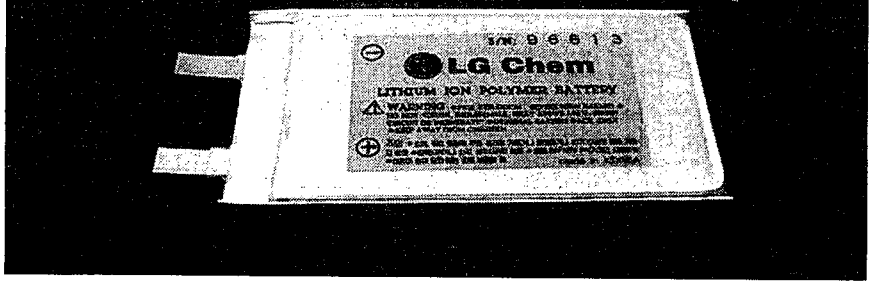
고용량, 고성능 리튬이온폴리머전지의 개발

안 순 호

(LG화학 Battery연구소)

Lithium Ion Polymer Batteries



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BATTERY FEATURES

- High Energy Density at Ultra-Slim Design (3 mm or below)
  Typically 350 Wh/L, 180 Wh/kg @ 3.6 mm
- Less Concern on Electrolyte Leakage
- Improved Battery Safety
- High Power Capability
- Low Impedance (AC @ 1 kHz and GSM DC)
- High Capacity at Low T (e.g. -10°C)
- Facile Size Change

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CHEMISTRY

Electrode Material	:	**$LiCoO_2$ / Graphite**
Separator	:	**Highly Absorbing Gel polymer**
Packaging	:	**Al laminate**

[redacted]

Cellular Phone (CDMA, GSM), PDA, Note PC etc.

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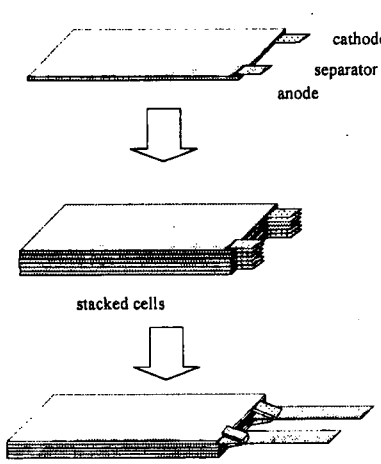
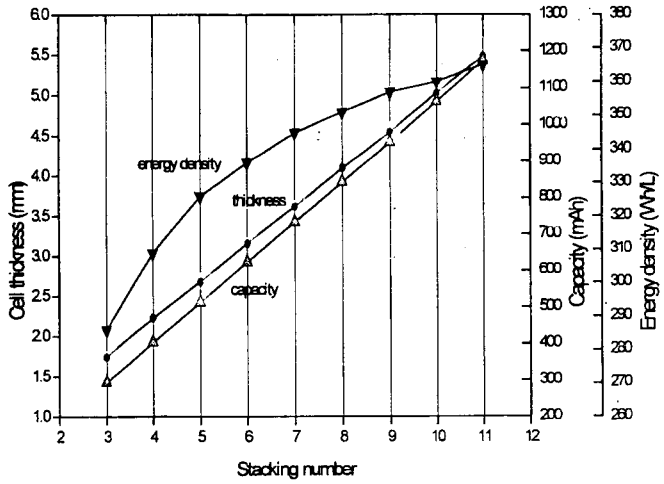
BATTERY STRUCTURE AND CAPACITY

Stacked-laminate design allows quick thickness variation and plurality of electrical connection.





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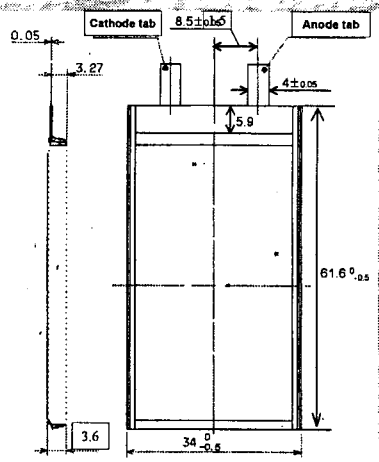
LG-PB 383562 PRODUCT INFORMATION



Nominal Capacity	720 mAh
Nominal Voltage	3.7 V
Cut-off Voltage	3 V
Dimensions(mm)	3.6(T)×35(W)×62(L)
Weight (g)	Approx. 15.2
Rated Capacity (mAh)	RT: 1C (705) 2C (685) -10℃: 1C (430)
Internal Impedance at 1 ㎑	Less than 35 mΩ

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383455 PRODUCT INFORMATION

Nominal Capacity	600 mAh (4.2V, 0.2C Discharge)
Nominal Voltage	3.7 V
Discharge Cut-off Voltage	3 V
Dimensions(mm)	3.7 (T) × 34 (W) × 55 (L)
Weight (g)	Approx. 12.8
Rate Characteristics	RT 0.5C/0.2C: 99% 1C/0.2C : 96% 2C/0.2C : 91% -10℃ 0.2C/0.2C(RT): 92% 0.5C/0.2C(RT): 83% 1C/0.2C(RT) : 71%
Internal Impedance at 1 ㎑	Less than 35 mΩ

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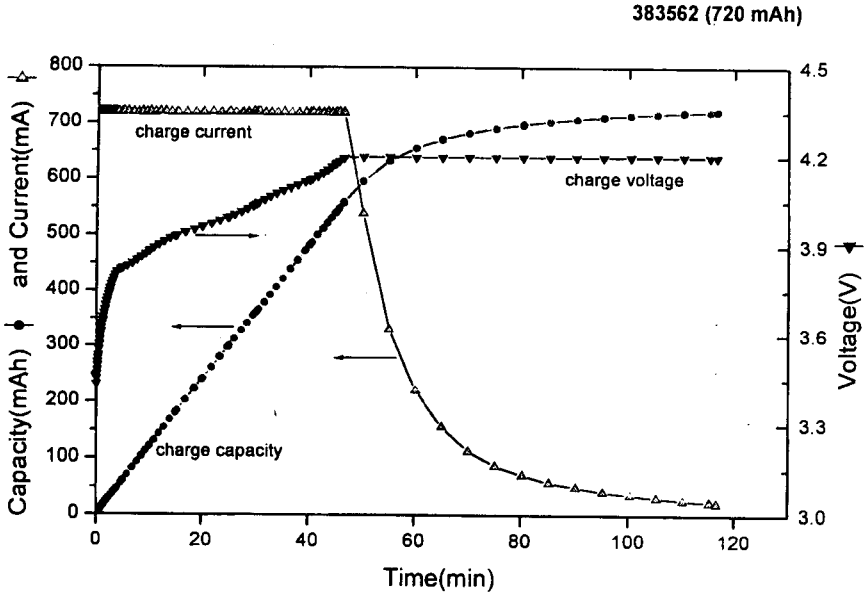
Charge Characteristics (CC-CV, 720mA, 4.2V, 20mA, 25℃)



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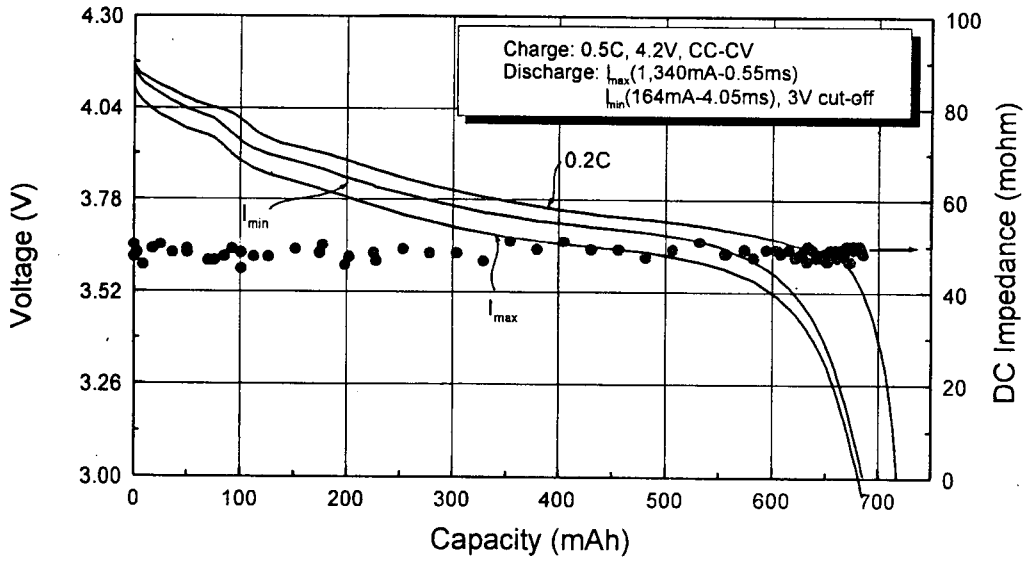
GSM Discharge @ 25 °C



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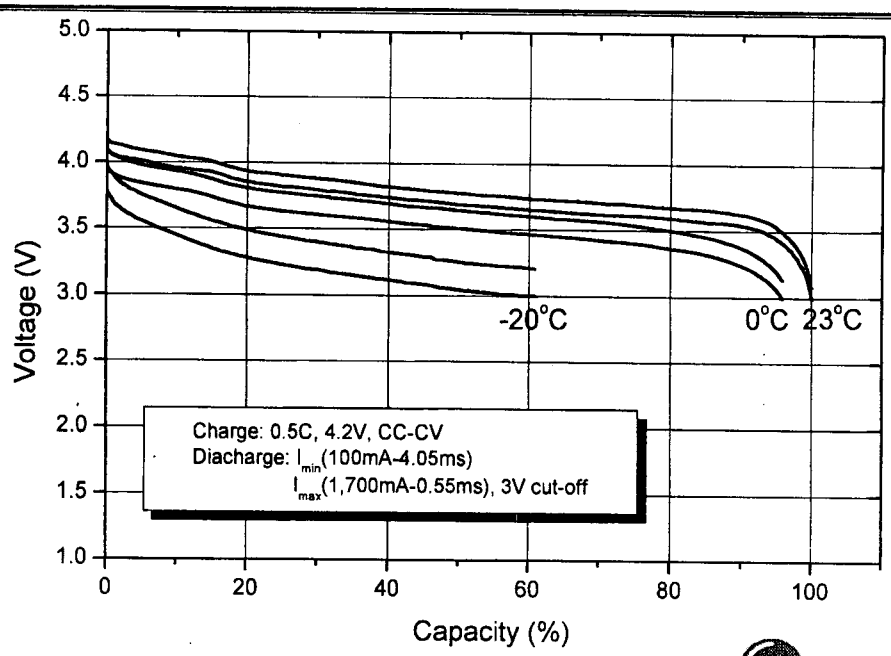
GSM Discharge (Low Temperature)



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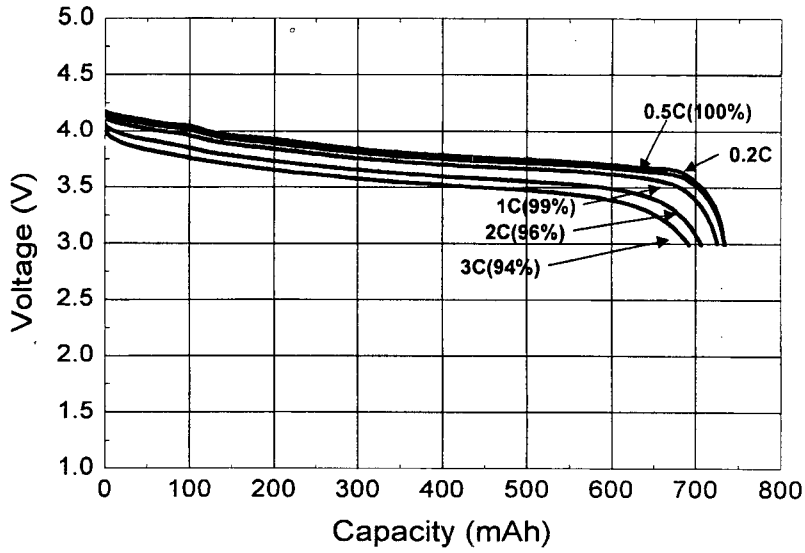
Discharge Profile (24℃)



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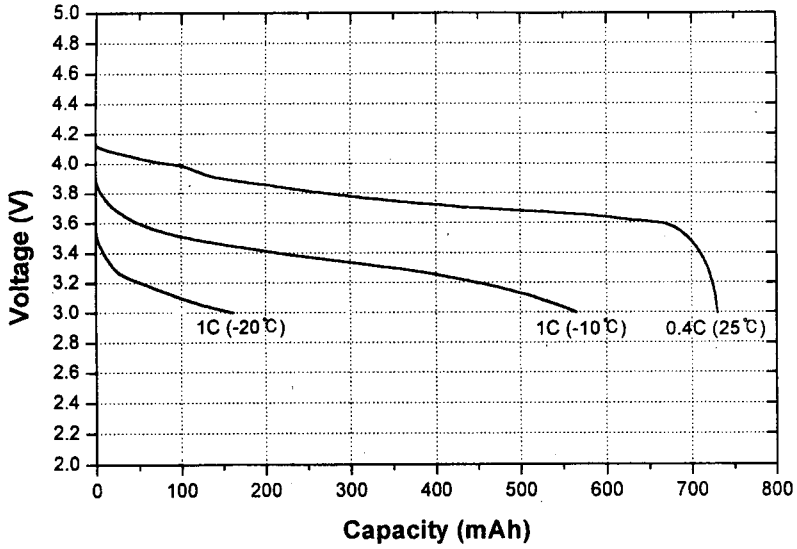
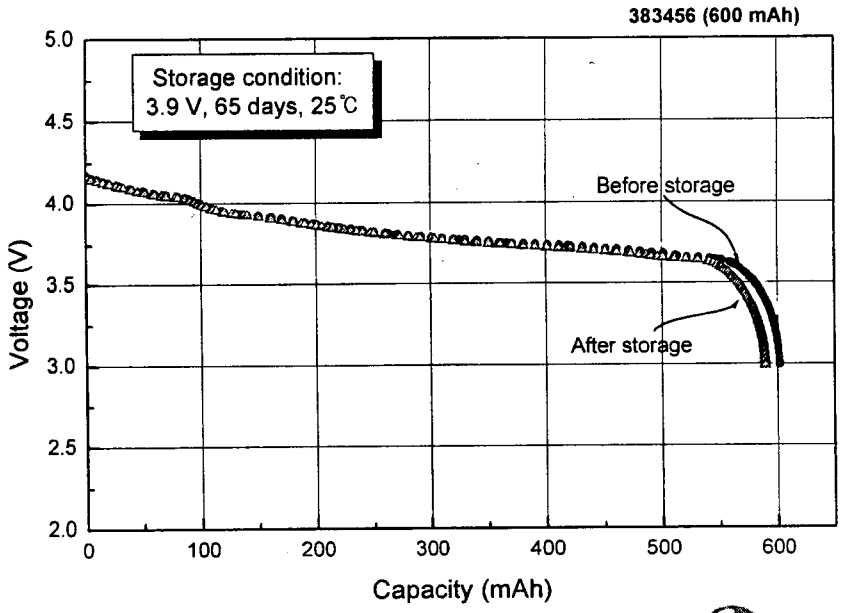
Discharge Characteristics (Low Temperature)

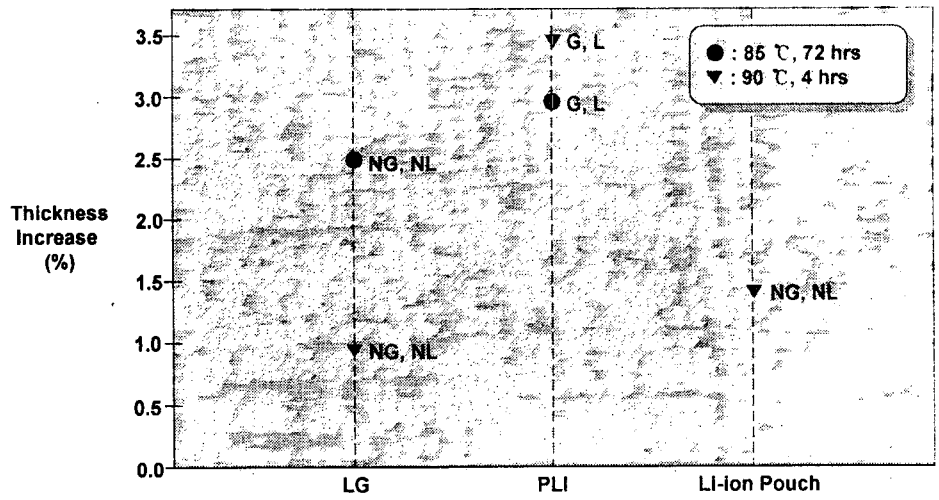


Capacity Recovery After Prolonged Storage



High Temperature Storage (4.2 V, 85 ℃ and 90 ℃)

•Outstanding stability for high temperature storage
- Very low swelling
- No Gas and no leakage



(NG:No Gas, NL:No Leakage, G:Gas, L:Leakage)

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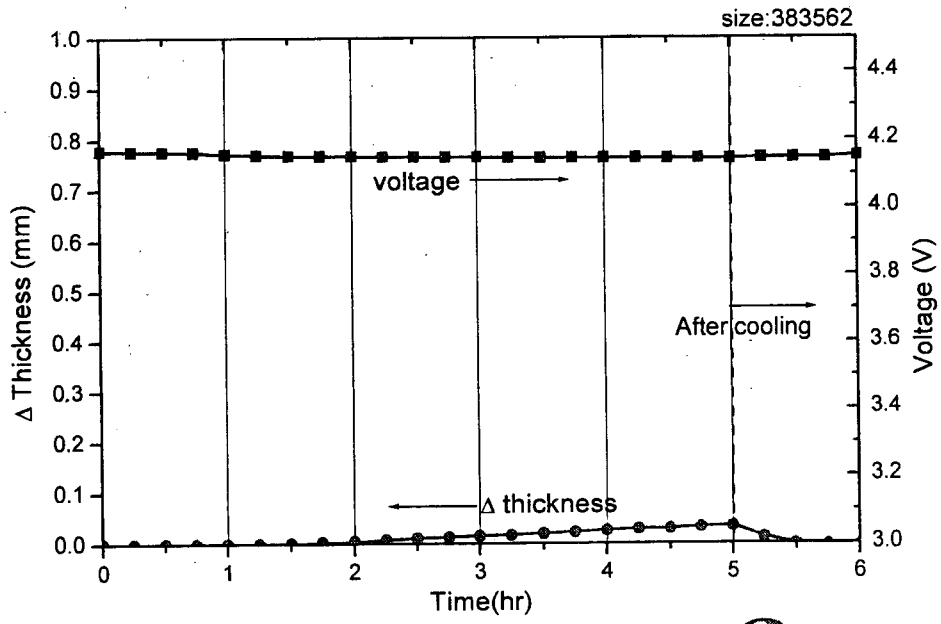
High Temperature Storage (4.2 V, 90 ℃ ,5hrs)



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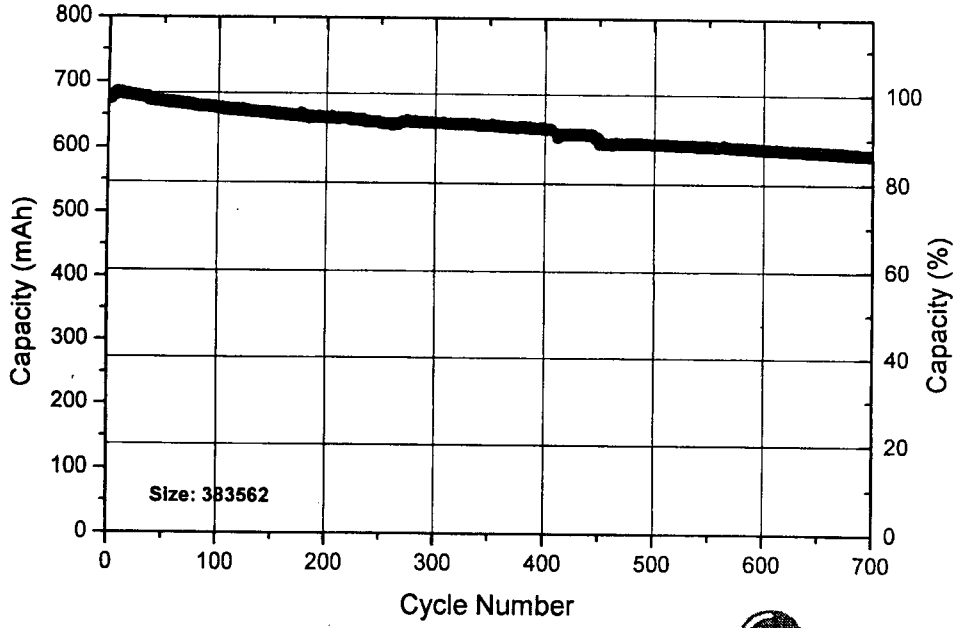
Cycle Life Characteristics (1C charge/1C discharge, 23℃)



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Safety Test Results

Test Methods	Conditions	Results (T max.)
Hot box test	5 °C/min, 4.2 V, 150 °C	NE, NF (10 hrs)
Short circuit test I	60 °C, 4.2 V	NE, NF (110 °C)
Short circuit test II	25 °C, 4.2 V	NE, NF (100 °C)
Impact test	UL1642	NE, NF (85 °C)
Overcharge test I	1.5 C, 12 V	NE, NF (90 °C)*
Overcharge test II	3 C, 12 V	NE, NF (95 °C)*
Forced discharge	1 C	NE, NF (52 °C)
Nail penetration test	4.2 V, 4 mm	NE, NF (80 °C)
Crush test	4.2 V, 13 kN	NE, NF (35 °C)
Side crush test	4.2 V, 13 kN	NE, NF (60 °C)

(NE: No Explosion, NF: No Fire)

* with PTC

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Summary/ Conclusions

- Developed Unique Polymer Battery Technology
- Gelling Polymer & Novel Stacking Technology
  - → Achieved 350 Wh/L (390 Wh/L) and 180 Wh/kg
  - → Performances (Power, Low T, Swelling, Storage, etc) As Good As or Better Than Liq. Li Ion Cells

- Next Issues;
  - → Inherently Safer Chemistry
  - → Wider Format
  - → Flexibility to Curvature;
    - Interfacial Problem (Uniformity Breaks)
      - Thinness Will Help.
      - Gelling Polymer Helps Maintain Interface Intact.