# UN TEST REPORT

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|---|---|
| Report Number. | SDI-UN-211217-01 |
| Date of issue | 2021.12.17 |
| Test period | 2019.10.01~2019.10.14 |
| Testing Laboratory | Samsung SDI Co., Ltd |
| Address | 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Korea |
| Contact | +82-41-560-3114 / http://samsungsdi.co.kr/ |
| Manufacturer's name | Samsung SDI Co., Ltd |
| Address | 467, Beonyeong-ro, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Korea |
| Contact | +82-41-560-3114 / http://samsungsdi.co.kr/ |
| Test Standard | Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, section 38.3 Sixth revised edition Amendment 1 |
| Description | **Lithium ion cell** |
| Model Name | **INR21700-50S** |
| Ratings | 3.6V 5000mAh (18.00Wh) |
| Mass | Max 72.0g |

**Test Result**

| No. | Test item | Result | Remark |
|---|---|---|---|
| T-1 | Altitude | PASS | |
| T-2 | Thermal Cycling | PASS | |
| T-3 | Vibration | PASS | |
| T-4 | Shock | PASS | |
| T-5 | External Short Circuit | PASS | |
| T-6 | Impact / Crush | PASS | |
| T-7 | Overcharge | N/A | Battery only |
| T-8 | Forced Discharge | PASS | |

| | Name | Signature | Date |
|---|---|---|---|
| Reported by | Hanhyung Woo | | 2021. 12. 17 |
| Approved by | Hong Jong Pil | | 2021. 12. 17 |

| T1 | ALTITUDE SIMULATION TEST | Results |
|---|---|---|
| Requirements | No mass loss, no leakage, no venting,<br>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. | ☒No leakage,<br>☒No venting,<br>☒No disassembly,<br>☒No rupture,<br>☒No fire,<br>☒No mass loss,<br>(Less than 0.2%)<br>☒No voltage drop<br>(Residual OCV not less than 90%)<br><br>See below table |

| Sample No. | Sample Condition | Voltage Before Test(V) | Weight Before Test(g) | Voltage After Test(V) | Weight After Test(g) | Residual OCV(%) | Percent of Weight Loss(%) |
|---|---|---|---|---|---|---|---|
| 1 | A | 4.185 | 70.335 | 4.179 | 70.329 | 99.86 | 0.01 |
| 2 | A | 4.185 | 70.279 | 4.179 | 70.279 | 99.86 | 0.00 |
| 3 | A | 4.185 | 70.265 | 4.179 | 70.265 | 99.86 | 0.00 |
| 4 | A | 4.185 | 70.289 | 4.179 | 70.289 | 99.86 | 0.00 |
| 5 | A | 4.185 | 70.340 | 4.179 | 70.339 | 99.86 | 0.00 |
| 6 | B | 4.187 | 70.201 | 4.182 | 70.199 | 99.88 | 0.00 |
| 7 | B | 4.187 | 70.129 | 4.182 | 70.130 | 99.88 | 0.00 |
| 8 | B | 4.187 | 70.138 | 4.183 | 70.130 | 99.90 | 0.01 |
| 9 | B | 4.188 | 69.899 | 4.185 | 69.899 | 99.93 | 0.00 |
| 10 | B | 4.187 | 70.126 | 4.182 | 70.126 | 99.88 | 0.00 |

□ Supplementary Information:

Sample Condition A : at first cycle, in fully charged states(5 pcs)

Sample Condition B : after 25th cycles ending in fully charged states(5 pcs)

| T2 | THERMAL TEST | Results |
|---|---|---|
| Requirements | No mass loss, no leakage, no venting,<br>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. | ☒No leakage,<br>☒No venting,<br>☒No disassembly,<br>☒No rupture,<br>☒No fire,<br>☒No mass loss,<br>(Less than 0.2%)<br>☒No voltage drop<br>(Residual OCV not less than 90%)<br><br>See below table |

| Sample No. | Sample Condition | Voltage Before Test(V) | Weight Before Test(g) | Voltage After Test(V) | Weight After Test(g) | Residual OCV(%) | Percent of Weight Loss(%) |
|---|---|---|---|---|---|---|---|
| 1 | A | 4.179 | 70.329 | 4.108 | 70.335 | 98.30 | 0.00 |
| 2 | A | 4.179 | 70.279 | 4.110 | 70.279 | 98.35 | 0.00 |
| 3 | A | 4.179 | 70.265 | 4.111 | 70.265 | 98.37 | 0.00 |
| 4 | A | 4.179 | 70.289 | 4.112 | 70.289 | 98.40 | 0.00 |
| 5 | A | 4.179 | 70.339 | 4.114 | 70.337 | 98.44 | 0.00 |
| 6 | B | 4.182 | 70.199 | 4.109 | 70.201 | 98.25 | 0.00 |
| 7 | B | 4.182 | 70.130 | 4.110 | 70.134 | 98.28 | 0.00 |
| 8 | B | 4.183 | 70.130 | 4.113 | 70.138 | 98.33 | 0.00 |
| 9 | B | 4.185 | 69.899 | 4.115 | 69.900 | 98.33 | 0.00 |
| 10 | B | 4.182 | 70.126 | 4.115 | 70.126 | 98.40 | 0.00 |

□ Supplementary Information:

Sample Condition A : at first cycle, in fully charged states(5 pcs)

Sample Condition B : after 25th cycles ending in fully charged states(5 pcs)

| T3 | VIBRATION TEST | Results |
|---|---|---|
| Requirements | No mass loss, no leakage, no venting,<br>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. | ☒No leakage,<br>☒No venting,<br>☒No disassembly,<br>☒No rupture,<br>☒No mass loss,<br>(Less than 0.2%)<br>☒No voltage drop<br>(Residual OCV not less than 90%)<br><br>See below table |

| Sample No. | Sample Condition | Voltage Before Test(V) | Weight Before Test(g) | Voltage After Test(V) | Weight After Test(g) | Residual OCV(%) | Percent of Weight Loss(%) |
|---|---|---|---|---|---|---|---|
| 1 | A | 4.108 | 70.335 | 4.107 | 70.335 | 99.98 | 0.00 |
| 2 | A | 4.110 | 70.279 | 4.109 | 70.276 | 99.98 | 0.00 |
| 3 | A | 4.111 | 70.265 | 4.110 | 70.263 | 99.98 | 0.00 |
| 4 | A | 4.112 | 70.289 | 4.111 | 70.288 | 99.98 | 0.00 |
| 5 | A | 4.114 | 70.337 | 4.112 | 70.336 | 99.95 | 0.00 |
| 6 | B | 4.109 | 70.201 | 4.108 | 70.199 | 99.98 | 0.00 |
| 7 | B | 4.110 | 70.134 | 4.109 | 70.136 | 99.98 | 0.00 |
| 8 | B | 4.113 | 70.138 | 4.112 | 70.131 | 99.98 | 0.01 |
| 9 | B | 4.115 | 69.900 | 4.113 | 69.896 | 99.95 | 0.01 |
| 10 | B | 4.115 | 70.126 | 4.114 | 70.123 | 99.98 | 0.00 |

□ Supplementary Information:

Sample Condition A : at first cycle, in fully charged states(5 pcs)

Sample Condition B : after 25th cycles ending in fully charged states(5 pcs)

| T4 | SHOCK | Results |
|---|---|---|
| Requirements | No mass loss, no leakage, no venting,<br>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. | ☒No leakage,<br>☒No venting,<br>☒No disassembly,<br>☒No rupture,<br>☒No fire,<br>☒No mass loss,<br>(Less than 0.2%)<br>☒No voltage drop<br>(Residual OCV not less than 90%)<br><br>See below table |

| Sample No. | Sample Condition | Voltage Before Test(V) | Weight Before Test(g) | Voltage After Test(V) | Weight After Test(g) | Residual OCV(%) | Percent of Weight Loss(%) |
|---|---|---|---|---|---|---|---|
| 1 | A | 4.107 | 70.335 | 4.107 | 70.334 | 100.00 | 0.00 |
| 2 | A | 4.109 | 70.276 | 4.109 | 70.275 | 100.00 | 0.00 |
| 3 | A | 4.110 | 70.263 | 4.110 | 70.262 | 100.00 | 0.00 |
| 4 | A | 4.111 | 70.288 | 4.111 | 70.287 | 100.00 | 0.00 |
| 5 | A | 4.112 | 70.336 | 4.112 | 70.334 | 100.00 | 0.00 |
| 6 | B | 4.108 | 70.199 | 4.108 | 70.198 | 100.00 | 0.00 |
| 7 | B | 4.109 | 70.136 | 4.109 | 70.131 | 100.00 | 0.01 |
| 8 | B | 4.112 | 70.131 | 4.112 | 70.136 | 100.00 | 0.00 |
| 9 | B | 4.113 | 69.896 | 4.113 | 69.896 | 100.00 | 0.00 |
| 10 | B | 4.114 | 70.123 | 4.114 | 70.123 | 100.00 | 0.00 |

□ Supplementary Information:

Sample Condition A : at first cycle, in fully charged states(5 pcs)

Sample Condition B : after 25th cycles ending in fully charged states(5 pcs)

| T5 | EXTERNAL SHORT-CIRCUIT | Results |
|---|---|---|
| Requirements | External temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire within six hours of this test. | ☒No disassembly,<br>☒No rupture<br>☒No fire.<br>☒External Temperature did not exceed 170 °C.<br><br>see below table |

| Sample No. | Sample Condition | Maximum Temperature(°C) | Test result |
|---|---|---|---|
| 1 | A | 102 | O |
| 2 | A | 106 | O |
| 3 | A | 108 | O |
| 4 | A | 120 | O |
| 5 | A | 114 | O |
| 6 | B | 106 | O |
| 7 | B | 115 | O |
| 8 | B | 117 | O |
| 9 | B | 108 | O |
| 10 | B | 112 | O |

□ Supplementary Information:

Sample Condition A : at first cycle, in fully charged states(5 pcs)

Sample Condition B : after 25th cycles ending in fully charged states(5 pcs)

Test result : O-No Disassembly, No Rupture, No Fire / D-Disassembly / R-Rupture / F-Fire

| T6 | ☒ Impact / ☐ Crush | Results |
|---|---|---|
| Requirements | Cells and component cells meet this requirement if their external temperature does not exceed 170℃ and there is no disassembly and no fire during the test and within six hours after this test. | ☒External temperature did not exceed 170℃,<br>☒no disassembly,<br>☒no fire during test and within 6 hours after test<br><br>See below table |

| Sample No. | Sample Condition | Voltage Before Test(V) | Maximum Temperature(°C) | Test result |
|---|---|---|---|---|
| T6-1 | C | 3.720 | 26 | O |
| T6-2 | C | 3.772 | 26 | O |
| T6-3 | C | 3.720 | 26 | O |
| T6-4 | C | 3.721 | 26 | O |
| T6-5 | C | 3.721 | 26 | O |
| T6-6 | D | 3.758 | 26 | O |
| T6-7 | D | 3.760 | 26 | O |
| T6-8 | D | 3.764 | 25 | O |
| T6-9 | D | 3.755 | 26 | O |
| T6-10 | D | 3.756 | 26 | O |

□ Supplementary Information:

Sample Condition C : at first cycle, in 50% charged states(5 pcs)

Sample Condition D : at 25th cycle, in 50% charged states(5 pcs)

Test result : O-No Disassembly, No Fire / D-Disassembly / F-Fire

| T8 | FORCED DISCHARGE | Results |
|---|---|---|
| Requirements | Rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test. | ☒No disassembly,<br>☒no rupture,<br>☒no fire during the test and within seven days after the test.<br><br>See below table |

| Sample No. | Sample Condition | Test result | Sample No. | Sample Condition | Test result |
|---|---|---|---|---|---|
| T8-1 | E | O | T8-11 | F | O |
| T8-2 | E | O | T8-12 | F | O |
| T8-3 | E | O | T8-13 | F | O |
| T8-4 | E | O | T8-14 | F | O |
| T8-5 | E | O | T8-15 | F | O |
| T8-6 | E | O | T8-16 | F | O |
| T8-7 | E | O | T8-17 | F | O |
| T8-8 | E | O | T8-18 | F | O |
| T8-9 | E | O | T8-19 | F | O |
| T8-10 | E | O | T8-20 | F | O |

□ Supplementary Information:

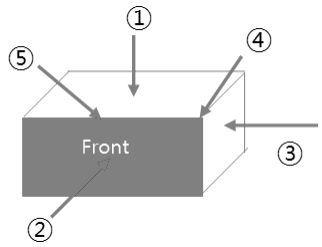
Sample Condition E : at first cycle, in fully discharged states (10 pcs)

Sample Condition F : after 25th cycles ending in fully discharged states(10 pcs)

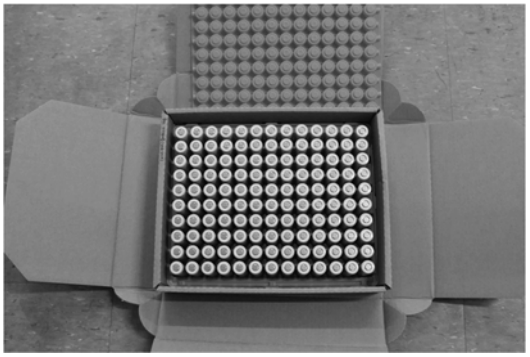
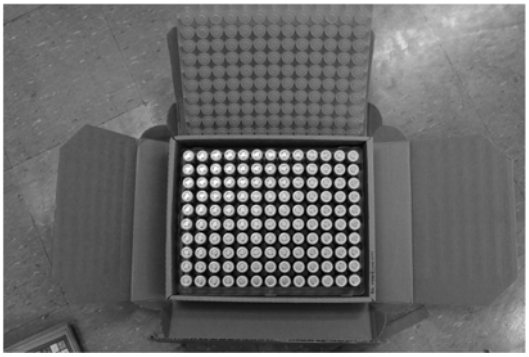
Test result : O-No Disassembly, No Fire / D-Disassembly / F-Fire

□ Test Conditions

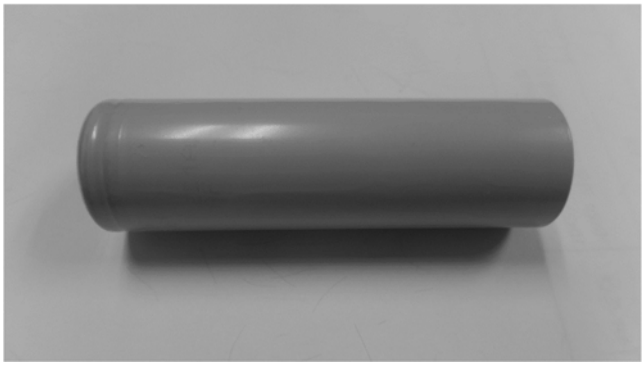
Initial test current : 25A, Test duration : 12min

| P1 | Package Drop Test | Results |
|---|---|---|
| Procedure | IATA Dangerous Goods Regulations<br>Each package must be capable of withstanding a 1.2m drop test in any orientation<br>  | ☒ Without damage to cells or batteries contained therein,<br>☒ Without shifting of the contents so as to allow battery to battery(or Cell to cell) contact.<br>☒ Without release of contents<br><br>See below photo |

| Cell Qty per box | Cell weight (kg) | Net weight per box (kg) |
|---|---|---|
| 130 | 0.070 | 9.10 |

| | Before Test | After Test |
|---|---|---|
| Weight (kg) | 9.73 | 9.73 |
| Test result |  |  |

Sample Photo

| front | back |
| --- | --- |
|  |  |



- End of Report -