

# LiFePO<sub>4</sub> Li-ion battery——

**New pattern、Safe、EV power Li-ion  
battery**

# Characteristic of LiFePO<sub>4</sub>

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- LiFePO<sub>4</sub> material is safe than LiCoO<sub>2</sub> & LiMn<sub>2</sub>O<sub>4</sub> for it's stable structure can be kept very well under continuous charging & discharging situations.
- The superior high temperature & storage performance make LiFePO<sub>4</sub> the most suitable one for Li-ion battery positive material.
- Longer than 1000 cycle life is more suitable for application use.

# Characteristic of LiFePO<sub>4</sub>

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- With a higher capacity reaches 170mAh, LiFePO<sub>4</sub> much more better than LiCoO<sub>2</sub>'s 145mAh & LiMn<sub>2</sub>O<sub>4</sub>'s 148mAh per gram in characteristic.
- LiFePO<sub>4</sub>'s discharge plateau is more even than due to its lower discharge voltage, which is 3.2~3.3V, lower than normal LiCoO<sub>2</sub> & LiMn<sub>2</sub>O<sub>4</sub> material's 3.6~3.7 V.
- The superexcellent high current discharge performance can be used under 7C's continuous & 20C's instant situations.

# Characteristic of LiFePO<sub>4</sub>

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- With the abundant Fe & P resources & low cost, LiFePO<sub>4</sub> is recognized as the prior positive material for electric power application by the Li-ion battery industry.

# LiFePO4/LiCoO2/LiMn2O4 performance comparison

	LiFePO4	LiCoO2	LiMn2O4
<b>Theoretic capacity per gram (mAh/g)</b>	170	145	148
<b>Discharge plateau (V)</b>	3.2~3.3	3.6~3.7	3.6~3.7
<b>Cycle life</b>	>1000 cycle	>500 cycle	>300 cycle
<b>Hi-temp performance (°C)</b>	>75	0~45	0~45
<b>Safety</b>	Superior	Normal	Better
<b>Hi-current discharge</b>	10C>5 min Instant>20C	10C>5 min Instant>25C	Worse



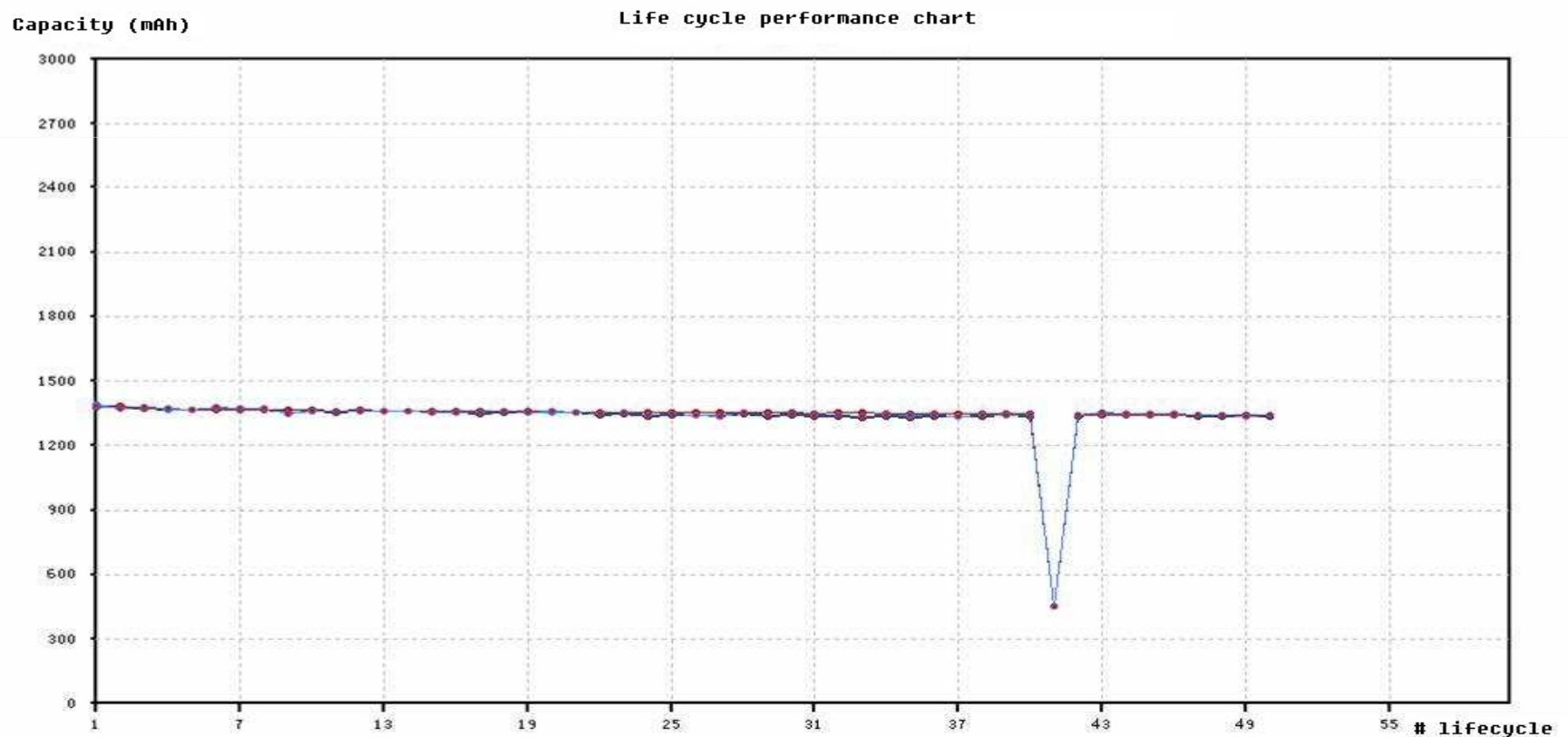
# LiFePO<sub>4</sub> Li-ion battery

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- HLP18650P(1200Mah)
- HLP18500P(1000Mah)

# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

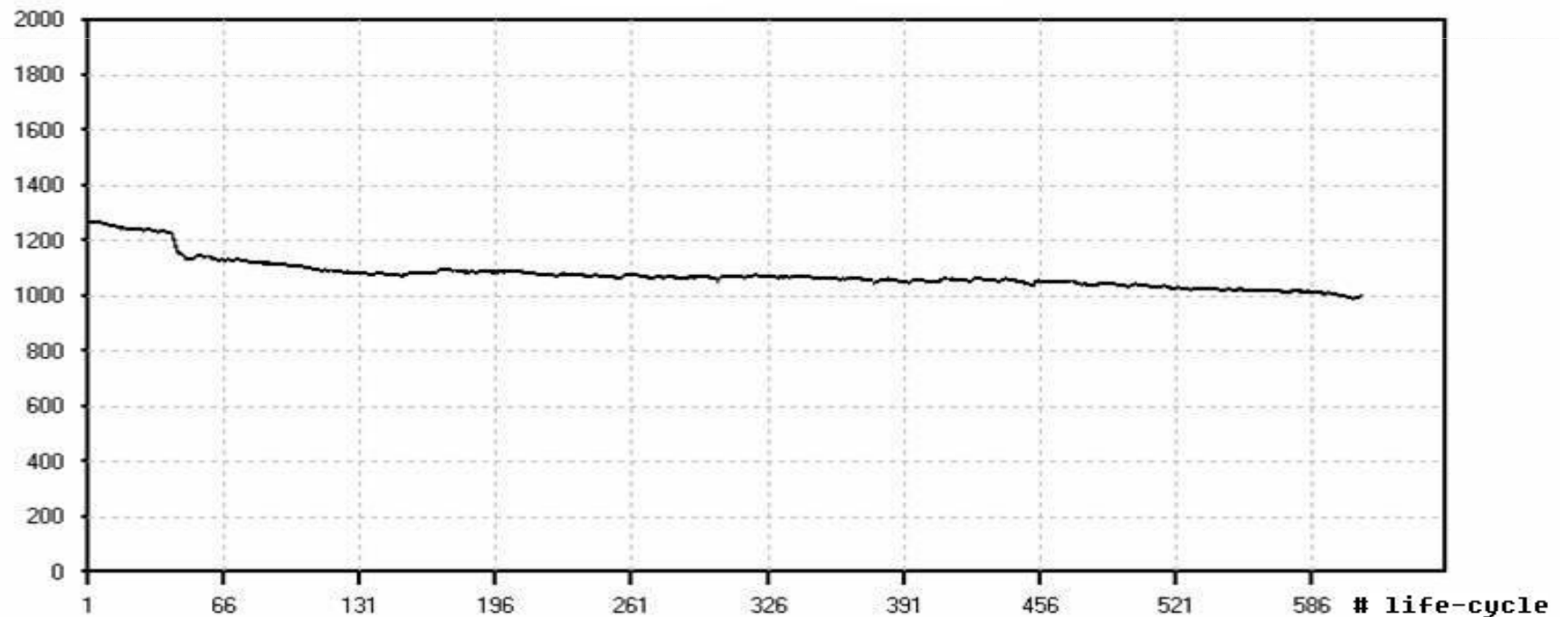
- Cycle life (1C<sub>5</sub>A charge/7C<sub>5</sub>A discharge)



# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

- Cycle life (Hi-temp. 60 °C  
1C charge/discharge)

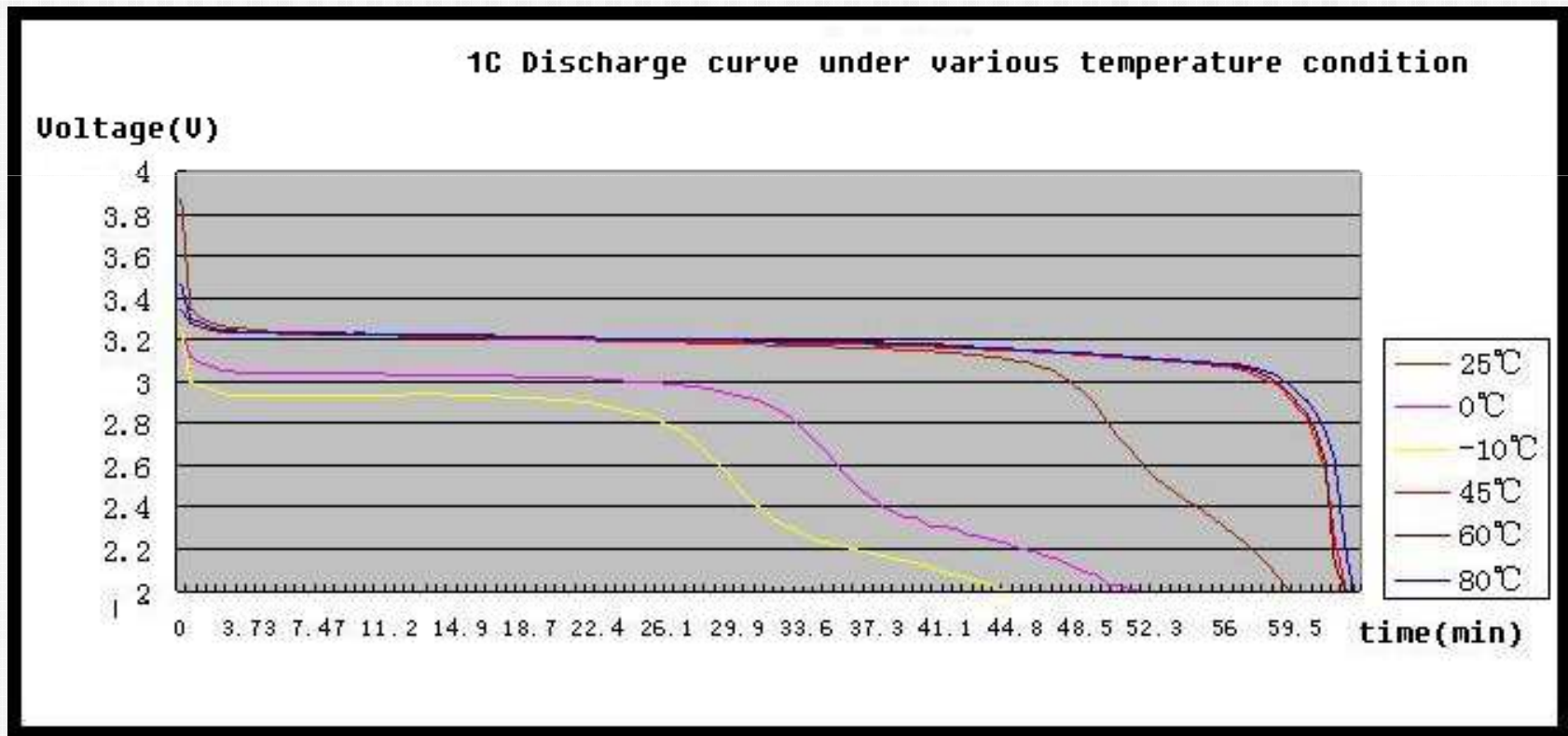
Capacity (mAh) Life cycle performance chart at Hi-temp 60°C, 1C charge/discharge rate





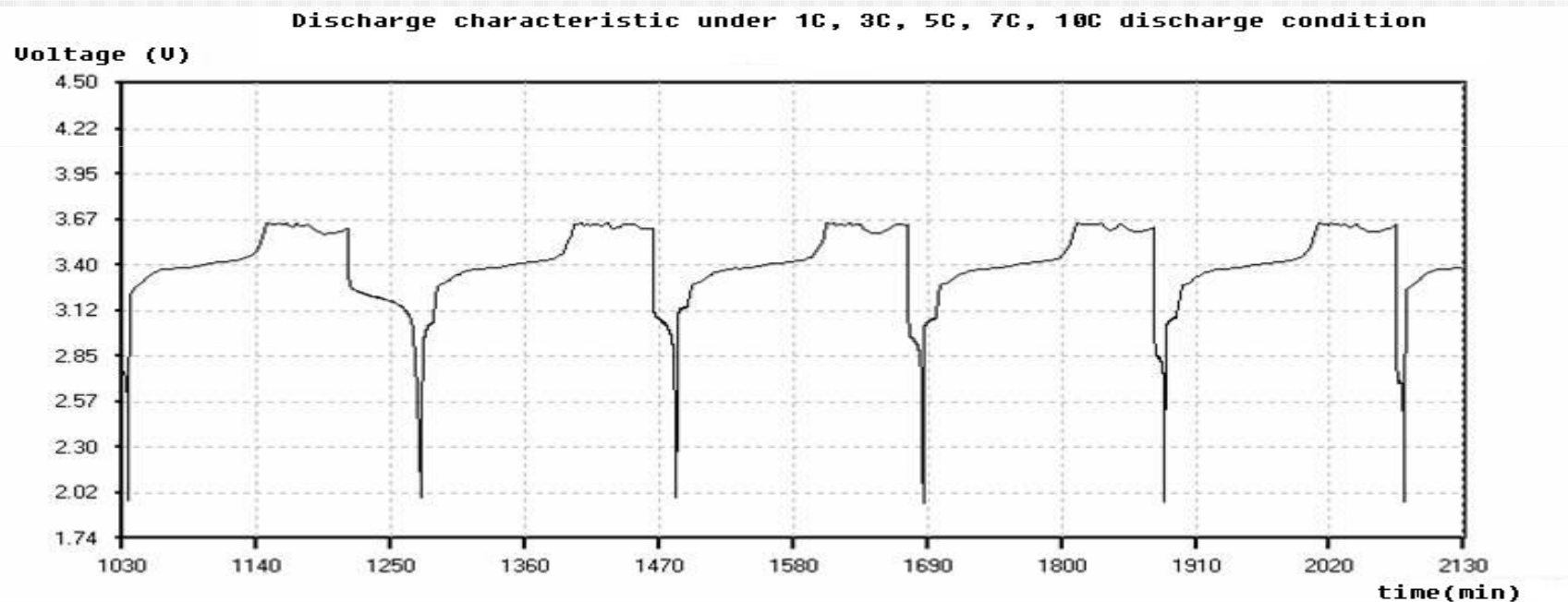
# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

## ■ Discharge curve



# LiFePO4 Li-ion battery performance (18650/1200mAh)

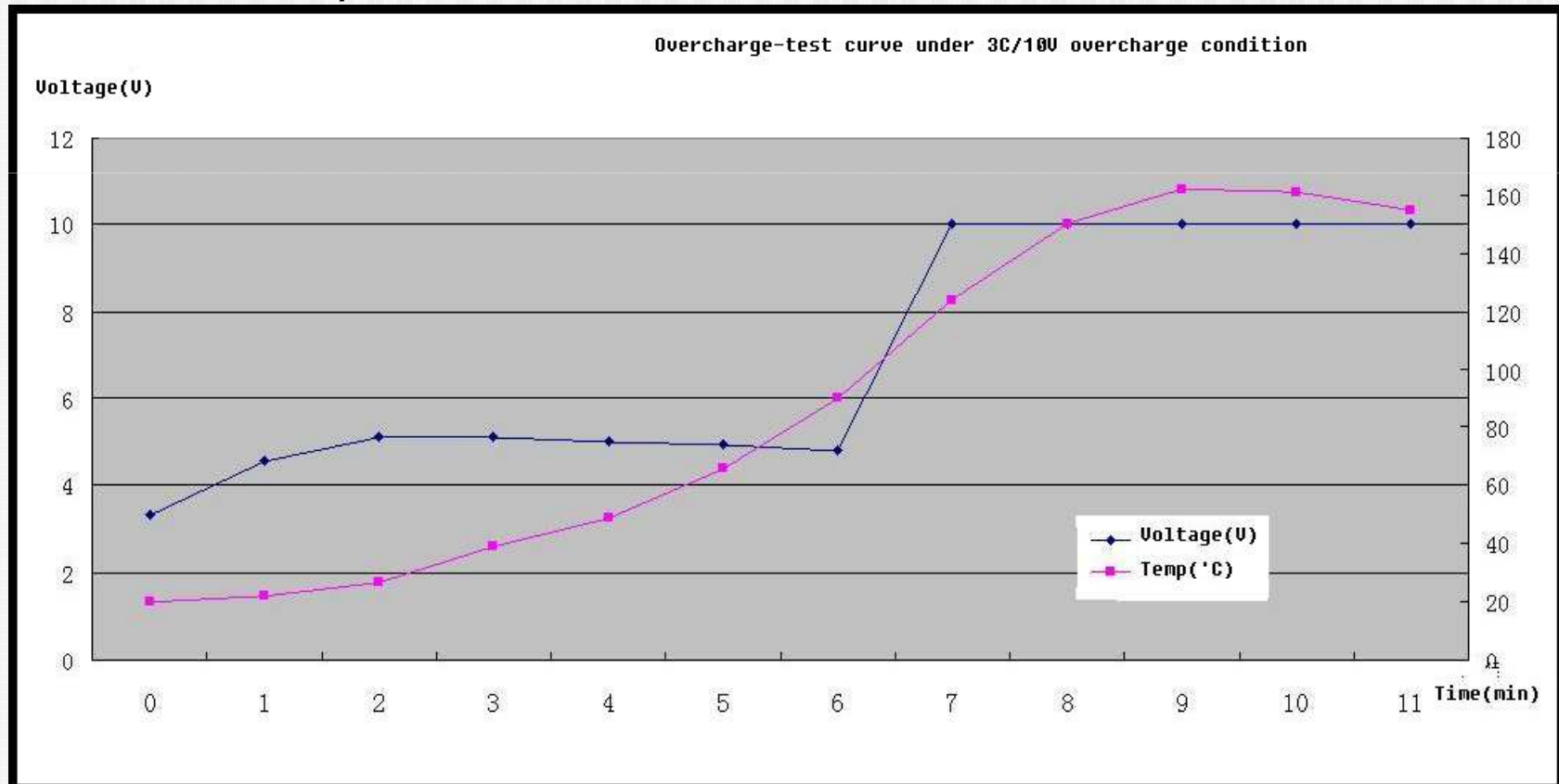
- High current discharge performance



Rate	1C	3C	5C	7C	10C
mAH	1309	1283	1292	1304	1279
Percentage	100%	98%	99%	100%	98%

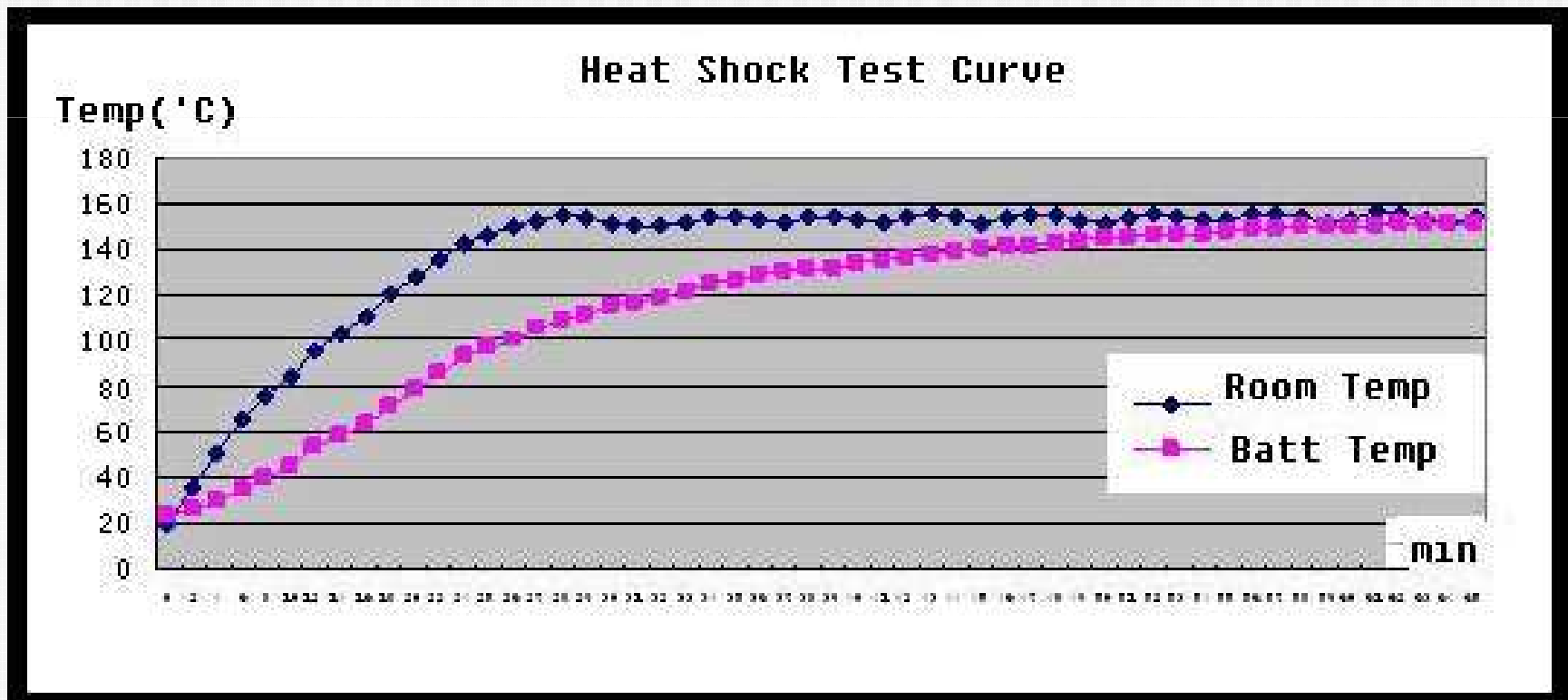
# LiFePO4 Li-ion battery performance (18650/1200mAh)

- Safety (Overcharge test with 3C<sub>5</sub>A/10V)



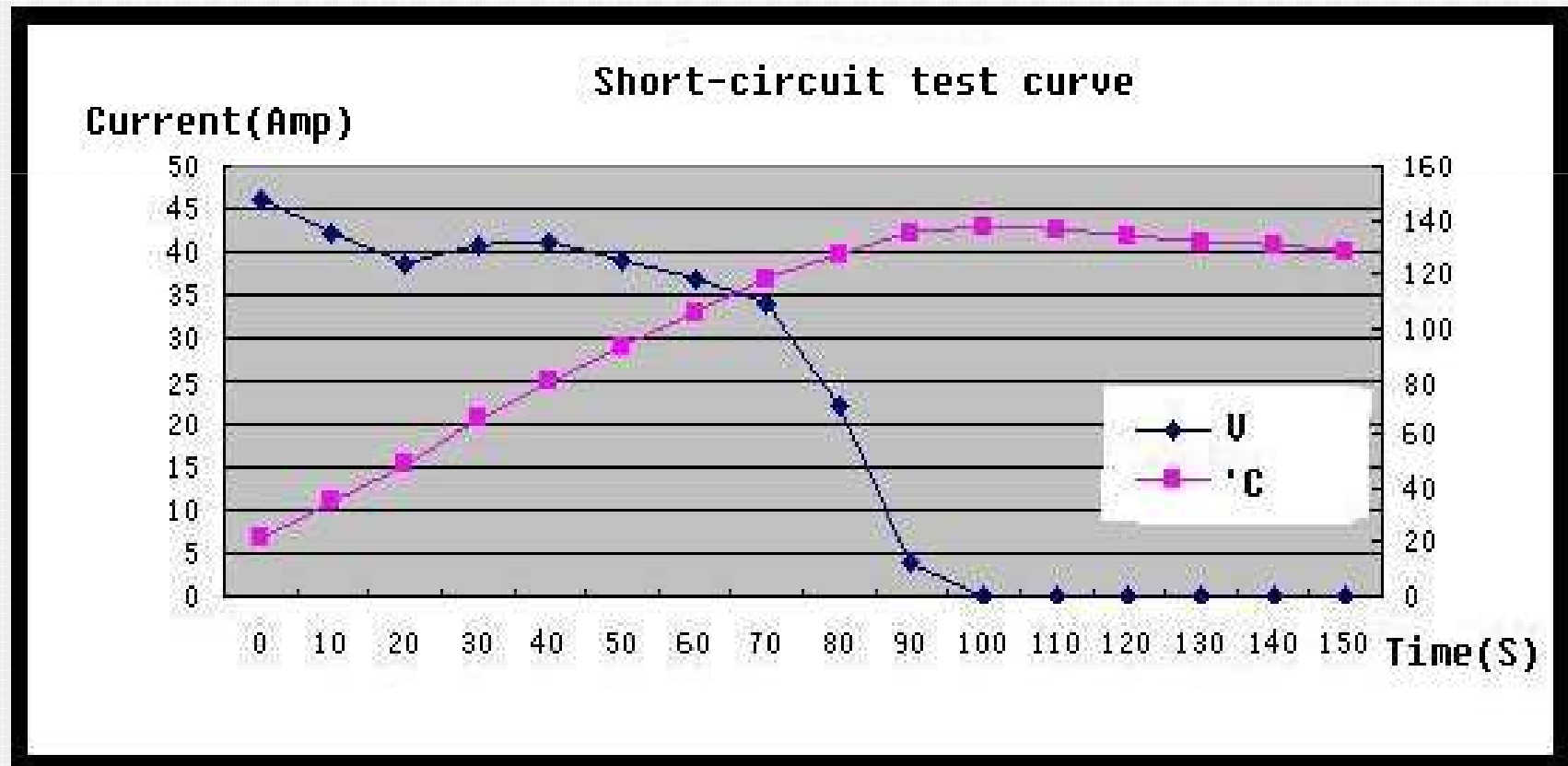
# LiFePO4 Li-ion battery performance (18650/1200mAh)

- Safety (Heat shock test in 150°C 30MIN)



# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

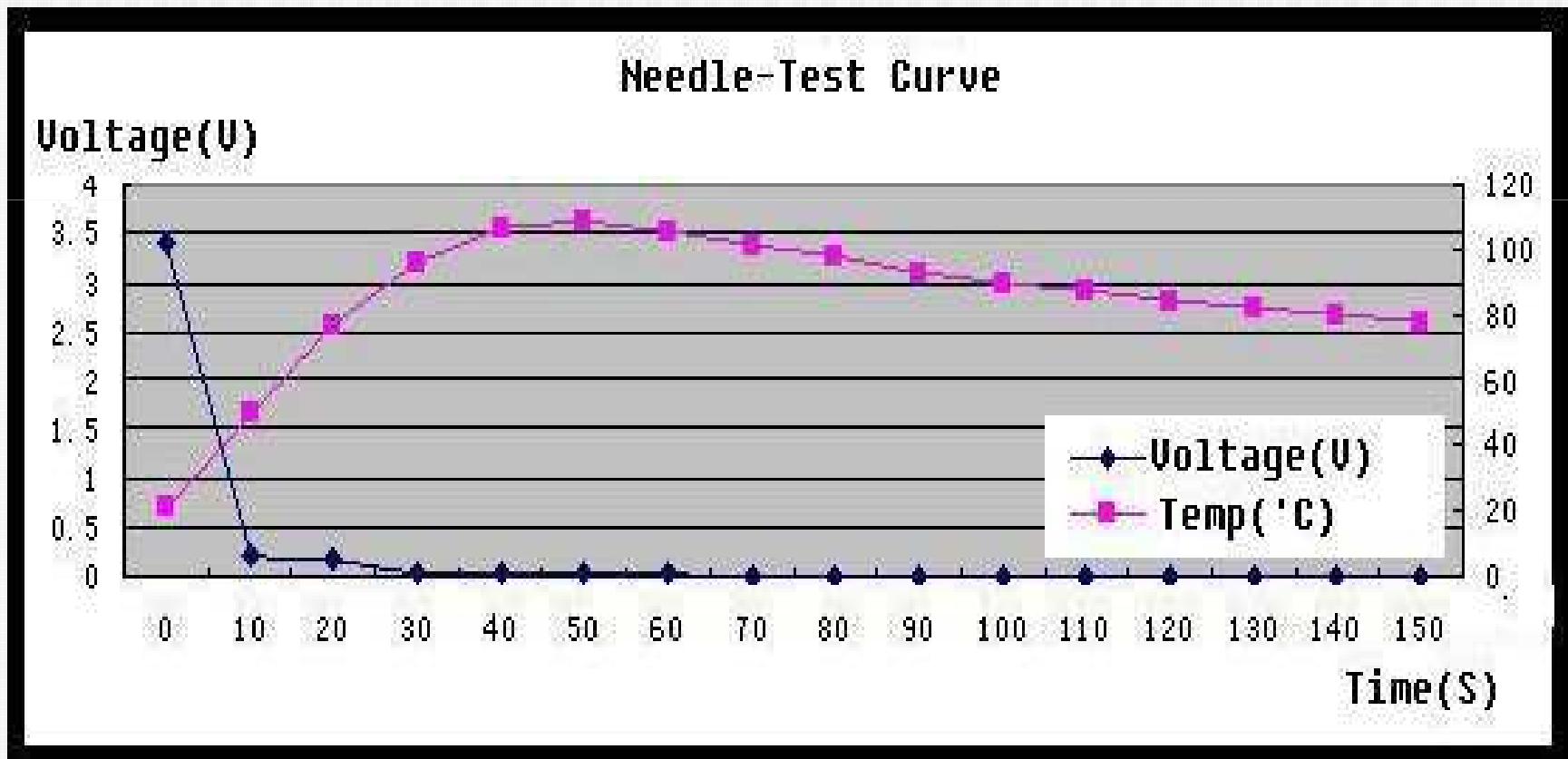
- Safety (short circuit test)





# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

## ■ Safety (Needle test)



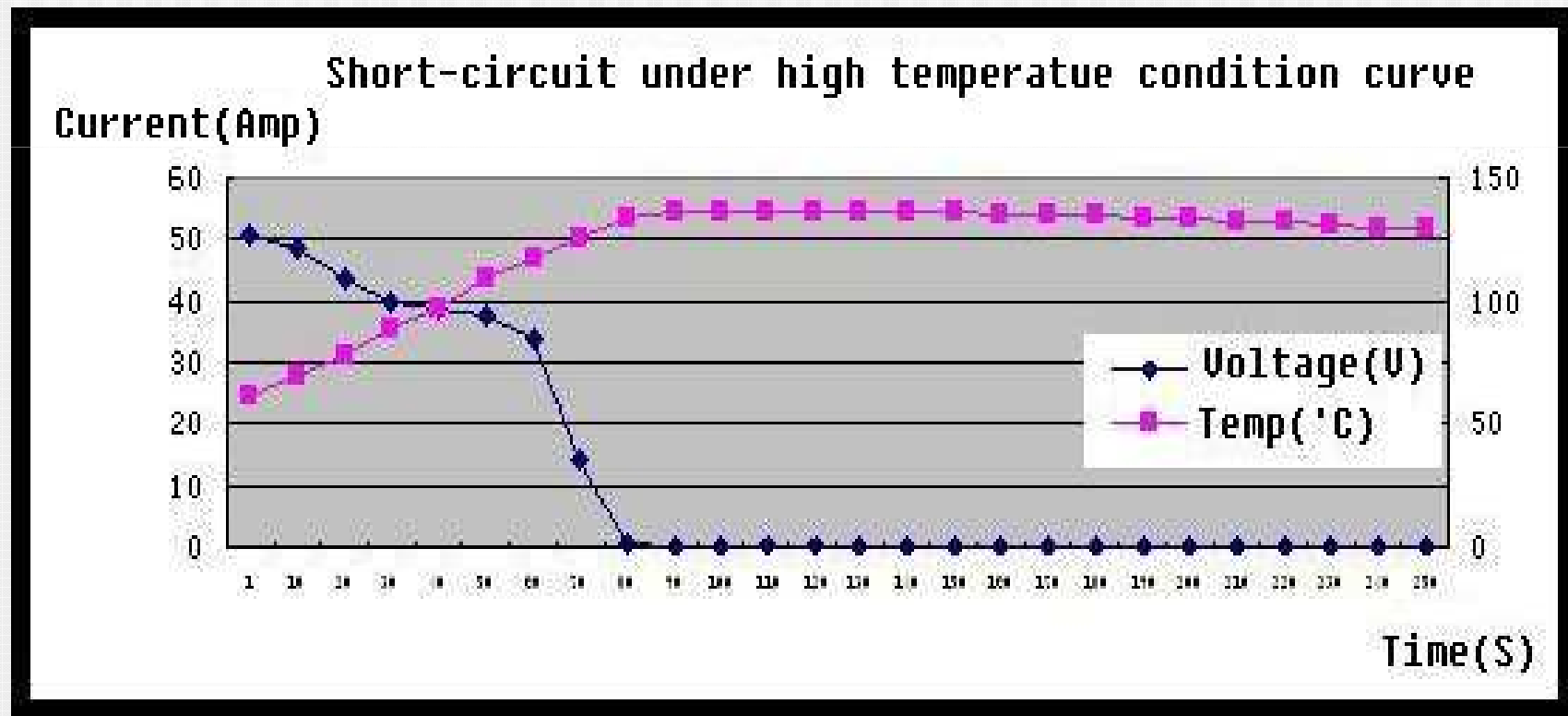
# LiFePO<sub>4</sub> Li-ion battery performance (18650/1200mAh)

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- Safety (Impact test)
- Conduct free drop impaction with 10 kg hammer on the fully charged batteries fixed in the test platform
- The surface temperature reached 89 & 99 after the test then the temperature slow down, no fire & explosion occurred. The battery passed impact test.
- See the demo.....

# LiFePO4 Li-ion battery performance (18650/1200mAh)

- Hi-temp. short circuit (60 °C )



# Safe LiFePO<sub>4</sub> Li-ion battery

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- Demo of VALENCE product performance
- Demo of crush test
- Demo of needle test
- Demo of impact test

# Application of LiFePO<sub>4</sub> Li-ion battery in electric tools

- Comparison of Hypercell battery & SONY battery  
( Black & Decker LI3000 mode electric tools )

Battery type	Capacity	#of Cell	Working Voltage	Max Current	Min Current	Initial Current	Charging current	Charging Voltage	Discharge cut-off voltage
18650	1200mAh	1	3.6/3.2V	9A	2A	3.5A	270mA	4.2V	2.5V/2.0V



# Application of LiFePO<sub>4</sub> Li-ion battery in electric tools

- Black & Decker LI3000 mode electric tools



# Application of LiFePO<sub>4</sub> Li-ion battery in electric tools

## ■ SONY battery

	0.5C	1C	5C	10C
1#	1132mAh	1128 mAh	1102 mAh	1106 mAh
2#	1121 mAh	1117 mAh	1109 mAh	1100 mAh

1# 1C/0.5C=99.6%, 5C/0.5C=97.3%, 10C/0.5C=97.7%

2# 1C/0.5C=99.6%, 5C/0.5C=98.9%, 10C/0.5C=98.1%

# Application of LiFePO<sub>4</sub> Li-ion battery in electric tools

## ■ Hypercell battery

	0.5C	1C	5C	7C	10C
1#	1341	1351	1353	1339	1255
2#	1280	1286	1285	1262	1195

1# 1C/0.5C= 100.7% 5C/0.5C=100.9% 7C/0.5C=99.9% 10C/0.5C=93.1%  
2# 1C/0.5C=100.5% 5C/0.5C=100.4% 7C/0.5C=98.6% 10C/0.5C=93.4%

# Application of LiFePO<sub>4</sub> Li-ion battery in electric tools

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- Except for the discharge performance in 10 C5A status is a little lower than SONY product, Hypercell battery's capacity is about 10 percent higher than SONY product.
- The test shows that Hypercell 18650 battery's application test time is 46 minutes, while SONY product's time is only 42 minutes with the 2A current unload test & 9A current loaded test, 3.5A current start up test status.



# Conclusion

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- There will be a great transform in electric application Li-ion with  $\text{LiFePO}_4$  material's superior low cost、Safety、Heat stable and discharge characteristics etc.