ULTIMO Lithium Ion Capacitor

Elektrobus conference
Esslingen, June 19th, 2009

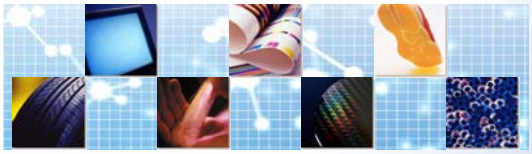
It all started in 1957 …

Japan Synthetic Rubber was created by the Japanese government to produce synthetic rubber for making car tires ….

Groundbreaking Chiba Plant

Opening Ceremony Yokkaichi Plant

JSR Corporation today



Since 1957 JSR has developed a unique expertise in the field of polymer chemistry.

We are a $4 billion leading supplier of advanced polymer materials with more than 5000 employees.

We have a Global Supply Network

Contingency and Global Presence

- Three companies operate the business under "Global One Concept/Strategy"
- Local agents, warehouses and support
- Our goal: **To collaborate closely with global technology leaders !**

European Headquarters is based in Leuven, Belgium

Manufacturing

- Design Concept: Copy exact to JSR Corp. & US manufacturing process
- Plant Completion: November 2002
- Available space for new materials
- Total Investment: 20 million EUR

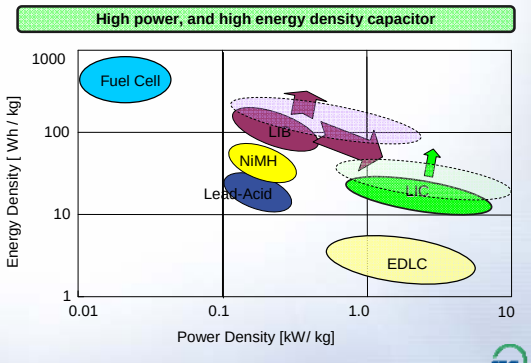
Support our European Customers

- Semiconductor Product Line
- New Business Development
- Multi-functional lab
- Capital: 11 MEUR (100% owned by JSR)
- 75 employees

Lithium Ion Capacitor
(JME-LIC)

Introduction JSR Micro's sister company

Comparing LIC to other technologies



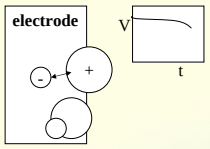
LIC is a Capacitor, not a battery

Battery

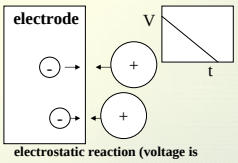
Based on electrochemical reactions.
→ Slow charge/discharge rate.

Capacitor

Based on electrostatic induction.
→ Rapid charge/discharge rate.

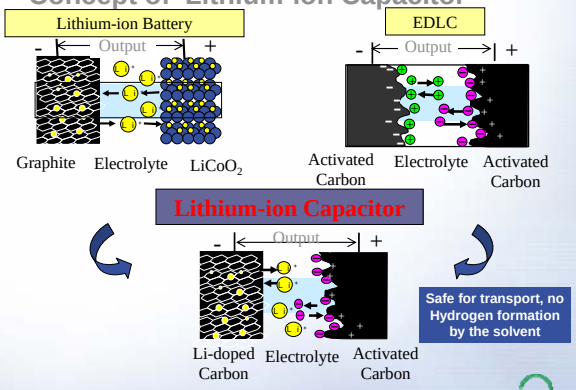


redox reaction (constant voltage)

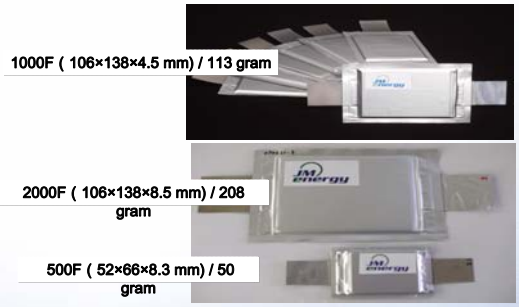


electrostatic reaction (voltage is proportional to quantity of electricity)

Concept of Lithium-ion Capacitor



Cell Dimension of Li-ion Capacitor



1000F (106×138×4.5 mm) / 113 gram

2000F (106×138×8.5 mm) / 208 gram

500F (52×66×8.3 mm) / 50 gram

Very small, light weight device

JM Energy Yamanashi HQ Plant

Contact at Yamanashi HQ plant:
Construction Project
JM Energy Corporation
8566 Nishi-ide, Ooizumi-cho, Hokuto-city, Yamanashi, 409-1501 Japan
Main Phone: 81-551-38-8008

October, 2008(plan)	Manufacturing facility of 300K cells/year (Investment: 2 billions Japanese yen)
2009	600K cells/year
2010	1.2 million cells/year
2011	2.4 million cells/year

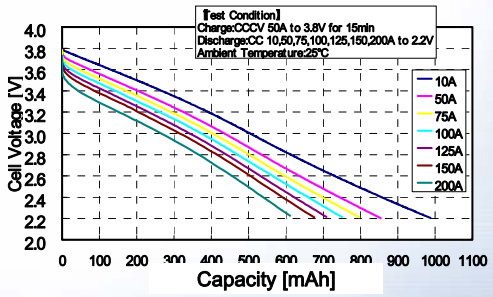
LIC Cell Performance (500,1000, 2000F)

3.8V operating voltage !

25Wh/L for a 2000F cell !

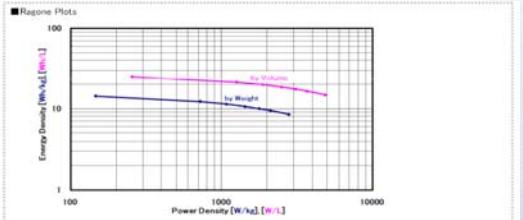
	Measurement		Standard Type 1000F Series	Standard Type 2000F Series	Low Resistant Type 1000F Series	Low Resistant Type 2000F Series	Test Condition
1	Operating Temperature		- 20℃ ~ 70℃		- 20℃ ~ 70℃		
2	Rated Voltage	Maximum	3.8V		3.8V		
		Minimum	2.2V				
3	Initial Property	Capacitance	550F	1100F	2200F		100mA constant current discharge at 25℃
		ESR	3.9mΩ	2.8mΩ	1.4mΩ		
		DC-IR	7.5mΩ	4.5mΩ	2.3mΩ		
		Energy Density by Weight	15Wh/kg	12Wh/kg	14Wh/kg	11Wh/kg	
		Energy Density by Volume	26Wh/L	21Wh/L	25Wh/L	18Wh/L / 19Wh/L	
4	Capacitance	- 20℃ from 25℃	75%	75%	75%	75%	10CA constant current discharge
		70℃ from 25℃	105%	105%	105%	105%	
5	Heat Resistance	from Initial	90%	90%	90%	90%	3.8V, 70℃, and 1000hours
6	Cycle Test Performance	from Initial	90%	90%	90%	90%	100CA constant current discharge 25℃,100K Cycles
7	Self Discharge	Voltage	Less than 5%	Less than 5%	Less than 5%	Less than 5%	3 months at 25℃
8	Dimensions	Convex	52× 66× 9 mm	138× 106× 4.5 mm	138× 106× 9 mm	138× 106× 5.5 mm / 138× 106× 10.5 mm	

Discharge Curve (2000F, Standard Type)



Fast recharge and discharge capability

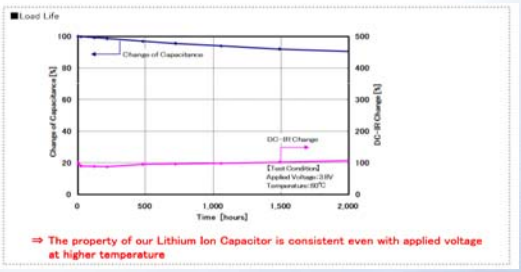
Ragone plot:
excellent Energy to Power characteristics



⇒ Large energy density and power density was achieved by our Lithium Ion Capacitor

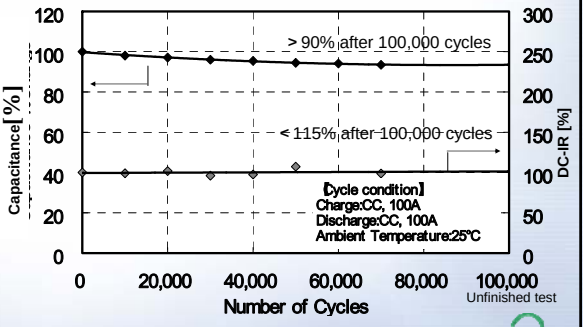
Load life at high temperature:

Good performance at a temperature of 60°C

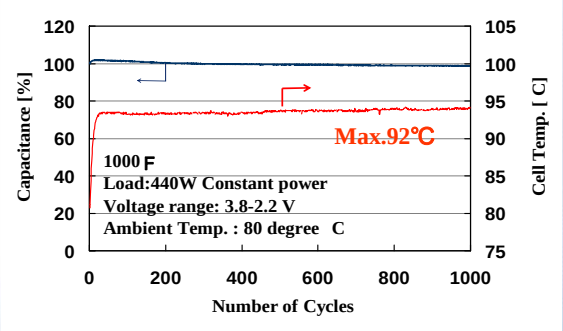


⇒ The property of our Lithium Ion Capacitor is consistent even with applied voltage at higher temperature

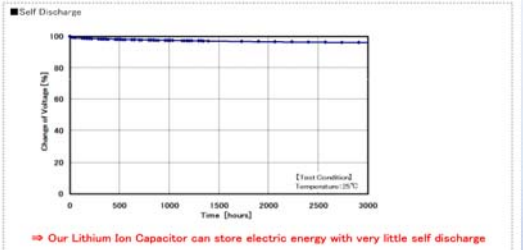
Excellent Cycle Test Performance (Ultimo 2000F Standard example)



LIC cell performs even at High Temperature



Self discharge: less than 5% after 3 months

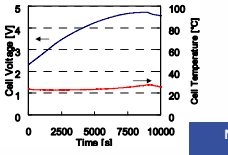


⇒ Our Lithium Ion Capacitor can store electric energy with very little self discharge

Safety Test of LIC Cells

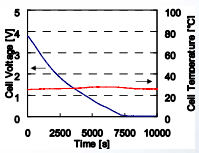
Over Charge test

Charge up to 250% of rated capacitance with 1A constant current



Over Discharge test

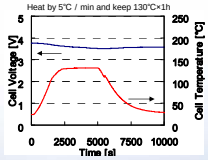
Discharge to 0V with 1A constant current



No fires
no explosions

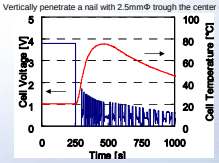
Heat test

Heat by 5°C / min and keep 130°C×1h

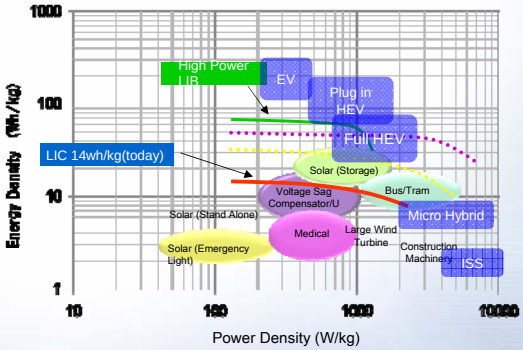


Nail test

Vertically penetrate a nail with 2.5mmΦ trough the center of the cell

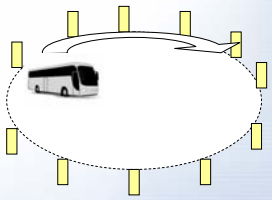


Target Markets and future development



Current ongoing projects for buses

- Start-stop
- Trolley-bus
- Fast charge – discharge inner city bus



Conclusions

- Lithium Ion Capacitor (LIC) technology has ideal characteristics for use in transport applications:
  - Very fast charging
  - Higher Energy Density than EDLC Super-capacitors
  - Higher Power Density than Lithium Ion Battery technologies
  - Very light weight
  - Small size
  - Convenient shape for efficient stacking within a vehicle
- Lithium Ion Capacitors are currently being produced in HVM at JM Energy

http://www.jmenergy.co.jp
http://www.jsrmicro.be

Thank you !

More information: Kurt.Adams@jsrmicro.be