Report No.: SZABB191125042-06

# MSDS REPORT

| | | |
|---|---|---|
| Client Name | : | Anhui Teamsky New Energy Technology Co., Ltd |
| Address | : | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province |
| Product Name | : | Li-ion Cell |
| Date | : | Mar. 04, 2020 |

**Shenzhen Anbotek Compliance Laboratory Limited**



**Shenzhen Anbotek Compliance Laboratory Limited**
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# MATERIAL SAFETY DATA SHEET

## 1. Chemical Product and Company Identification

| | |
|---|---|
| Sample name: | Li-ion Cell |
| Battery model: | TS18650C |
| Rating: | Nominal Voltage: 3.7V<br>Rated Capacity: 2200mAh, 8.14Wh<br>Weight: 44.8g |
| Manufacturer: | Anhui Teamsky New Energy Technology Co., Ltd |
| Address: | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province |
| Factory: | Anhui Teamsky New Energy Technology Co., Ltd |
| Address: | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province |
| Telephone no: | 0563-2812699 |
| Fax: | / |
| E-mail: | / |
| Date of received: | Dec. 16, 2019 |
| Date of report: | Dec. 17, 2019 |

Written by: Fannie Zhu Approved by: Davis Yang

## 2. Composition/Information on Ingredients

| Chemical Name | Percent of Content | CAS No. |
|---|---|---|
| Lithium Cobalt Dioxide ($LiCoO_2$) | 25%~35% | 12190-79-3 |
| Graphite (C) | 15%~20% | 7782-42-5 |
| Poly Vinylidene Fluoride (PVDF) | 1%~5% | 24937-79-9 |
| Acetylene Black (SP) | 0.5%~3% | 1333-86-4 |
| Aluminum(AL) | 21%~23% | 7429-90-5 |
| Copper(Cu) | 10%~11% | 7440-50-8 |
| Lithium hexafluorophosphate ($LiPF_6$) | 10%~15% | 21324-40-3 |

## 3. Hazards Summarizing

**Danger sort:** N/A

**Routes of entry:**

1. Eyes and Skin—When leaking, the electrolyte solution contained in the battery irritates to ocular tissues and the skin.
2. Inhalation—Respiratory (and eye) irritation may occur if fumes are released due heat or an abundance of leaking batteries.
3. Ingestion—The ingestion of the battery can be harmful. Content of open battery can cause serious chemical burns of mouth, esophagus and gastrointestinal tract.

**Health harm:**

Exposure to leaking electrolyte from ruptured or leaking battery can cause:

1. Inhalation—Burns and irritation of the respiratory system, coughing, wheezing, and shortness of breath.
2. Eyes—Redness, tearing, burns. The electrolyte is corrosive to all ocular tissues.
3. Skin—The electrolyte is corrosive and causes skin irritation and burns.
4. Ingestion—The electrolyte solution causes tissue damage to throat and gastrointestinal track.

**Environment harm:** Not necessary under conditions of normal use.

**Explosion danger:** The battery may be explosive at high temperature (above 150°C) or exposing to the fire.


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## 4. First Aid Measures

**Skin contact:** Not anticipated. If the battery is leaking and the contained material contacts the skin, flush with copious amounts of clear water for at least 15 minutes.
**Eye contact:** Not anticipated. If the battery is leaking and the contained material contacts eyes, flush with copious amounts of clear water for at least 15 minutes. Get medical attention at once.
**Inhalation:** Not anticipated. If the battery is leaking, remove to fresh air. If irritation persists, consult a physician.
**Ingestion:** Not anticipated. If the battery is leaking and the contained material is ingested, rinse mouth and surrounding area with clear water at once. Consult a physician immediately for treatment.

## 5. Fire Fighting Measures

**Unusual Fire and Explosion Hazards:** Battery may explode or leak potentially hazardous vapors subject to: exposed to excessive heat (above the maximum rated temperature as specified by the manufacturer) or fire, over-charged, short circuit, punctured and crushed.
**Hazardous Combustion Products:** Fire, excessive heat, or over voltage conditions may produce hazardous decomposition products. Damaged batteries can result in rapid heating and the release of flammable vapors.
**Extinguishing Media:** Dry chemical type extinguishers are the most effective means to extinguish a battery fire. A $CO_2$ extinguisher will also work effectively.
**Fire Fighting Procedures:** Use a positive pressure self-contained breathing apparatus if batteries are involved in a fire. Full protective clothing is necessary. During water application, caution is advised as burning pieces of flammable particles may be ejected from the fire.

## 6. Accidental Release Measures

The material contained within the battery would only be released under abusive conditions. In the event of battery rupture and leakage, collect all the released materials that are not hot or burning in an appropriate waste disposal container while wearing proper protective clothing and ventilate the area. Placed in approved container and disposed according to the local regulations.

## 7. Handling and Storage

**Handling:**

1. Batteries are designed to be recharged. However, improperly charging a battery may

cause the battery to flame. When charging the battery, use dedicated chargers and follow the specified conditions.

2. Never disassemble or modify a battery.
3. Do not immerse, throw, and wet a battery in water.
4. Should a battery unintentionally be crushed, thus releasing its contents, rubber gloves must be used to handle all battery components. Avoid the inhalation of any vapors that may be emitted.
5. Short circuit causes heating. In addition, short circuit reduces the life of the battery and can lead to ignition of surrounding materials. Physical contact with to short-circuited battery can cause skin burn.
6. Avoid reversing the battery polarity, which can cause the battery to be damaged or flame.
7. In the event of skin or eye exposure to the electrolyte, refer to Section 4, First Aid Measures.

**Storage:**

1. Batteries should be separated from other materials and stored in a noncombustible, well ventilated, sprinkler-protected structure with sufficient clearance between walls and battery stacks. Do not place batteries near heating equipment, nor expose to direct sunlight for long periods.
2. Do not store batteries above 35°C or below –20°C. Store batteries in a cool (about 20°C±5°C) in a long time, dry and ventilated area that is subject to little temperature change. Elevated temperatures can result in reduced battery cycle life. Battery exposure to temperatures in excess of 60°C will result in the battery venting flammable liquid and gases.
3. Keep batteries in original package until use and do not jumble them.

## 8. Exposure Controls/Personal Protection

**Engineering Controls:** Keep away from heat and open flame.
**Ventilation:** Not necessary under conditions of normal use. In case of abuse, use adequate mechanical ventilation (local exhaust) for the battery that vent gas or fumes.
**Respiratory Protection:** Not necessary under conditions of normal use. If battery is burning, leave the area immediately. During fire fighting fireman should use self-contained breathing, full-face respiratory equipment. Fires may be fought but only from safe fire fighting distance, evacuate all persons from the area of fire immediately.
**Eye Protection:** Not necessary under conditions of normal use. Use safety glasses with side shields if handling a leaking or ruptured battery.

**Body Protection:** Not necessary under conditions of normal use. Use rubber apron and protective working in case of handling a leaking of ruptured battery.
**Protective Gloves:** Not necessary under conditions of normal use. Use chemical resistant rubber gloves if handling a leaking or ruptured battery.
**Others:** Use good chemical hygiene practice. Wash hands thoroughly after cleaning-up a battery spill caused by leaking battery. No eating, drinking, or smoking in battery storage area.

## 9. Physical and Chemical Properties

| | |
|---|---|
| **State:** | Solid |
| **Odor:** | N/A |
| **pH:** | N/A |
| **Vapor pressure:** | N/A |
| **Vapor density:** | N/A |
| **Boiling point:** | N/A |
| **Solubility in water:** | Insoluble |
| **Specific gravity:** | N/A |
| **Density:** | N/A |

## 10. Stability and Reactivity

**Stability:** Stable
**Conditions to Avoid:** Do not heat, throw into fire, disassemble, short circuit, immerse in water or overcharge, etc.
**Incompatibility:** None during normal operation. Avoid exposure heat, open flame and corrosives.
**Hazardous Polymerization:** Will not occur.
**Hazardous Decomposition Products:** The battery may release irritative gas once the electrolyte leakage.

## 11. Toxicological Information

The battery does not elicit toxicological properties during routine handling and use. If the battery is opened through misuse or damage, discard immediately. Internal components of cell are irritant and sensitization.
**Irritancy:** The electrolytes contained in this battery can irritate eyes with any contact. Prolonged contact with the skin or mucous membranes may cause irritation.
**Sensitization:** No information is available.
**Teratogenicity:** No information is available.


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**Carcinogenicity:** No information is available.
**Mutagenicity:** No information is available.
**Reproductive toxicity:** No information is available.

## 12. Ecological Information

1. When properly used and disposed, the battery does not present environmental hazard.
2. The battery does not contain mercury, cadmium, or lead.
3. Do not let internal components enter marine environment. Avoid releasing to water ways, wastewater or ground water.

## 13. Disposal Considerations

1. Disposal of the battery should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.
2. The battery should be completely discharged prior to disposal and/or the terminals taped or capped to prevent short circuit. When completely discharged it is not considered hazardous.
3. The battery contains recyclable materials. Recycling options available in your local area should be considered when disposing of this product, through licensed waste Carrier.

## 14. Transport Information

According to PACKING INSTRUCTION 965 ~ 967 of IATA DGR 61st Edition for transportation, the special provision 188 of IMDG (inc Amdt 39-18). The batteries should be securely packed and protected against short-circuits. Examine whether the package of the containers are integrate and tighten closed before transport. Take in a cargo of them without falling, dropping, and breakage. Prevent collapse of cargo piles. Don't put the goods together with oxidizer and chief food chemicals. The transport vehicle and ship should be cleaned and sterilized before transport. During transport, the vehicle should prevent exposure, rain and high temperature. For stopovers, the vehicle should be away from fire and heat sources. When transported by sea, the assemble place should keep away from bedroom and kitchen, and isolated from the engine room, power and fire source. Under the condition of Road Transportation, the driver should drive in accordance with regulated route, don't stop over in the residential area and congested area.


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**(a) UN number**

3480&3481

**(b) UN Proper shipping name**

LITHIUM ION BATTERIES (including lithium ion polymer batteries) or; LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)

**(c) Transport hazard class(es)**

9

**(d) Packing Instruction (if applicable)**

965 II/ IB, 966 II, 967 II

**(e) Marine pollutant (Yes/No)**

No

**(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)**

No information available.

**(g) Special precautions**

No information available.

## 15. Regulatory Information

The transport of rechargeable lithium-ion batteries regulated by the united nations as detailed in the “model Regulations on the transport of dangerous Goods Ref. ST/SG/AC.10/1 Revision 20 2017”.

Defined by UN in the “Recommendations on the transport of Dangerous Goods Chapter 38.3 Manual of Tests and Criteria Ref. ST/SG/AC.10/11 Rev.6/Amend.1 2017”. The Lithium-ion Cells and the battery Packs may or may not be assigned to the UN No. 3480 Class-9 that is restricted for transport.

## 16. Other Information

**Prepared Department:** Anhui Teamsky New Energy Technology Co., Ltd

-- End of report --



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Report No.: SZABB191125043-01
报告编号

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

| | | |
|---|---|---|
| Client Name<br>委托单位 | : | Anhui Teamsky New Energy Technology Co., Ltd<br>安徽天时新能源科技有限公司 |
| Address<br>地址 | : | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province<br>宣城市青戈江西大道 288 号安徽天时产业园 |
| Product Name<br>产品名称 | : | Li-ion Cell<br>锂离子电芯 |
| Date<br>日期 | : | Mar. 04, 2020<br>2020 年 03 月 04 日 |

**Shenzhen Anbotek Compliance Laboratory Limited**
**深圳安博检测股份有限公司**

## 1. SAMPLE DESCRIPTION 样品描述:

| | | | |
|---|---|---|---|
| Sample Name:<br>样品名称 | Li-ion Cell<br>锂离子电芯 | Cell Mode:<br>电芯型号 | TS18650C |
| Manufacturer:<br>制造商 | Anhui Teamsky New Energy Technology Co., Ltd<br>安徽天时新能源科技有限公司 | | |
| Address of manufacturer:<br>制造商地址 | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province<br>宣城市青戈江西大道 288 号安徽天时产业园 | | |
| Factory:<br>工厂 | Anhui Teamsky New Energy Technology Co., Ltd<br>安徽天时新能源科技有限公司 | | |
| Address of factory:<br>工厂地址 | No. 288, Qingyijiang Avenue, The Science Park Of Economic and Technological Development Zone, Xuancheng City, Anhui Province<br>宣城市青戈江西大道 288 号安徽天时产业园 | | |

| | | | | | |
|---|---|---|---|---|---|
| Nominal Voltage:<br>标称电压 | 3.7V | Rated Capacity:<br>额定容量 | 2200mAh<br>8.14Wh | Trademark:<br>商标 | / |
| Charge Current:<br>充电电流 | 1100mA | Maximum Continuous Charge Current:<br>最大连续充电电流 | 2200mA | End Charge Current:<br>充电截止电流 | 44mA |
| Cut-off Voltage:<br>终止电压 | 3V | Maximum Discharge Current:<br>最大放电电流: | 2200mA | Limited Charge Voltage:<br>充电限制电压 | 4.2V |

| | |
|---|---|
| Date of Sample Received:<br>样品接收日期 | Nov. 25, 2019<br>2019 年 11 月 25 日 |
| Date of Test:<br>检测日期 | Nov. 25, 2019 to Dec. 17, 2019<br>2019 年 11 月 25 日 至 2019 年 12 月 17 日 |

Tested by: 检测 Checked by: 审核 Approved by: 批准



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## 2.REFERENCE METHOD 参考方法

United Nations Recommendations On The Transport Of Dangerous Goods, Manual Of Tests And Criteria (ST/SG/AC.10/11/Rev.6/Amend.1)
《联合国关于危险货物运输的建议书—试验和标准手册》 (ST/SG/AC.10/11/Rev.6/Amend.1)

## 3. EQUIPMENT LIST 设备清单

| Name of equipment /Model<br>设备名称/型号 | Serial No.<br>编号 | Due Date<br>校准有效期 |
|---|---|---|
| Low Pressure Test Machine<br>模拟高空低压试验箱<br>BE-DY-125 | SE-132 | 2020-04-02 |
| High Fast Temperature&Humidity Chamber<br>快速温变箱<br>ZJ-KSWB1506 | SE-1488 | 2020-07-30 |
| Vibration Machine<br>振动台<br>EV103V | SE-439 | 2020-04-07 |
| Shock Machine<br>机械冲击台<br>HSKT-10 | SE-440 | 2020-04-07 |
| Thermostat Short-circuit Testing Machine<br>温控型短路试验机<br>BE-1000W | SE-133 | 2020-04-02 |
| Impact Testing Machine<br>撞击试验机<br>BE-5060 | SE-136 | 2020-07-31 |
| Battery Charge And Discharge System<br>电池充放电系统<br>CT-3008-25V10A-NA | SE-172 | 2020-04-02 |
| TRUE RMS multimeter<br>台式万用表<br>MS8040 | SE-511 | 2020-04-02 |
| Electronic Weight Meter<br>电子天平<br>DTT-A+200 | SE-534 | 2020-04-02 |
| Temperature rise recorder<br>温升记录仪<br>34970A | SE-004 | 2020-04-02 |


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## 4. Environmental Conditions of the test 环境条件

Temperature: (20±5) °C 温度

R.H.: (40~70) %RH 相对湿度

## 5. TEST ITEM AND CONCLUSION 测试项目及结论

| ITEM 测试项目 | SAMPLE NUMBER 样品编号 | STANDARD 执行标准 | CONCLUSION 结论 |
|---|---|---|---|
| Altitude simulation 高度模拟 | C1~C5, C6~C10 | ST/SG/AC.10/11/Rev. 6/Amend.1 | PASS 通过 |
| Thermal test 热测试 | | | PASS 通过 |
| Vibration 振动 | | | PASS 通过 |
| Shock 冲击 | | | PASS 通过 |
| External short circuit 外部短路 | | | PASS 通过 |
| Impact 撞击 | C11~C15, C16~C20 | | PASS 通过 |
| Overcharge 过度充电 | N.A. | | N.A. |
| Forced discharge 强制放电 | C21~C30, C31~C40 | | PASS 通过 |

Notes 说明：

C1~C5: Cells at first cycle in fully charged states;
为第 1 个充放电周期完全充电状态的电芯；

C6~C10: Cells after 25 cycles ending in fully charged states;
为第 25 个充放电周期后完全充电状态的电芯；

C11~C15: Cells at first cycle at 50% of the design rated capacity;
为第 1 个充放电周期 50%设计额定容量状态的电芯；

C16~C20: Cells at 25 cycle at 50% of the design rated capacity;
为第 25 个充放电周期 50%设计额定容量状态的电芯；

C21~C30: Cells at first cycle in fully discharged states;
为第 1 个充放电周期完全放电状态的电芯；

C31~C40: Cells after 25 cycles ending in fully discharged states;
为第 25 个充放电周期后完全放电状态的电芯；



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## 6. TEST METHOD 测试方法

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

Mass loss(%) = (M1-M2) / M1×100

Where M1 is the mass before the test and M2 is the mass after the test. When mass loss does not exceed the values in Table blow, it shall be considered as “no mass loss”.
小型电芯或电池必须按顺序进行试验 T.1 至 T.5。试验 T.6 和 T.8 应使用未另外试验过的电芯或电池。试验 T.7 可以使用原先在试验 T.1 至 T.5 中使用过的未损坏电池进行，以便测试交替充电放电过的电池。

质量损失依照下式计算：

质量损失(%)= $(M_1-M_2)/M_1$ *100

式中 M1 是实验前的质量，M2 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 loss limit<br>质量损失限值 |
|---|---|
| M＜1 克(g) | 0.5% |
| 1g≤M≤75 克(g) | 0.2% |
| M＞75 克(g) | 0.1% |

T.1 Altitude simulation
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).
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.
T.1 高度模拟

试验电芯和电池应在压力等于或低于 11.6 千帕和环境温度为(20°C±5°C) 下存放至少 6 小时。

要求电芯和电池无渗漏、无排气、无解体、无破裂、无起火，并且每个试验电芯或电池在试验后的开路电压不小于其在进行这一实验前电压的 90%。有关电压的要求不适用于完全放电状态的试验电芯和电池。

T.2 Thermal test
Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambie nt temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.
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.


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T.2 热测试

试验电芯和电池应先在试验温度等于 72°C±2°C 的条件下存放至少 6 小时，接着再在试验温度等于-40°C±2°C 的条件下存放至少 6 小时。两个极端试验温度之间的最大时间间隔为 30 分钟。此程序重复进行，完成 10 次，接着将所有试验电芯和电池在环境温度（20°C±5°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。

要求电芯和电池无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电芯或电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压的要求不适用于完全放电状态的试验电芯和电池。

T.3 Vibration

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.
The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).
For cells and small batteries: from 7 Hz a peak acceleration of 1 gn 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 gn occurs (approximately 50 Hz).A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.
For large batteries: from 7 Hz to a peak acceleration of 1 gn 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 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.
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.

T.3 振动

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 7Hz 和 200Hz 之间，在回到 7Hz，跨度为 15 分钟。这一振动过程须对三个相互垂直的电芯安装方位的每一方向重复进行 12 次，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 千克的电芯和电池（电芯和小型电池），和对 12 千克及更大的电池有所不同。

对电芯和小型电池：从 7Hz 开始，保持 1g 的最大加速度，直到频率达到 18Hz。然后将振幅保持在 0.8mm（总位移 1.6mm），并增加频率直到最大加速度达到 8g（频率约为 50Hz）。将最大加速度保持在 8g 直到频率增加到 200Hz。

对大型电池：从 7 赫兹开始保持 1gn 的峰值加速度直到频率达到 18 赫兹。然后将振幅保持在 0.8 毫米（总行程 1.6 毫米）并增加频率直到最大加速度达到 2gn（频率约为 25 赫兹）。将峰值加速度保持在 2gn 直到频率增加到 200 赫兹。

要求电芯和电池无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电芯或电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压的要求不适用于完全放电状态的试验电芯和电池。


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T.4 Shock

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 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn 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 电池** | **Minimum peak acceleration 最小峰值加速度** | **Pulse duration 脉冲持续时间** |
|---|---|---|
| Small batteries 小型电池 | 150 $g_n$ or result of formula $\text{Acceleration(gn)}=\sqrt{\left(\frac{100850}{\text{mass}^*}\right)}$ whichever is smaller | 6 ms |
| Large batteries 大型电池 | 50 $g_n$ or result of formula $\text{Acceleration(gn)}=\sqrt{\left(\frac{30000}{\text{mass}^*}\right)}$ whichever is smaller | 11 ms |

* Mass is expressed in kilograms.

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.

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.

T.4 冲击

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。

每个电芯须经受最大加速度 150g 和脉冲持续时间 6 毫秒的半正弦波冲击。另外，大型电芯或许须经受最大加速度 50g 和脉冲持续时间 11 毫秒的半正弦波冲击。

电池须经受半正弦波冲击的峰值加速度取决于电池组的质量。对小型电池的脉冲持续时间为 6 毫秒，对大型电池的脉冲持续时间为 11ms.下面的公式用于计算相应的最小峰值加速度。

每个电芯或电池须在三个相互垂直的安装方位的正方向经受三次冲击，接着再反方向经受三次冲击，总共经受 18 次冲击。

要求电芯和电池无渗漏、无排气、无解体、无破裂和无起火，并且每个试验电芯或电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压的要求不适用于完全放电状态的试验电芯和电池。

T.5 External short circuit

The cell or battery to be tested shall be shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57±4°C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57±4°C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.


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This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57±4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.
The short circuit and cooling down phases shall be conducted at least at ambient temperature.
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 during the test and within six hours after the test.
T.5 外部短路

在一定的时间内加热电芯或电池使其外壳达到 57±4°C 均匀稳定的温度，温升时间取决于电芯或电池的尺寸和外观，并且被评估和记录。如果这种评估记录不可行，那么小型电芯或电池的暴露时间应至少持续 6 小时，大型电芯或电池应至少持续 12 小时。然后使电芯或电池在 57°C±4°C 下经受总外电阻小于 0.1 欧姆的短路条件。

这一短路条件应在电芯或电池外壳温度回到 57°C±4°C 后持续至少 1 小时，或者大电池的温度下降至最大温升值的一半并保持低于此温度值。

短路和冷却期间应至少在环境温度下进行。

要求电芯和电池外壳温度不超过 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。

T.6 Impact / Crush
Impact (applicable to cylindrical cells greater 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.
Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells not more 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 kN ± 0.78 kN;
(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.
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.
T.6 撞击/挤压

撞击（适用于直径不小于 18 毫米的圆柱形电芯）

试样电芯或组成电芯放在平坦光滑的表面上，一根 316 型不锈钢棒横放在试样中心，钢棒直径 15.8 毫米±0.1 毫米，长度至少 6 厘米，或电芯最长端的尺度，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水平支撑表面呈 90 度落下。


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接受撞击的试样，纵轴应与平坦表面平行并与横放在试样中心的直径 15.8±0.1 毫米弯曲表面的纵轴垂直。每一试样只经受一次撞击。

挤压（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）

将电芯或组成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 厘米每秒。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 13KN±0.78KN；

（b） 电芯的电压下降至少 100mV；

（c） 电芯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 100mV 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。

每个试样电芯或组成电芯只做一次挤压试验。试样应继续观察 6 小时。试验应使用之间未做过其他试验的电芯或组成电芯进行。

要求电芯或组成电芯外壳温度不超过 170℃， 并且在试验过程中及试验后 6 小时内无解体，无起火。

T.7 Overcharge

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.

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

T.7 过度充电

充电电流必须是制造商建议的最大持续充电电流的两倍。试验的最小电压如下：

（a）制造商建议的充电电压不大于 18V 时，试验的最小电压应是电池最大充电电压的两倍或 22V 两者中的较小者；

（b）制造商建议的充电电压大于 18V 时，试验的最小电压应为最大充电电压的 1.2 倍。

试验应在环境温度下进行，进行试验的时间应为 24 小时。

要求充电电池在试验过程中和试验后 7 天内无解体，无起火。

T.8 Forced discharge

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).

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.

T.8 强制放电

每个电芯应在环境温度下与 12V 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，放电时间应等于其额定容量除以初始试验电流。

要求原电芯或充电电芯在试验过程中和试验后 7 天内无解体，无起火。


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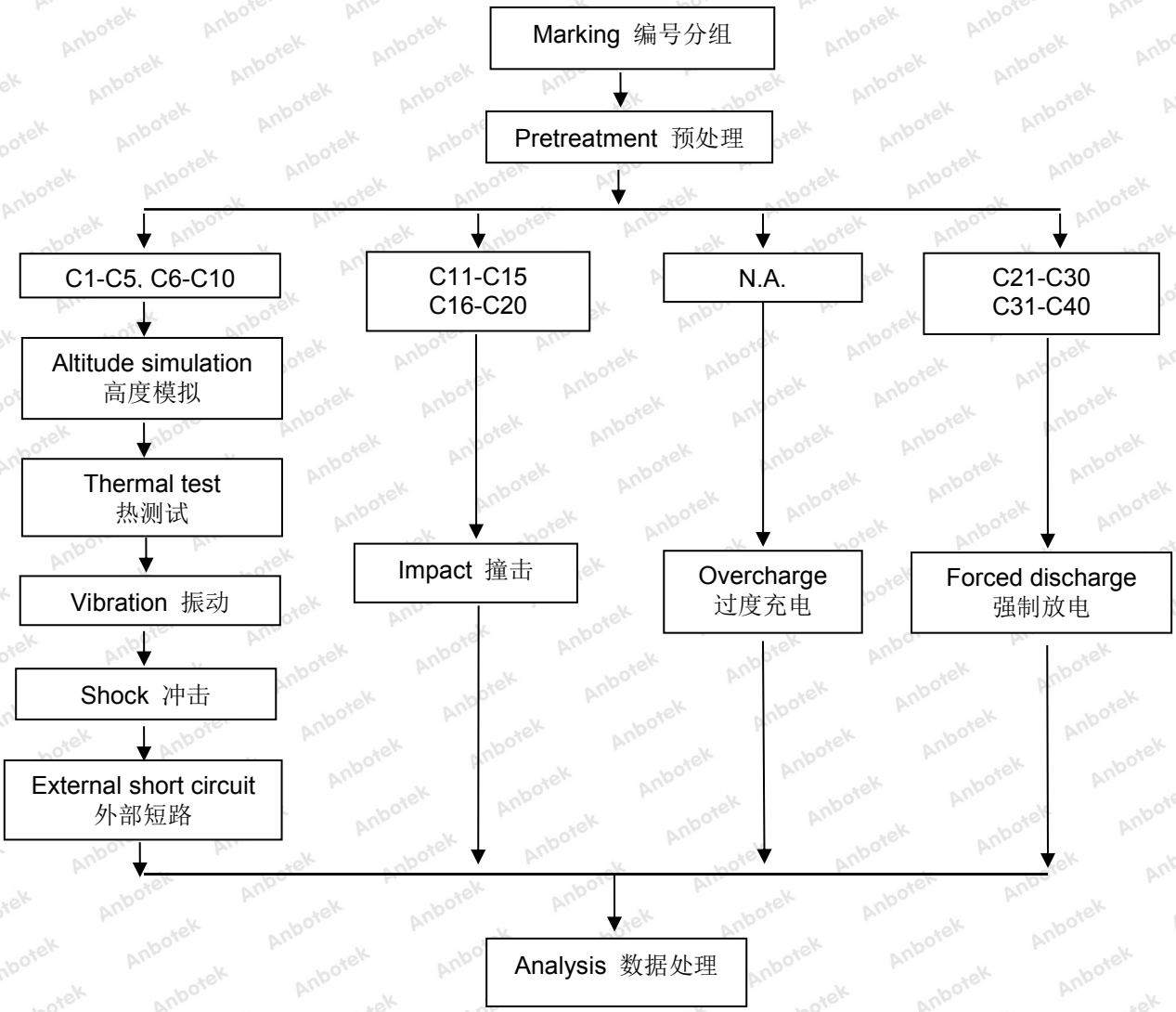
## 7. TEST PROCEDURE 测试程序





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## 8. DATA 测试数据

T.1 Altitude simulation 高度模拟

| No. 电池编号 | Pre-test 测试前 | | After test 测试后 | | Mass loss 质量亏损 (%) | Voltage loss 电压亏损 (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) 有无渗漏，排气，解体，破裂和起火（是/否） |
|---|---|---|---|---|---|---|---|
| | Mass 质量 克(g) | Voltage 电压 伏(V) | Mass 质量 克(g) | Voltage 电压 伏(V) | | | |
| C1 | 44.289 | 4.173 | 44.289 | 4.171 | 0.00 | 0.05 | N |
| C2 | 44.412 | 4.176 | 44.408 | 4.174 | 0.01 | 0.05 | N |
| C3 | 44.250 | 4.176 | 44.250 | 4.173 | 0.00 | 0.07 | N |
| C4 | 44.133 | 4.175 | 44.133 | 4.173 | 0.00 | 0.05 | N |
| C5 | 44.678 | 4.169 | 44.678 | 4.168 | 0.00 | 0.02 | N |
| C6 | 44.526 | 4.171 | 44.526 | 4.169 | 0.00 | 0.05 | N |
| C7 | 44.418 | 4.175 | 44.414 | 4.172 | 0.01 | 0.07 | N |
| C8 | 44.459 | 4.172 | 44.459 | 4.170 | 0.00 | 0.05 | N |
| C9 | 44.658 | 4.174 | 44.658 | 4.171 | 0.00 | 0.07 | N |
| C10 | 44.610 | 4.170 | 44.610 | 4.168 | 0.00 | 0.05 | N |

T.2 Thermal test 热测试

| No. 电池编号 | Pre-test 测试前 | | After test 测试后 | | Mass loss 质量亏损 (%) | Voltage Loss 电压亏损 (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) 有无渗漏，排气，解体，破裂和起火（是/否） |
|---|---|---|---|---|---|---|---|
| | Mass 质量 克(g) | Voltage 电压 伏(V) | Mass 质量 克(g) | Voltage 电压 伏(V) | | | |
| C1 | 44.289 | 4.171 | 44.275 | 4.146 | 0.03 | 0.60 | N |
| C2 | 44.408 | 4.174 | 44.391 | 4.152 | 0.04 | 0.53 | N |
| C3 | 44.250 | 4.173 | 44.238 | 4.150 | 0.03 | 0.55 | N |
| C4 | 44.133 | 4.173 | 44.118 | 4.153 | 0.03 | 0.48 | N |
| C5 | 44.678 | 4.168 | 44.662 | 4.145 | 0.04 | 0.55 | N |
| C6 | 44.526 | 4.169 | 44.512 | 4.148 | 0.03 | 0.50 | N |
| C7 | 44.414 | 4.172 | 44.399 | 4.150 | 0.03 | 0.53 | N |
| C8 | 44.459 | 4.170 | 44.440 | 4.147 | 0.04 | 0.55 | N |
| C9 | 44.658 | 4.171 | 44.637 | 4.146 | 0.05 | 0.60 | N |
| C10 | 44.610 | 4.168 | 44.593 | 4.144 | 0.04 | 0.58 | N |



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T.3 Vibration 振动

| No. 电池编号 | Pre-test 测试前 | | After test 测试后 | | Mass loss 质量亏损 (%) | Voltage Loss 电压亏损 (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) 有无渗漏，排气，解体，破裂和起火（是/否） |
|---|---|---|---|---|---|---|---|
| | Mass 质量 克(g) | Voltage 电压 伏(V) | Mass 质量 克(g) | Voltage 电压 伏(V) | | | |
| C1 | 44.275 | 4.146 | 44.275 | 4.146 | 0.00 | 0.00 | N |
| C2 | 44.391 | 4.152 | 44.391 | 4.151 | 0.00 | 0.02 | N |
| C3 | 44.238 | 4.150 | 44.235 | 4.150 | 0.01 | 0.00 | N |
| C4 | 44.118 | 4.153 | 44.118 | 4.152 | 0.00 | 0.02 | N |
| C5 | 44.662 | 4.145 | 44.662 | 4.145 | 0.00 | 0.00 | N |
| C6 | 44.512 | 4.148 | 44.512 | 4.148 | 0.00 | 0.00 | N |
| C7 | 44.399 | 4.150 | 44.396 | 4.149 | 0.01 | 0.02 | N |
| C8 | 44.440 | 4.147 | 44.440 | 4.147 | 0.00 | 0.00 | N |
| C9 | 44.637 | 4.146 | 44.637 | 4.146 | 0.00 | 0.00 | N |
| C10 | 44.593 | 4.144 | 44.593 | 4.144 | 0.00 | 0.00 | N |

T.4 Shock 冲击

Peak acceleration: 150 gn, Pulse duration: 6 ms
峰值加速度：150 gn， 脉冲时间：6 ms

| No. 编号 | Pre-test 测试前 | | After test 测试后 | | Mass loss 质量亏损 (%) | Voltage Loss 电压亏损 (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) 有无渗漏，排气，解体，破裂和起火（是/否） |
|---|---|---|---|---|---|---|---|
| | Mass 质量 克(g) | Voltage 电压 伏(V) | Mass 质量 克(g) | Voltage 电压 伏(V) | | | |
| C1 | 44.275 | 4.146 | 44.275 | 4.146 | 0.00 | 0.00 | N |
| C2 | 44.391 | 4.151 | 44.391 | 4.150 | 0.00 | 0.02 | N |
| C3 | 44.235 | 4.150 | 44.235 | 4.150 | 0.00 | 0.00 | N |
| C4 | 44.118 | 4.152 | 44.118 | 4.152 | 0.00 | 0.00 | N |
| C5 | 44.662 | 4.145 | 44.658 | 4.145 | 0.01 | 0.00 | N |
| C6 | 44.512 | 4.148 | 44.512 | 4.148 | 0.00 | 0.00 | N |
| C7 | 44.396 | 4.149 | 44.396 | 4.148 | 0.00 | 0.02 | N |
| C8 | 44.440 | 4.147 | 44.440 | 4.147 | 0.00 | 0.00 | N |
| C9 | 44.637 | 4.146 | 44.634 | 4.146 | 0.01 | 0.00 | N |
| C10 | 44.593 | 4.144 | 44.593 | 4.144 | 0.00 | 0.00 | N |


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T.5 External short circuit 外部短路

| No. 编号 | Peak temperature (°C)<br>最高温度 | Whether disassembly, rupture, fire (Y/N)<br>有无解体，破裂，起火（是/否） |
|---|---|---|
| C1 | 74.0 | N |
| C2 | 78.5 | N |
| C3 | 69.4 | N |
| C4 | 73.8 | N |
| C5 | 72.4 | N |
| C6 | 70.9 | N |
| C7 | 67.6 | N |
| C8 | 72.3 | N |
| C9 | 77.8 | N |
| C10 | 74.2 | N |

T.6 Impact 撞击

| No. 编号 | Peak temperature (°C)<br>最高温度 | Whether disassembly, fire (Y/N)<br>有无解体，起火（是/否） |
|---|---|---|
| C11 | 93.5 | N |
| C12 | 90.8 | N |
| C13 | 84.1 | N |
| C14 | 88.9 | N |
| C15 | 92.4 | N |
| C16 | 90.7 | N |
| C17 | 90.2 | N |
| C18 | 86.4 | N |
| C19 | 89.1 | N |
| C20 | 92.6 | N |

T.7 Overcharge 过度充电

| No. 编号 | Whether disassembly, fire (Y/N)<br>有无解体，起火（是/否） |
|---|---|
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |
| N.A. | N.A. |


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T.8 Forced discharge 强制放电

| No. 编号 | Whether disassembly, fire (Y/N)<br>有无解体，起火（是/否） |
|---|---|
| C21 | N |
| C22 | N |
| C23 | N |
| C24 | N |
| C25 | N |
| C26 | N |
| C27 | N |
| C28 | N |
| C29 | N |
| C30 | N |
| C31 | N |
| C32 | N |
| C33 | N |
| C34 | N |
| C35 | N |
| C36 | N |
| C37 | N |
| C38 | N |
| C39 | N |
| C40 | N |



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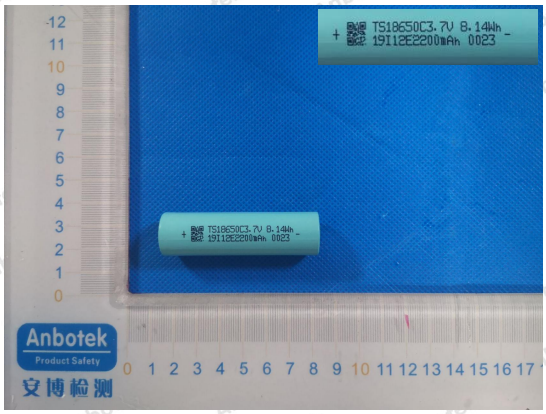
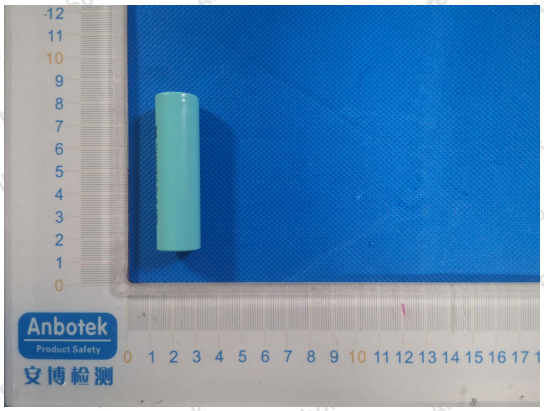
## 9. PHOTOS OF THE SAMPLE 样品照片

Cell 电芯





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# DECLARATION

# 声明

1. United Nations Recommendations On The Transport Of Dangerous Goods, Manual Of Tests And Criteria (ST/SG/AC.10/11/Rev.6/Amend.1).
   《联合国关于危险货物运输的建议书—试验和标准手册》(ST/SG/AC.10/11/Rev.6/Amend.1)。
2. Test place Lab: Shenzhen Anbotek Compliance Laboratory Limited
   Address:East of 4/F., Building A, Hourui No.3 Industrial Zone, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
   测试实验室：深圳安博检测股份有限公司
   地址：广东省深圳市宝安区西乡街道后瑞第三工业区A栋四楼东
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-- End of report --

-- 报告结束 --


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