

Technical Information of 18650HG2 (3.0Ah)

Aug.25. 2015

Cylindrical Cell Development 3 Team



Summary

Type		Specification	Actual
Chemistry		Li[NiMnCo]O ₂ (H-NMC) / Graphite + SiO	
Dimensions (mm)	Diameter	18.3 +0.2 / -0.3 mm	
	Height	65.00 ± 0.2 mm	
Weight (g)		Max. 48	44~45
Initial IR (mΩ AC 1kHz)		Max. 17	14~16
Initial IR (mΩ DC)		Max. 30	24~26
Nominal Voltage (V)		3.6	
Charge Method		Nominal : 1.5A 4.2V, 50mA End-current (CC-CV)	
		Fast : 4A 4.2V, 100mA End-current (CC-CV)	
Charge Time	Nominal (min)	165min	
	Fast (min)	85min	
Charge Current	Nominal Current (A)	1.5A	
	Max. Current (A)	4A	
Discharge	End Voltage (A)	2V	
	Max. Current (A)	20A (Continued discharge current)	
0.2C Capacity	Nominal (Ah)	3.0 Ah	
Energy Density	Nominal (Wh/kg)	240	

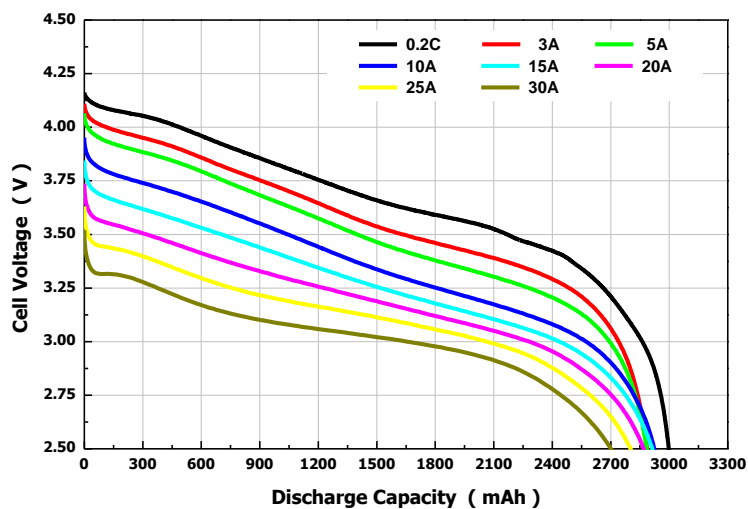
Resistance – AC and DCIR (soc100%, RT)

No.	Requirement [mΩ]	DC IR [mΩ]	Requirement [mΩ]	AC IR [mΩ]
		1 st		
1	≤ 30	24.0	≤ 20	14.0
2		24.1		14.1
3		24.2		14.2
4		24.2		14.1
5		24.0		14.0

Rate Performance

• Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 100mA cut-off
- Discharge (CC) : 0.2C-3A-5A-10A-15A-20A-25A-30A discharge, 2.5V cut-off (no temperature. cut off)



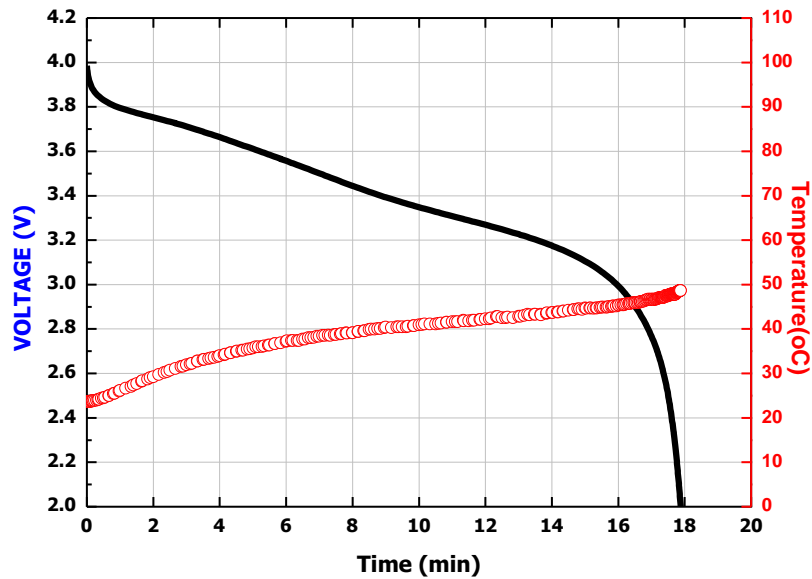
	0.2C	3A	5A	10A	15A	20A	25A	30A
Capacity (mAh)	3000	2886	2884	2925	2913	2873	2802	2702
% C_N	100	96	96	98	97	96	93	90
Energy (Wh)	11.0	10.3	10.1	9.8	9.5	9.2	8.7	8.2
% W_N	102	95	94	91	88	85	81	76

Running Time and Temperature Rise

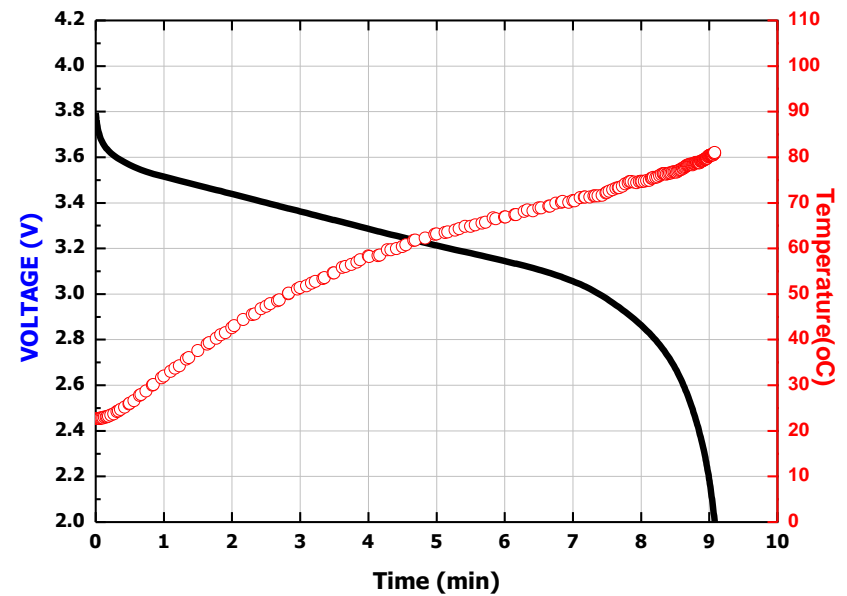
• Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 100mA cut-off
- Discharge : 10 and 20A, 2.0V cut off

[10A Discharging]



[20A Discharging]

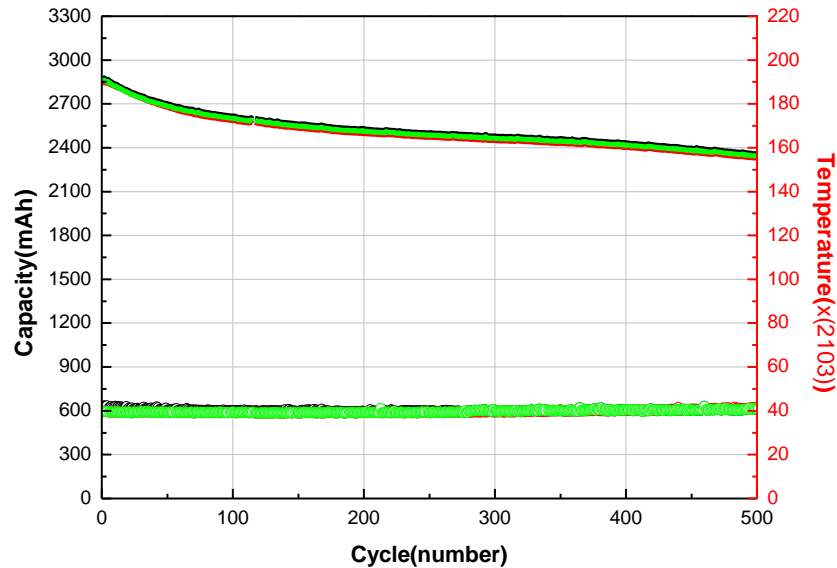


Cycle life (7.5A, RT & 40°C)

▪ Test Conditions

- Charge : 4A, 4.2V, 500mA Cut-off at 25°C
- Discharge : 7.5A, 2.5V cut-off at 25°C

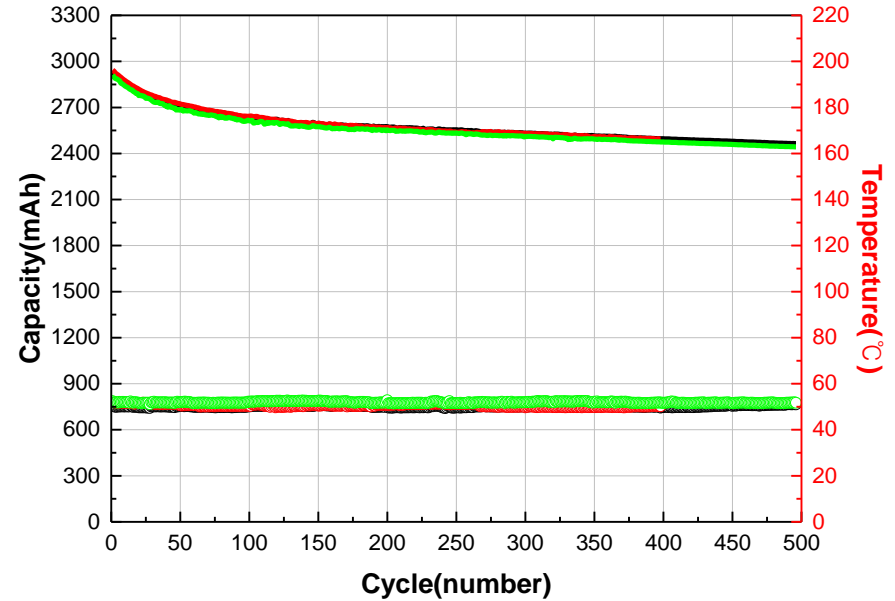
[25°C Cycle]



▪ Test Conditions

- Charge : 4A, 4.2V, 500mA Cut-off at 40°C
- Discharge : 7.5A, 2.5V cut-off at 40°C

[40°C Cycle]

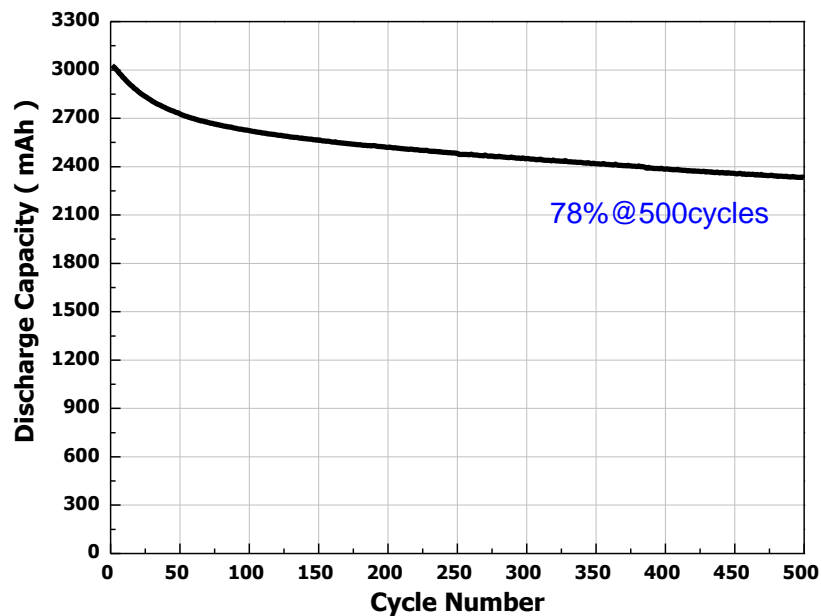


Cycle life (10A and 15A, RT)

- Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 0.1A cut-off
- Discharge (CC) : 10A discharge, 2.0V cut-off

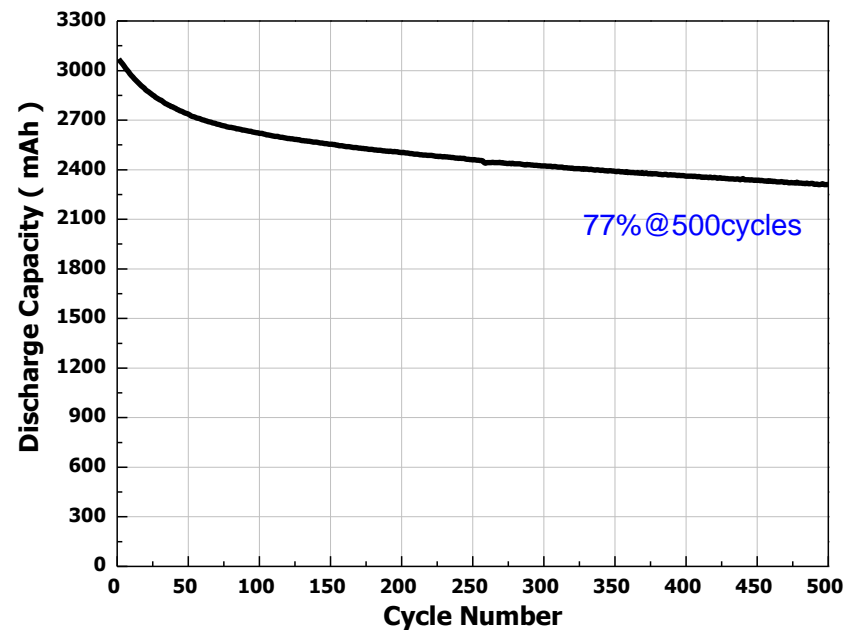
[10A Cycle]



- Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 0.1A cut-off
- Discharge (CC) : 15A discharge, 2.0V cut-off

[15A Cycle]

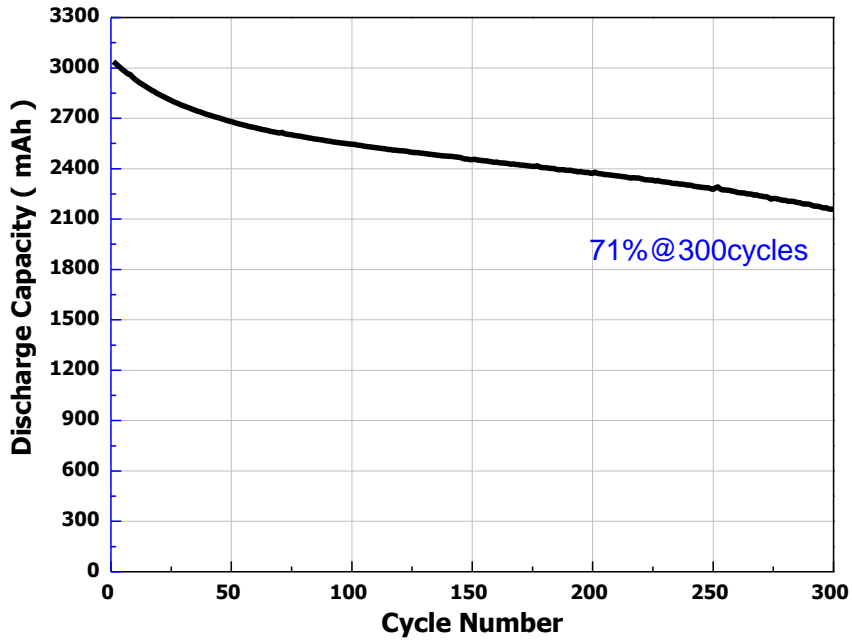


Cycle life (20A, RT)

- Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 0.1A cut-off
- Discharge (CC) : 20A discharge, 2.0V cut-off

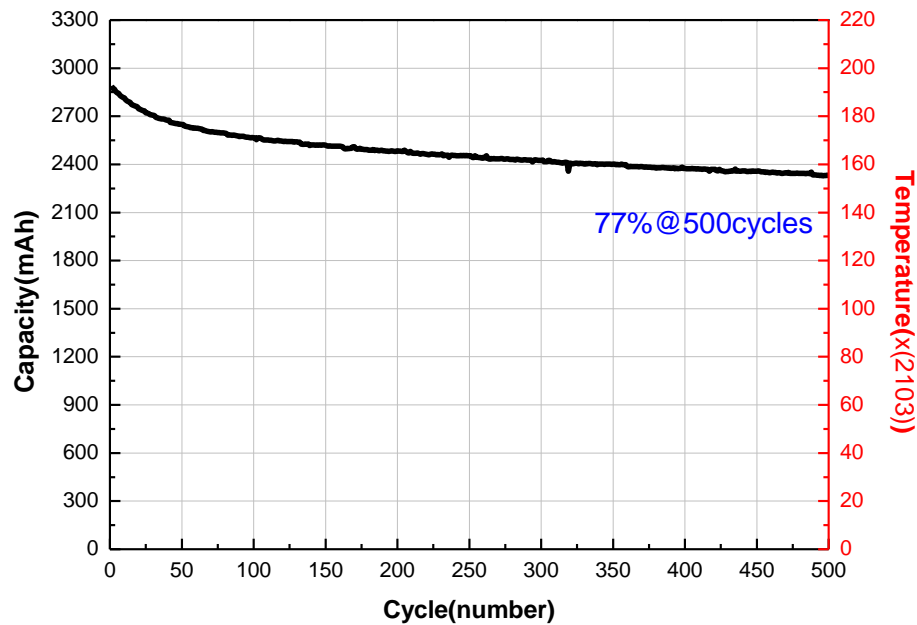
[20A Cycle]



Cycle life (Pulse Cycle, RT)

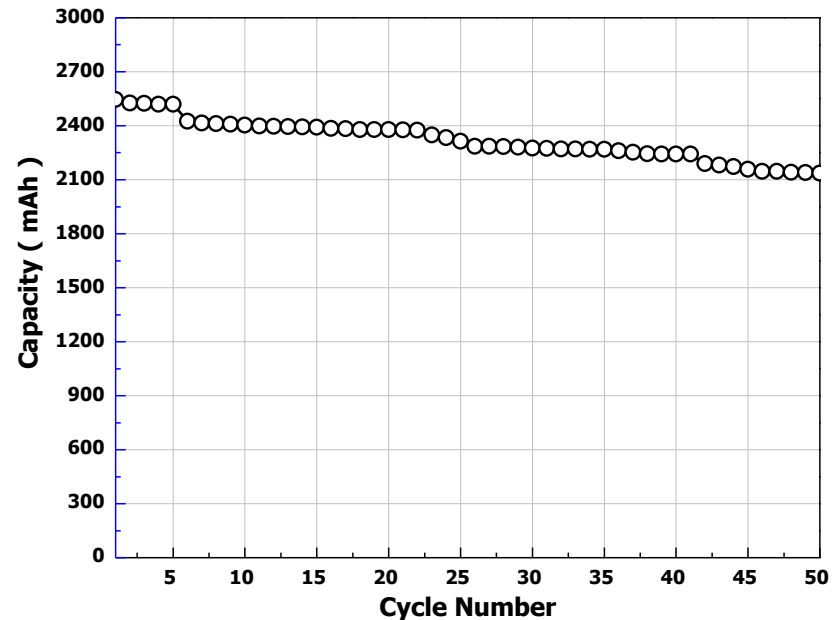
▪ Test Conditions

- Charge : 4A, 4.2V, 500mA Cut-off at 25°C
- Discharge : **20A 5sec ON + 1sec OFF**, 2.5V or 90°C cut-off at 25°C



• Test Conditions

- Charge : 4A to 4.2V, 100mA Cut-off at 23°C
- Discharge : **95A (0.5sec) → 80A (0.5sec) → 45A (0.5sec) → 30A (6sec) → rest (12sec)**, 1.5V cut-off at 23°C

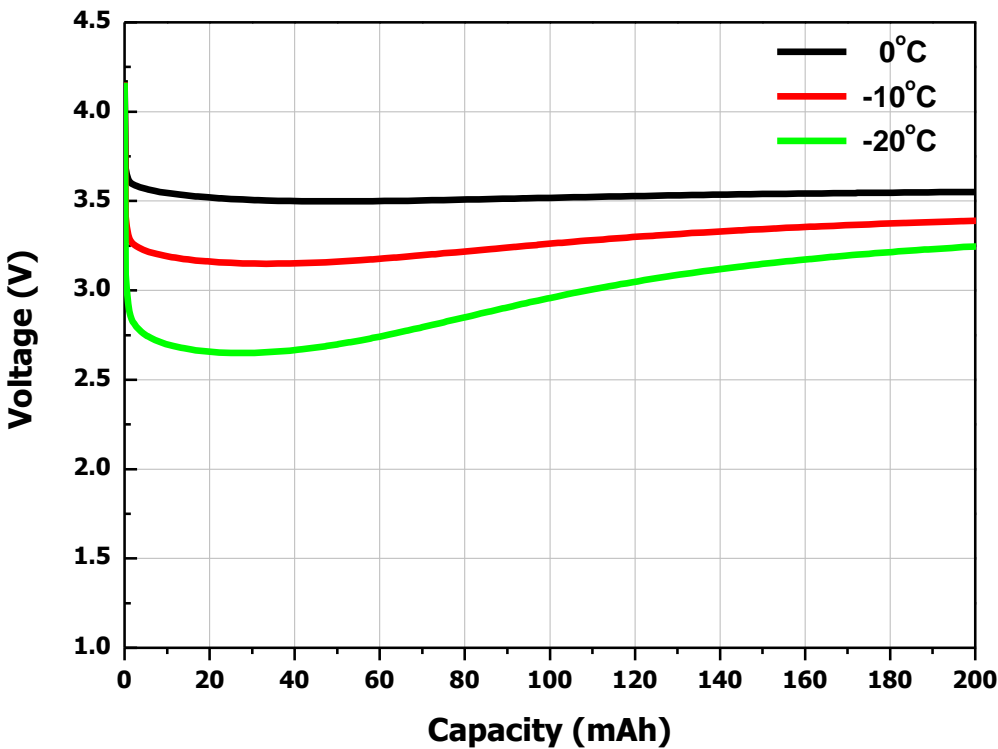


Low Temperature Discharge Profiles (10A)

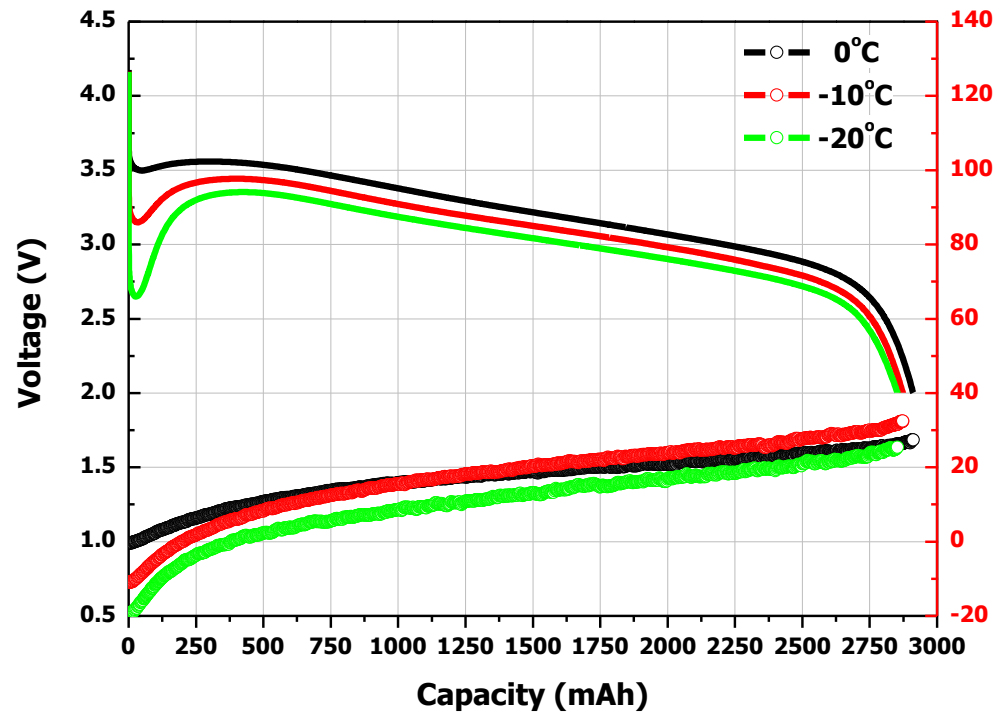
Test Condition

- Charge (CC/CV): 4A charge to 4.2V, 100mA cut-off at RT
- Discharge (CC) : 10A, at 0, -10, -20°C, 1.5V cut-off

Discharge vs. Temp.



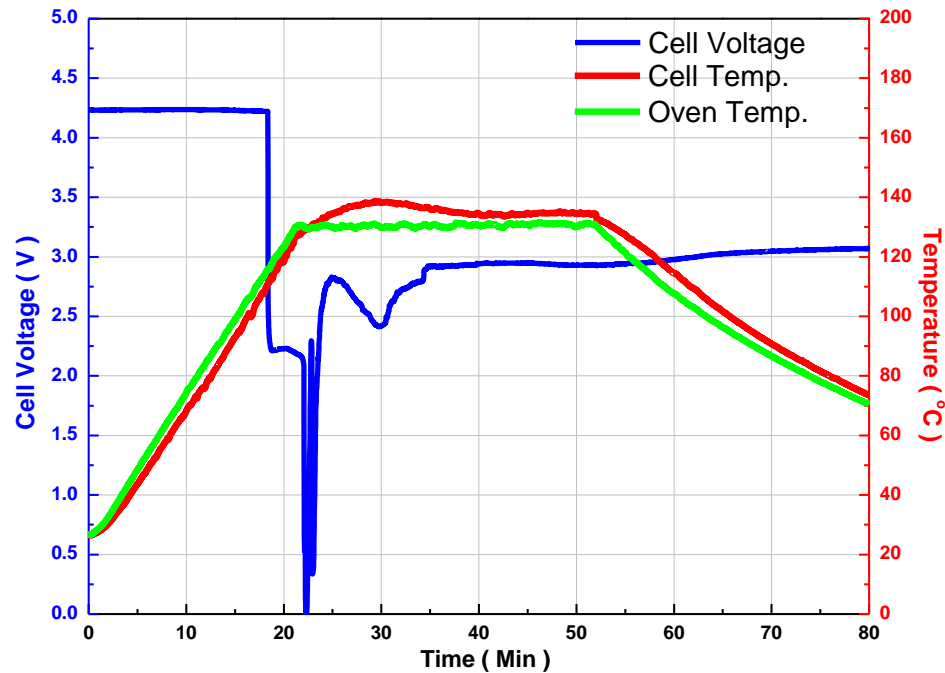
Discharge vs. Temp.



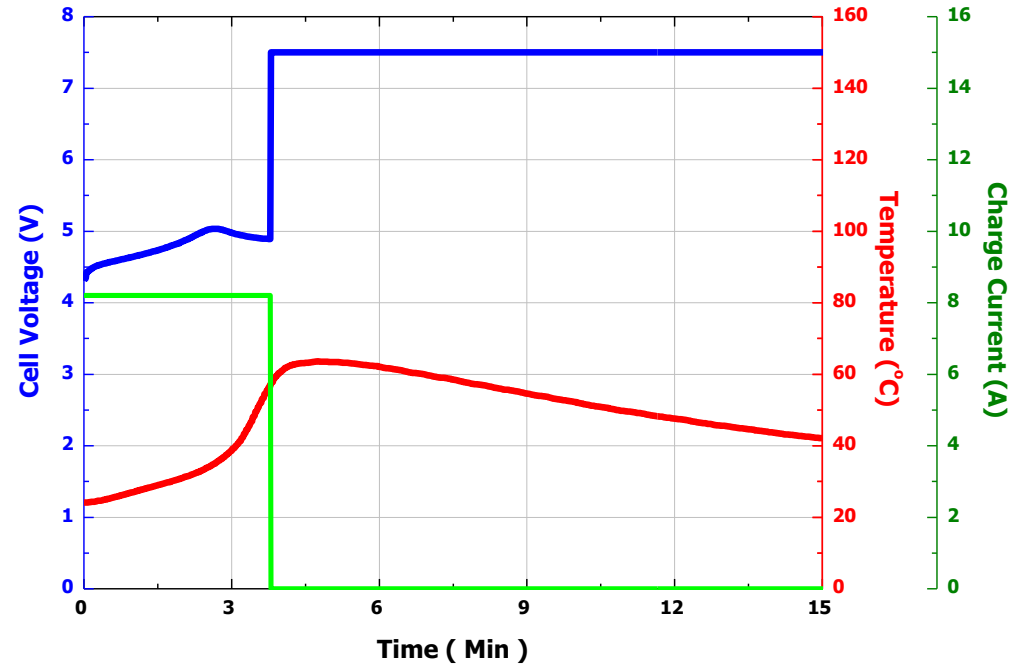
Safety Test (Hot box and Overcharging)

Confidential

[Hot box, 130°C, 1h]

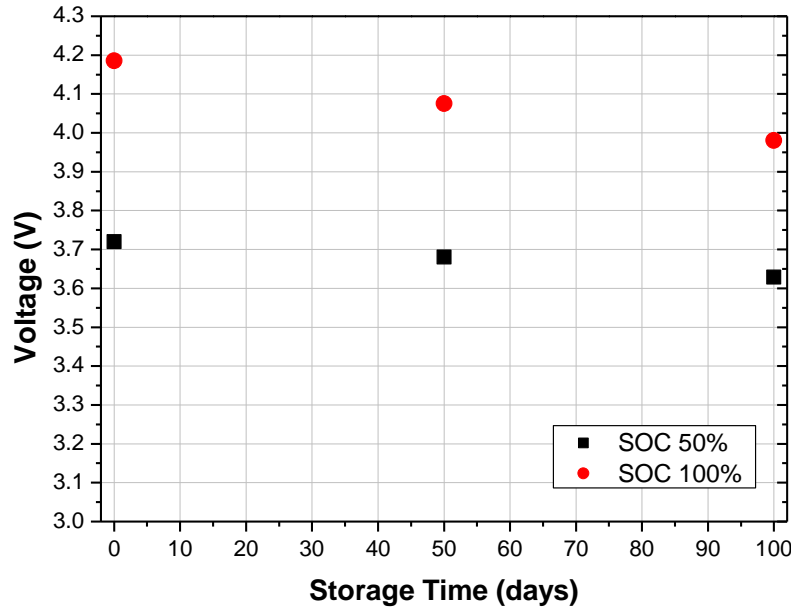


[Overcharging, 8.2A]



Self Discharge Rate

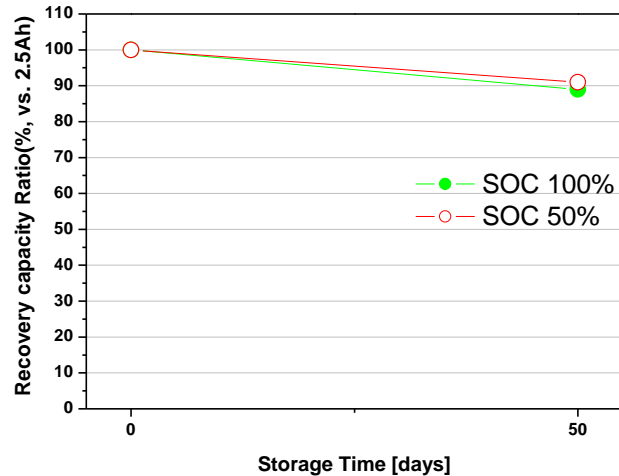
- We calculated the self discharge rate with 60°C storage data.
- The result, voltage can be decreased 6mV/month at SOC100% or 2mV at SOC50%



	initial	After storage for 50day at 60°C (Δ OCV)	Self discharge rate (/month at 25°C)	Acceleration
SOC100%	4.185V	4.075V (110mV)	110mV/20month = 5.5mV/month	Δ 35°C(12times acceleration) 50day*12 = 600day (20month)
SOC50%	3.720V	3.680V (40mV)	40mV/20month = 2mV/month	

Storage Properties (60°C, 50day)

<Storage at 60°C for 50day>



▪ Test Conditions (Capacity measurement)

- Charge : 4A charge to 4.2V, 100mA Cut-off at RT
- Discharge : 10A, 2.5V Cut-off at RT

<Acceleration Test>

- According to our acceleration test, HG2 exhibit storage properties(recovery capacity) of around 90% at for 50day in 60°C condition. It means that guarantee for 2years at 25°C.

Generally, temperature acceleration is based on Arrhenius model and 2times acceleration per 10°C

$$k(T) = A \exp \frac{E_a}{RT}$$

		Acceleration test		Logic of Calculation
SOC100%	After 2 years at 25°C	60°C (50day)	91%	$\Delta 35^\circ\text{C}$ (12times acceleration) 50day*12 = around 2year

Dimension of HG2

Can material: Steel (Nickel-plated)
Tube material: Colored PET ($t=0.08 \pm 0.02$ mm)

