

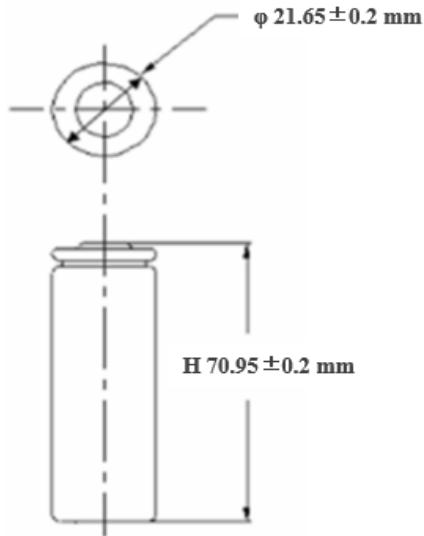


Product Introduction

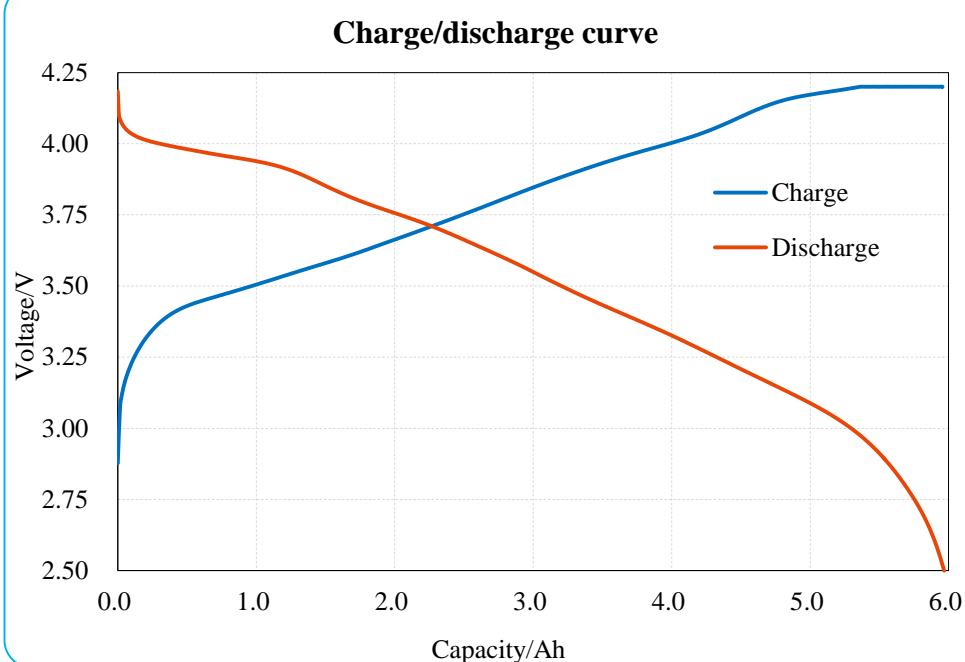
INR21700-60M

21700-3.6V/6.0Ah

- Nominal Specification
- Electrical Characteristics
- Storage Characteristics
- Cycle Life Characteristics
- Safety Characteristics



Item		Specification
Capacity	Nominal	6000mAh@0.2C
	Minimum	5850 mAh@0.2C
Voltage	Nominal	3.60 V
	Charge Cut-off	4.20 V
	Discharge Cut-off	2.50 V
Energy Density		296Wh/Kg
Dimension	Diameter	21.65 ± 0.2 mm
	Height	70.95 ± 0.2 mm
Weight		≤75g
ACR		≤25mΩ
Charge Current	Standard	3.0A (0.5C)
	Max	4.2A (0.7C)
Discharge Current	Standard	6.0A (1.0C)
	Max	12.0A (2.0C)
Cycle life	+3.0A/-6.0A(+0.5C/-1C) (4.2V-2.75V)	≥500 @70%SOC



Standard charge/discharge:

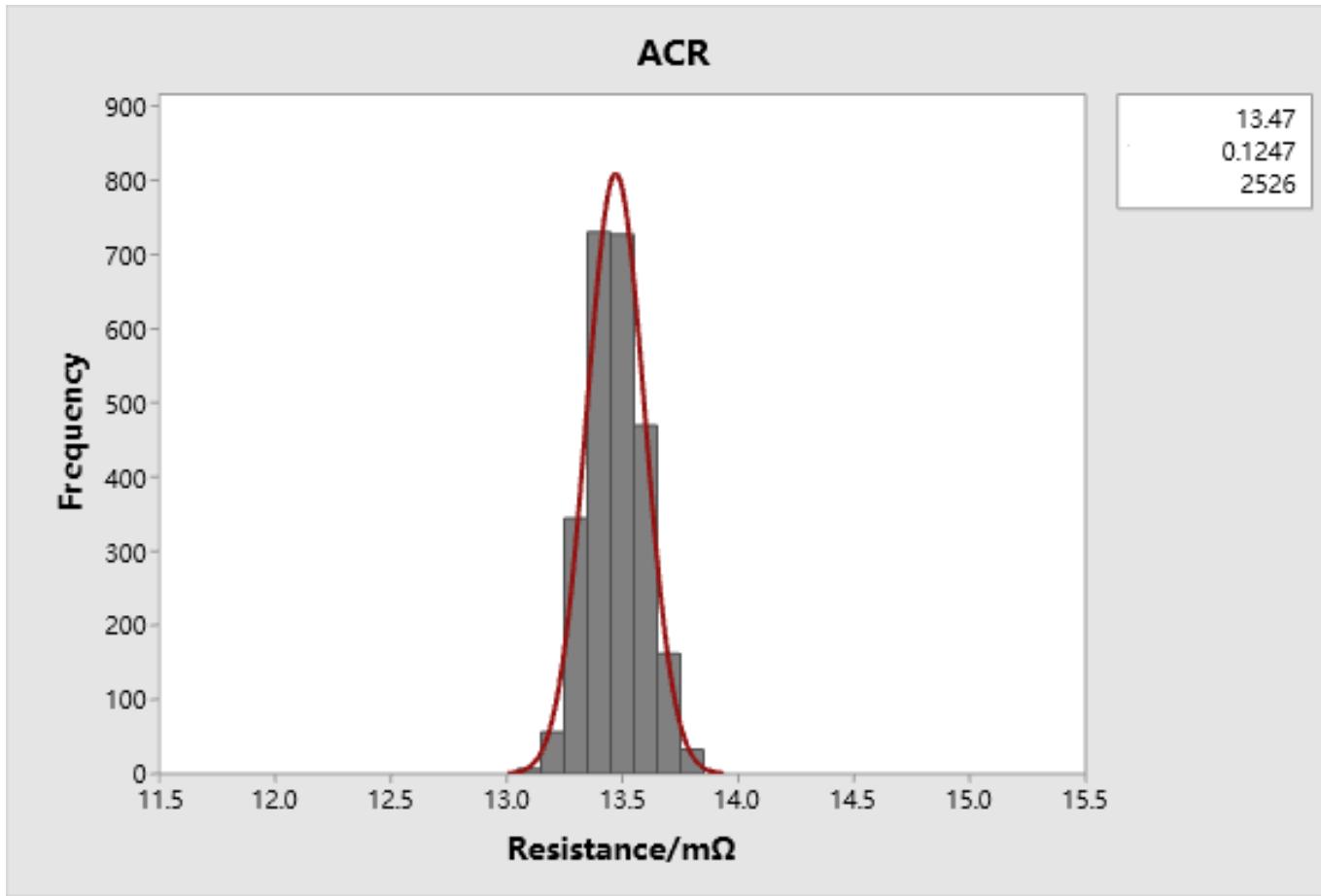
Standard charge: 0.5C CC to 4.2V, CV to 0.02C;

Rest: 10min

Standard discharge: 1C DC to 2.5V

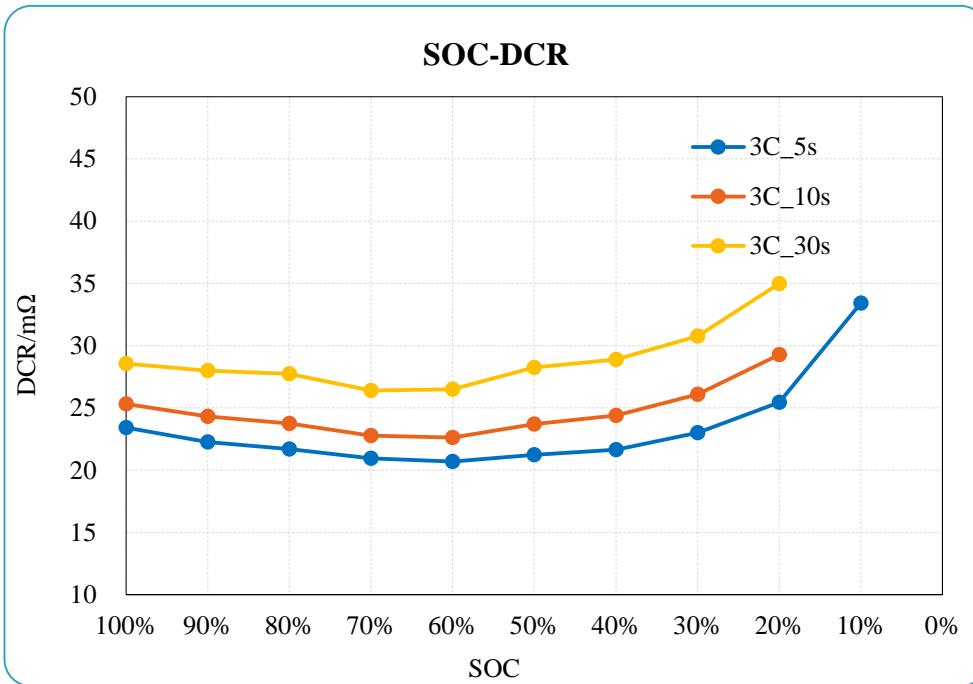
Temperature: 25°C

Item	Charge	Discharge
Current	3A	6A
Rate	0.5C	1C
Capacity/Ah	5.956	5.968
Energy/Wh	22.759	20.931



Item	Average	Minimum	Maximum
ACR/mΩ	13.5	13.1	13.8

ACR: 35%SOC, AC 1kHz



DCR at discharge:

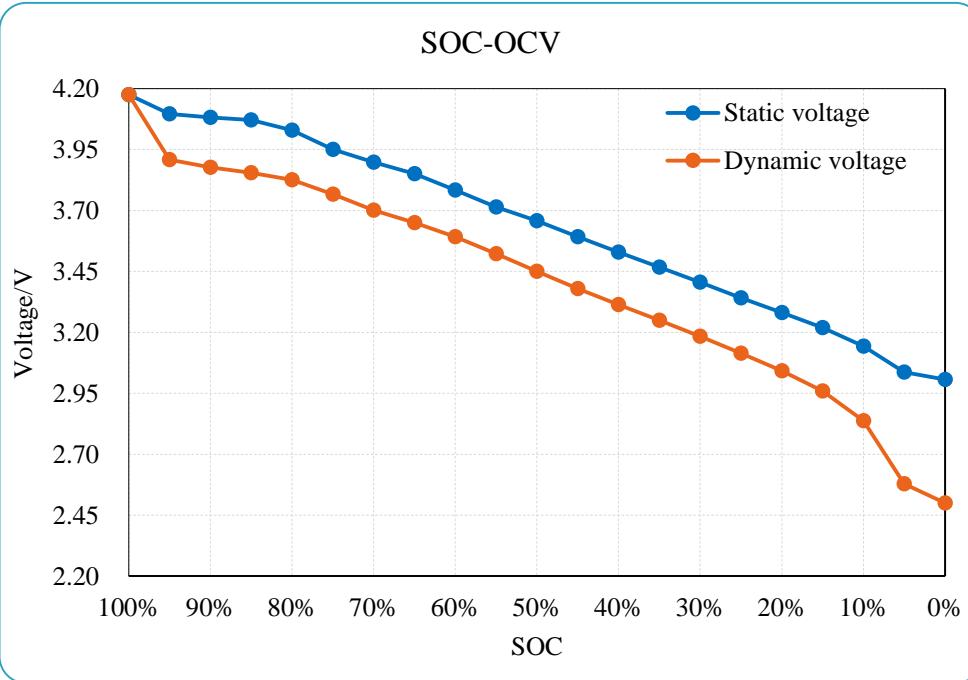
- Step 1. Standard charge and discharge to get the initial capacity;
- Step 2. Conduct the pulse discharge test with 3C & 30s after the cell was full charged;
- Step 3. Adjust the SOC to 90%, 80%, ... 10% by discharge with 1C and then conduct the pulse discharge test (pulse test was conducted after 1h rest from SOC adjustment)

Item	SOC	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
DCR	3C_5s	23.4	22.3	21.7	21.0	20.7	21.2	21.6	23.0	25.5	33.4
	3C_10s	25.3	24.3	23.8	22.8	22.6	23.7	24.4	26.1	29.3	NA
	3C_30s	27.3	26.7	26.2	25.0	24.9	26.6	27.4	29.3	33.2	NA

Calculation formula:

$$DCR = (U_i - U_o) / I$$

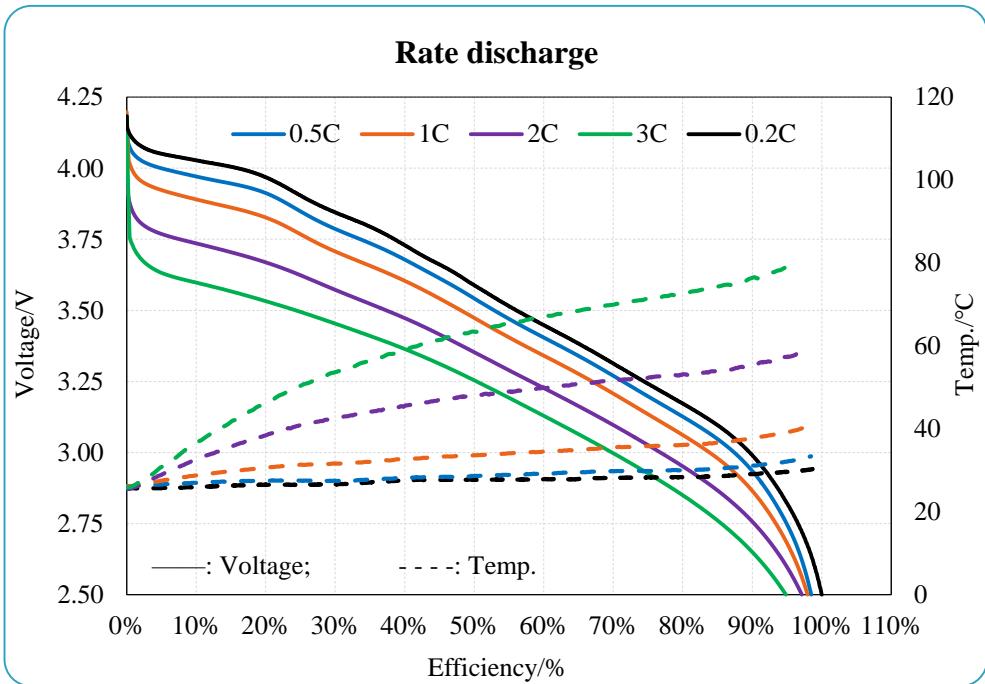
U_i: The voltage before pulse; **U_o:** The voltage at end of pulse; **I:** The pulse current



SOC-OCV at discharge direction:

- Step 1. Standard charge and discharge to get the initial capacity ' C_d ';
- Step 2. 0.5C CC to 4.2V, CV to 0.02C;
- Step 3. Rest 2 h, 1C DC to $10\%C_d$, 2.5V cut-off;
- Step 4. Repeat step 3 for 10 times;
- Step 5. Data collection: Record the voltage at the end of discharge from step 3 as 'dynamic voltage', and record the voltage after 2h' rest from step 3 as 'static voltage'.

Voltage/V \ SOC	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Static	4.174	4.081	4.029	3.898	3.783	3.658	3.528	3.405	3.280	3.143	3.007
Dynamic	4.174	3.877	3.825	3.701	3.592	3.450	3.314	3.184	3.041	2.838	2.500



Rate discharge:

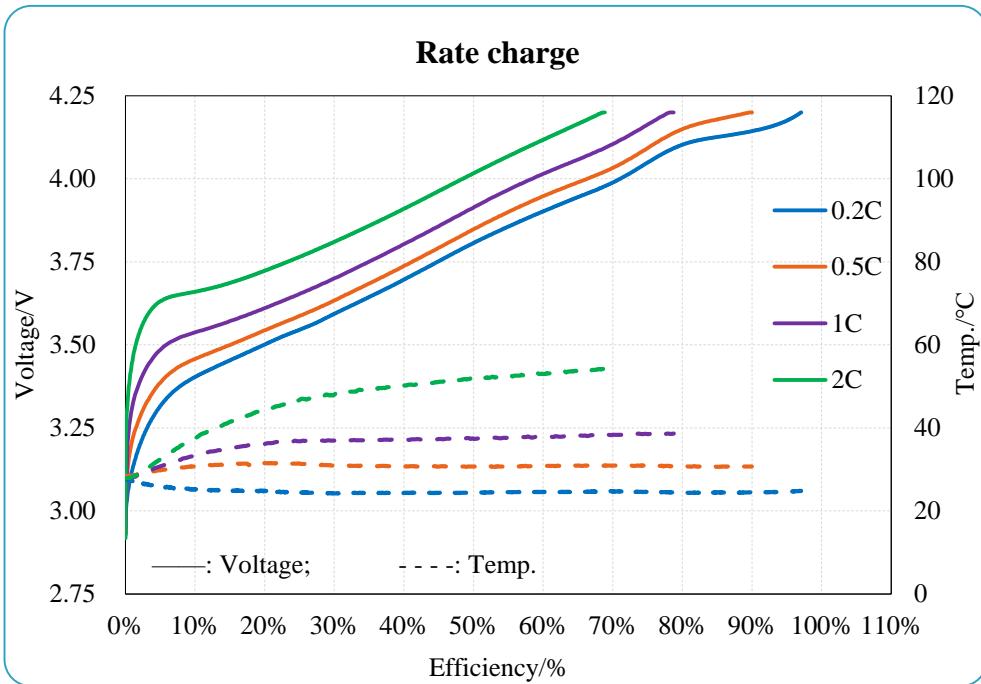
Step 1. Standard charge;

Step 2. Rest 10min;

Step 3. Discharge with various currents, 2.5V cut-off;

Discharge efficiency: Discharge cap. /Discharge cap. at 0.2C.

Current	1.2A	3A	6A	12A	18A
Rate	0.2C	0.5C	1C	2C	3C
Capacity/Ah	6.059	5.968	5.936	5.886	5.747
Efficiency/%	100.0%	98.5%	98.0%	97.1%	94.8%
Max. temp./°C	30.7	33.4	40.6	58.4	79.0
Temp. rise/°C	5.0	7.3	14.5	32.8	53.0



Rate charge:

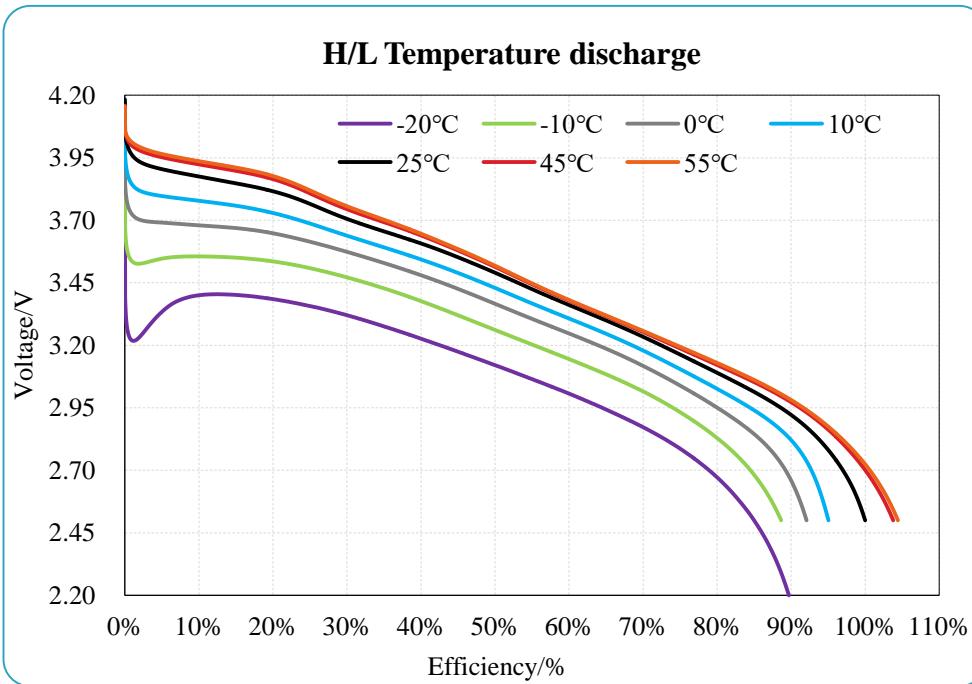
Step 1. Standard discharge;

Step 2. Rest 10min;

Step 3. CC charge with various currents to 4.2V;

Charge efficiency: Charge cap. /Discharge cap. at 1C.

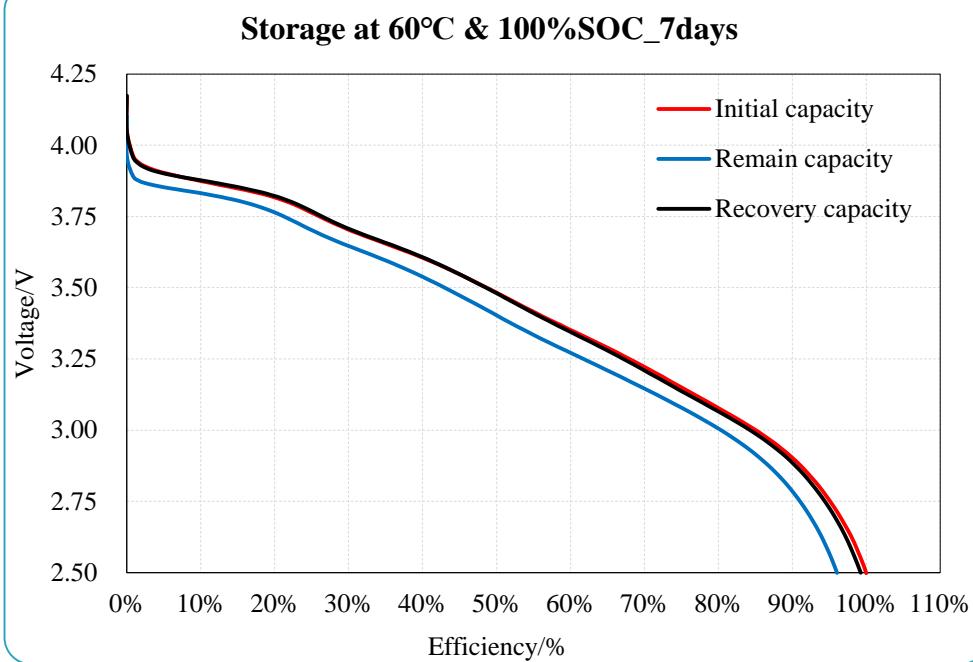
Discharge capacity (1C) /Ah	Current	1.2A	3A	6A	12A
	Rate	0.2C	0.5C	1C	2C
5.938	Charge capacity/Ah	5.764	5.344	4.676	4.088
	Efficiency/%	97.1%	90.0%	78.8%	68.9%
	Max. temp./°C	27.9	31.6	38.7	54.2
	Temp. rise/°C	0.0	3.1	10.8	26.3



Discharge at H/L temperature:

- Step 1. Standard charge;
- Step 2. Rest at corresponding temperature for 6h;
- Step 3. 1C DC to 2.5V (2.2 V cut-off at -20°C);
- Step 4. Efficiency= Discharge cap. /Discharge cap. (@25°C).

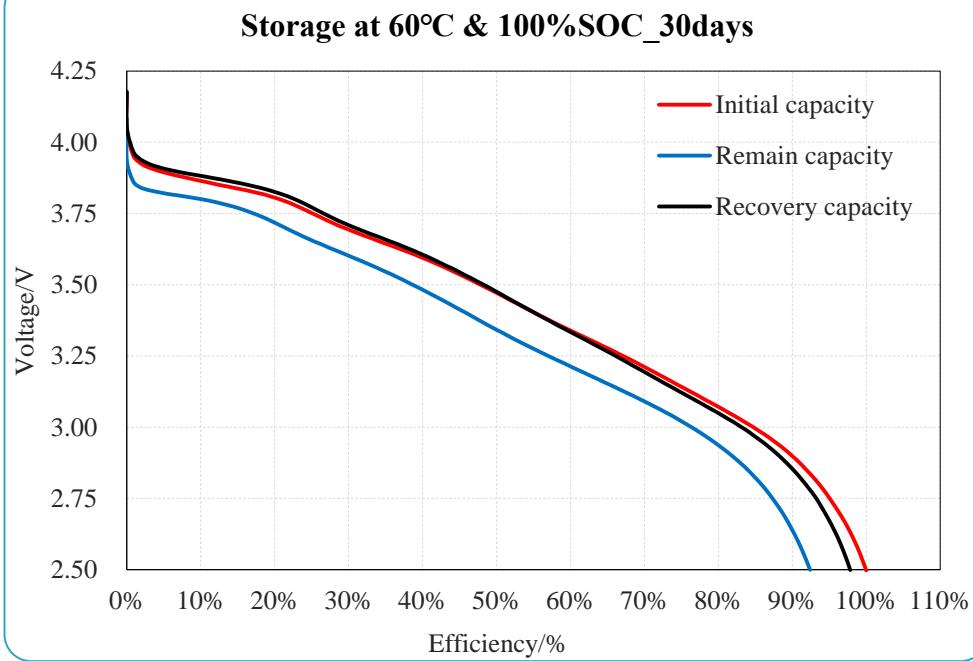
Temperature/°C	-20°C	-10°C	0°C	10°C	25°C	45°C	55°C
Rest time/h	24	5	5	5	5	5	5
Cut-off Voltage/V	2.2	2.5	2.5	2.5	2.5	2.5	2.5
Capacity/Ah	5.320	5.258	5.462	5.637	5.931	6.156	6.193
Efficiency	89.7%	88.7%	92.1%	95.0%	100.0%	103.8%	104.4%



Charge retention_60°C 7days:

- Step 1. Standard charge and discharge to get the initial capacity;
- Step 2. Store the cell at 60°C for 7 days after full charged;
- Step 3. Rest 4h at 25°C after finish storage, 1C DC to 2.5V (record **the remain capacity**);
- Step 5. Standard charge and discharge (record **the recovery capacity**).

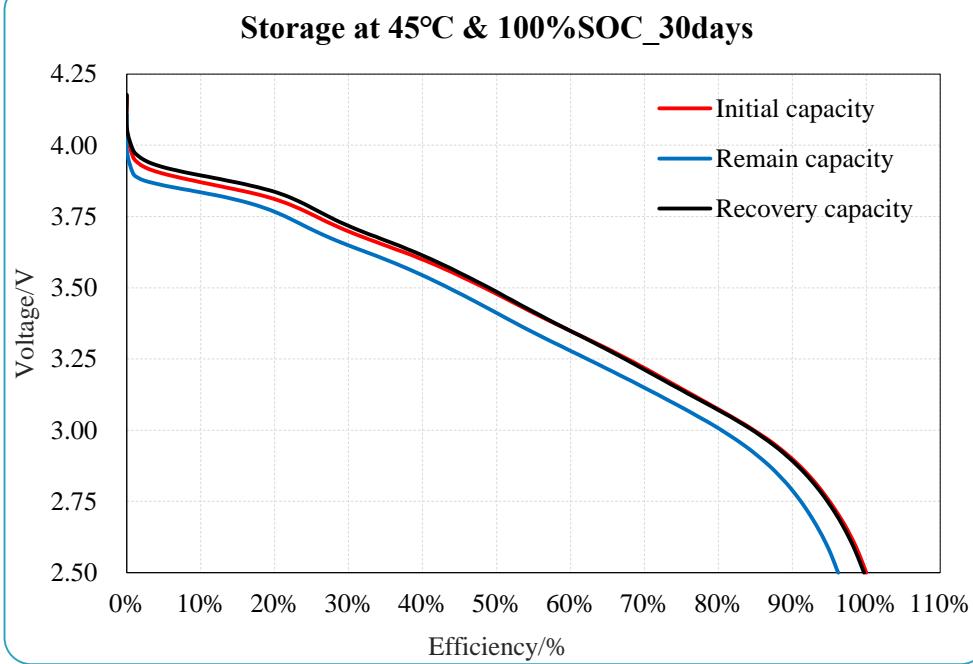
60°C_7days		Before storage			After storage				Retention	
No.	Resistance /mΩ	Voltage /V	Capacity /Ah	Resistance /mΩ	Voltage /V	Remain capacity/Ah	Recovery capacity/Ah	Remain capacity	Recovery capacity	
1#	13.9	4.163	5.918	14.9	4.108	5.685	5.875	96.1%	99.3%	
2#	13.8	4.162	5.924	14.8	4.108	5.680	5.863	95.9%	99.0%	
3#	13.9	4.162	5.928	15.1	4.108	5.697	5.880	96.1%	99.2%	



Charge retention_60°C 30days:

- Step 1. Standard charge and discharge to get the initial capacity;
- Step 2. Store the cell at 60°C for 30 days after full charged;
- Step 3. Rest 4h at 25°C after finish storage, 1C DC to 2.5V (record **the remain capacity**);
- Step 5. Standard charge and discharge (record **the recovery capacity**).

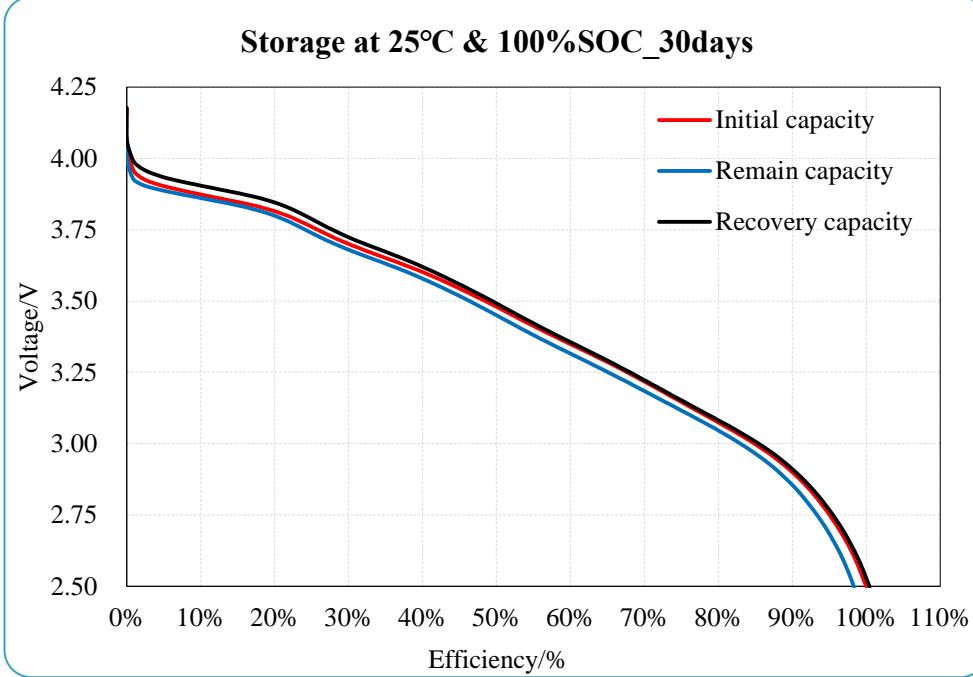
60°C_30days		Before storage			After storage				Retention	
No.	Resistance /mΩ	Voltage /V	Capacity /Ah	Resistance /mΩ	Voltage /V	Remain capacity/Ah	Recovery capacity/Ah	Remain capacity	Recovery capacity	
4#	13.8	4.162	5.929	16.2	4.089	5.479	5.801	92.4%	97.8%	
5#	13.9	4.162	5.923	16.5	4.090	5.468	5.780	92.3%	97.6%	
6#	13.8	4.162	5.917	16.5	4.089	5.449	5.772	92.1%	97.6%	



Charge retention_45°C 30days:

- Step 1. Standard charge and discharge to get the initial capacity;
- Step 2. Store the cell at 45°C for 30 days after full charged;
- Step 3. Rest 4h at 25°C after finish storage, 1C DC to 2.5V (record **the remain capacity**);
- Step 5. Standard charge and discharge (record **the recovery capacity**).

45°C_30days		Before storage			After storage				Retention	
No.	Resistance /mΩ	Voltage /V	Capacity /Ah	Resistance /mΩ	Voltage /V	Remain capacity/Ah	Recovery capacity/Ah	Remain capacity	Recovery capacity	
7#	13.7	4.163	5.936	14.4	4.113	5.713	5.871	96.2%	98.9%	
8#	13.8	4.163	5.920	14.5	4.112	5.698	5.852	96.2%	98.8%	
9#	13.5	4.162	5.925	14.2	4.113	5.704	5.856	96.3%	98.8%	



Charge retention_25°C 30days:

Step 1. Standard charge and discharge to get the initial capacity;

Step 2. Store the cell at 25°C for 30 days after full charged;

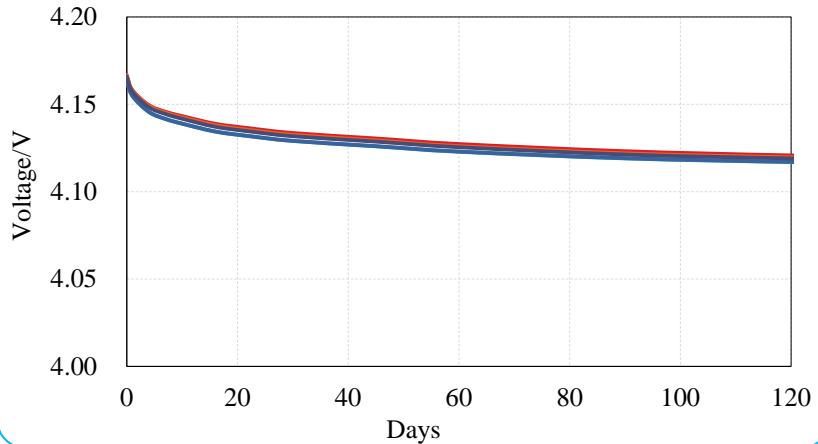
Step 3. Rest 4h at 25°C after finish storage, 1C DC to 2.5V
 (record **the remain capacity**);

Step 5. Standard charge and discharge
 (record **the recovery capacity**).

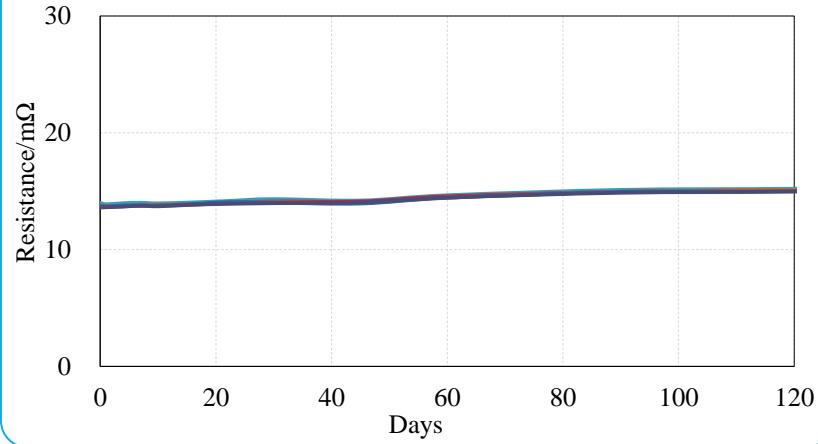
25°C_30days		Before storage			After storage				Retention	
No.	Resistance /mΩ	Voltage /V	Capacity /Ah	Resistance /mΩ	Voltage /V	Remain capacity/Ah	Recovery capacity/Ah	Remain capacity	Recovery capacity	
10#	13.7	4.163	5.927	13.9	4.135	5.821	5.911	98.2%	99.7%	
11#	13.7	4.163	5.921	13.8	4.133	5.821	5.910	98.3%	99.8%	
12#	13.9	4.161	5.936	14.0	4.132	5.842	5.926	98.4%	99.8%	

Storage- 100%SOC

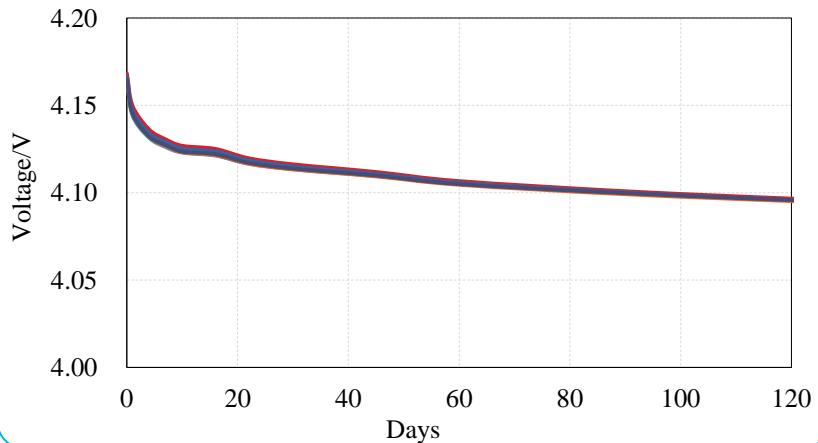
Storage at 25°C_100%SOC



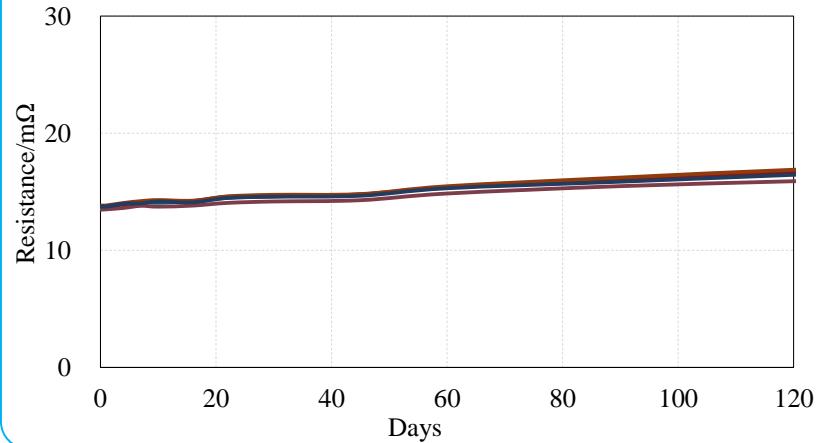
Storage at 25°C_100%SOC



Storage at 45°C_100%SOC

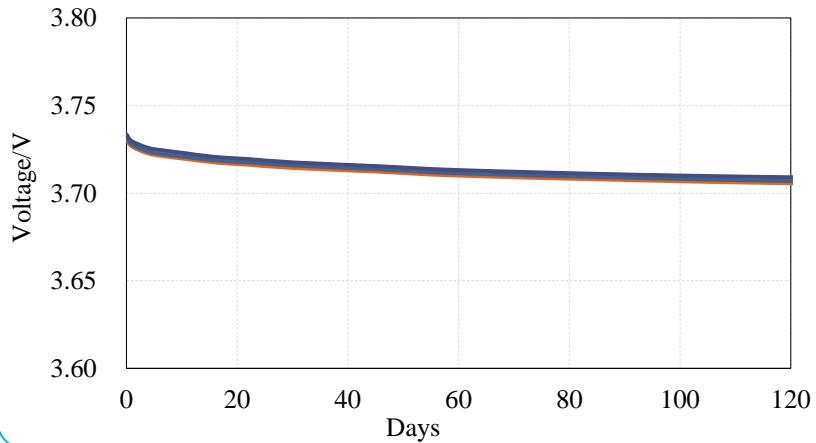


Storage at 45°C_100%SOC

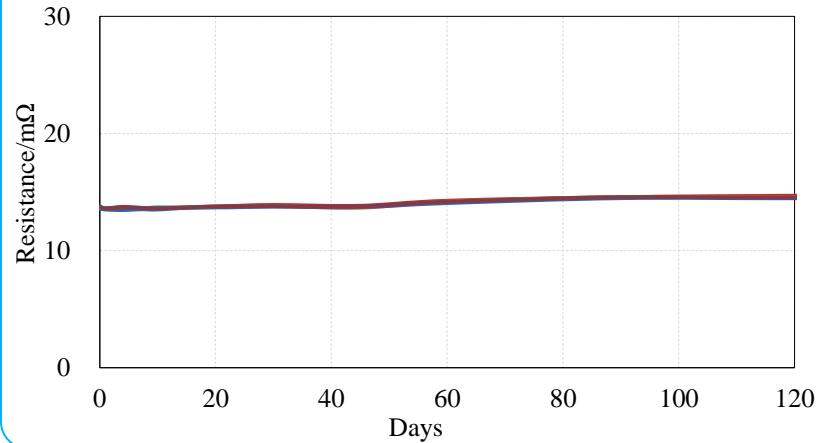


Storage- 50%SOC

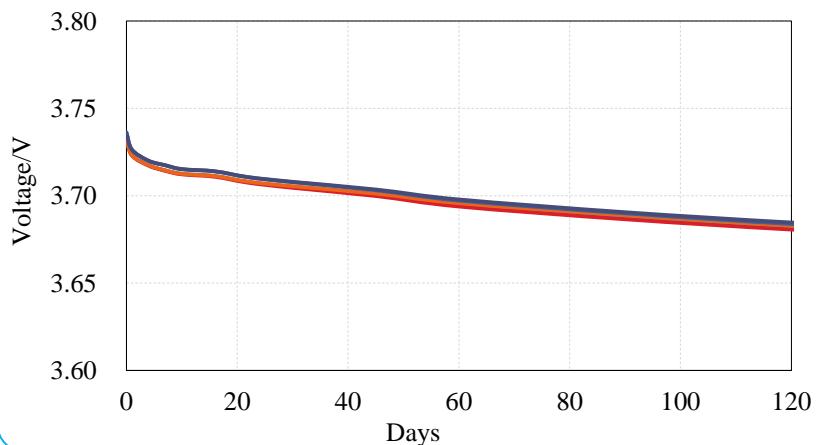
Storage at 25°C_50%SOC



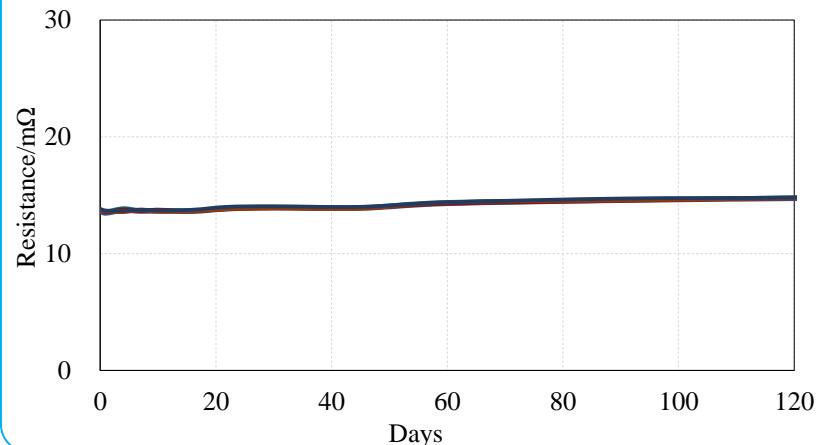
Storage at 25°C_50%SOC



Storage at 45°C_50%SOC

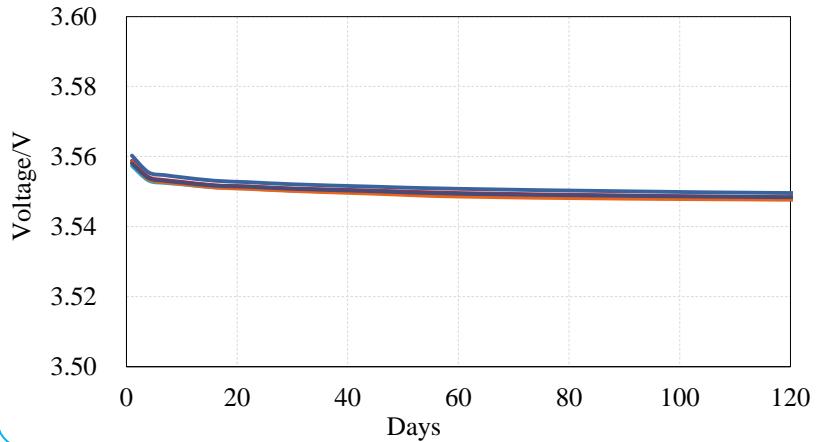


Storage at 45°C_50%SOC

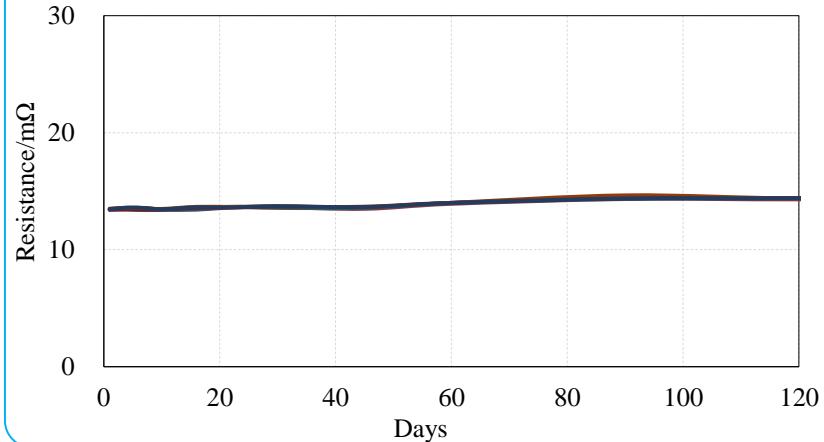


Storage- 35%SOC

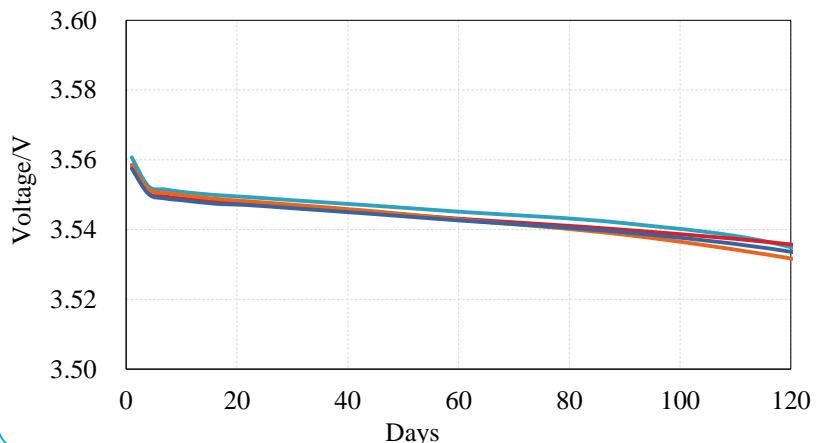
Storage at 25°C_35%SOC



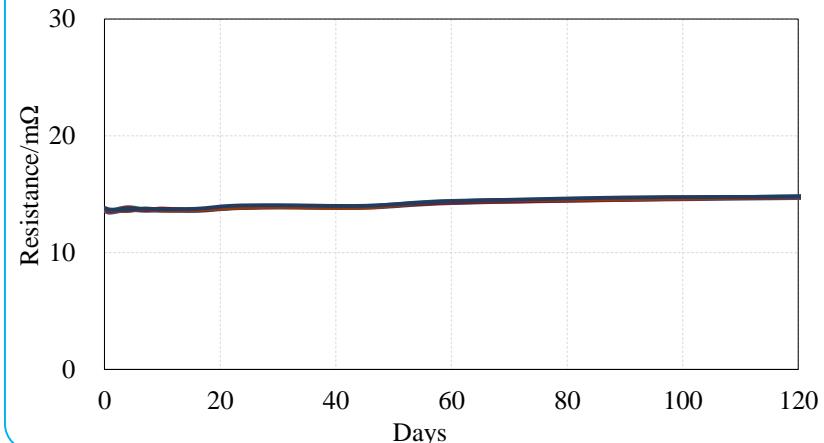
Storage at 25°C_35%SOC

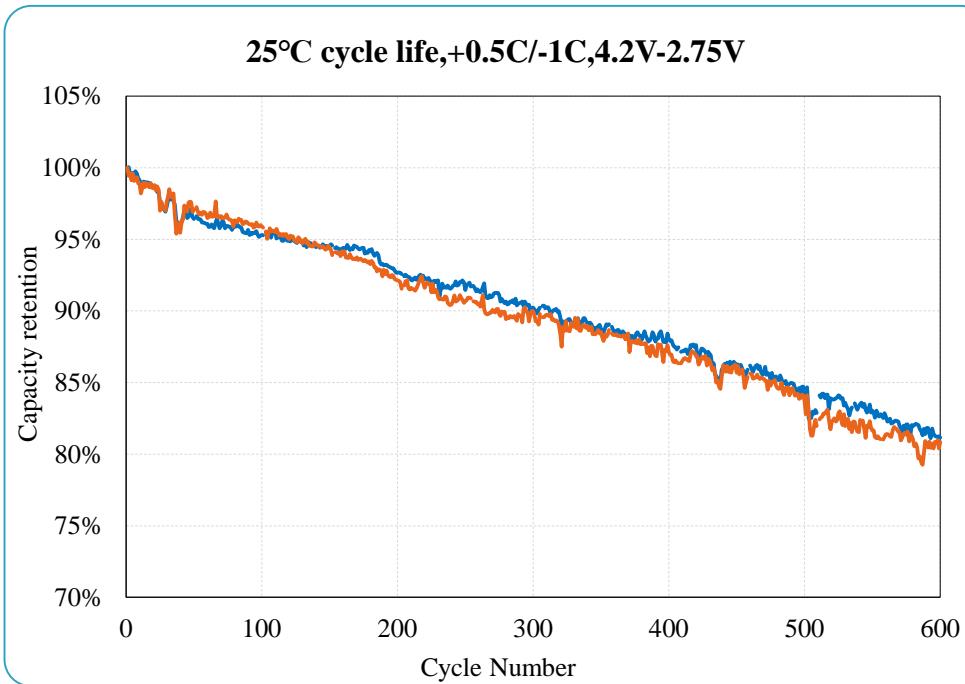


Storage at 45°C_35%SOC



Storage at 45°C_35%SOC



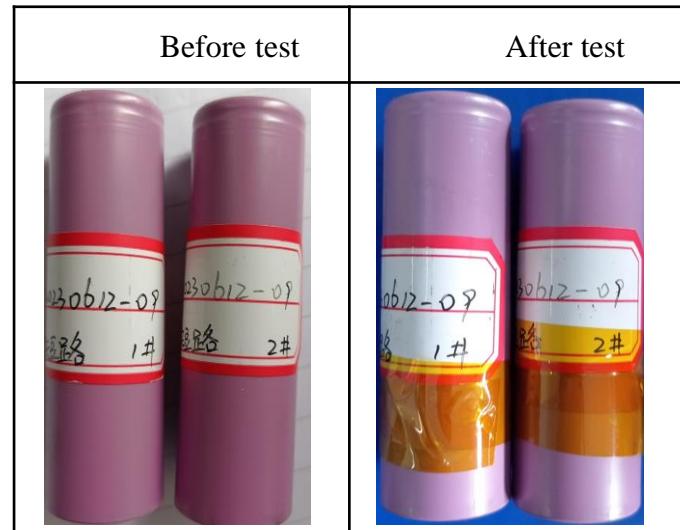
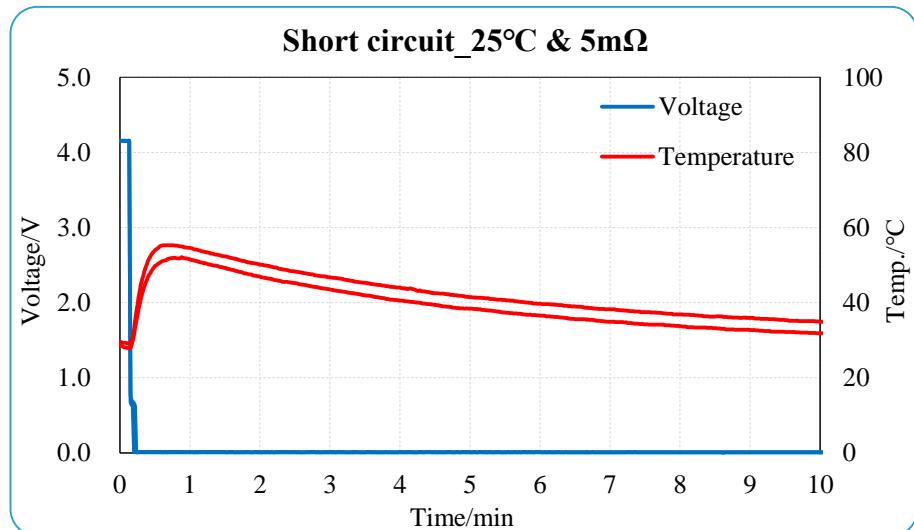


Temperature: 25°C

Charge: 0.5C CC to 4.2V, CV to 0.1C;

Discharge: 1C DC to 2.75V.

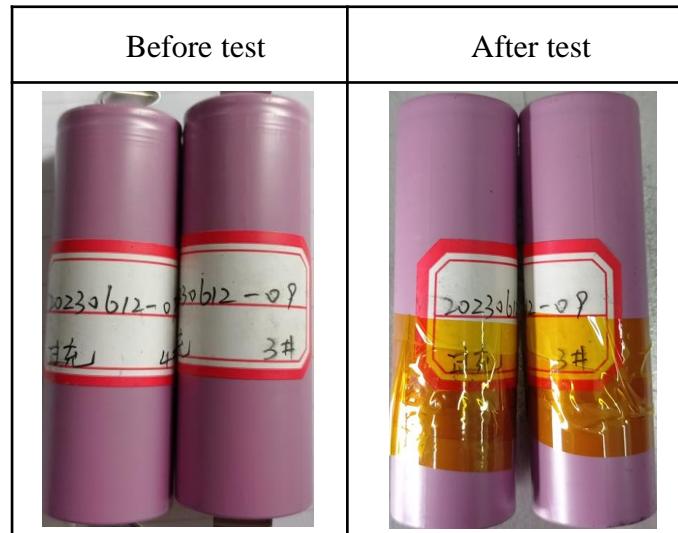
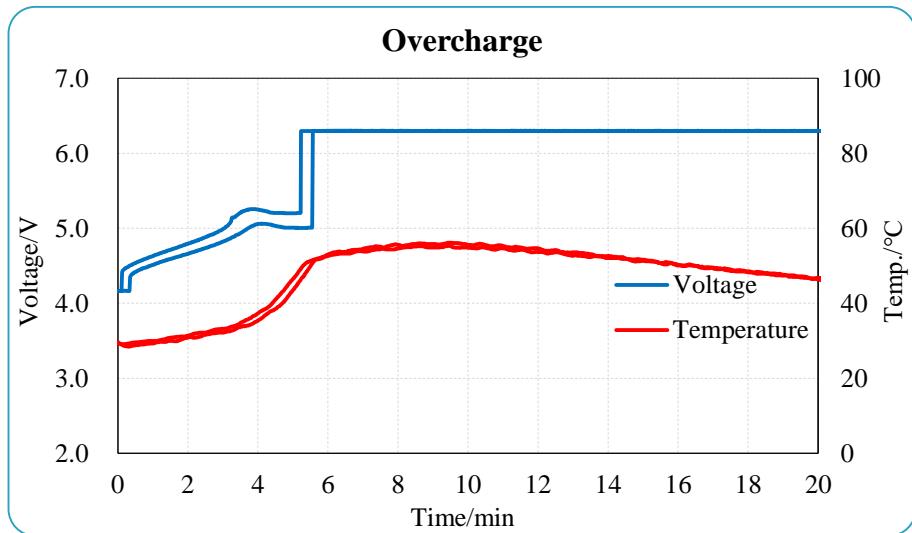
No.	Voltage range	1st cycle		200 th cycle		400 th cycle		600 th cycle	
		Capacity /Ah	Retention /%	Capacity /Ah	Retention /%	Capacity /Ah	Retention /%	Capacity /Ah	Retention /%
1#	4.2-2.75V	5.926	100%	5.491	92.7%	4.833	88.0%	4.810	81.2%
2#	4.2-2.75V	5.931	100%	5.465	92.1%	4.762	87.1%	4.795	80.8%



Test method: At $25 \pm 5^\circ\text{C}$, the fully charged cell is short circuited by connecting positive and negative terminal by a wire which resistance $\leq 5\text{m}\Omega$ for 10min.

Standard: No fire, No explosion

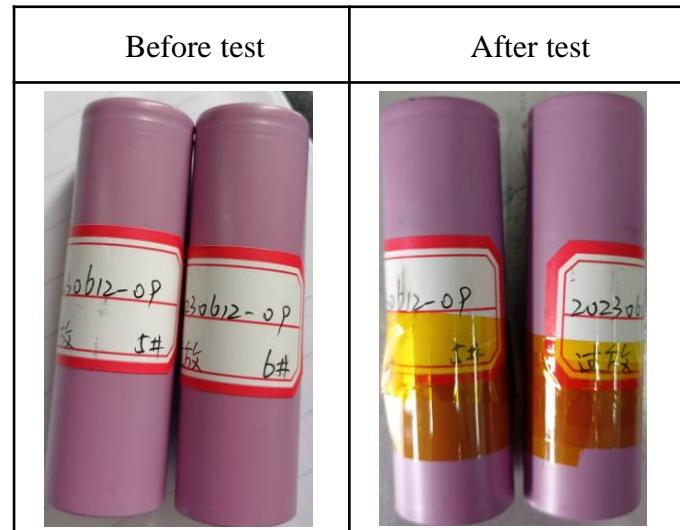
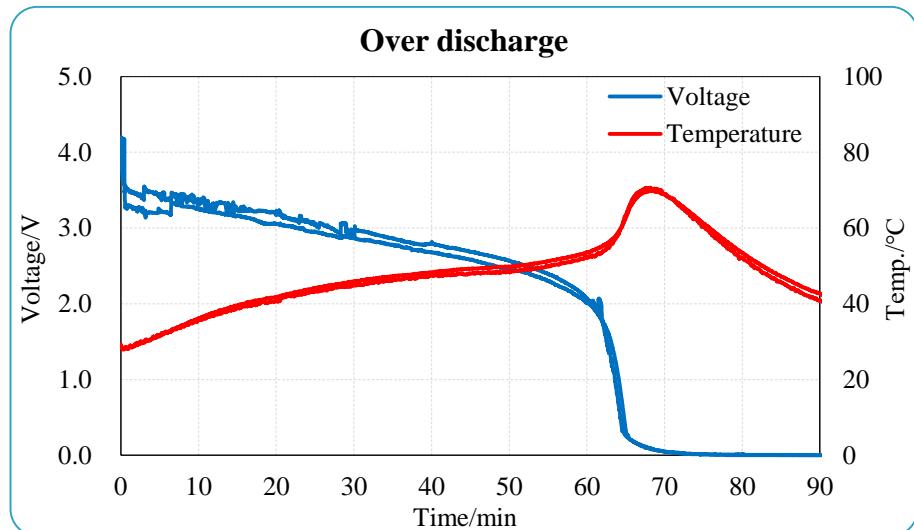
Data records						
No.	Cell status before testing				Max Temp. /°C	Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g		
1#	5.930	14.3	4.165	72.5	55.1	OK
2#	5.935	14.2	4.167	72.6	53.6	OK



Test method: At $25 \pm 5^\circ\text{C}$, the fully charged cell is charged at 1C current to 1.5 times of the cut-off voltage.

Standard: No fire, No explosion

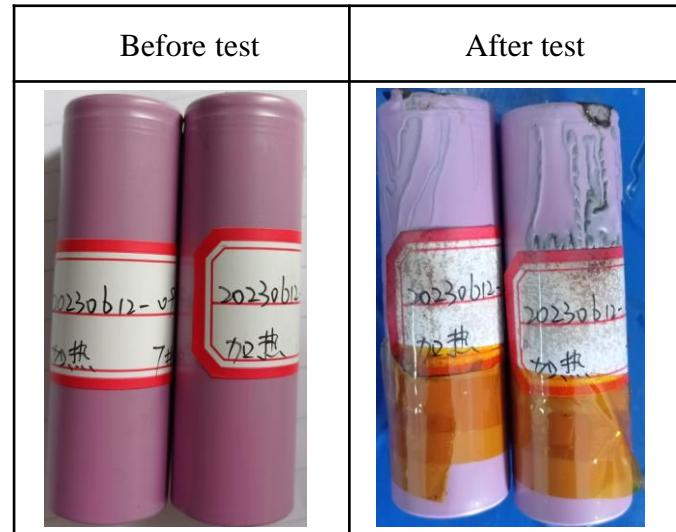
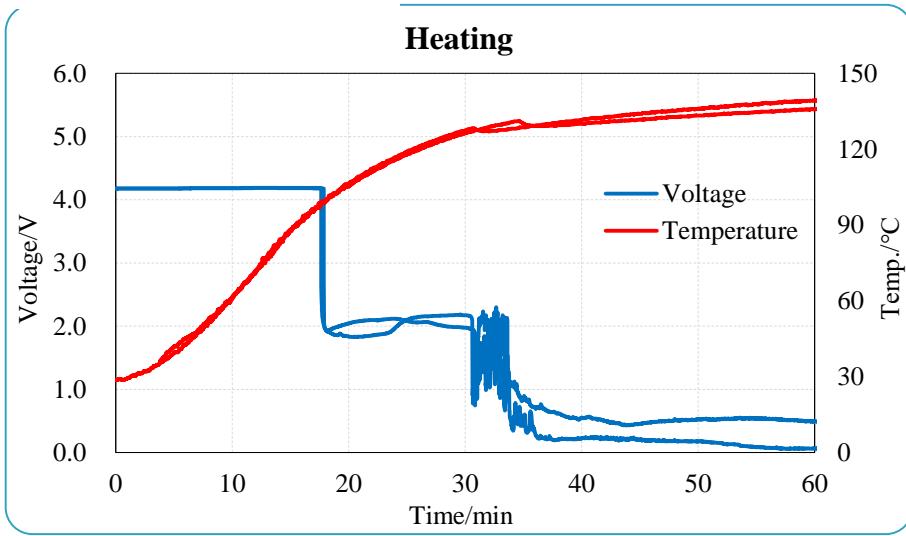
Data records						
No.	Cell status before testing				Max Temp. /°C	Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g		
3#	5.938	13.7	4.165	72.6	55.3	OK
4#	5.931	13.67	4.165	72.6	56.2	OK



Test method: At $25 \pm 5^\circ\text{C}$, the fully charged cell is discharged at 1C current for 90min.

Standard: No fire, No explosion, no leakage

Data records						
No.	Cell status before testing				Max Temp. /°C	Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g		
5#	5.939	14.0	4.167	72.7	70.7	OK
6#	5.934	14.2	4.164	72.6	69.8	OK



Test method: At $25 \pm 5^\circ\text{C}$, the fully charged cell is put into the temperature box, which is heated to 130°C by $5^\circ\text{C}/\text{min}$, and the heating is kept for 30 min

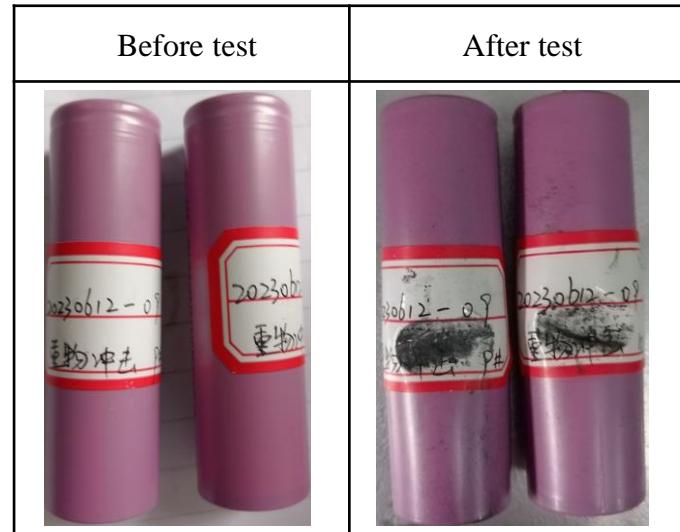
Standard: No fire, No explosion

Data records						
No.	Cell status before testing				Max Temp. /°C	Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g		
7#	5.940	14.3	4.168	72.5	138.3	OK
8#	5.935	14.1	4.166	72.7	138.7	OK

Test method:

At $25 \pm 5^\circ\text{C}$, the fully charged cell is placed on the platform, and a metal rod with a diameter of $15.8\text{mm} \pm 0.2\text{mm}$ was horizontally placed on the upper surface of the geometric center of the cell, and a weight of $9.1\text{kg} \pm 0.1\text{kg}$ was used to impact the cell's surface with the metal rod from a height of $610\text{mm} \pm 25\text{mm}$ in a free fall.

Standard: No fire, No explosion

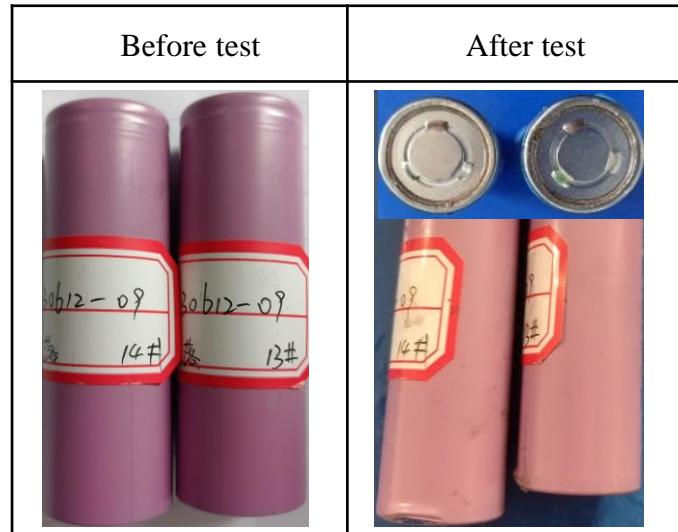


Data records					
No.	Cell status before testing				Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g	
11#	5.924	14.2	4.166	72.6	OK
12#	5.923	14.0	4.167	72.5	OK

Test method:

At $25 \pm 5^{\circ}\text{C}$, the fully charged cell is dropped by the positive and negative terminal down from a height of 1.0m onto the cement floor.

Standard: No fire, No explosion, No leakage

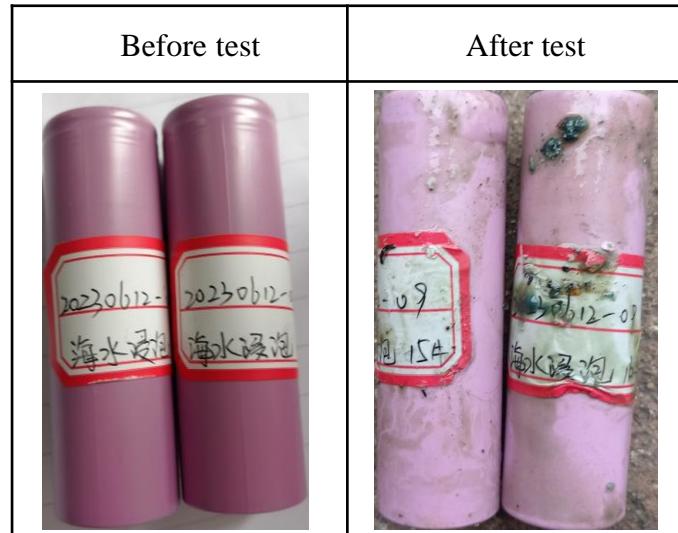


Data records					
No.	Cell status before testing				Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g	
13#	5.931	14.3	4.167	72.5	OK
14#	5.927	14.1	4.166	72.7	OK

Test method:

At $25 \pm 5^\circ\text{C}$, the fully charged cell is completely immersed in 3.5wt% NaCl solution for 2h

Standard: No fire, No explosion



Data records					
No.	Cell status before testing				Test results OK/NG
	Capacity/Ah	Resistance/mΩ	Voltage/V	Weight/g	
15#	5.936	14.3	4.167	72.5	OK
16#	5.931	14.2	4.165	72.7	OK

