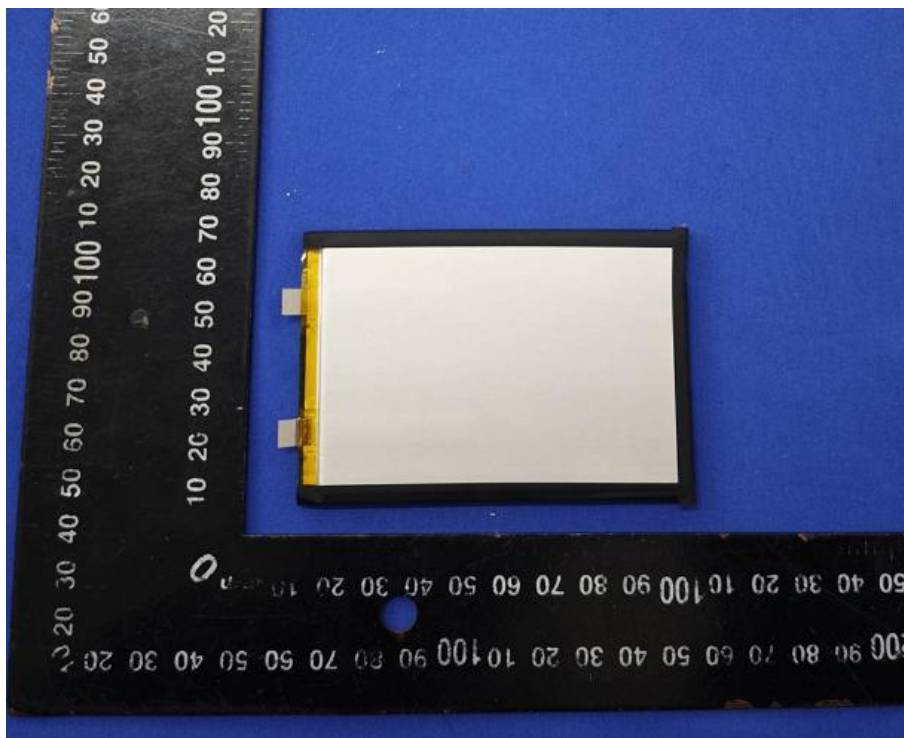


Fig.6

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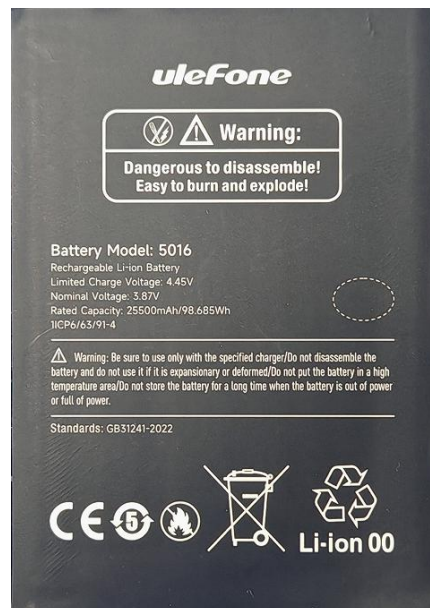


Fig.7

\*\*\*\*\*THE END OF REPORT 报告结束\*\*\*\*\*