



报告编号/Report Reference No.:  
SNB171213001001B

# UN38.3 检测报告

## UN38.3 Test Report

|                   |                                                  |
|-------------------|--------------------------------------------------|
| 产品名称:             | 圆柱锂离子电芯 INR18650K 2200mAh                        |
| Name of Products: | Cylindrical Lithium Ion Cell INR18650K 2200mAh   |
| 委托单位:             | 深圳市东恒新能源科技有限公司                                   |
| Client:           | Shenzhen Dongheng New Energy Technology Co., LTD |
| 制造商:              | 深圳市东恒新能源科技有限公司                                   |
| Manufacturer:     | Shenzhen Dongheng New Energy Technology Co., LTD |
| 签发日期:             | 2018-01-02                                       |
| Date of issue:    |                                                  |

深圳市北测检测技术有限公司  
Shenzhen NTEK Testing Technology Co., Ltd.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manufacturer<br>制造商                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Shenzhen Dongheng New Energy Technology Co., LTD<br>深圳市东恒新能源科技有限公司                                                                                                     |
| Address of manufacturer<br>制造商地址                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Zhuqing Road No.1, Caopu Village, Shijing Community, Pingshan Office, Pingshan New District, Shenzhen City, Guangdong Province, China<br>广东省深圳市坪山新区坪山办事处石井社区草埔村竹青路 1 号 |
| Factory<br>工厂                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Shenzhen Dongheng New Energy Technology Co., LTD<br>深圳市东恒新能源科技有限公司                                                                                                     |
| Address of factory<br>工厂地址                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Zhuqing Road No.1, Caopu Village, Shijing Community, Pingshan Office, Pingshan New District, Shenzhen City, Guangdong Province, China<br>广东省深圳市坪山新区坪山办事处石井社区草埔村竹青路 1 号 |
| Name of Products<br>产品名称                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Cylindrical Lithium Ion Cell<br>圆柱锂离子电池                                                                                                                                |
| Model/type reference<br>型号                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | INR18650K 2200mAh                                                                                                                                                      |
| Trade Mark<br>商标                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -                                                                                                                                                                      |
| <p>Tested according to 测试依据:</p> <p>Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Test and Criteria, PART III, section 38.3 Lithium metal and lithium ion batteries, the sixth revised edition (ST/SG/AC.10/11/Rev.6).</p> <p>联合国《关于危险货物运输的建议书, 试验和标准手册》, 第三部分, 38.3 节锂金属和锂离子电池要求, 第六修订版 (ST/SG/AC.10/11/Rev.6)</p>                                                                                                                                                                                                         |                                                                                                                                                                        |
| <p>Tests performed 测试项目:</p> <p>Test T.1: Altitude simulation 试验 T.1: 高度模拟      Test T.5: External short circuit 试验 T.5: 外部短路</p> <p>Test T.2: Thermal Test 试验 T.2: 温度试验      Test T.6: Impact 试验 T.6: 撞击</p> <p>Test T.3: Vibration 试验 T.3: 振动      Test T.8: Forced discharge 试验 T.8: 强制放电</p> <p>Test T.4: Shock 试验 T.4: 冲击</p>                                                                                                                                                                                                           |                                                                                                                                                                        |
| <p>Test Conclusion 试验结论:</p> <p>The Cylindrical Lithium Ion Cell submitted by Shenzhen Dongheng New Energy Technology Co., LTD is tested according to the <i>Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Test and Criteria, PART III, section 38.3 Lithium metal and lithium ion batteries, the sixth revised edition (ST/SG/AC.10/11/Rev.6).</i></p> <p>Test results: PASS</p> <p>由深圳市东恒新能源科技有限公司提交的圆柱锂离子电池按照联合国《关于危险货物运输的建议书, 试验和标准手册》, 第三部分, 38.3 节锂金属和锂离子电池要求, 第六修订版 (ST/SG/AC.10/11/Rev.6) 进行测试。</p> <p>测试结果: 合格</p> |                                                                                                                                                                        |
| Tested by:<br>主检人:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Reviewed by:<br>审核人:                                                                                                                                                   |
| Approved by:<br>批准人:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Seal of NTEK<br>报告单位 (盖章)                                                                                                                                              |

| General product information 通用产品信息:                |                                 |                                                |                                    |
|----------------------------------------------------|---------------------------------|------------------------------------------------|------------------------------------|
| Nominal Voltage<br>标称电压                            | 3.7V                            | Rated Capacity<br>额定容量                         | 2200mAh (8.14Wh)                   |
| Standard Charging<br>Current<br>标准充电电流             | 1100mA                          | Max. Continuous<br>Charging Current<br>最大充电电流  | 4400mA                             |
| Limited Charging<br>Voltage<br>充电限制电压              | 4.2V                            | Cut-Off Voltage<br>放电截止电压                      | 2.75V                              |
| Standard Continuous<br>Discharge Current<br>标准放电电流 | 1100mA                          | Max. Continuous<br>Discharge Current<br>最大放电电流 | 4400mA                             |
| Appearance<br>外观                                   | Pink and Cylindrical<br>圆柱形、粉红色 | Classification<br>类别                           | Small Lithium ion Cells<br>小型锂离子电芯 |
| Size (D×H)<br>尺寸                                   | 18.4×65.0mm                     |                                                |                                    |

|                                         |            |                         |            |
|-----------------------------------------|------------|-------------------------|------------|
| Date of receipt of test<br>item<br>接收日期 | 2016-07-13 | Completion Date<br>完成日期 | 2017-03-03 |
|-----------------------------------------|------------|-------------------------|------------|

## Remarks 备注说明:

Cells of A1#-A10# are fully charged at first cycle;

Cells of A11#-A15# at 50% of the design rated capacity at first cycle;

Cells of A16#-A25# are fully discharged at first cycle;

Cells of A26#-A35# are fully discharged after 50 cycles;

Test environment condition: Room temperature: 15-25°C, Room humidity: 40-70%

Note: All test data of this report are based on the original test report NTEK-2017DC0218007S, dated by 2017-03-03.

电芯 A1#-A10#为首次循环满电状态;

电芯 A11#-A15#为首次循环 50%充电状态;

电芯 A16#-A25#为首次循环完全放电状态;

电芯 A26#-A35#为 50 个循环后完全放电状态;

试验环境条件: 环境温度: 15-25°C, 环境湿度: 40-70%

注: 本报告中的所有测试数据基于原始报告 NTEK-2017DC0218007S, 出版日期为 2017-03-03。

## Summaries of testing 测试摘要:

Each cell type is subjected to tests T.1 to T.8. Tests T.1 to T.5 are conducted in sequence on the same cells. Tests 6 and 8 are conducted using not otherwise tested cells.

每一种类型的电芯均应进行T.1至T.8项试验。电芯必须按顺序在相同的一组电芯上进行试验T.1至T.5。试验T.6和T.8应使用未另外试验过的电芯。

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

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

为了量化质量损失，可用以下公式计算：

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

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 below, it is considered as "no mass loss".

式中： $M_1$ 是试验前的质量， $M_2$ 是试验后的质量。如果质量损失不超过下表所列的数值，应视为“无质量损失”。

| Mass M of cell or battery<br>电芯或电池的质量 | Mass loss limit<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%                      |

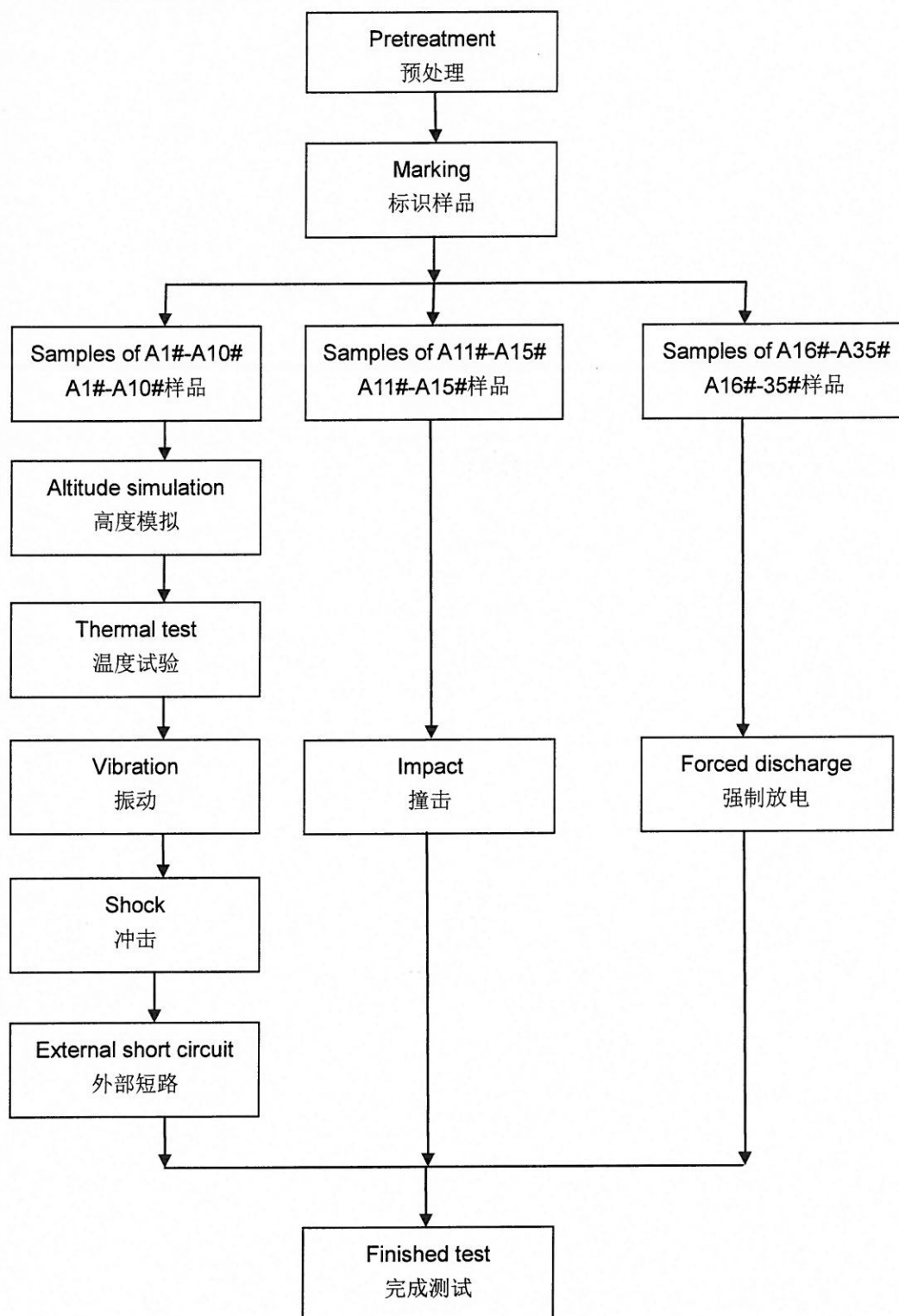
In tests T.1 to T.4, cells meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell after testing is not less than 90% of its voltage immediately prior to this procedure.

在T.1至T.4的试验中，电芯须满足无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯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%。

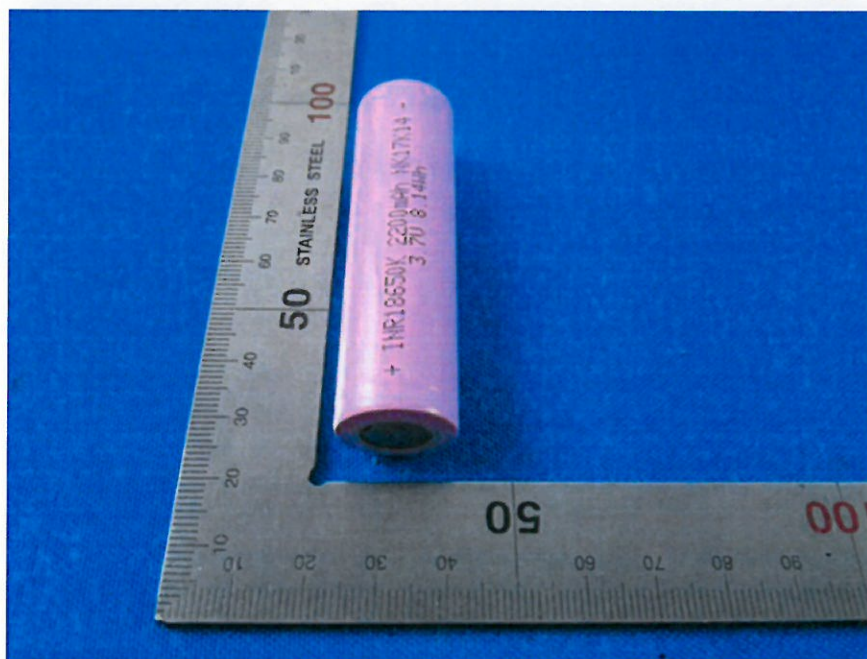
#### Test equipments 检测设备:

N170 Battery test system 电池检测系统  
 N171 Electronic balance 电子天平  
 N172 Low pressure chamber 低气压试验箱  
 BAT-0017 Programmable Temperature & Humidity Controller 可编程恒温恒湿箱  
 N173 Vibration test system 振动测试系统  
 N174 Hydraulic Hoist Vertical Shock System 液压垂直冲击系统  
 N175 Short circuit tester 短路测试机  
 N177 Explosion-proof chamber 防爆箱  
 N178 DC Source 直流电源  
 N180 Digital multimeter 数字式万用表  
 N185 uR1000 recorder uR1000 记录仪  
 N176 Battery Impact tester 电池撞击试验机

## Test Procedure 测试程序



Photos of sample 样品照片



## Test results 测试结果:

### Test T.1: Altitude simulation 试验T.1: 高度模拟

#### Test method 测试方法

Cells are stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ( $20 \pm 5^\circ\text{C}$ ).

试验电芯被放置在压力等于或低于11.6 kPa和环境温度( $20 \pm 5^\circ\text{C}$ )下存放至少6小时。

#### Requirement 要求

Cells 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 after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验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%。

#### Test Data showed in table below 测试数据见下表

| State of samples<br>样品状态                 | No.<br>编号 | Prior to test 试验前 |                   | After test 试验后 |                   | Mass loss<br>质量损失 (%) | Voltage after test/ voltage prior to test (%)<br>试验后电压/ 试验前电压 | Results<br>结果 |
|------------------------------------------|-----------|-------------------|-------------------|----------------|-------------------|-----------------------|---------------------------------------------------------------|---------------|
|                                          |           | Mass<br>质量 (g)    | Voltage<br>电压 (V) | Mass<br>质量 (g) | Voltage<br>电压 (V) |                       |                                                               |               |
| Fully charged at first cycle<br>首次循环满电状态 | A1#       | 43.548            | 4.17              | 43.548         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A2#       | 43.687            | 4.17              | 43.687         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A3#       | 43.735            | 4.17              | 43.735         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A4#       | 43.454            | 4.17              | 43.454         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A5#       | 43.862            | 4.17              | 43.862         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A6#       | 43.097            | 4.17              | 43.097         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A7#       | 43.517            | 4.17              | 43.517         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A8#       | 43.687            | 4.17              | 43.687         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A9#       | 43.744            | 4.17              | 43.744         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A10#      | 43.636            | 4.17              | 43.548         | 4.17              | 0.00                  | 100.0                                                         | PASS<br>合格    |

#### Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电芯未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 20.3°C

## Test T.2: Thermal test 试验T.2: 温度试验

### Test method 测试方法

Cells are to be stored for at least six hours at a test temperature equal to  $72 \pm 2^\circ\text{C}$ , followed by storage for at least six hours at a test temperature equal to  $-40 \pm 2^\circ\text{C}$ . The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test cells are to be stored for 24 hours at ambient temperature ( $20 \pm 5^\circ\text{C}$ ).

电芯放置在试验温度等于 $72 \pm 2^\circ\text{C}$ 的条件下存放至少6小时, 接着再在试验温度等于 $-40 \pm 2^\circ\text{C}$ 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, 共完成10次, 接着将所有试验电芯在环境温度( $20 \pm 5^\circ\text{C}$ )下存放24小时。

### Requirement 要求

Cells 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 after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯须无渗漏、无泄气、无解体、无破裂和无起火, 并且每个试验电芯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%。

Test Data showed in table below 测试数据见下表

| State of samples<br>样品状态                 | No.<br>编号 | Prior to test 试验前 |                   | After test 试验后 |                   | Mass loss<br>质量损失 (%) | Voltage after test/<br>voltage prior to test (%)<br>试验后电压/<br>试验前电压 | Results<br>结果 |
|------------------------------------------|-----------|-------------------|-------------------|----------------|-------------------|-----------------------|---------------------------------------------------------------------|---------------|
|                                          |           | Mass<br>质量 (g)    | Voltage<br>电压 (V) | Mass<br>质量 (g) | Voltage<br>电压 (V) |                       |                                                                     |               |
| Fully charged at first cycle<br>首次循环满电状态 | A1#       | 43.548            | 4.17              | 43.526         | 4.14              | 0.051                 | 99.28                                                               | PASS<br>合格    |
|                                          | A2#       | 43.687            | 4.17              | 43.659         | 4.14              | 0.064                 | 99.28                                                               | PASS<br>合格    |
|                                          | A3#       | 43.735            | 4.17              | 43.720         | 4.13              | 0.034                 | 99.04                                                               | PASS<br>合格    |
|                                          | A4#       | 43.454            | 4.17              | 43.432         | 4.14              | 0.051                 | 99.28                                                               | PASS<br>合格    |
|                                          | A5#       | 43.862            | 4.17              | 43.843         | 4.13              | 0.043                 | 99.04                                                               | PASS<br>合格    |
|                                          | A6#       | 43.097            | 4.17              | 43.069         | 4.14              | 0.065                 | 99.28                                                               | PASS<br>合格    |
|                                          | A7#       | 43.517            | 4.17              | 43.503         | 4.14              | 0.032                 | 99.28                                                               | PASS<br>合格    |
|                                          | A8#       | 43.687            | 4.17              | 43.668         | 4.14              | 0.044                 | 99.28                                                               | PASS<br>合格    |

|  |      |        |      |        |      |       |       |            |
|--|------|--------|------|--------|------|-------|-------|------------|
|  | A9#  | 43.744 | 4.17 | 43.725 | 4.13 | 0.043 | 99.04 | PASS<br>合格 |
|  | A10# | 43.636 | 4.17 | 43.618 | 4.14 | 0.041 | 99.28 | PASS<br>合格 |

#### Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电芯未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 21.5°C

### Test T.3: Vibration 试验T.3: 振动

#### Test method 测试方法

Cells 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 is a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle is 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 is as follows: 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.

电芯紧固于振动台面, 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 Hz和200 Hz之间, 再回到7 Hz, 1次循环时间为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方向重复进行12次, 总共为时3小时。其中一个振动方向必须与端面垂直。

对数扫频方式: 从7 Hz开始, 保持1  $g_n$ 的最大加速度, 直到频率达到18 Hz。然后将振幅保持在0.8mm (总位移1.6mm), 并增加频率直到峰值加速度达到8  $g_n$  (频率约为50 Hz)。将峰值加速度保持在8  $g_n$ 直到频率增加到200 Hz。

#### Requirement 要求

Cells 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 after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯须无渗漏、无泄气、无解体、无破裂和无起火, 并且每个试验电芯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%。

Test Data showed in table below 测试数据见下表

| State of samples<br>样品状态 | No.<br>编号 | Prior to test 试验前 |                   | After test 试验后 |                   | Mass loss<br>质量损失 (%) | Voltage after test/<br>voltage prior to test (%)<br>试验后电压/<br>试验前电压 | Results<br>结果 |
|--------------------------|-----------|-------------------|-------------------|----------------|-------------------|-----------------------|---------------------------------------------------------------------|---------------|
|                          |           | Mass<br>质量 (g)    | Voltage<br>电压 (V) | Mass<br>质量 (g) | Voltage<br>电压 (V) |                       |                                                                     |               |
| Fully charged            | A1#       | 43.526            | 4.14              | 43.526         | 4.14              | 0.00                  | 100.0                                                               | PASS          |

|                            |      |        |      |        |      |      |       |            |
|----------------------------|------|--------|------|--------|------|------|-------|------------|
| at first cycle<br>首次循环满电状态 |      |        |      |        |      |      |       | 合格         |
|                            | A2#  | 43.659 | 4.14 | 43.659 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A3#  | 43.720 | 4.13 | 43.720 | 4.13 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A4#  | 43.432 | 4.14 | 43.432 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A5#  | 43.843 | 4.13 | 43.843 | 4.13 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A6#  | 43.069 | 4.14 | 43.069 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A7#  | 43.503 | 4.14 | 43.503 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A8#  | 43.668 | 4.14 | 43.668 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A9#  | 43.725 | 4.13 | 43.725 | 4.13 | 0.00 | 100.0 | PASS<br>合格 |
|                            | A10# | 43.618 | 4.14 | 43.618 | 4.14 | 0.00 | 100.0 | PASS<br>合格 |

#### Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电芯未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 20.3°C

#### Test T.4: Shock 试验 T.4: 冲击

##### Test method 测试方法

Cells are secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test cell. Each cell is subjected to a half-sine shock of peak acceleration of 150 g<sub>n</sub> and pulse duration of 6 milliseconds. Each cell is subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

试验电芯用刚性支架紧固在试验装置上, 支架支撑着每个试验电芯的所有安装面。每个电芯须经受峰值加速度150 g<sub>n</sub>和脉冲持续时间6 ms的半正弦波冲击。每个电芯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 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 after testing is not less than 90% of its voltage immediately prior to this procedure.

电芯须无渗漏、无泄气、无解体、无破裂和无起火, 并且每个试验电芯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%。

Test Data showed in table below 测试数据见下表

| State of samples<br>样品状态                 | No.<br>编号 | Prior to test 试验前 |                   | After test 试验后 |                   | Mass loss<br>质量损失 (%) | Voltage after test/ voltage prior to test (%)<br>试验后电压/ 试验前电压 | Results<br>结果 |
|------------------------------------------|-----------|-------------------|-------------------|----------------|-------------------|-----------------------|---------------------------------------------------------------|---------------|
|                                          |           | Mass<br>质量 (g)    | Voltage<br>电压 (V) | Mass<br>质量 (g) | Voltage<br>电压 (V) |                       |                                                               |               |
| Fully charged at first cycle<br>首次循环满电状态 | A1#       | 43.526            | 4.14              | 43.526         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A2#       | 43.659            | 4.14              | 43.659         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A3#       | 43.720            | 4.13              | 43.720         | 4.13              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A4#       | 43.432            | 4.14              | 43.432         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A5#       | 43.843            | 4.13              | 43.843         | 4.13              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A6#       | 43.069            | 4.14              | 43.069         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A7#       | 43.503            | 4.14              | 43.503         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A8#       | 43.668            | 4.14              | 43.668         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A9#       | 43.725            | 4.13              | 43.725         | 4.13              | 0.00                  | 100.0                                                         | PASS<br>合格    |
|                                          | A10#      | 43.618            | 4.14              | 43.618         | 4.14              | 0.00                  | 100.0                                                         | PASS<br>合格    |

## Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电芯未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 21.2°C

## Test T.5: External short circuit 试验T.5: 外部短路

## Test method 测试方法

Cells to be tested are heated for a period of time necessary to reach a homogeneous stabilized temperature of  $57 \pm 4^\circ\text{C}$ , measured on the external case. This period of time depends on the size and design of the cell and is assessed and documented. Then the battery at  $57 \pm 4^\circ\text{C}$  is subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell external case temperature has returned to  $57 \pm 4^\circ\text{C}$ .

The short circuit and cooling down phases are conducted at least at ambient temperature.

试验电芯首先被加热或恒定一段时间, 使其达到  $57 \pm 4^\circ\text{C}$  并使其外表面温度均匀恒定在  $57 \pm 4^\circ\text{C}$ 。该加热时间

或热恒定时间的长短取决于该电芯的尺寸和设计,并同时加以评估及提供文件证明。然后该电芯在 $57 \pm 4^\circ\text{C}$ 的条件下承受一个外部总阻抗小于 $0.1\Omega$ 的短路条件。

该短路测试持续到电芯外表面温度返回至 $57 \pm 4^\circ\text{C}$ 后再保持至少1小时。

该短路和冷却阶段均被执行在 $57 \pm 4^\circ\text{C}$ 的环境温度下。

#### Requirement 要求

Cells 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.

电芯外壳温度不超过 $170^\circ\text{C}$ , 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。

Test data showed in table below 测试数据见下表

| State of samples<br>样品状态                 | No.<br>编号 | Maximum outer casing temperature<br>电池表面最高温度 ( $^\circ\text{C}$ ) | Results<br>结果 |
|------------------------------------------|-----------|-------------------------------------------------------------------|---------------|
| Fully charged at first cycle<br>首次循环满电状态 | A1#       | 67.1                                                              | PASS 合格       |
|                                          | A2#       | 63.8                                                              | PASS 合格       |
|                                          | A3#       | 59.6                                                              | PASS 合格       |
|                                          | A4#       | 70.3                                                              | PASS 合格       |
|                                          | A5#       | 65.7                                                              | PASS 合格       |
|                                          | A6#       | 65.1                                                              | PASS 合格       |
|                                          | A7#       | 57.4                                                              | PASS 合格       |
|                                          | A8#       | 66.4                                                              | PASS 合格       |
|                                          | A9#       | 65.5                                                              | PASS 合格       |
|                                          | A10#      | 70.1                                                              | PASS 合格       |

#### Notes 注释:

There is no disassembly, no rupture and no fire during the test and within six hours after test.

电芯在测试中和测试后 6 小时内未解体、未破裂, 未起火。

Room temperature 环境温度:  $19.4^\circ\text{C}$

#### Test T.6: Impact 试验T.6: 撞击

##### Test method 测试方法

Each cell is to be placed on a flat smooth surface. A  $15.8 \text{ mm} \pm 0.1 \text{ mm}$  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  $9.1 \text{ kg} \pm 0.1 \text{ kg}$  mass is to be dropped from a height of  $61 \pm 2.5 \text{ cm}$  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 is oriented  $90^\circ$  degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the  $15.8 \text{ mm} \pm 0.1 \text{ mm}$  diameter curved surface lying across the centre of the test sample.

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

每个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  $15.8 \pm 0.1$  毫米, 长度至少 6 厘米, 或电芯的最长尺度, 取二者中较大者。将一块  $9.1 \pm 0.1 \text{ kg}$  的重锤从  $61 \pm 2.5$  厘米高处跌落到钢棒和试样

交叉点, 使用一个几乎没有摩擦的、对落体重锤阻力很小的垂直导轨或管道加以控制。垂直导轨或管道用于引导落锤沿与水平支撑表面呈 90 度落下。

接受撞击的试样, 纵轴应与测试平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。每一试样只经受一次撞击。

#### Requirement 要求

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 the test.

元件电池芯外壳温度不超过  $170^{\circ}\text{C}$ , 并且在试验过程中及试验后 6 小时内无解体, 无起火。

Test data showed in table below 测试数据见下表

| State of samples<br>样品状态                                                       | No.<br>编号 | Maximum outer casing temperature<br>电池表面最高温度 ( $^{\circ}\text{C}$ ) | Results<br>结果 |
|--------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------|---------------|
| 50% charged of the<br>design rated capacity<br>at first cycle<br>首次循环 50% 充电状态 | A11#      | 123.0                                                               | PASS 合格       |
|                                                                                | A12#      | 105.1                                                               | PASS 合格       |
|                                                                                | A13#      | 120.8                                                               | PASS 合格       |
|                                                                                | A14#      | 130.7                                                               | PASS 合格       |
|                                                                                | A15#      | 127.6                                                               | PASS 合格       |

#### Notes 注释:

There is no disassembly, no rupture and no fire during the test and within six hours after test.

电芯在测试中和测试后 6 小时内未解体、未起火。

Room temperature 环境温度:  $22.1^{\circ}\text{C}$

### Test T.8: Forced discharge 试验 T.8: 强制放电

#### Test method 测试方法

Each cell is 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 is forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

每个电芯在环境温度下与 12V 直流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。

电芯与一个适当大小的电阻负载串联以调节到规定大小的放电电流。每块电芯的放电时间 (单位为 h) 等于电芯的额定容量除以试验初始放电电流 (单位 A)。

#### Requirement 要求

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

电芯在试验过程中和试验后 7 天内无解体, 无起火。

Test data showed in table below 测试数据见下表

|                                |        |
|--------------------------------|--------|
| Initial current 初始电流(mA) ..... | 4400mA |
| Supply voltage 试验电压(Vdc) ..... | 12Vdc  |

| Time interval 试验时间(Minutes).....: 30 Minutes         |           |               |
|------------------------------------------------------|-----------|---------------|
| State of samples<br>样品状态                             | No.<br>编号 | Results<br>结果 |
| Fully discharged at first cycle<br>首次循环完全放电状态        | A16#      | PASS 合格       |
|                                                      | A17#      | PASS 合格       |
|                                                      | A18#      | PASS 合格       |
|                                                      | A19#      | PASS 合格       |
|                                                      | A20#      | PASS 合格       |
|                                                      | A21#      | PASS 合格       |
|                                                      | A22#      | PASS 合格       |
|                                                      | A23#      | PASS 合格       |
|                                                      | A24#      | PASS 合格       |
|                                                      | A25#      | PASS 合格       |
| Fully discharged after fifty cycles<br>50 个循环后完全放电状态 | A26#      | PASS 合格       |
|                                                      | A27#      | PASS 合格       |
|                                                      | A28#      | PASS 合格       |
|                                                      | A29#      | PASS 合格       |
|                                                      | A30#      | PASS 合格       |
|                                                      | A31#      | PASS 合格       |
|                                                      | A32#      | PASS 合格       |
|                                                      | A33#      | PASS 合格       |
|                                                      | A34#      | PASS 合格       |
|                                                      | A35#      | PASS 合格       |

## Notes 注释:

There is no disassembly and no fire during the test and within seven days after the test.

电芯在测试中和测试后 7 天内未解体, 未着火。

Room temperature 环境温度: 19.5°C

\*\*\*\*\*End of Test Report 检测报告结束\*\*\*\*\*

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