EV용 대용량 전지의 특성평가기술

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Evaluation Technology of Characteristics for EV-Size Batteries

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Abstract

This paper presents the results of tests performed by various methods for electric vehicle batteries. Many works for preparing the EV standards and test procedures to evaluate power trains and EV batteries are in progress by SAE, IEC/TC69, ISO/TC22, JEVA, CEN/TC301, etc.

EV-Size lithium ion battery have been studied by Sony, KERI/STC, SAFT, VARTA, Sanyo, GS battery and Hitachi. Lithium ion battery module for EV have been demonstrated by Sony(battery)/Nissan(vehicle) and KERI/STC in 1996.

We have studied evaluation of lithium ion batteries for consumer use and EVs based on IEC draft standards, UL safety test methods, SBA guideline for safety evaluation on secondary lithium cells and mentioned above.

Acknowledgements

Dr. David V. Ragone(MIT) give us the method for constructing a Ragone Plot. Dr. Ken Lillie(Rover Group) and Dr. Georg Immel(BMW) provide for power profile of the ECE-15-cycle for testing batteries of electric vehicles on the bench. And Dr. T. Eguro(Furukawa Battery Co.) suggested useful test procedure for power ability of electric vehicle batteries. We appreciate all these help.

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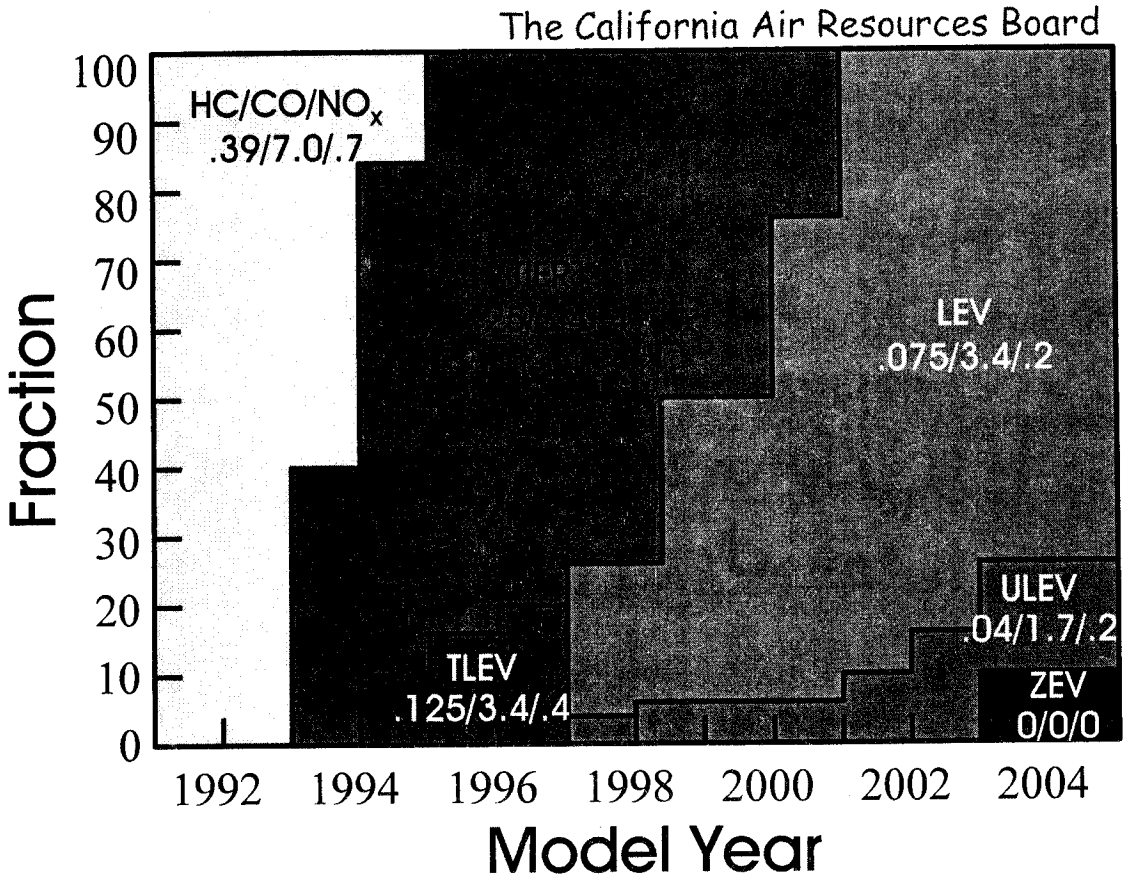
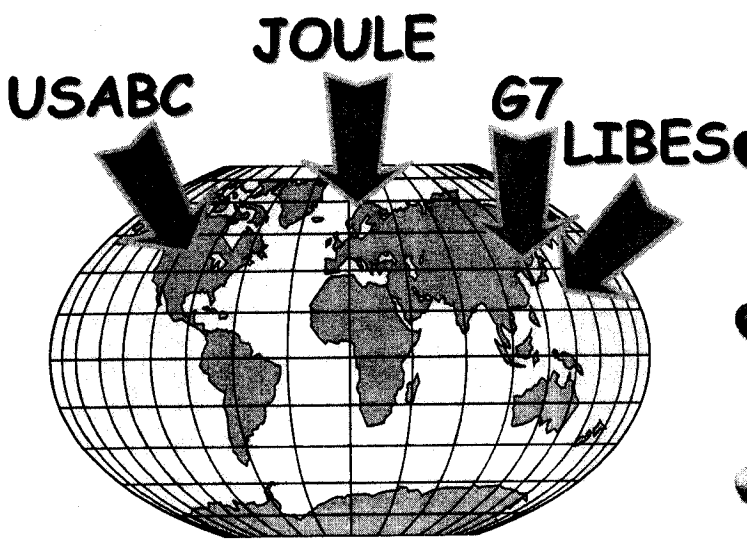
The Clean Air Acts by CARB

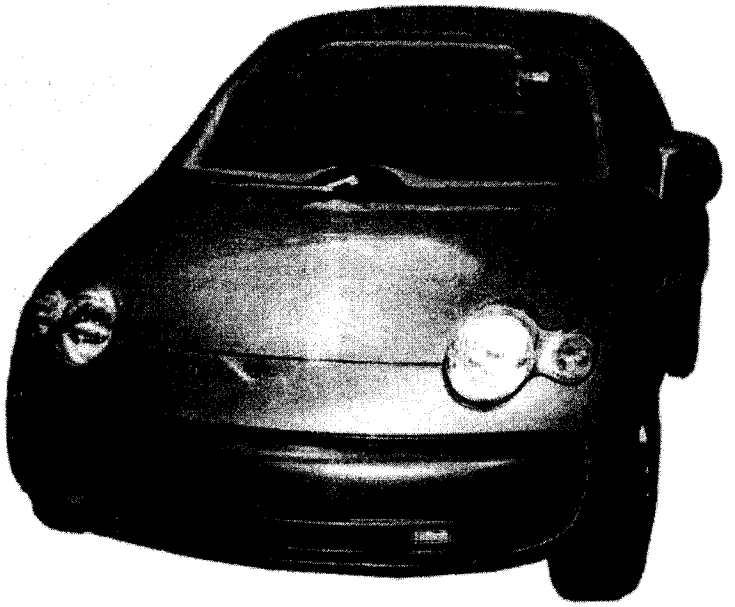


World Wide Research Programs



- Formed in 1991, the United States Advanced Battery Consortium is an historic $262 million partnership among the Big Three domestic automakers, the U.S. Department of Energy, the Electric Power Research Institute and battery manufacturers. and forced to develop secondary batteries for electric vehicle. *($ 112.8million/3 years)*
- The european community supports the Li battery development in the framework of the JOULE-II program.
- LIBES project in SUNSHINE program in Japan was established to study Li secondary batteries for BESS and EV applications. *($140million/10 years)*
- R&D of Li secondary battery of project in Korea have carried out to develop Li secondary batteries for EV applications. *(18million/10 years)*

FEV 2 & Prarie Joy EV

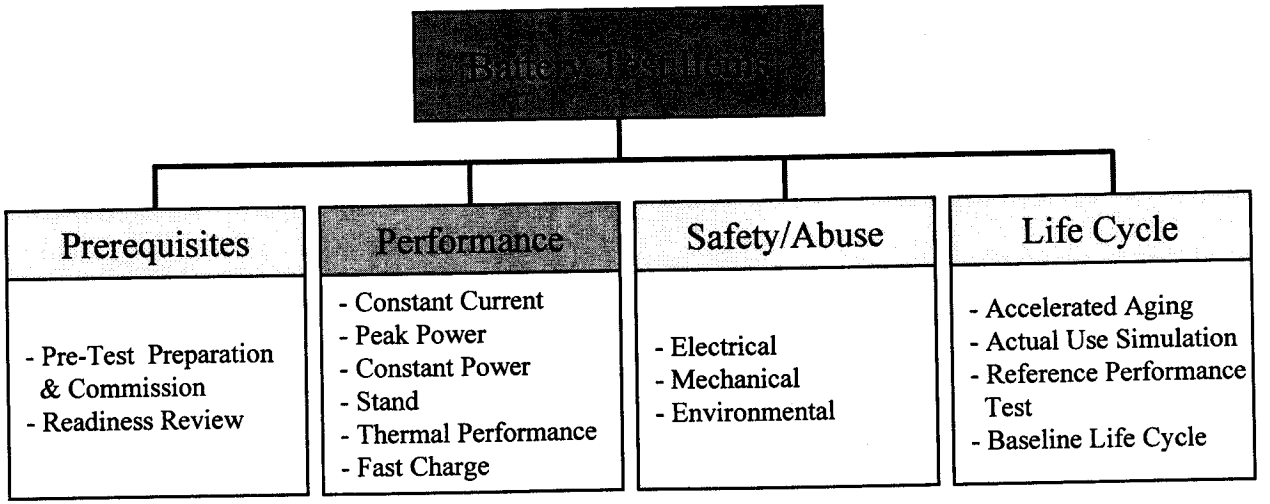


FEV II(1995)

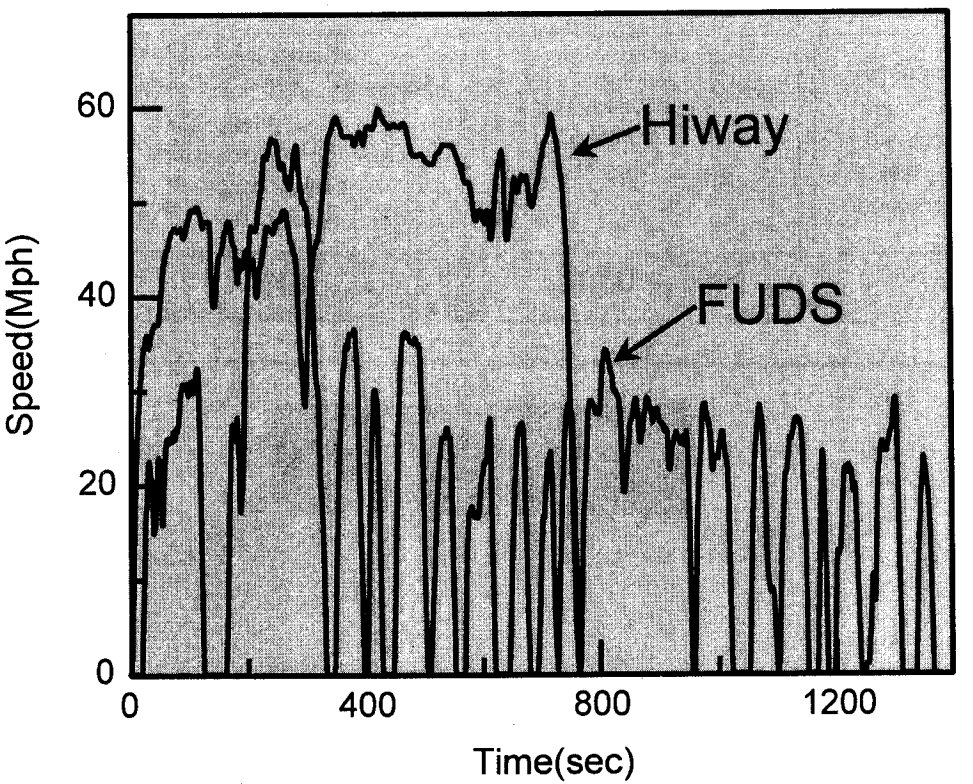
Prarie Joy(1996)

Nissan & Sony Energy Tec. Demonstrate Lithium Ion Technology

Test Items for Batteries



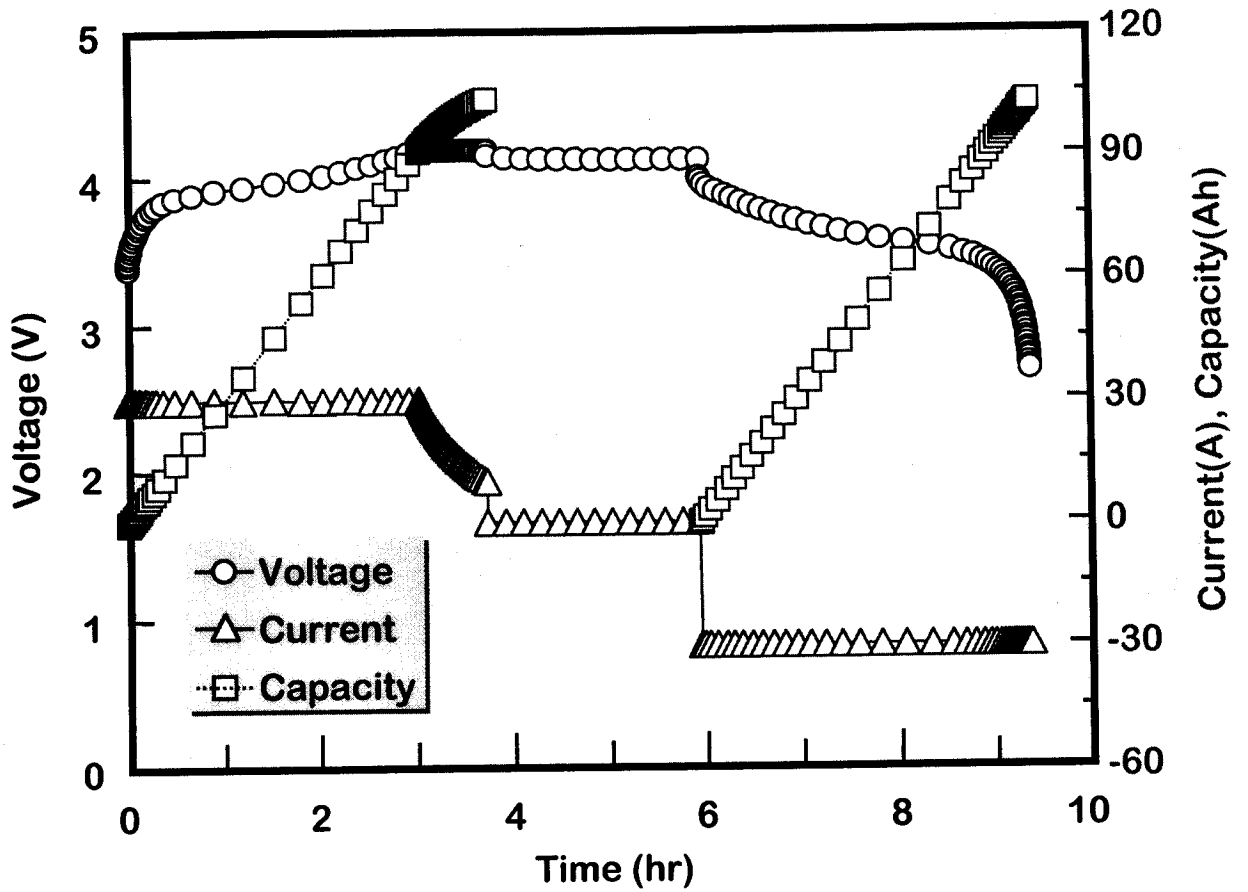
FUDS & Hiway



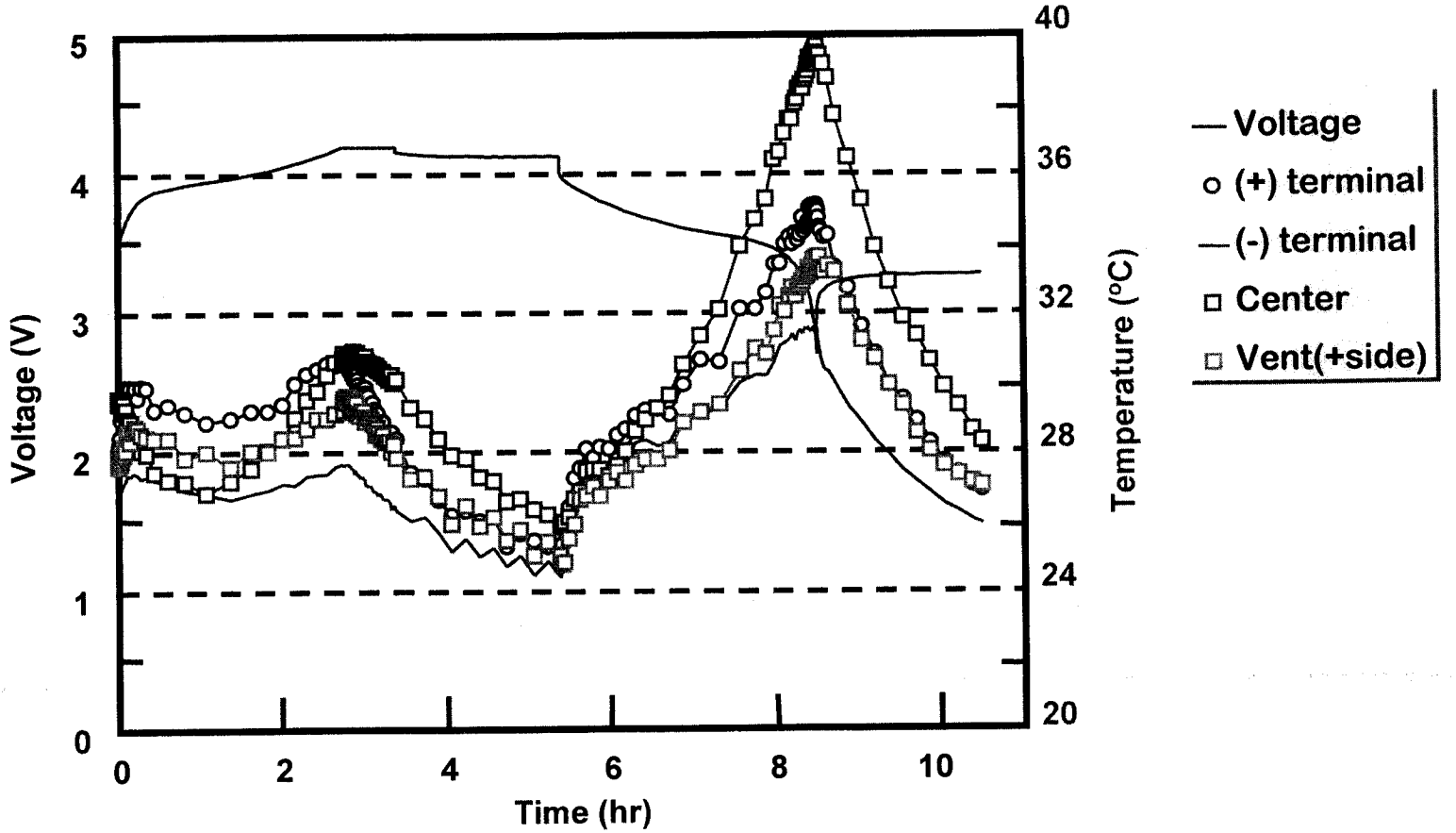
Driving Cycle Comparison

Item \ Method		FUDS	SFUDS	GSFUDS	Europe 93		UFUDS
					City	Suburban	
Power Density (W/kg)	Average	10.1	9.9	10	3.9	22.2	15
	Maximum	79	79	80	31	56	120
Speed (km/h)	Average	31.12	30.6	31.3	-	-	31.3
	Maximum	91.1	87.5	87.7	50	90	87.7
Energy Consumption (Wh/km)		225	224	223	-	-	-
Cycle Time(h)		0.38	0.1	0.1	0.22	0.11	0.1
Cycle Distance(km)		11.9	3.1	3.1	-	-	3.1

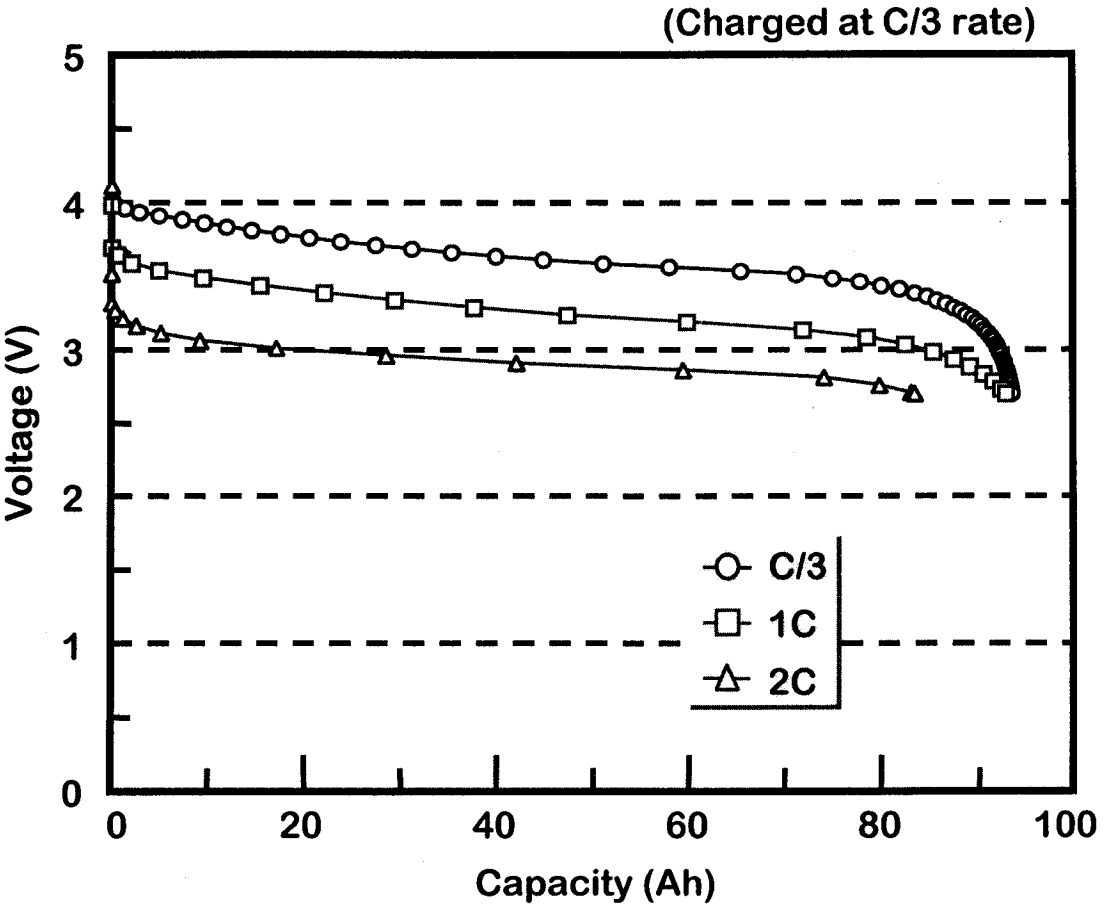
Charge & Discharge Characteristics of EV Battery



Voltage & Temperature Profile of EV Battery

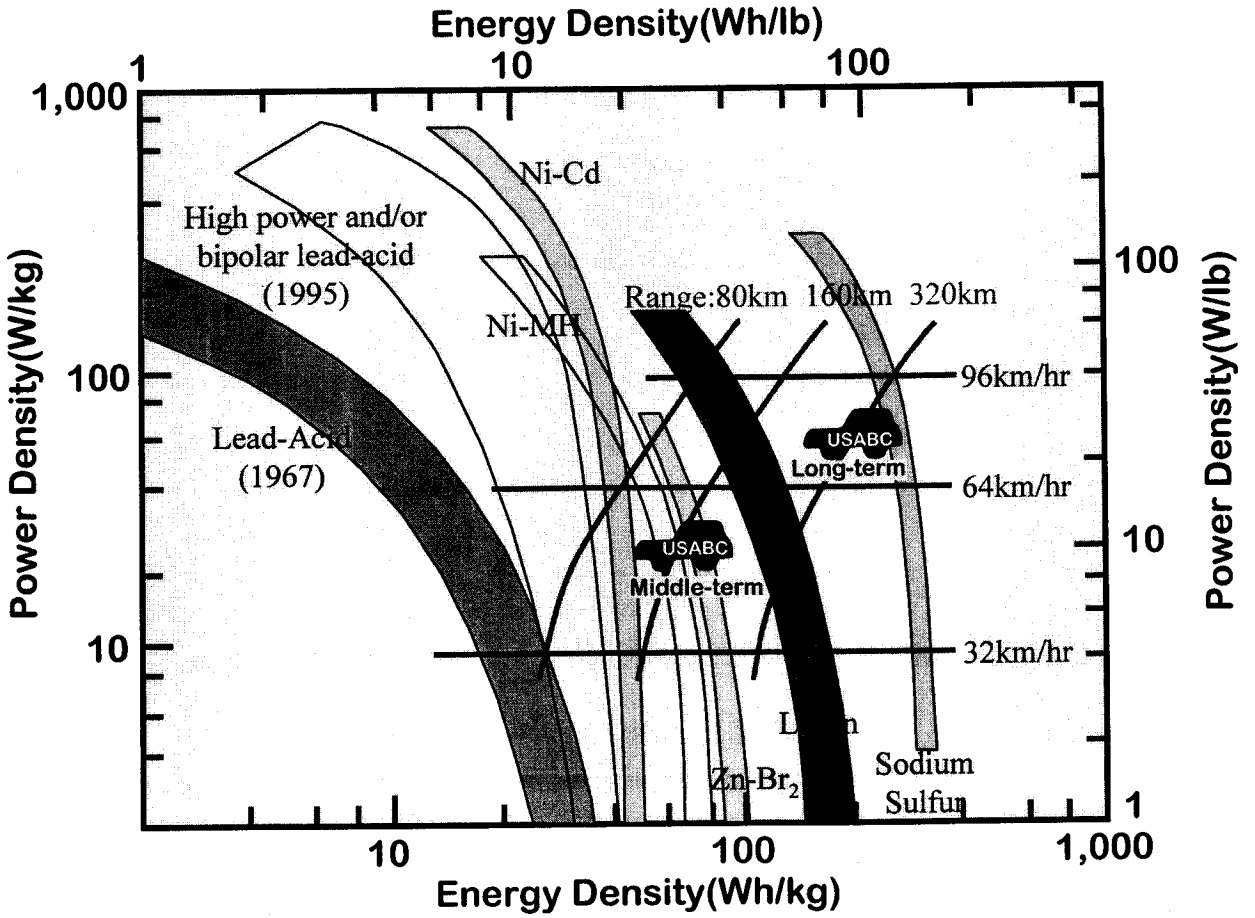


Rate Capability



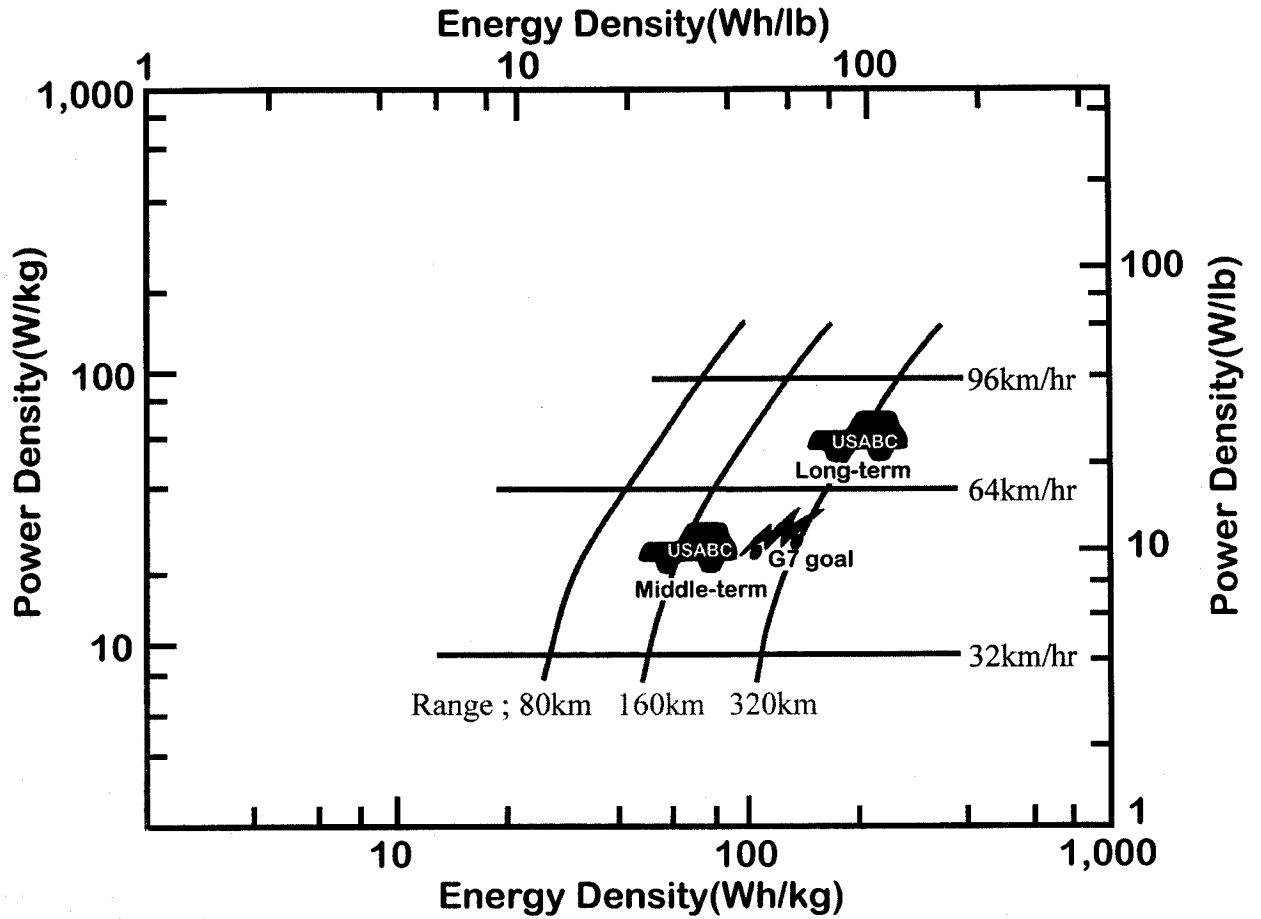
Energy Density and Power Density

- 무게 1,000kg의 차량의 속도와 주행가능거리
- USABC의 중기 및 장기목표를 위한 전지성능

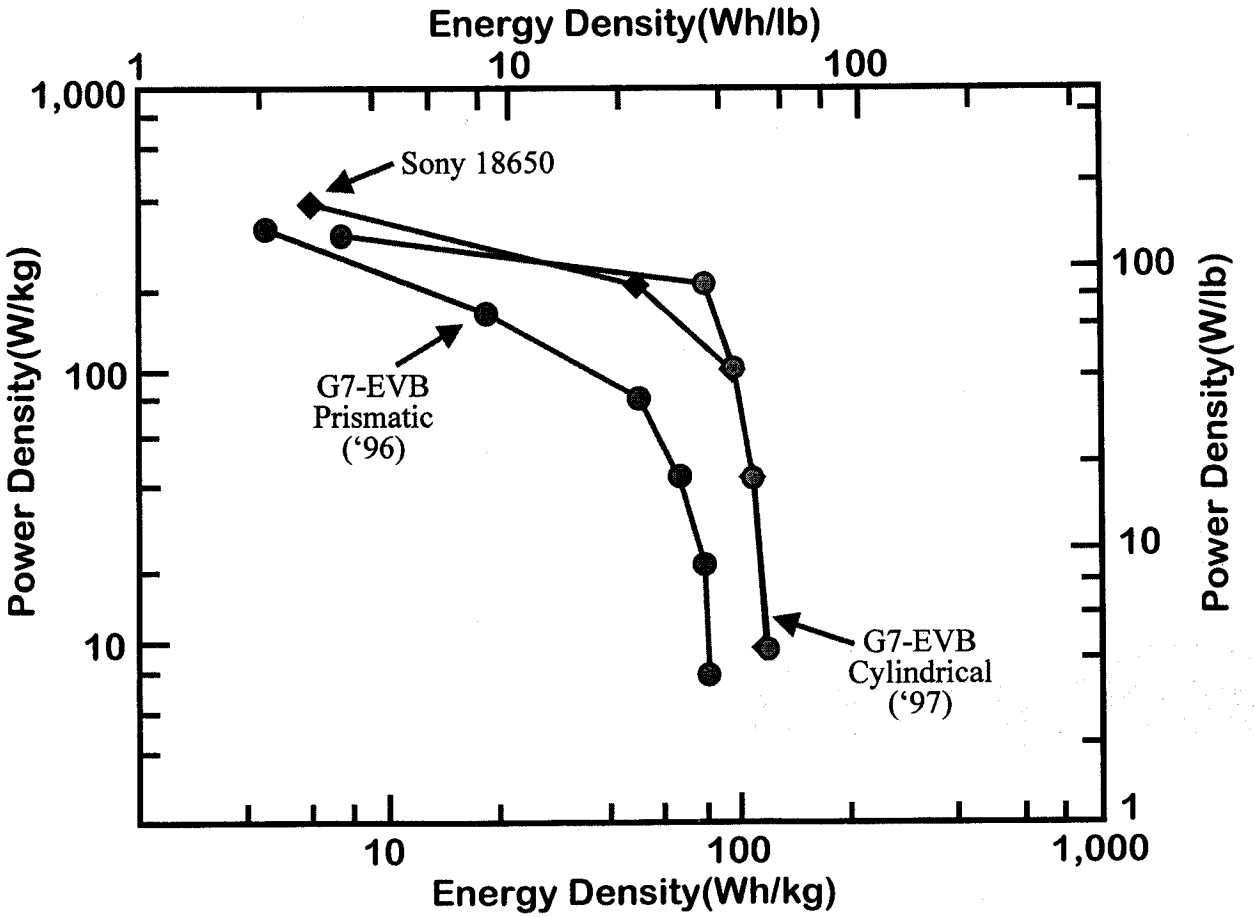


Target of G7 and Mid- & Long-Term Target of USABC

- USABC ; Simulated with 1,000kg of Vehicle Weight
- G7 ; 1,200kg of Vehicle Weight, 300km(40~60km/h)



Power-Energy(Ragone) Curve

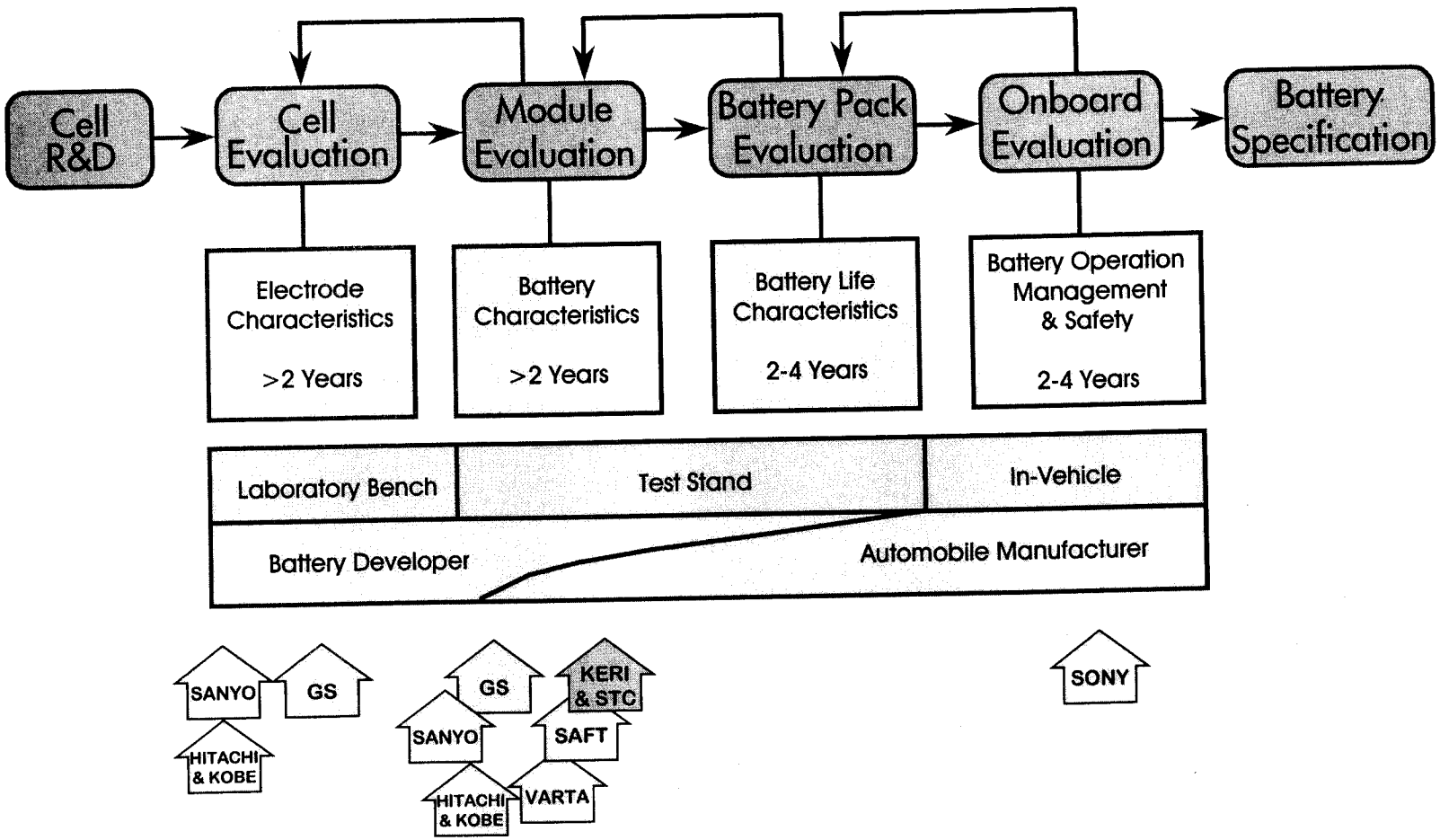


Several Organizations are in the Development of Large Lithium Ion Batteries for EV Batteries (Dec. 1996)

Characteristics	Sony	KERI/STC	Varta	SAFT
Chemistry				
• Anode	**Hard Carbon**	**Grahpite**	**Grahpite**	**Grahpite**
• Cathode	**$LiCoO_2$**	**$LiCoO_2$**	**$LiCoO_2$**	**$LiNiO_2$**
Cell Configuration				
• Design	**Cylindrical**	**Prismatic**	**Prismatic**	**Prismatic**
• Capacity(Ah)	**100**	**100**	**30**	**110**
• Weight(kg)	**3.3**	**3.88**	**1.67**	**3.45**
• Volume(l)	**1.45**	**1.63**	**0.95**	**1.68**
Module				
• Energy(kWh)	**2.9 (8 cells in series)**	**3.9 (12 cells in series)**	**2 (16 cells in series)**	**3* (8 cells in series)**
• Specific Energy(Wh/kg)	**100**	**76**	**75**	**150***
• Energy Density(Wh/l)	**160**	**178**	**130**	**250***
Battery				
• Energy(kWh)	**35**	**25***	**40***	**30***
• Specific Energy(Wh/kg)	**90**	**120***	**102***	**120***
• Energy Density(Wh/l)	**150**	**-**	**145***	**200***
• Specific Power(W/kg)	**300**	**200***	**205***	**230***

*** projected performance**

EV Battery Evalustion : Key Stages, Objectives, and Lead Roles



from California Air Resource Board & KERI