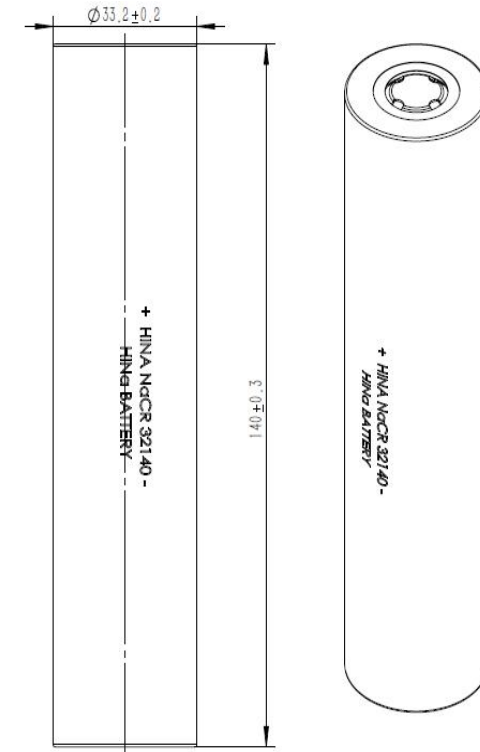


NaCR32140-MP10 Test Data

**Product Center
Jerry Wan
2023.10**

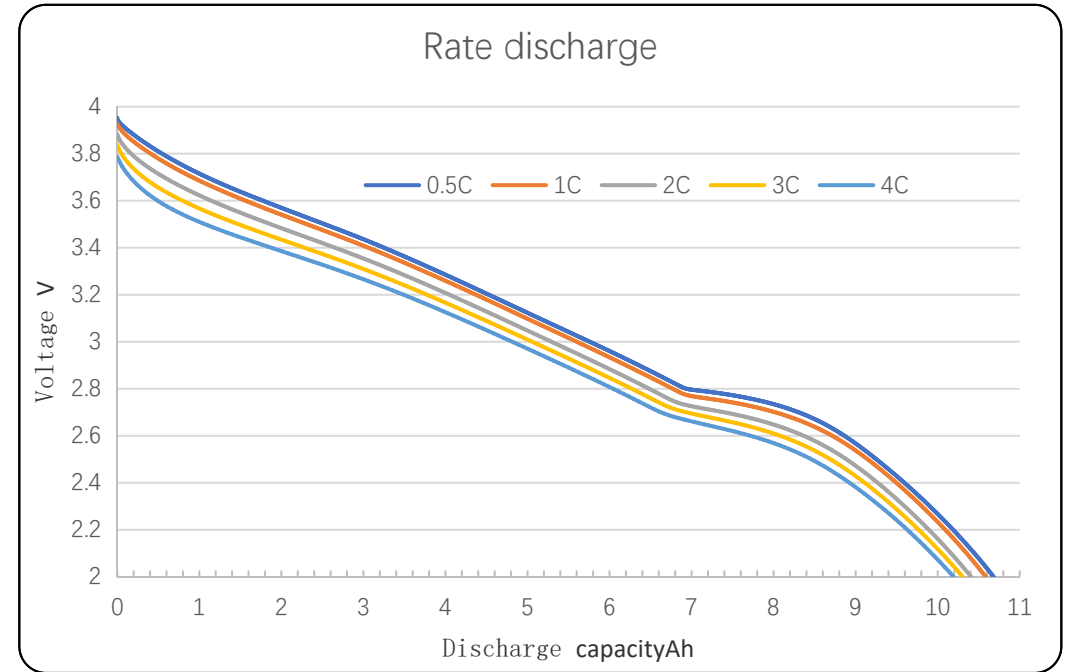
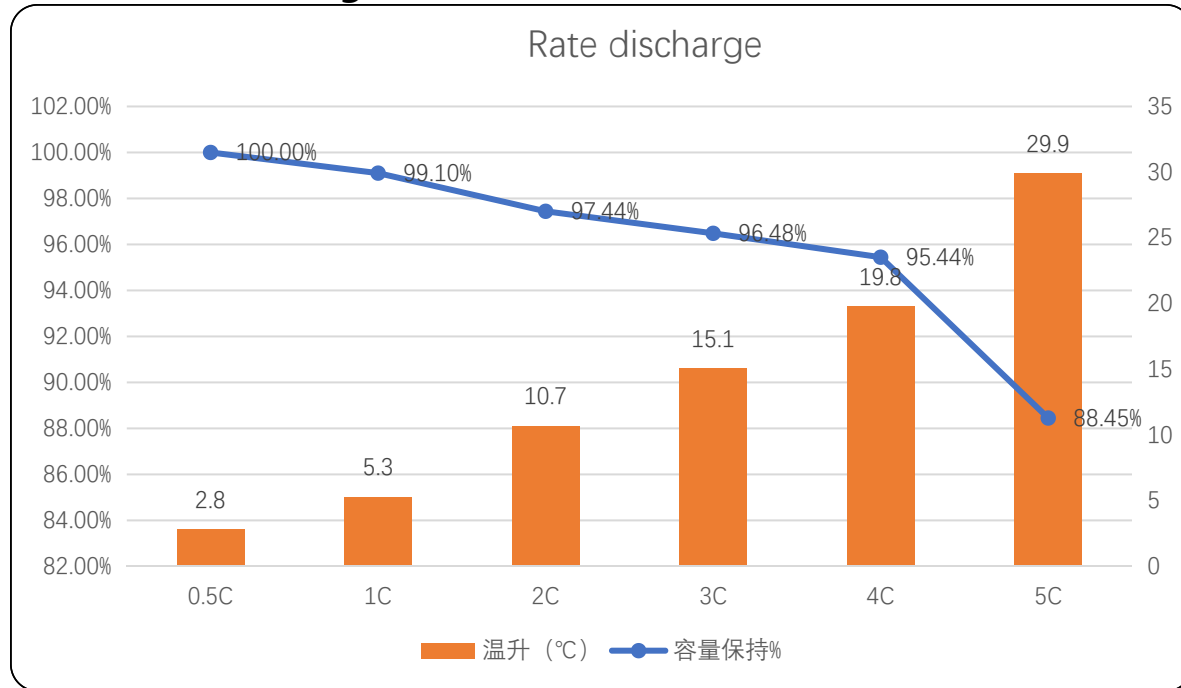
Basic information about battery cells

Serial Number	Project	Standard		Remark
1	Nominal capacity@3.95V~2.0V	10.0	Ah	0.5C discharge @25°C
2	Rated voltage	3.0	V	/
3	AC internal resistance	≤3	mΩ	AC 1kHz,3.2V
4	DC internal resistance	≤10	mΩ	2C 30s,3.2V
5	Battery weight	270±5	g	/
6	Battery size	Diameter: Φ33.2±0.2 Height: 140±0.3	mm	Dimensions
7	Charge cutoff voltage	3.95 3.9 3.8	V	0°C<T- 10°C≤T≤0°C- 20°C≤T<-10°C
8	Charge cut-off current	500(0.05C) 1000(0.1C)	mA	T>0°C T≤0°C
9	Discharge cutoff voltage	2.0	V	Can be discharged to 0V
10	Standard continuous charging current	5000	mA	0.5C
11	Maximum continuous charging current	30000	mA	3C CC to 3.95V charging capacity > 90% temperature rise < 20°C
12	Standard continuous discharge current	5000	mA	0.5C
13	Maximum continuous discharge current	30000	mA	3C CC to 2V Discharge capacity > 90% Temperature rise < 20°C



Rate discharge test

- ◆ 0.5C constant current and constant voltage charging to 3.95V , different rates of discharge to 2.0V

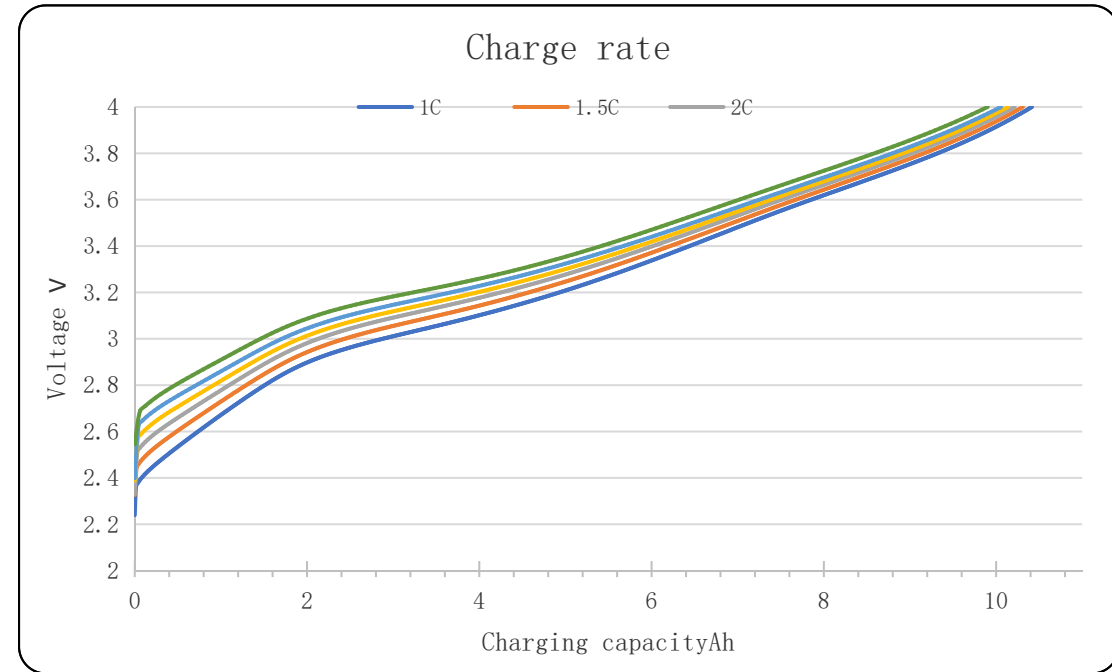
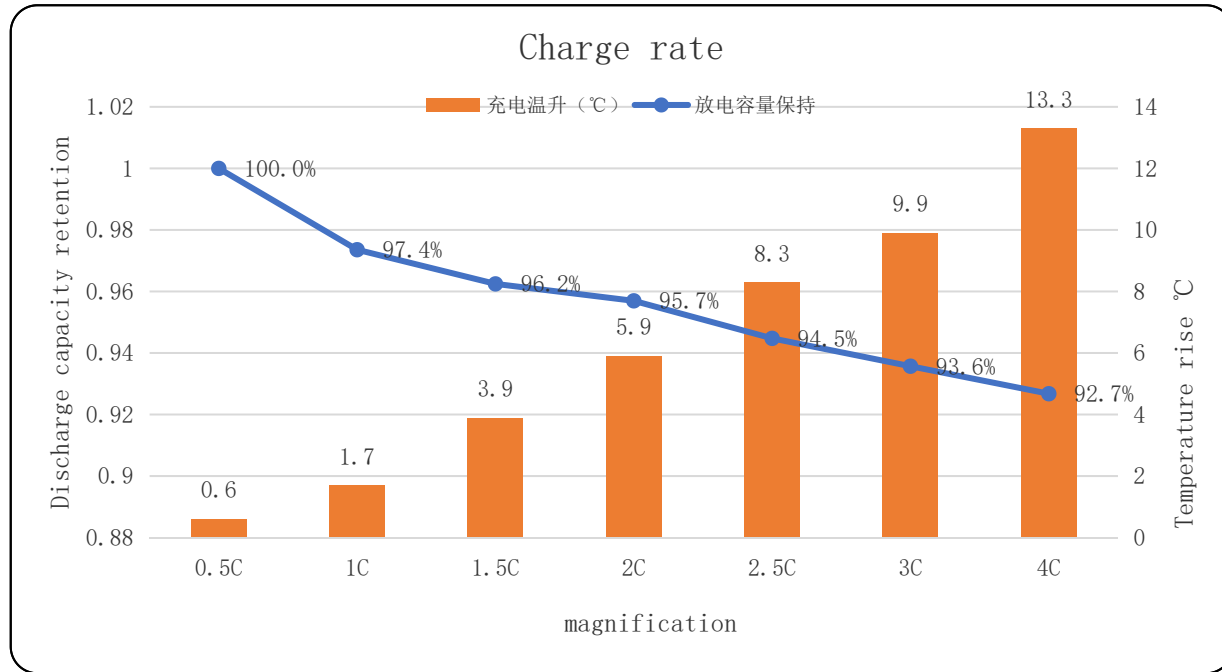


Temperature Raise, Capacity Retention

- Can meet 4C continuous discharge, capacity retention rate > 95% , single temperature rise < 20°C .

Rate charging test

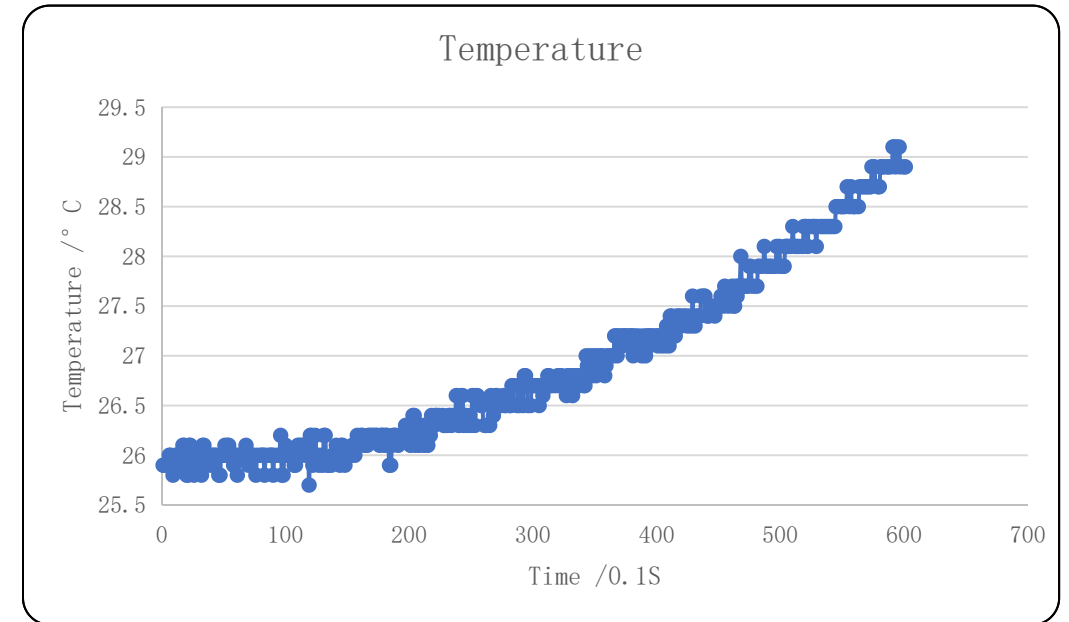
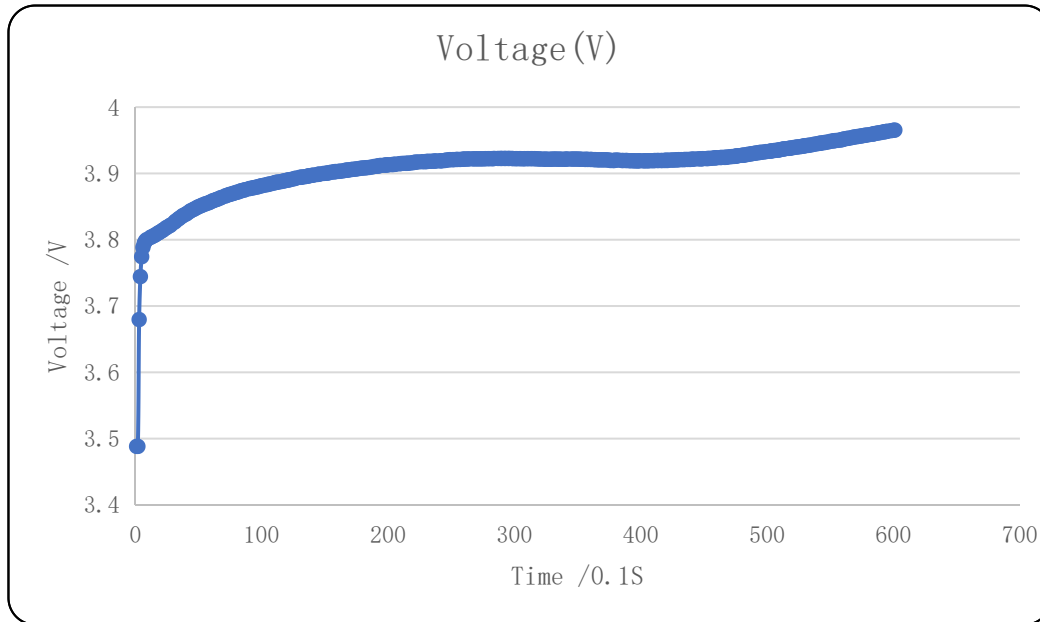
- ◆ 0.5C constant current discharge to 2.0V , constant current charge at different rates to 3.95V



- It can meet 4C continuous charging, the capacity retention rate is > 92% , and the unit temperature rise is < 15°C .

Pulse charging test

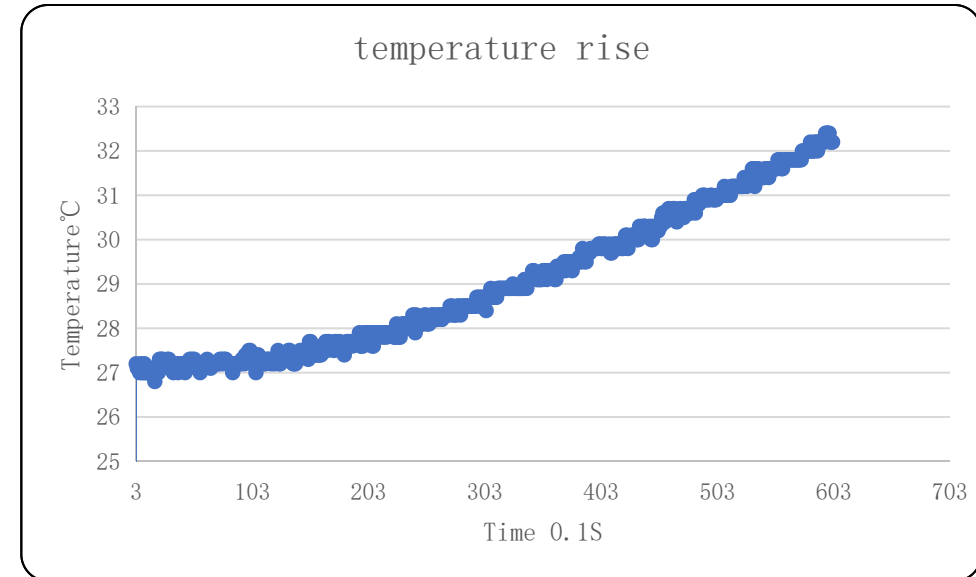
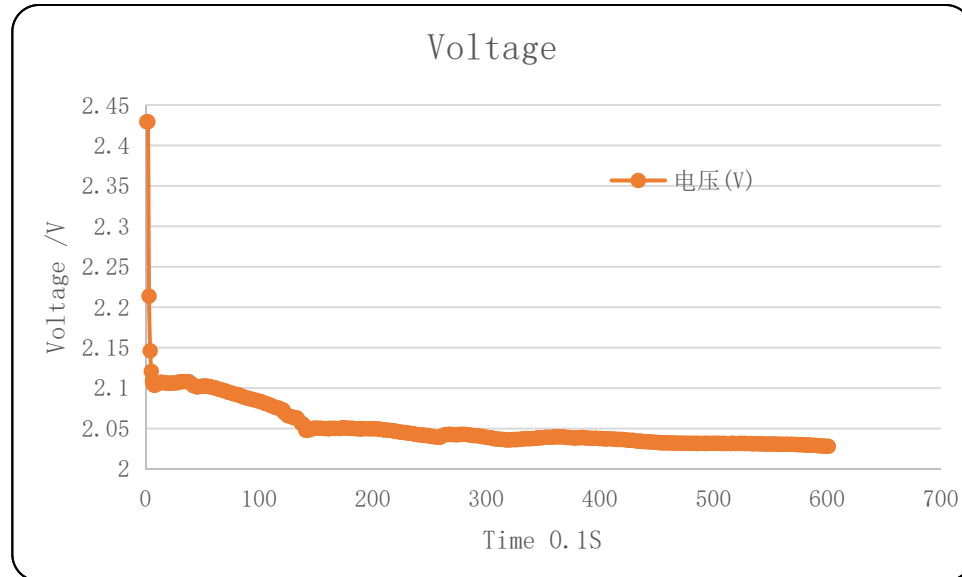
- The battery adjusts SOC to 40% at normal temperature . After being left aside for 6 hours , it is charged at 10C for 60s or the voltage reaches 3.95V .



- Cell can support 10C pulse charging for 60s at 40% SOC at room temperature .

Pulse discharge

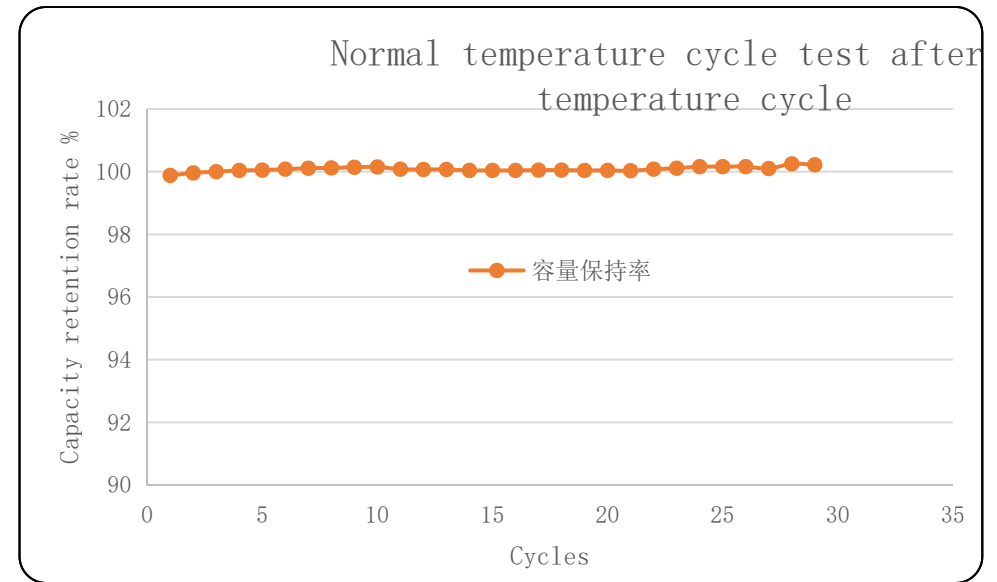
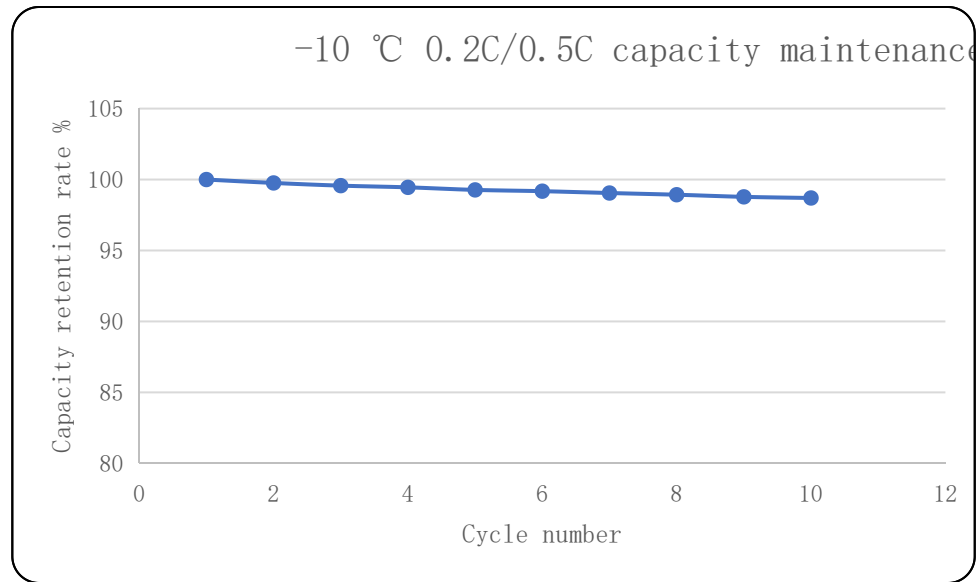
- The cell SOC set to 50% at room temperature , and then discharges it at 10C for 60s or the voltage reaches 2.0V after being left aside for 6 hours .



- Cell can support 10C pulse for 60s at 50% SOC at normal temperature.

Low temperature charging test

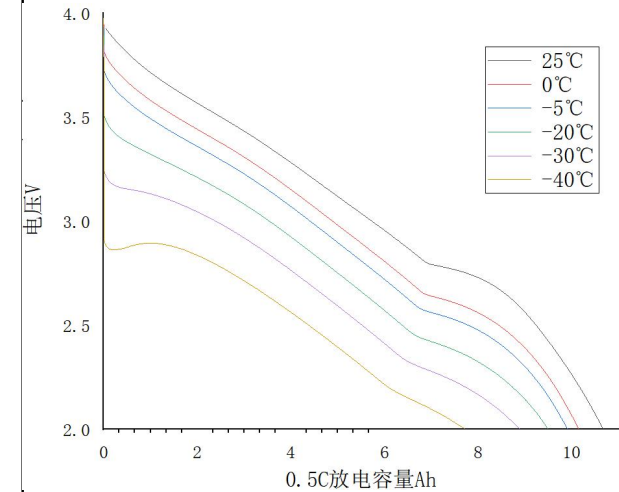
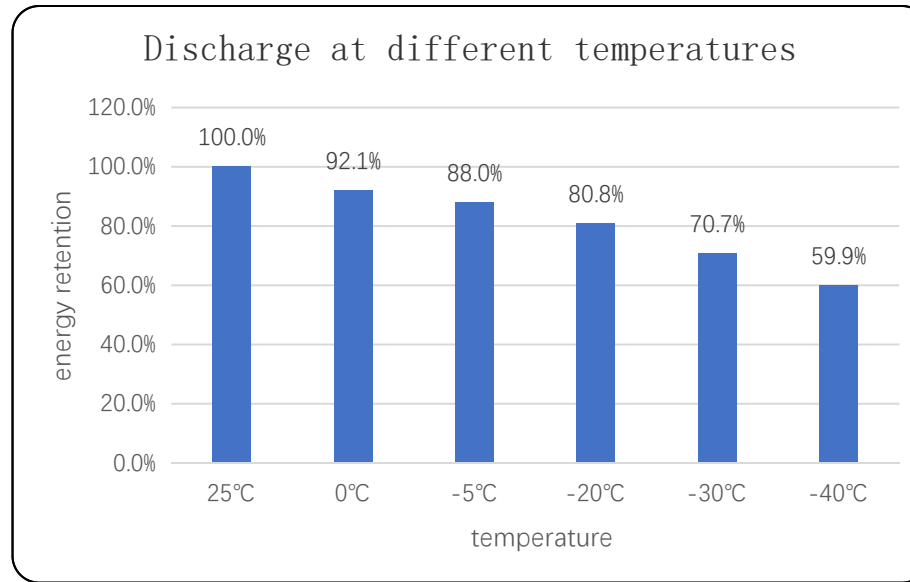
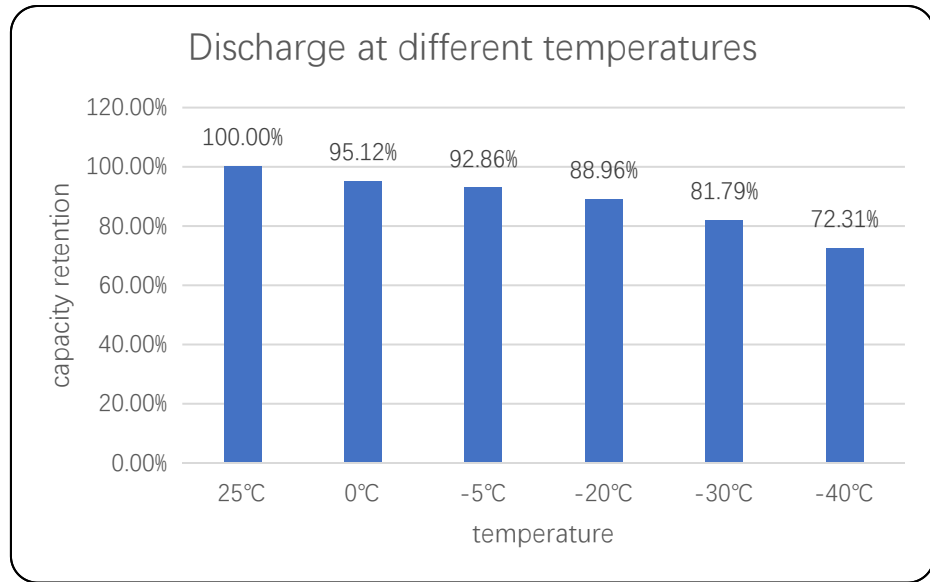
- The battery is charged at a constant current of 0.2C to 3.90V at -10°C , then charged to the upper limit voltage at 0.1C, and fully discharged at 0.5C at a temperature of -10°C , for 10 cycles.



It can be continuously charged to 3.9V at 0.2C at -10°C , and can be charged at 0.2C and discharged at -10°C at 0.5C. The available capacity is $> 92\%$, and has no impact on the cycle after returning to normal temperature.

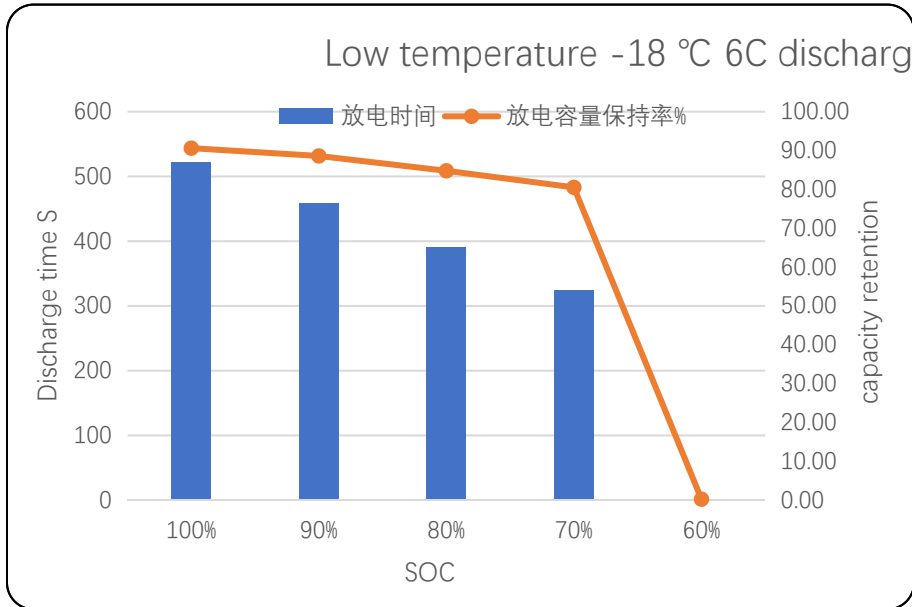
Low temperature discharge capability

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at 25°C , then discharge to 2.0V at 0.5C after being left at different temperatures for 6 hours .



- Capacity retention > 88% and energy retention > 80% at -20°C .

- ◆ Charge to different SOC at 0.5C constant current and voltage at 25°C , then discharge to 2.0V at 6C after leaving it for 6 hours at -18°C.



- At -18°C , SOC > 60% can achieve 6C continuous discharge.

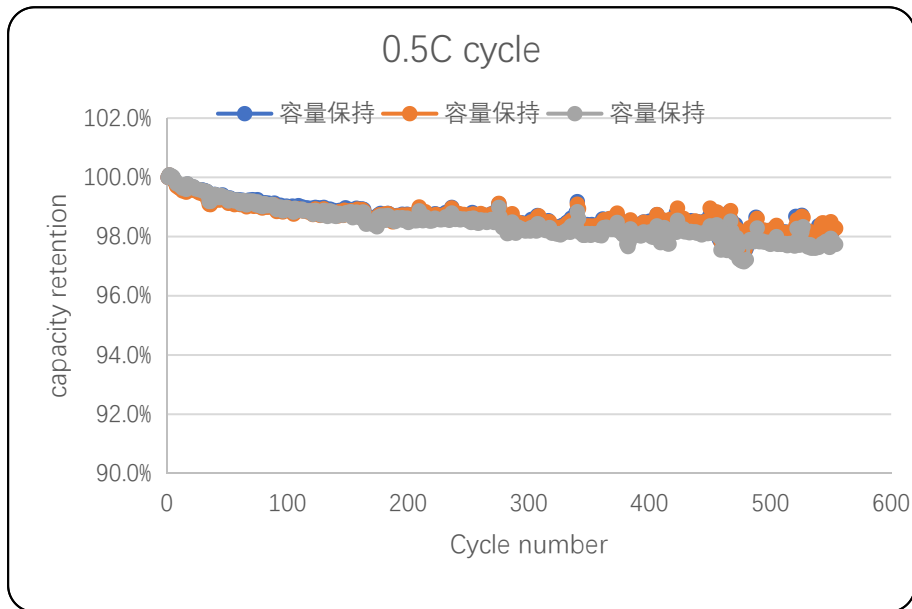
High temperature storage capacity

		047CZAC2ADD13AD4 E0000927					047CZAC2ADD13AD4 E0002441			
Store at 85°C for 3 days	Initial cell capacity	Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)		Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)
		10.6822	34.3967	32.7558	3.0636		10.6379	34.3737	32.6385	3.0713
	Verification after shelving	Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)		Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	
		9.8599	0	29.065	2.9216		9.7897	0	28.8603	
		10.5707	33.9545	32.0631	3.0152		10.5214	33.7948	31.9214	
	capacity retention	92.30%	energy retention	88.73%		capacity retention	92.03%	energy retention	88.42%	
Capacity recovery	98.96%	energy recovery	97.89%		Capacity recovery	98.90%	energy recovery	97.80%		
		047CZAC2ADD13AD4 E0002346				047CZAC2ADD13AD4 E0002362				
Store at 60°C for 7 days	Initial cell capacity	Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)		Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)
		10.5651	34.0806	32.4497	3.0793		10.586	34.1441	32.5077	3.08
	Verification after shelving	Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)		Discharge capacity(Ah)	Charging energy (Wh)	Discharge energy(Wh)	Median voltage (V)
		9.8935	0	29.6289	2.9972		9.8967	0	29.6187	2.9938
		10.5042	33.7701	32.1555	3.0614		10.5401	33.7591	32.2694	3.0636
	capacity retention	93.64%	energy retention	91.31%		capacity retention	93.49%	energy retention	91.11%	
Capacity recovery	99.42%	energy recovery	99.09%		Capacity recovery	99.57%	energy recovery	99.27%		

- After being left at 85°C for 3 days, the energy retention is > 88% and the energy recovery is > 97% .
- After being left at 60°C for 7 days, the energy retention is > 91% and the energy recovery is > 99% .

Cycle life 2~3.95V 0.5C

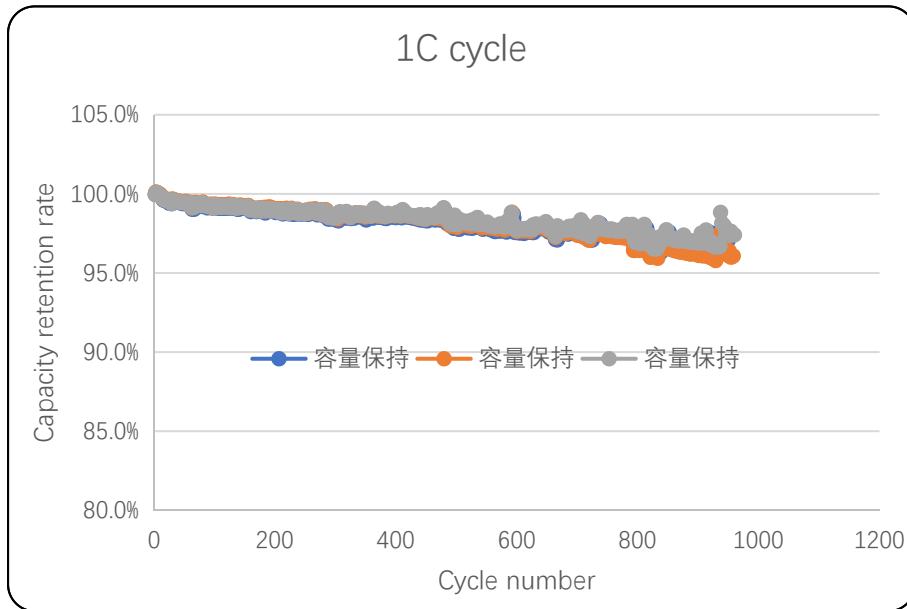
- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at 25°C ± 5°C , discharge to 2.0V at 0.5C



- Capacity Retention is 98% after 500 cycles .

Cycle life 2~3.95V 1C

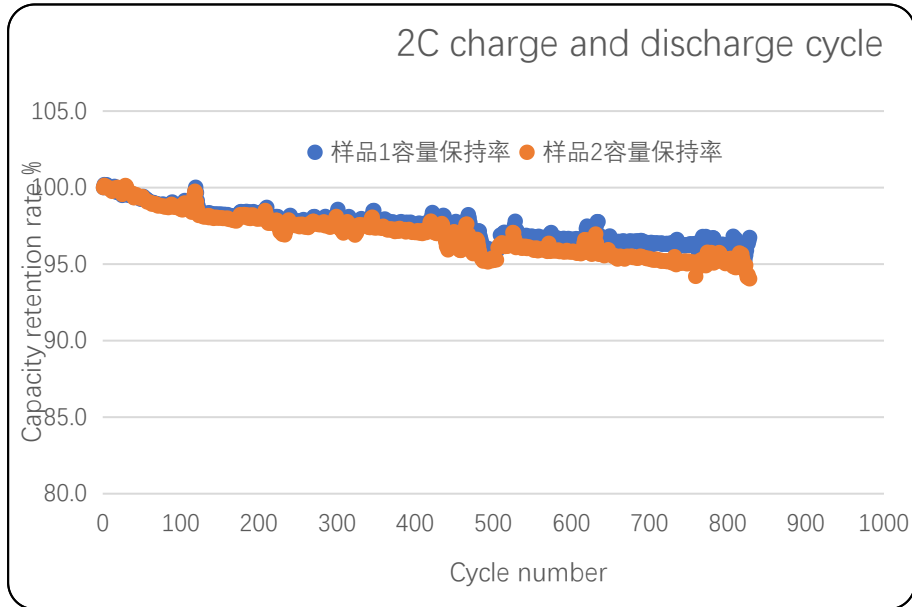
- ◆ Charge to 3.95V at 1C constant current and constant voltage at 25 °C ± 5 °C , discharge to 2.0V at 1C



- Capacity Retention is 97% after 950 cycles .

Cycle life 2~3.95V 2C

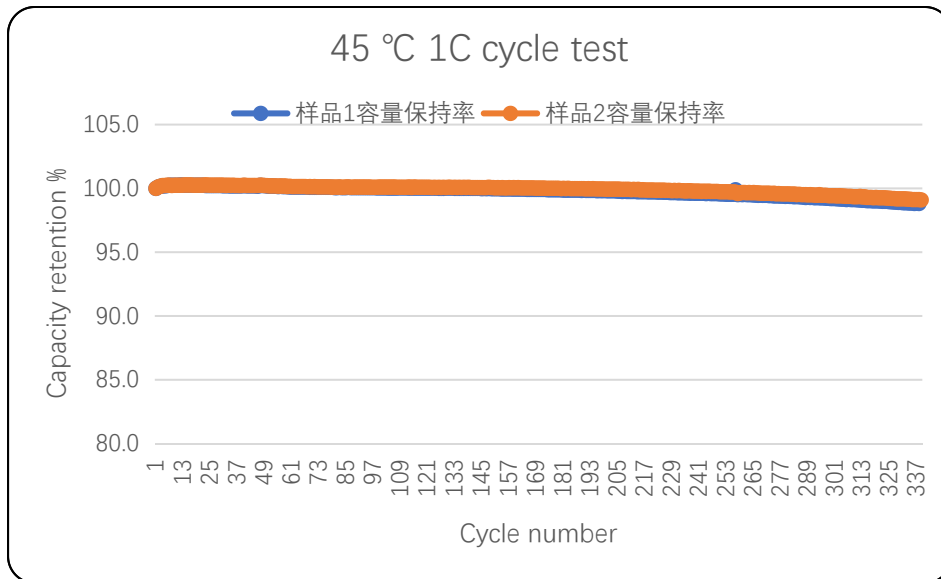
- ◆ Charge to 3.95V at 2C constant current at 25°C ± 5°C , discharge to 2.0V at 2C



- Capacity Retention is 95% after 830 cycles .

Cycle life High temperature 45°C 2~3.95V 1C

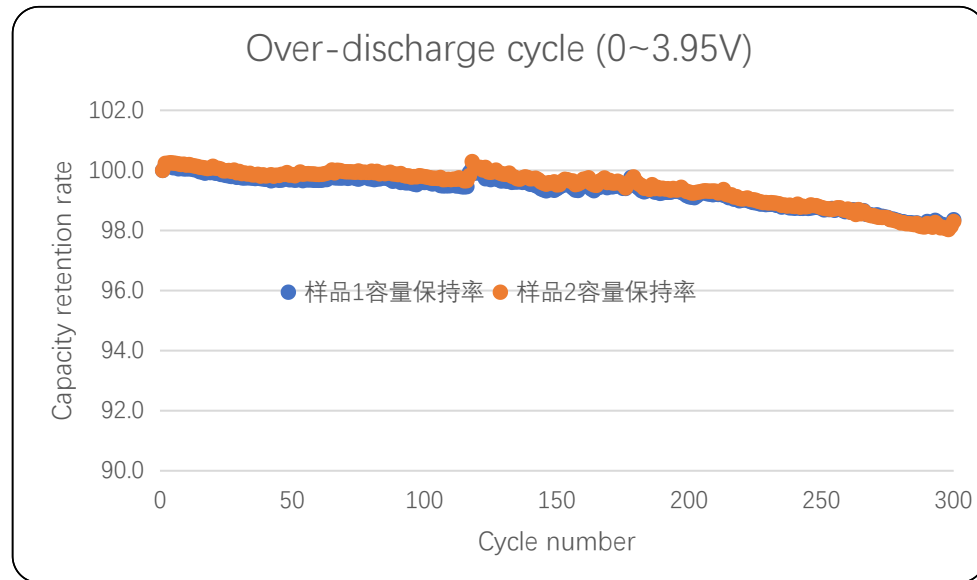
- ◆ Charge to 3.95V at 1C constant current and constant voltage at 45 °C ± 2 °C , discharge to 2V at 1C



- Capacity retention rate of the battery cell after 337 cycles at high temperature 45°C is > 98% .

Cycle life 0~3.95V 1C

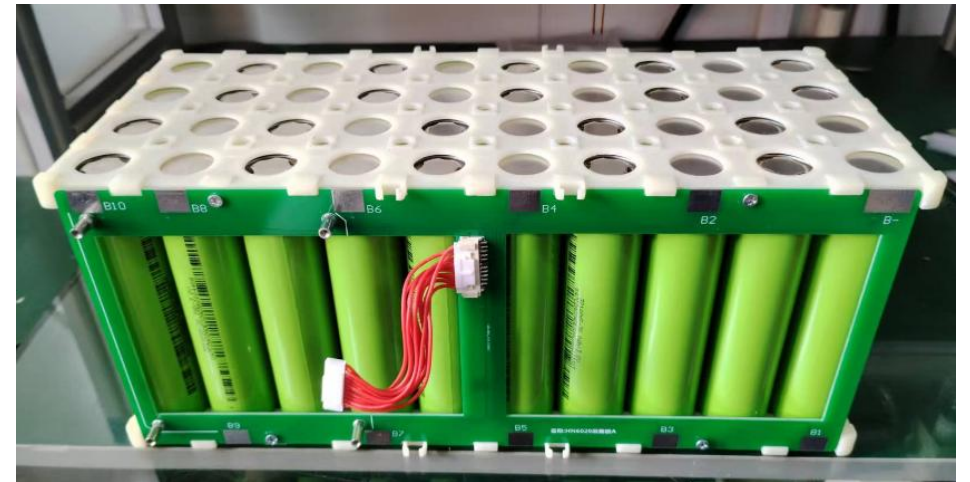
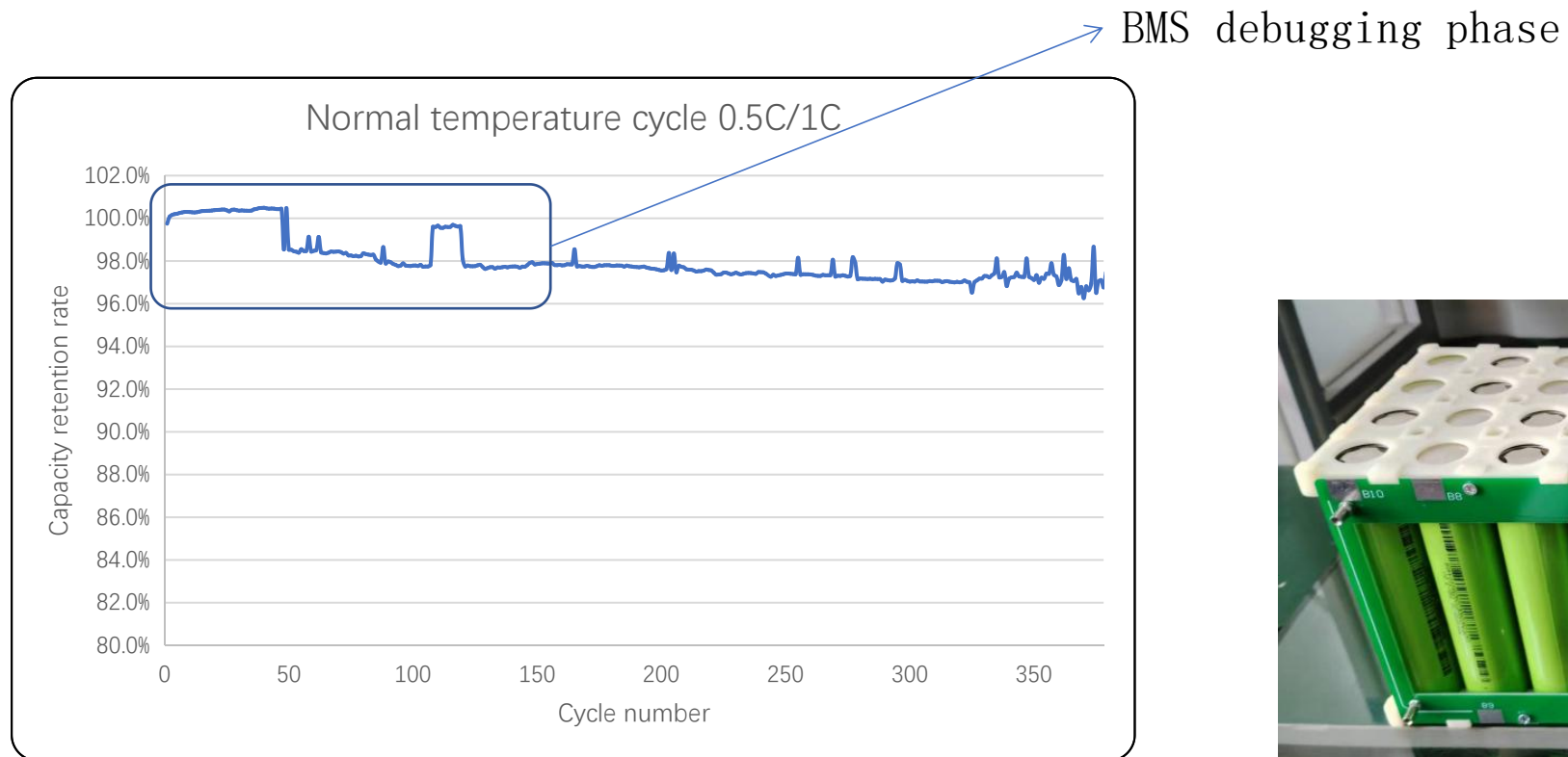
- ◆ Charge to 3.95V at 1C constant current and constant voltage at 25 °C ± 5 °C , discharge to 0V at 1C



- " starvation " phenomenon in battery cells , and there is no safety risk in over-discharging, which reduces actual maintenance costs.

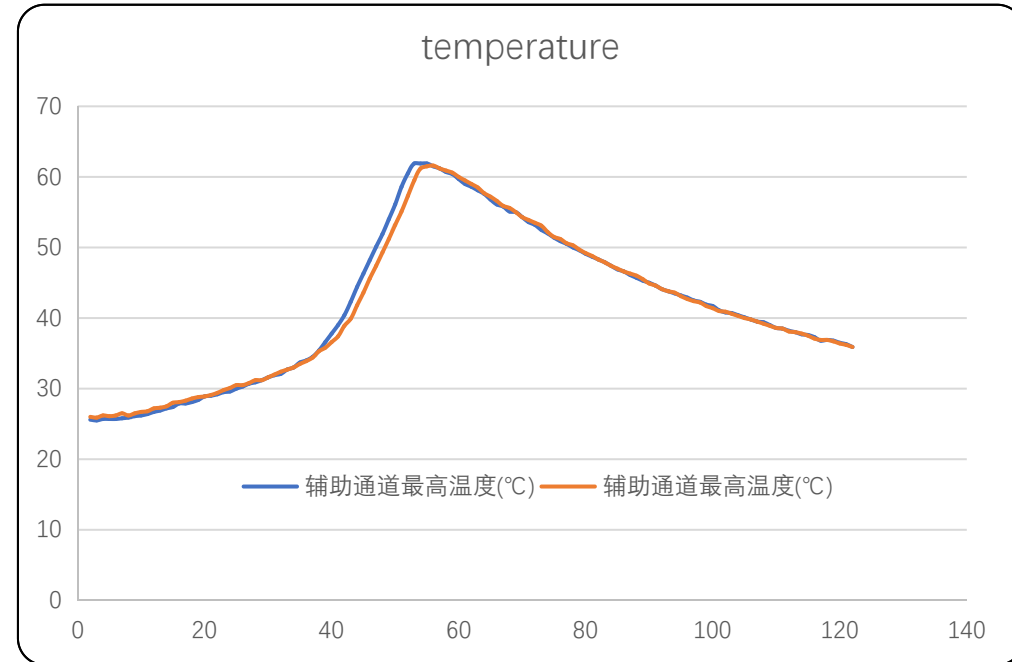
Battery pack cycle life 0.5C/1C

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, discharge to 2.0V at 1C



- The capacity retention rate of the battery pack after 370 cycles is $> 96\%$.

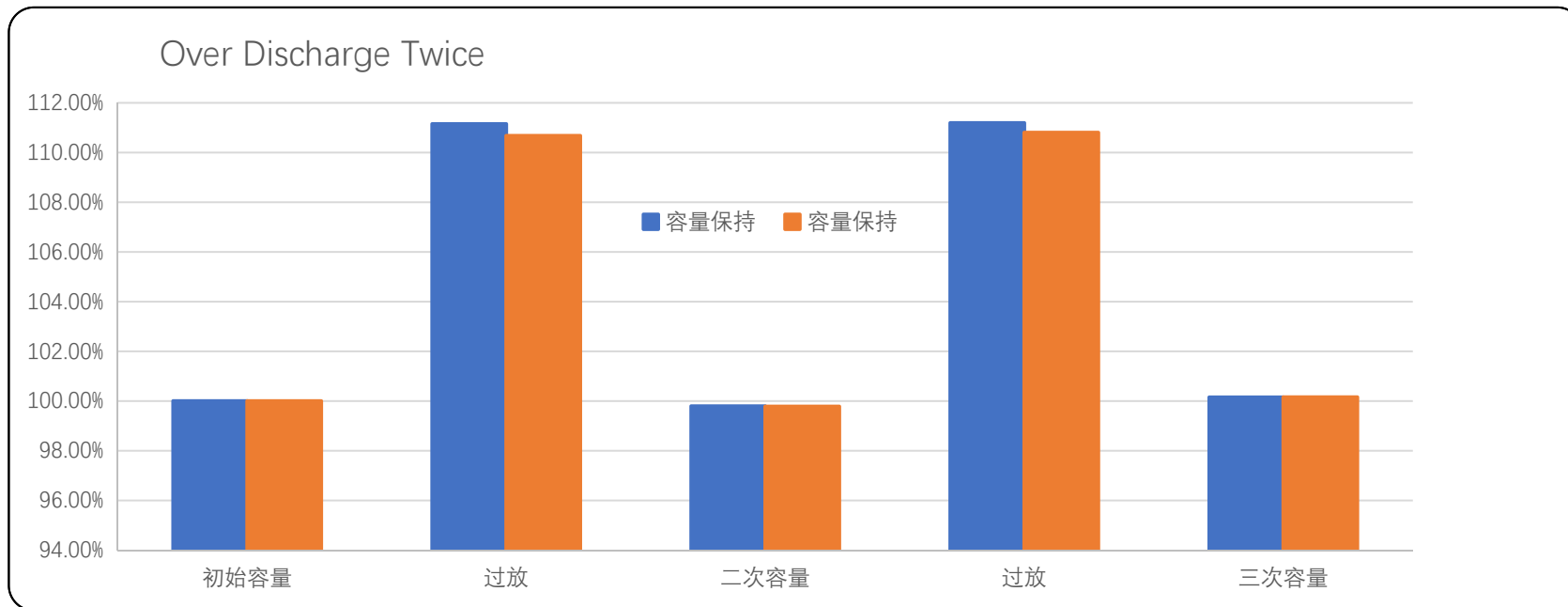
- ◆ 1C constant current charge to 6.0V at 25 °C ± 5 °C



- Test passed

Safety --- over discharge

- ◆ At 1C constant current to 0V at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, then fully discharge it to 0V.
- ◆ and then verify the capacity once .

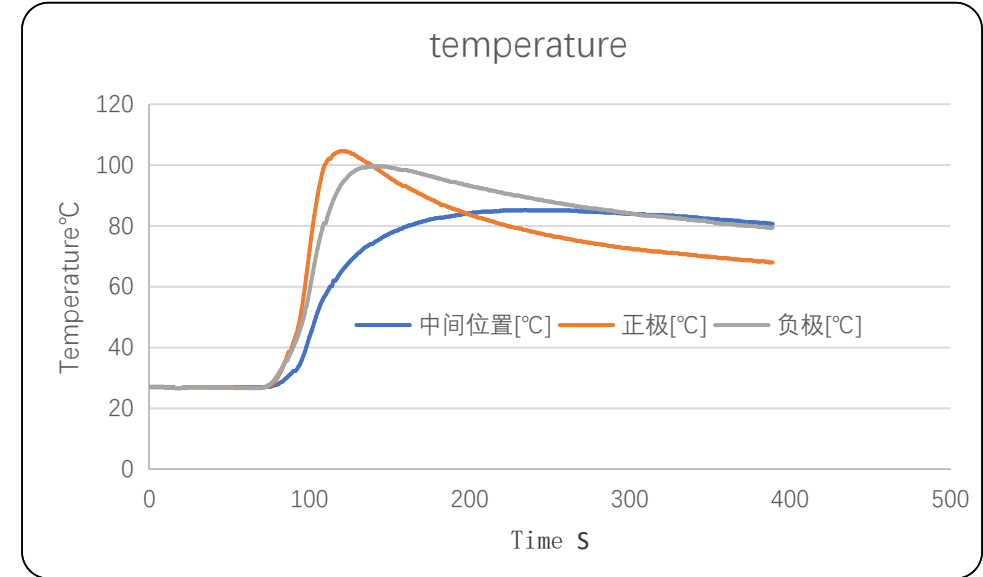


Initial Capacity, Over Discharge, 2nd Capacity, Over Discharge, 3rd Capacity

- Test passed

Safety --- External short circuit

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, and short circuit for 10min with an external circuit resistance of $< 5\text{m}\Omega$.

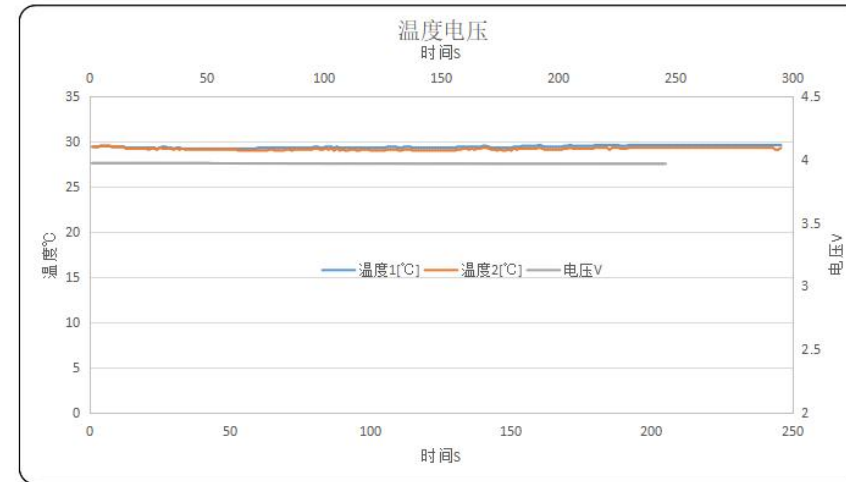
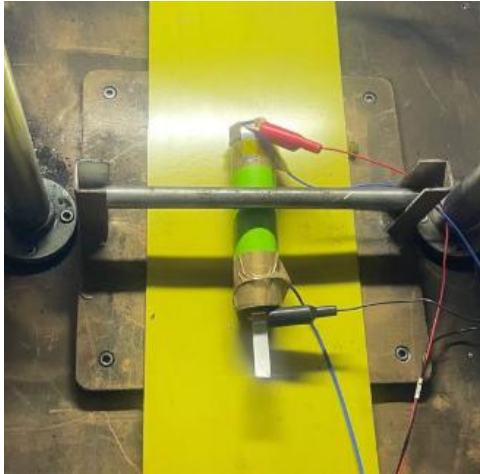


Body Middle VS Cathode VS Anode Temperature

- The battery did not catch fire or explode and passed the test.

Safety --- impact of heavy objects

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, weight height 610mm, weight weight 9.1kg, 15.8mm steel rod



Temperature VS Time VS Voltage

- The battery has not caught fire, exploded or leaked, and has passed the test.

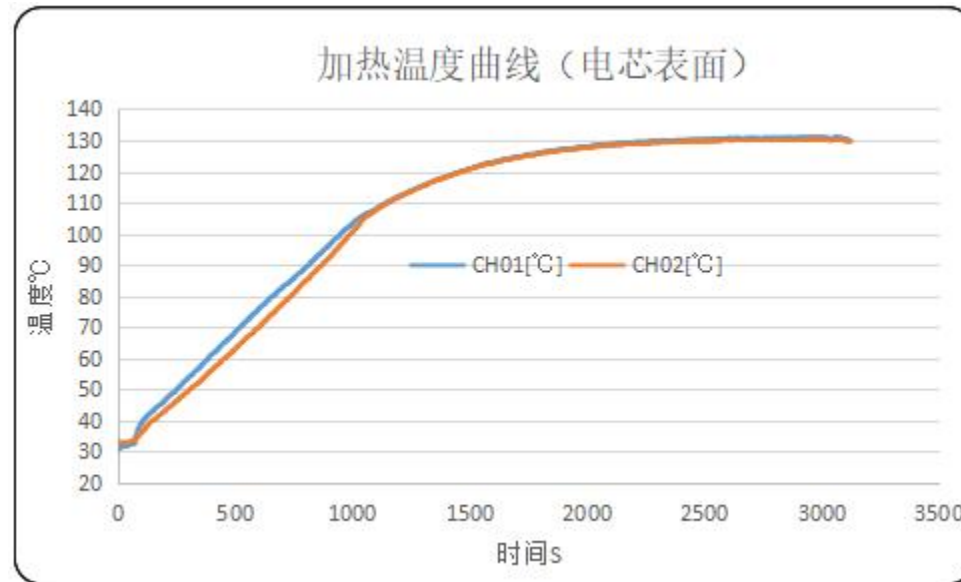
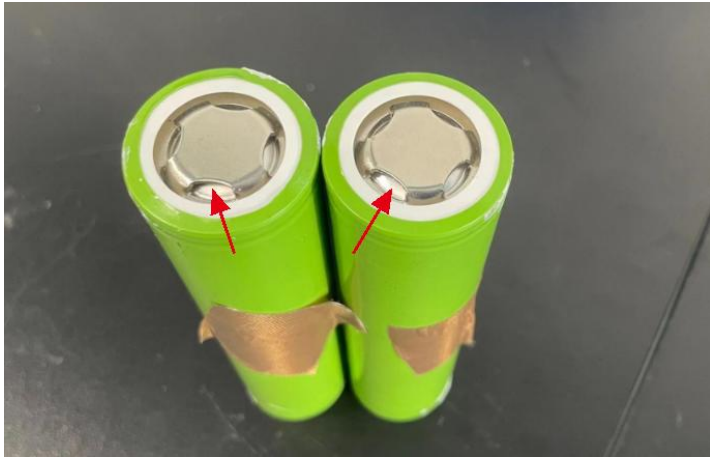
Safety --- low pressure test

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, and leave the battery under an absolute pressure of 11.6kPa for 6 hours at room temperature.



- The battery did not catch fire or explode and passed the test.

- ◆ Charge to 3.95V at 0.5C constant current and constant voltage at $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.
- ◆ After the battery is fully charged, place it in the heating test box.
- ◆ Heat to $130\text{ }^{\circ}\text{C}$ at $5\text{ }^{\circ}\text{C}/\text{min}$ and then keep it for 30min.



Cell Surface Temperature Curve

- The CIDs of the battery cells have all been turned over. There is no abnormality in appearance after the test, and there is no terminal voltage. The test passed.

Summary:

- This product has excellent rate performance, especially unique rate charging performance.
- This product has excellent low temperature performance, especially it can support -40°C discharge and -20°C charging.
- This product has the performance of not being afraid of over-discharge, which can reduce maintenance costs and improve product transportation safety in actual engineering applications.
- This product has a high service life.
- This product has strategic resource advantages and excellent cost performance.