

PRELIMINARY SPECIFICATIONS

CUSTOMER:

PRODUCT:

Lithium Ion Polymer

Rechargeable Battery

MODEL:

AL20078153A-001

REVISE NO:

C

DATE:

2008/02/25

| APPROVED | CHECKED | ENGINEER |
|----------|---------|----------|
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REVISION AND UPDATES

| REV | ECO NO. | DESCRIPTION | Date |
|-----|---------|---|------------|
| B | | 1. Correct the rated specification in item 2.5, 2.8, 2.10 & 2.12. 2. Increase the 2000& 3000 cycles in item 4.2.6 & 4.2.7. 3. Correct the Tab lead position item 6. | 2008/01/23 |
| C | | 1. Correct the rated specification in item 2.1 & 2.2. 2. Correct the capacity in item 4.2.2~4.2.11. 3. Correct the mark printing in item 9 & 10. 4. Correct the cell length in item 3 & 9. | 2008/02/25 |

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1. Scope

This specification defines the **Lithium Ion Polymer rechargeable battery**, Model No.: **AL20078153A**, which is designed specifically for power application.

2. Rated Specification

| Item | | Rating | Note |
|---|-----------|-------------------------------|---|
| 2.1 Nominal Capacity | | 10000mAh | Discharge: 0.2C, cut off voltage: 2.0V (*) |
| 2.2 Minimum Capacity | | 9500mAh | Discharge: 0.2C, cut off voltage: 2.0V (*) |
| 2.3 Cut Off Voltage | | 2.0V | |
| 2.4 Nominal Voltage | | 3.3V | |
| 2.5 Charge Current | Standard | 0.2CmA | |
| | Rapid | 2.0CmA or less | |
| 2.6 Charge Voltage | | 3.6V | |
| 2.7 Maximum Charge Voltage | | 3.65V | |
| 2.8 Charge Time | Standard | Approx. 6h | Charge Current: 2000mA |
| | Rapid | Approx. 45 min. | Charge Current: 20000mA |
| 2.9 Maximum Charge Current | | 5.0CmA | |
| 2.10 Maximum Discharge Current | | 10CmA | For Continuous Discharge Mode |
| 2.11 Weight | | Approx. 360 g | |
| 2.12 Operating Temperature and Humidity Range | Charge | -10~60°C , 85%RH. Max. | |
| | Discharge | -10~60°C , 85%RH. Max. | |
| 2.13 Storage Temperature | | -20~45°C | At the shipment state |
| 2.14 Recommended Storage Temperature | | 20°C | At the shipment state |

(*): Recommend: For BMS (Battery Management System)

Charge/discharge current <1C, charge to 3.9V/discharge to 2.6V

Charge/discharge current >1C, charge to 3.9V/discharge to 2.4V

3. Cell Dimension:

Length: Max. **155.0 mm** (without tab)

Width: Max. **79.0 mm** (Measure with 400g pressure at initial 3.3V state)

Thickness: Max. **21.0 mm** (Measure with 400g pressure at initial 3.3V state)

Max. **25.0 mm** (Measure with 400g pressure after 85°C storage 96 hours)

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4. Electrical Performance

4.1 Standard Test Condition

Cells to be used for testing are those delivered within 1 month and are not used. Charging /Discharging are carried at $23\pm 2^{\circ}\text{C}$ in standard Charging / Discharging method and left less than 24 hours.

Tests are under $23\pm 2^{\circ}\text{C}$ and $65\pm 20\%$ RH

4.2 Performance

| Item | Condition | Specification |
|---|---|---|
| 4.2.1 Open-Circuit Voltage | The open-circuit voltage shall be measured within 24 hours after standard charge | 3.30V or more. |
| 4.2.2 Internal Resistance | Measured at AC 1kHz impedance meter within 1 hour after Standard charge | $\leq 5\text{m}\Omega$ |
| 4.2.3 Rated Capacity 1 (0.2C) | Measured with discharge current 0.2CmA with 2.0V cut-off at $23\pm 2^{\circ}\text{C}$ within 1 hour after Standard charge | ≥ 9500 mAh |
| 4.2.4 Rated Capacity 2 (0.5C) | Measured with discharge current 0.5CmA with 3.0V cut-off at $23\pm 2^{\circ}\text{C}$ within 1 hour after Standard charge | ≥ 9200 mAh |
| 4.2.5 Rated Capacity 3 (1.0C) | Measured with discharge current 1.0CmA with 3.0V cut-off at $23\pm 2^{\circ}\text{C}$ within 1 hour after Standard charge | ≥ 9000 mAh |
| 4.2.6 Cycle Life 1 (at 25°C) | Each cycle is an interval between the charge (charge current 2CmA) and discharge (discharge current 2CmA) with 2.0V cut-off. The number of cycles at which the capacity (2C) decreases to 80% of the initial capacity (2C). | 1000 cycles |
| 4.2.6 Cycle Life 2 (at 25°C) | Each cycle is an interval between the charge (charge current 2CmA) and discharge (discharge current 2CmA) with 2.0V cut-off. The number of cycles at which the capacity (2C) decreases to 70% of the initial capacity (2C). | 2000 cycles |
| 4.2.6 Cycle Life 3 (at 60°C) | Each cycle is an interval between the charge (charge current 2CmA) and discharge (discharge current 2CmA) with 2.0V cut-off. The number of cycles at which the capacity (2C) decreases to 65% of the initial capacity (2C). | 300 cycles |
| 4.2.7 Storage characteristics 1 | (1) The capacity on standard discharge shall be measured after standard charge and then storage at $23 \pm 2^{\circ}\text{C}$ for 28 days | ≥ 7600 mAh (Remaining capacity) Ref. Appendix |
| | (2) After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. | ≥ 8360 mAh (Recovery capacity) Ref. Appendix |
| 4.2.8 Storage characteristics 2 | (1) The capacity on standard discharge shall be measured after standard charge and then storage at $45 \pm 2^{\circ}\text{C}$ for 28 days | ≥ 5220 mAh (Remaining capacity) Ref. Appendix |
| | (2) After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. | ≥ 8070 mAh (Recovery capacity) Ref. Appendix |

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| Item | Condition | | | | | Specification | | |
|--|---|---------|-------------------------|---------|-------------------------|--|-------------------------|--|
| 4.2.9 Long term storage characteristics | After standard charge and then storage at 23 ± 2 °C for 365 days. The discharge time of the second discharge shall be measured after standard discharge, standard charge, and standard discharge. | | | | | ≥ 8070 mAh Ref. Appendix | | |
| 4.2.10 Charging/Discharging Characteristics at Different Temperature | The capacity shall be measured after standard charge and discharge at the temperature shown in the following table. | | | | | More than the value in the following table | | |
| | -20°C | -10°C | 0°C | 10°C | 23°C | 45°C | 60°C | |
| | 5220mAh | 6650mAh | 7100mAh | 7600mAh | 9500mAh | 9000mAh | 9000mAh | |
| 4.2.11 C-Rate Characteristics at 23°C | The capacity and discharging temperature shall be measured after standard charge and different rate discharge at 23°C shown in the following table. | | | | | More than the value in the following table | | |
| | 1C | | 3C | | 5C | | 10C | |
| | 9000 mAh | | 8550 mAh | | 8070 mAh | | 7600 mAh | |
| | $\leq 40^\circ\text{C}$ | | $\leq 50^\circ\text{C}$ | | $\leq 60^\circ\text{C}$ | | $\leq 70^\circ\text{C}$ | |

5. Precautions in handling

5.1 Prohibition of mechanically damaged cells such as dropping

- Please do not use the cell that are yielded, dented or bent on their terrace part or cup part by mechanical shock such as dropping
- If any damage (black colored point, Aluminum corrosion, crack, etc.) was found on laminated film package of the cell, please do not use them.

5.2 Please do not damage the cell

- Casing of the cell is Aluminum laminated plastic film. The laminated film is easy to be damaged by sharp edge such as pin, needle, edge of devices like nickel tabs, etc., comparing with metal casing cell.
- If laminated film packaging is damaged, electrolyte leakage may occur.

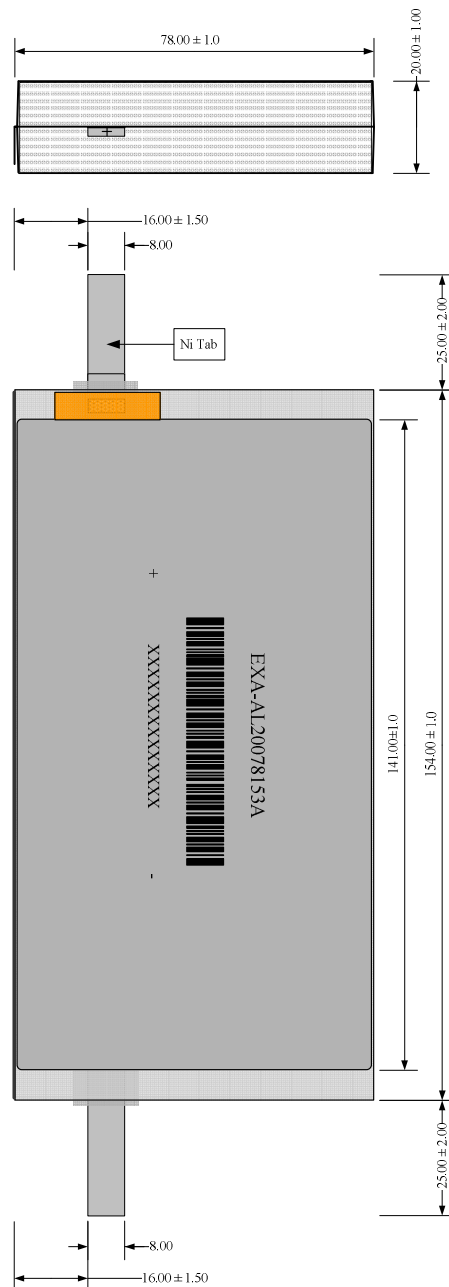
5.3 Never short-circuit between positive and negative terminal tabs.

- Short-circuit gives damage to the cell. Please do not re-use short-circuit cells even if short-circuit is not severe.
- Momentary slight short-circuit may cause voltage drop and change of impedance.
- Please be careful about that severe short-circuit may cause not only large voltage drop, change of impedance but also heat generation of the cell. If the cell generates heat, heat sealed part of laminated film may be damaged and possibly it leads to electrolyte leakage.
- The cells are possible to be easy short-circuiting between positive and negative tabs if placed on conductive surface such as metal table. Please care about working environment when treating cell. For example, using non-conductive table is recommended. Please do not leave conductive tools close to the cells, etc.

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- 5.4 Do not store the cell near flame or heater. Otherwise the cell might be damaged or cause fire.
- 5.5 Follow the polarity sign on the cell, make correct connection before use.
- 5.6 Charge and discharge the cell with correct method, or it might reduce cycle life of the cell even damage cell.
- 5.7 Do not use the cell with other batteries. Or it might damage the cell or other batteries due to excessive discharge or unbalanced discharge.
- 5.8 Do not solder lead directly to the cell body.
- 5.9 Do not heat nor solder the terminal of the cell with a kind of metal.

6. Dimension drawing
Unit: mm



Shipping voltage=3.3V

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7. Markings on cell

EXA-AL20078153A



+ XXXXXXXXXXXXXXXX -

xxxxxxxxxxxxxx: Lot number

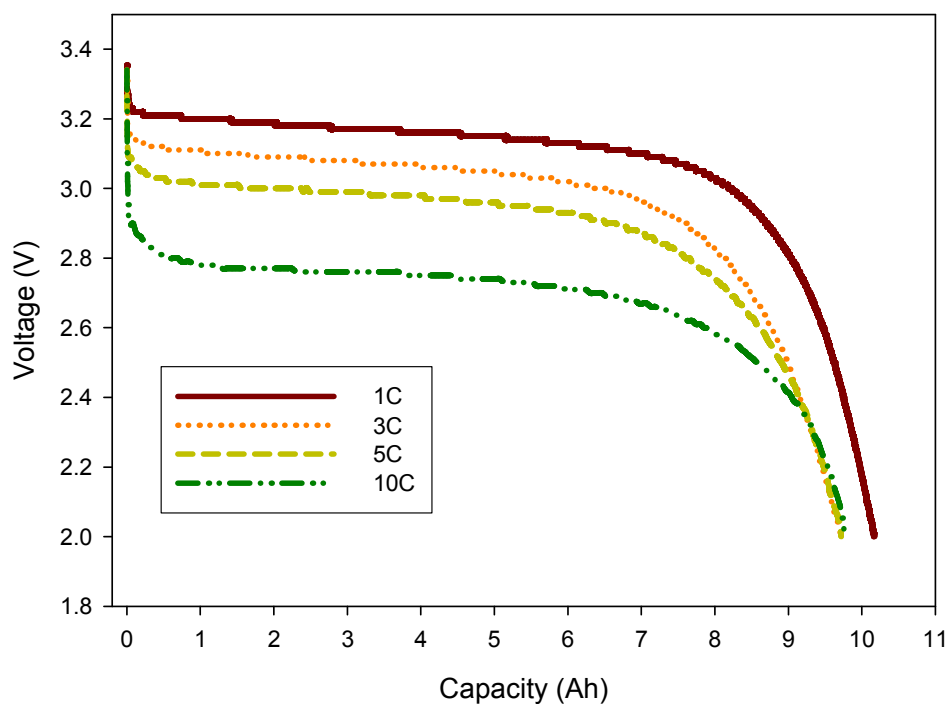
8. Others

Any matters that this specification does not cover should be conferred between both parties.

9. Appendix:

9.1 C-Rate:

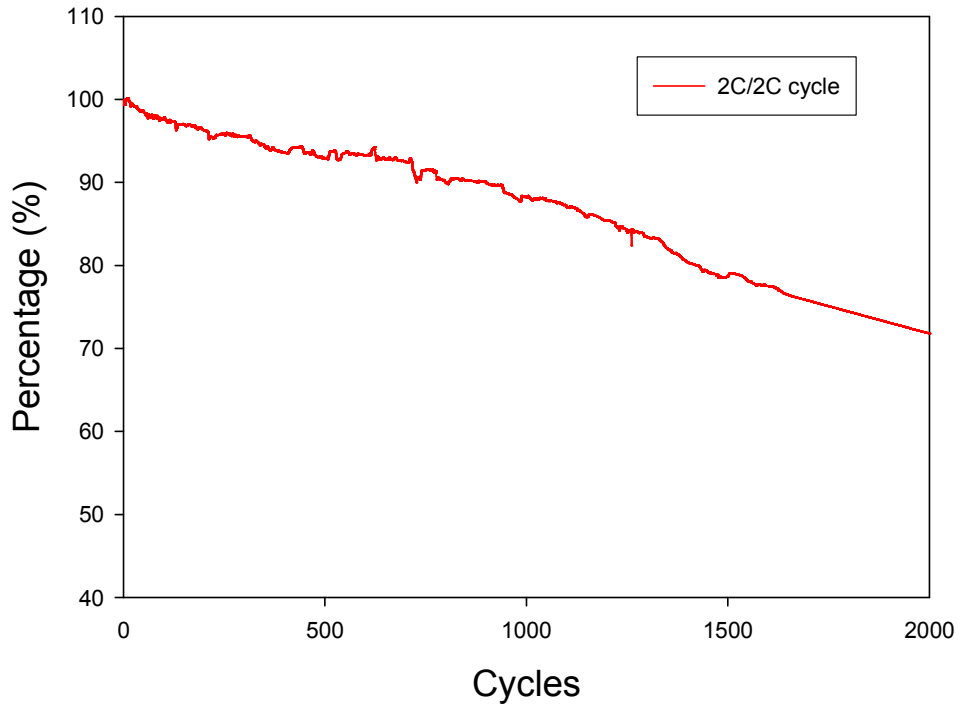
EXA 10Ah C-rate discharge test



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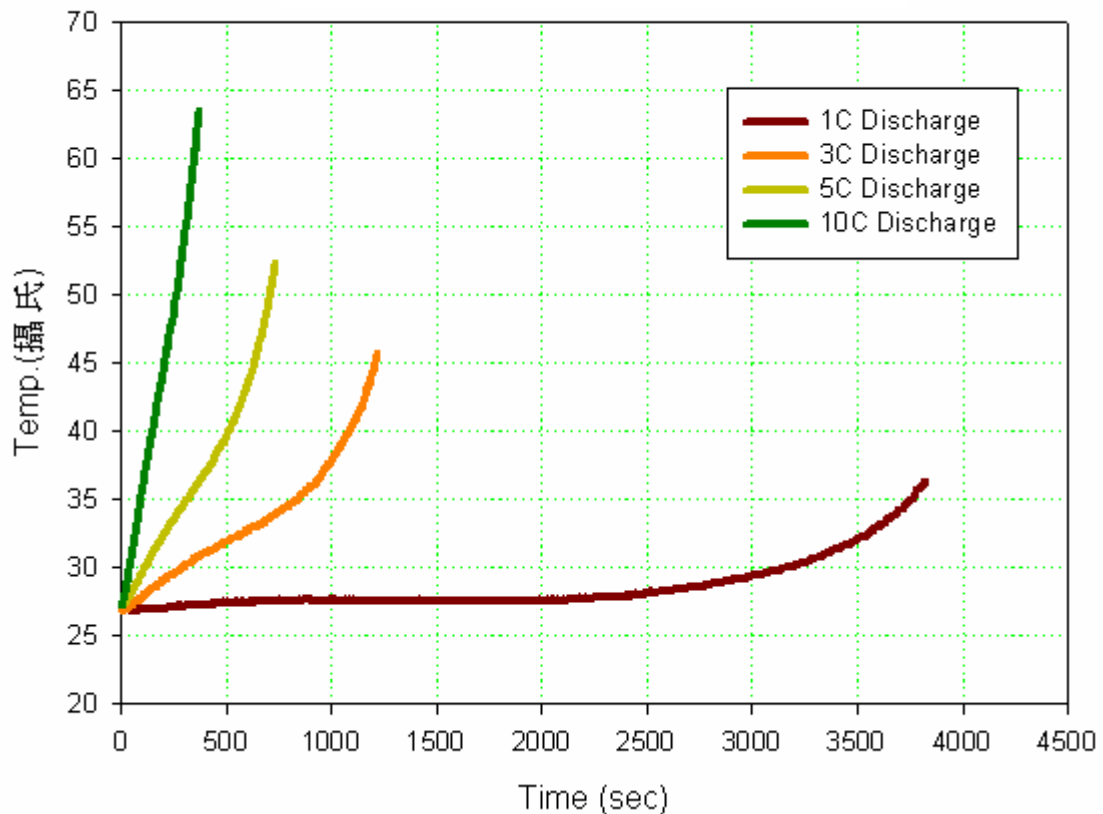
9.2 Cycle Life at 25°C

LiFePO4 2C Charge 2C Discharge



9.3 Cell Temperature at different discharge C-rate

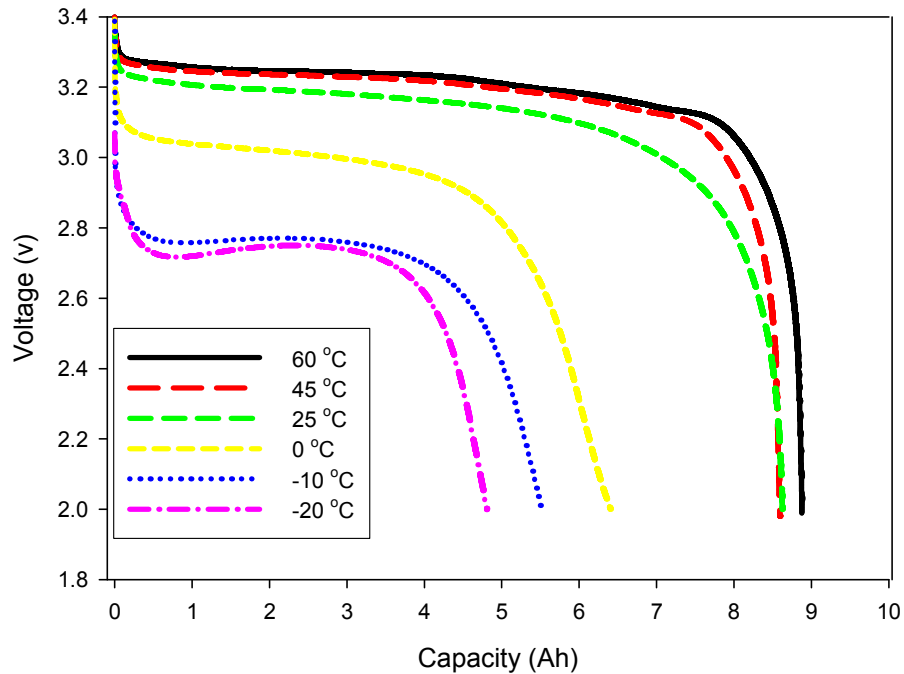
AL20078153A - Temp. Test



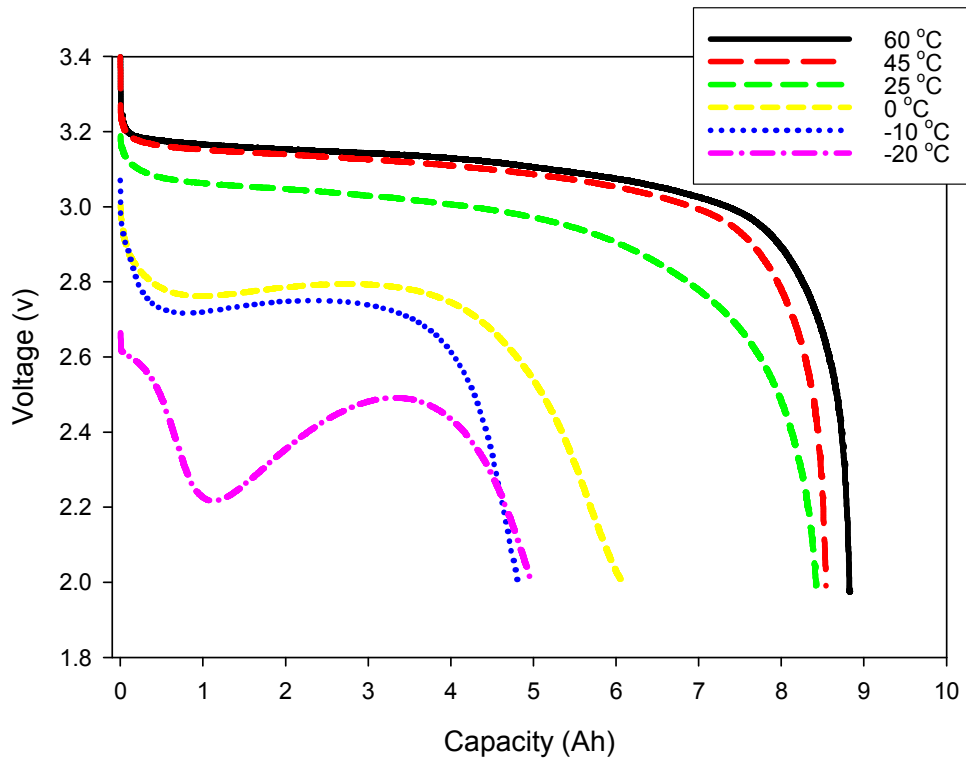
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9.4 Temperature Performance

EXA 10Ah 1C Charge-Discharge

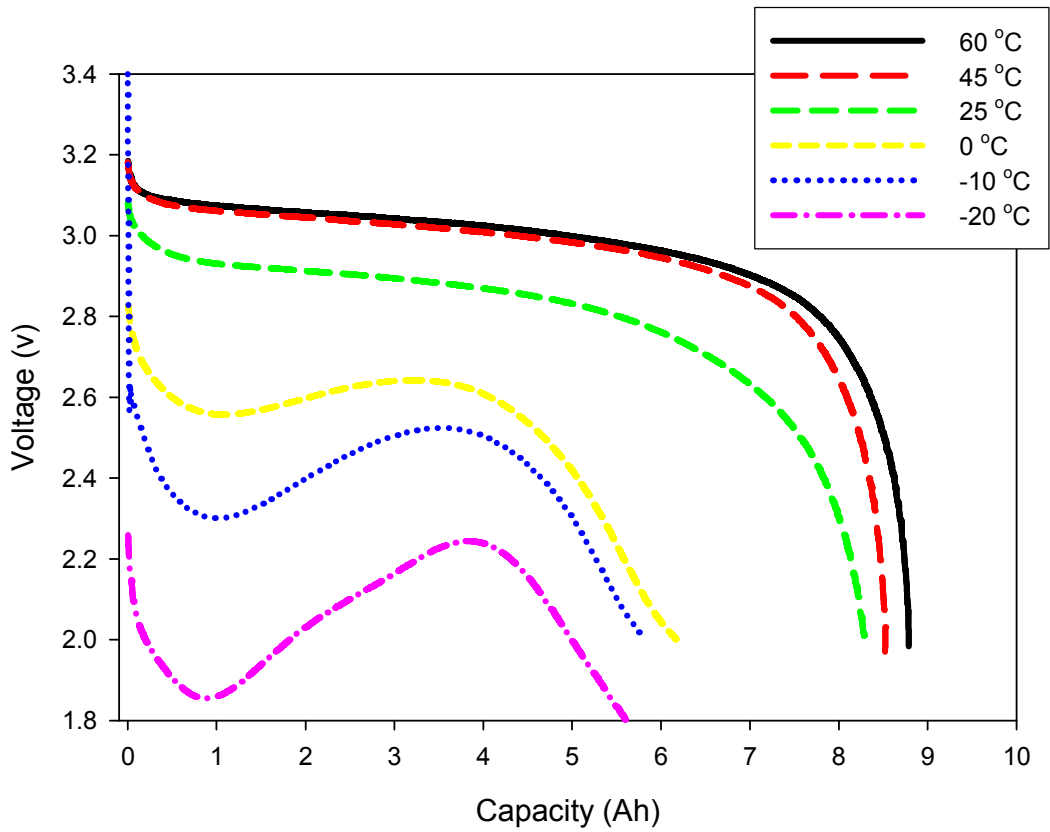


EXA 10Ah 3C Charge-Discharge at Different Temperature



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EXA 10Ah 5C Charge-Discharge



9.5 Storage Characteristics

Storage Characteristics of Lithium Ion Polymer Rechargeable Battery

