锂离子电芯规格书

Specification for Lithium-ion Rechargeable Cell

电芯型号：32700- 6.0 Ah 磷酸铁锂电芯

Cell Type：32700- 6.0Ah $LiFePO_4$ Cell

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1. 基本信息 General Information

1.1 适用范围 Scope

本规格书规定由合肥道沃能源科技有限公司生产的圆柱型锂离子电芯的技术要求，测试方法及注意事项，如需获取本规格书以外的技术要求，请与合肥道沃能源科技有限公司联系相关事宜。

This specification specifies the technical requirements, testing methods and precautions for cylindrical lithium ion batteries produced by DAW Power Technology Co., Ltd.

if you need to obtain technical requirements other than

this specification, please contact DAW Power Technology Co., Ltd. for relevant matters.

1.2 产品分类 Product Classification

圆柱型可充电锂离子电芯

Cylindrical Rechargeable Lithium-ion Cell

1.3 型号名称 Model Name

$LiFePO_4$-32700- 6.0Ah

1.4 电芯特点 Benefits

- 抗压镀镍钢外壳 Sturdy and pressure resistant steel envelope
- 高容量 High capacity
- 出色的循环寿命 Excellent cycle life
- 优秀的高低温性能 Excellent high and low temperature performance
- 电压输出稳定 Steady output voltage
- 自放电小 Low self-discharge
- 双重安全保护 Double safety protection
- 高抗振和抗冲击能力 With outstanding high level of vibrations and shocks

1.5 主要应用 Main Application

- 电动交通工具 EV/PHEV
- 通信后备电源 UPS
- 储能 Storage energy
- 启动电源 Starting power supply

1.6 电池组装 Battery Assembly

单个电芯根据具体应用组装成一定规格的电池组，由电池组与电子系统共同参与完成电池组的性能管理、热 管理和安全管理。

Individual cells should be integrated in specific battery pack according to customers' demands. The battery pack together with electronic system provides performance, thermal and safety management.

2. 标准规格 Nominal Specification

项目 **Item**		条件 **Condition/ Note**	规格 **Specification**	备注
2.1 标称容量 Norminal Capacity		1C 放电容量 1C discharge capacity	6.0 Ah	
2.2 交流内阻 AC Impedance		在 1000 Hz 下测量 At AC 1000 Hz	6.5 mΩ	
2.3 标称电压 Nominal Voltage			3.2 V	
2.4 电芯尺寸 Cell Size		电芯直径 Cell Diameter	32.2±0.3 mm Max. 32.5 mm	图形结构详细信息，请参阅附图 1。 For details, please prefer to Figure 1.
		电芯高度 Cell Height	70.5±0.3 mm Max. 70.8mm	
2.5 电芯重量 Cell Weight		（光身电芯）	140± 5 g	
2.6 充电截止电压 End-of-charge Voltage		恒流充电 CC Mode	3.65 V	
2.7 充电截止电流 End-of-charge Current		恒压充电 CV Mode	0.3 A	
2.8 充电方式 Charging Method		标准充电 Standard Charging	1 C at CC/CV	60 min
		快速充电 Max Continuous Charging	6 C at CC/CV	10 min
2.9 放电截止电压 End-of-discharge Voltage		恒流放电 CC Mode	2.0 V	
2.10 最大持续放电电流 Max continuous Discharging Current			36 A	
2.11 最大瞬时放电电流 Max Pulse Discharging Current			48 A	3s
2.12 循环性能 Cycle Life		1 C/ 100 % DOD	≥2000 cycles	
2.13 操作温度范围 Operating Temperature Range	充电温度 Charging Temperature		0~60 °C	
	放电温度 Discharging Temperature		-20~ 60°C	
	储存温度 Storage Temperature	1 年 1 year	-20~ 45°C	
2.14 外观 Appearance		无破裂、划痕、变形、污渍、电解液泄露等 Without break, scratch, distortion, contamination, leakage and so on		

3. 测试条件 Test Conditions

3.1 标准测试条件 Standard Test Conditions

若无特别要求，此规格书上的室温为 25 ℃ ±2 ℃，产品测试条件为：温度 25 °C ±5 °C，湿度 15~90 %RH，大气压力 86 kPa~106 kPa。

If no otherwise requirement, room temperature(RT) is 25 °C ±2 °C, and all tests stated in this Specification are conducted at 25 °C±5 °C, 15~90 %RH and atmospheric pressure of 86 kPa~ 106 kPa.

3.2 标准充电 Standard Charging Method

“标准充电”即在标准测试条件下，电芯先以恒定电流 1 C 充电至 3.65 V，再以 3.65 V 的恒定电压充电至电流小于 0.05 C，搁置 1h。

“Standard Charging” means that in standard test conditions, charge the cell at a constant current of 1 C until the voltage reaches 3.65 V, then charge it at a constant voltage of 3.65 V until the current decreases less than 0.05 C and placed for 1 h.

3.3 标准放电 Standard Discharging Method

“标准放电”即在标准测试条件下，电芯以恒定电流 1 C 放电至 2.0 V。

“Standard Discharging” means that in standard test conditions, discharge the cell at a constant current of 1 C until the voltage reaches 2.0 V.

4. 电性能 Electrochemical Performance

测试项目 **Test Item**	测试方法 **Test Method**	检验标准 **Criteria**
4.1 交流内阻 AC Impedance	电芯按 3.2 规定充电后在 1000 Hz 下测量。 Cell shall be measured at 1000 Hz after charged per 3.2.	≤ 8 mΩ
4.2 初始容量（C_{ini}） Initial Capacity	电芯按 3.2 规定充电后，按 3.3 规定完全放电。 Cell shall be charged per 3.2 and discharged per 3.3 within 1h after full charge.	初始容量≥ 6.0 Ah C_{ini} ≥ 6.0 Ah
4.3 循环寿命 Cycle Life	电芯按 1 C CC/CV 充电后搁置 30 min，然后以 1 C 恒流放电至 2.0 V 结束，搁置 30 min，再进行下一次循环，连续 2000 次。 Cell shall be charged at CC/CV mode(CC: 1 C, CV: 3.65 V, End-of-charge current: 0.05 C); After stored for 30 min, cell shall be discharged at CC mode(1 C, End-of-charge voltage: 2.0 V); After stored for 30 min, tests shall be continued for 2000 times.	容量保持率 ≥80 % Capacity retention ≥ 80 %

4.4 倍率放电性能 High-rated Discharging Performance	电芯按 3.2 规定充电后，室温下以 6 C 电流放电至终止电压。 Cell shall be charged per 3.2, and discharged at 6C to ending voltage at RT.	放电容量： Discharge Capacity: ≥ 90%C_{ini}
4.5 低温性能 Low Temperature Performance	电芯按 3.2 规定充电后，将电芯放入一定温度的低温箱中恒温 4 h，然后以 1 C 电流放电至终止电压。 Cell shall be charged per 3.2 and stored in a temperature-controlled environment for 4h. Then discharged cell at 1C to ending voltage.	放电容量： Discharge Capacity: ≥ 70%C_{ini}（-20°C）
4.4 常温存储 Room Temperature Storage Test	电芯按 3.2 规定充电后，在 25 °C ±2 °C 下搁置 28 天，再以 1 C 恒流放电至终止电压。 Cell shall be charged per 3.2, then stored at 25 °C ±2 °C for 28 days. Finally discharged cell at 1 C to ending voltage.	容量保持率 ≥ 90 % Capacity retention ≥90%
4.5 高温存储 High Temperature Storage Test	电芯按 3.2 规定充电后，在 55 °C ±2 °C 下搁置 7 天后，室温搁置 5h，再以 3.3 规定放电。 Cell shall be charged per 3.2, then stored at 55 °C ±2 °C for 7 days. After standing for 5h，discharged cell per 3.3.	容量保持率 ≥ 90 % Capacity retention ≥ 90 %

5. 环境特性 Environment Characteristic

测试项目 **Test Item**	测试方法 **Test Method**	检验标准 **Criteria**
5.1 恒温恒湿性能 Constant Temperature and Humidity Test	电芯按3.2规定充电后，将电芯放入45 °C ±2 °C（90~95% RH）的恒温恒湿箱中搁置48h后取出，在室温下搁置2 h，观察1h。 Cell shall be charged per 3.2, and stored in 45 °C ±2 °C (90~95% RH) for 48 h. Then be placed in RT for 2h and checked for 1h.	电芯无变形、无锈蚀、不冒烟、不爆炸 No distortion, no rust, no fume and no explosion.
5.2 温度冲击性能 Thermal Shock Test	电芯按 3.2 规定充电后，放入温度箱中，60 min 内降至 -40 °C，保持 90 min 后，在 60 min 内升至 25 °C，再在 90 min 内升至 85 °C，保持 110 min，然后在 70 min 内降至 25 °C。重复上述步骤 5 次，观察 1h。 Cell shall be charged per 3.2, and put into an oven. Temperature inside the oven will drop to -40 °C in 60 min and remain for 90 min. Then it will rise to 25 °C in 60 min and keep rising to 85 °C in 90 min, following by remaining for 110 min. And it will drop to 25 °C in 70 min. Repeat this process for 5 times, then check it for 1h.	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.
5.3 低气压测试 Low-pressure Test	电芯按3.2规定充电后，放入低气压箱中，调节气压为11.6 kPa，温度为室温，静置6 h后，观察1h。 Cell shall be charged per 3.2, then stored it for 6h at an absolute pressure of 11.6 kPa (RT). Check it for 1h.	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.
5.4 跌落测试 Drop Test	电芯按 3.2 规定充电后，正负端子向下从 1.5 m 高度自由跌落到水泥地面上，观察1h。	电芯不爆炸、不起火 No explosion, no fire.

	Cell shall be charged per 3.2, then dropped from a height of 1.5 m onto the concrete ground. Positive and negative terminals of cells shall be towards the ground. Check it for 1h.	
5.5 浸泡测试 Soaking Test	电芯按 3.2 规定充电后，完全浸入 3.5 wt% NaCl 溶液中 2 h，观察 1 h。 Cell shall be charged per 3.2, then completely soaking into NaCl solution (3.5 wt %) for 2h. Check it for 1h.	电芯不爆炸、不起火 No explosion, no fire.

6. 安全特性 Safety Characteristic

测试项目 **Test Item**	测试方法 **Test Method**	检验标准 **Criteria**
6.1 短路 External Short-Circuiting Test	电芯按 3.2 规定充电后，将正、负极经外部短路 10 min，外部线路电阻应小于 5 mΩ；静置 1h。 Cell shall be charged per 3.2, then short-circuited by connecting the positive and negative terminals with a resistance of <5 mΩ for 10 min. Check it for 1h.	电芯不爆炸、不起火 No explosion, no fire.
6.2 过充电 Over-charge Test	电芯按 3.2 规定充电后，以 1C 电流充电至 5.5 V 或充电达 1h 后停止充电，观察 1h。 Cell shall be charged per 3.2, then charged at 1C to ending voltage of 5.5 V or charged at 1C for 1h. Check it for 1h.	电芯不爆炸、不起火 No explosion, no fire.
6.3 过放电 Over-discharge Test	电芯按 3.2 规定充电后，以 1C 电流放电 90min，观察 1h。 Cell shall be charged per 3.2, then discharged at 1C for 90 min. Check it for 1h.	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.
6.4 挤压测试 Crush Test	电芯按 3.2 规定充电后，以半径为 75 mm 半圆柱体垂直电芯极板方向，以(5±1) mm/s 速度挤压，当电压为 0 V 或变形量达到 30%或挤压力达到 200 kN 后停止挤压，观察 1h。 Cell shall be charged per 3.2,then crush the cell perpendicularly to the cell plate at a rate of (5±1) mm/s with a semi-cylinder (radius of 75 mm). When met any of the following criteria, stopping crushing and check it for 1h. 1. Voltage reaches 0V; 2. Deformation reaches 30%; 3. Pressure reaches 200 kN.	电芯不爆炸、不起火 No explosion, no fire.
6.5 针刺测试 Acupuncture Test	电芯按 3.2 规定充电后，用 ϕ5 mm~ϕ8 mm 的耐高温钢以(25±5)mm/s 的速度，从垂直于蓄电池极板的方向贯穿，贯穿位置宜靠近所刺面的几何中心，钢针停留在蓄电池中，观察 1h。 Cell shall be charged per 3.2,then acupuncture the cell perpendicularly to the cell plate at a rate of (25±5)mm/s with a ϕ5 mm~ϕ8 mm steel needle and remain it inside.	电芯不爆炸、不起火 No explosion, no fire.

	The acupuncturing location shall be near the geometric center of plane. Check it for 1h.	
6.6 热冲击测试（130 ℃） Heating Test	电芯按 3.2 规定充电后，放置入温度箱，以 5 ℃/min 的速率由室温升至 130 ℃±2 ℃，并保持 30 min 后停止加热，观察 1h。 Cell shall be charged per 3.2, then heated in an oven. Temperature will rise to 130 ℃±2 ℃ at a rate of 5 ℃/min and remain for 30 min. Check it for 1h.	电芯不起火，不爆炸。 No explosion, no fire.

7. 存储与运输 Storage and Transportation

7.1 由于电芯的特性，需要对电芯进行合适的包装来保护。

Based on the character of cell, proper environment for transportation of pack need to be created to protect the battery.

7.2 运输过程中需保证电芯带电量为 50% SOC，以确保不受短路和液体的损伤。

During transportation, 50% SOC must be kept to ensure that short circuit, appearance of liquid in the battery or immersion of battery in liquid never occur.

7.3 电芯需在-20 ℃-45 ℃ 的干燥、清洁、通风的环境下存储。

Cell should be kept at -20°C-45°C in warehouse where it’s dry, clean and well-ventilated.

7.4 装卸电池时需注意避免跌落、翻转和堆积。

During loading of battery, attention must be paid against dropping, turning over and serious stacking.

8. 安全守则 Precautions and Safety Instructions

为避免电芯泄露，过热和爆炸，请注意以下事项：

In order to prevent the battery leakage, getting hot and explosion, please pay attention to preventing measures as following:

Warning!

- 请勿将电池投入水中。非使用时，电池需在干燥阴凉处存放。

  Never throw the battery into water. Store it under dry, shady circumstance when not use.
- 请勿颠倒正负极使用。

  Never misidentify the positive and negative terminals.
- 请勿直接用金属接通正负极，避免短路。

  Never connect the positive and negative terminals of battery with metal to prevent short-circuiting.
- 请勿将电池与金属一起储存或运输。

  Never ship or store the battery together with metal.
- 请勿敲击、投掷或踩踏电池。

Never knock, throw or trample the battery.

- 请勿用钉子或其它利器破坏电池。

  Never cut through the battery with nail or other edge tool.

Tips!

- 请勿在过高的温度下使用或储存电池，否则会引起电池过热，致使寿命减短和性能降低，甚至起火。长时间储存的温度范围建议是 10~45 °C。

  Never use or store the battery under the over-high temperature. Otherwise it will lead to battery over-heating, which might lose some function and reduce life, even getting fire. The proposed temperature for long-term storage is 10~45°C.

- 请勿将电池投入火中或其它热源中，避免起火、爆炸和环境污染。废电池需回收至供应商处，移交回收站处理。

  Never throw the battery into fire or heating machine to avoid fire, explosion and environment pollution; scrap battery should be returned to the supplier and handled by the recycle station.

- 请勿将电池置于强静电场或强磁场中，否则会破坏保护设备。

  Never use the battery under strong static electronic and magnetic field, otherwise it will destroy the protecting device.

- 若电解液泄露并进入眼睛，请勿揉捏，经水洗后尽快就医。

  Never knead eyes if leakage electrolyte gets into eyes. Wash eyes by water and seek medical advice ASAP.

- 若电池在使用、储存、充电过程中发出异味，过热，形变或其他非常规情况，请停止使用并移除设备。

  If battery emit peculiar smell, over-heating, distortion or appear any unconventionality during using, storage or charging process, please stop using and take it out of the device.

- 请勿在充电中直接插拔电池，并使用规定充电设备进行充电。

  Never cut the battery in socket directly, please use the stated charger when charging.

- 使用前请检查电池电压和相关连接器；若有异常请勿使用。

  Check the voltage of battery and relevant connectors before using. Do not use until everything turns out to be normal.

- 在充电前请检查相关设备绝缘性、物理状态和老化情况。电池电压需高于截止电压，如有异常，需标记并勿更改现状，然后通知我们售后服务部门，待我们工作人员到场维修。

  Prior to charging, fully check the insulativity, physical condition and ageing status. The pack voltage must not be less than the cut-off voltage, if not, it needs to be labeled. The user should contact our Customer Service Department. It can’t be charged until repaired by our staff.

- 电池需在 50 %SOC 下储存，若半年未使用，需重新充电。

  The battery should be stored in 50% SOC. It needs to be charged once again if out of use for as long as half a year.

- 若电极端子污染，需用干净、干燥的棉布擦拭，否则会导致接触和操作不良。

Clean the dirty electrode with a clean dry cloth if any contamination appears, otherwise poor contact or operation failure may occur.

9. 技术咨询 Consultation

如有疑问，请按以下方式咨询：

As to obscurity, contact us as followings:

Headquarter ： DAW Power Technology Co., Ltd. , Economic Development Zone, Shucheng County,Lu 'an City, Anhui Province
厂址：安徽省六安市舒城县杭埠镇杭埠经济开发区

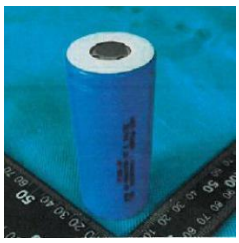
Email：Brett@dawpower.com WhatsApp：8613855177354

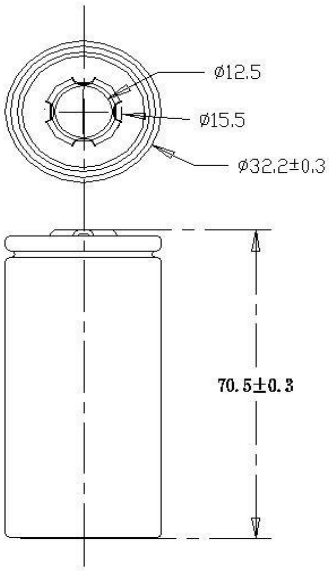
附件 Annex

附图 1 /Figure1

电池图片和外形尺寸

Cell’s appearance and dimension

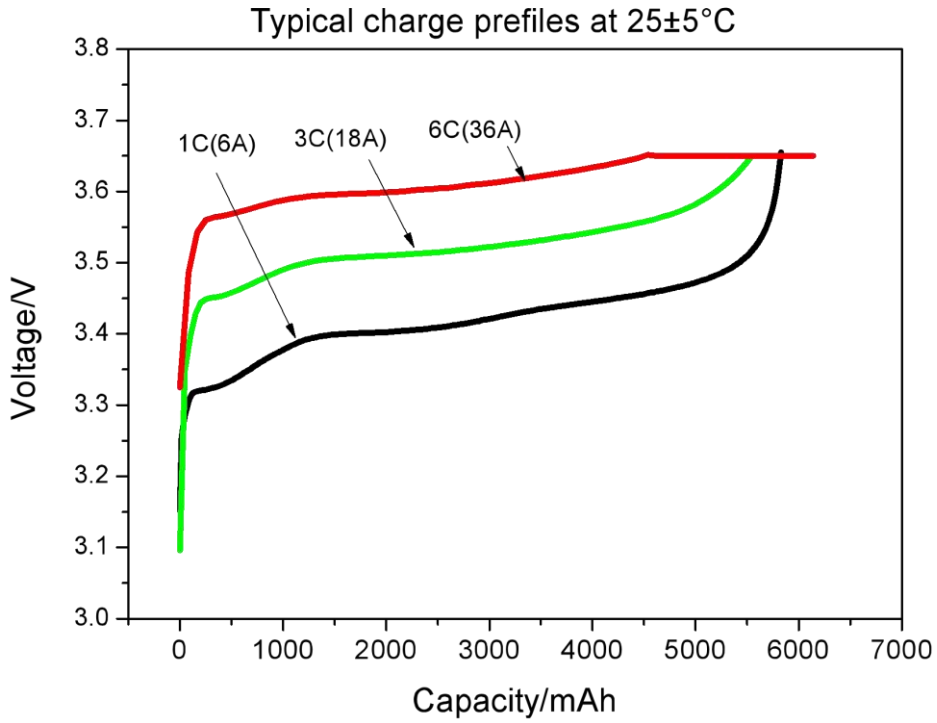




附图 2 /Figure2

6.0Ah 磷酸铁锂系电池不同倍率充电曲线

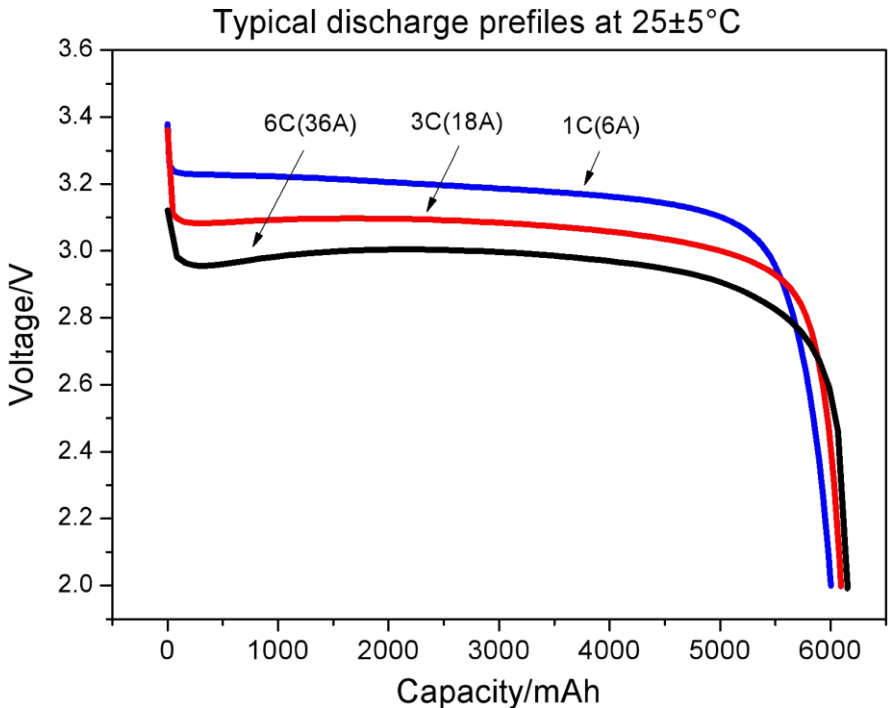
Different rate charge curve of 6.0Ah $LiFePO_4$ Cell



附图 3 /Figure3

6.0Ah 磷酸铁锂系电池不同倍率放电曲线

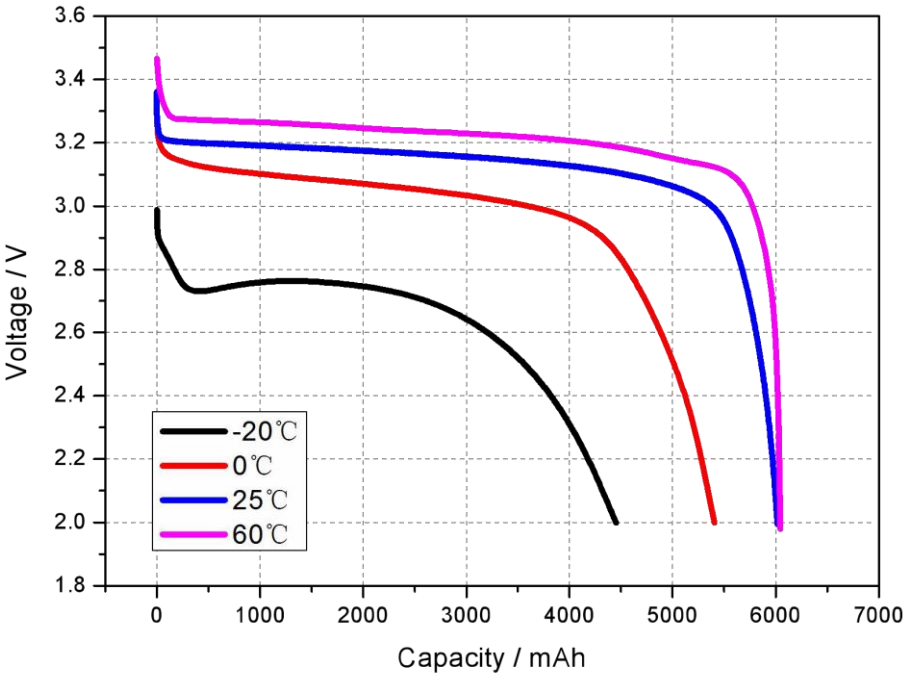
Different rate discharge curve of 6.0Ah $LiFePO_4$ cell



附图 4 /Figure4

6.0 Ah 磷酸铁锂电池不同温度放电曲线（1C）

Discharge curve of 6.0 Ah $LiFePO_4$ cell at different temperatures (1C)



附图 5 /Figure5

6.0 Ah 磷酸铁锂电池 1C 循环曲线图

Circular curve of 6.0 Ah $LiFePO_4$ cell