

LIB - high efficiency energy storage Mechatronic system for EH&HEV LIB testing



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Lithium Ion Batteries





•High energy density volumetric and gravimetric < 500Wh.kg⁻¹ •High discharge voltage 3.0 typical 3.6 up to 4.5V per cell (1.2V NiCd 2.0V LAB)

- •High discharge rates typical C/3 up to C (0.5C)
- •High charge rates typical C/4 up to C/2
- •Wide operation temperature range from –40°C up to 85°C
- Applications
 - 3C segment (computers, cell phones, camcorders)
 - HEV & PHEV,
 - high efficient energy storage from RES

Alternative energy storage

Fuel Cell vs. Li-Ion Battery

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Past Achievements: R&D of two electrochemical systems Li/SO₂, Li/MnO₂ Small scale production of primary Li/SO₂ (4 000 000 Ah,) and Li/MnO₂ (10 000 Ah) cells, Production of different batteries New research activities >AEM for positive electrodes 3.0V – 4.5V based on LiMnO₂ LiMn₂O₄, LiAl_xMn_{2-x}O₄, LiCoO₂, NMC >AEM for negative electrodes – based on C*, SnC*, SiC*, different nanocomposites **Electrolytes, binder, conductive binders, additives for electrolytes** We are ready for development of new type of cells/ batteries Long experience **Know-how** Large variety of technology **Knowledge about different electrochemical systems**



Lithium Electrochemistry Department 35 R&D





Mechatronic system for EH&HEV LIB testing

Cooperation with High School for Transport - Sofia







Lithium Ion Batteries

Active Electrode Materials:

Cathode materials 3& 4V

- * Anodes –alloys, composites
- ***** Electrolytes, additives

Volt.	AEM	Real capacity	Real capacity	Leading company
	Cathodes	LED	(Others)	
3V	Li _x MnO ₂	160	150	SAMSUNG, LG, NISSAN
4V	LiMn ₂ O ₄	125	120	Peugeot, Renault
4V	LiNiMnCoO ₂	150	165	BMW, Volkswagen, LG
	Anodes			
0.2V	Carbon	320	320	Typical for all
0.3V	SiC*	1980	-	R&D stage - we are leading
0.4V	Alloys Sn	800	700	R&D stage - we are leading



Our research is devoted to the:

Ministry of Environmental and Water– new eco materials for energy storage and conversion.

➢ Ministry of Economic, Energy and Tourism – high efficient energy conversion and storage, storage of energy from renewable energy sources RES, new politics for sustainable energy production & consumption

➤Ministry of Transport, Information Technology and Communication amelioration of urban transport EV&HEV, reduced environmental pollution, improved energy efficiency of transportation

Ministry of Regional Development – improved overall energy efficiency

National - European fund for development - Competitiveness

Priority: Development of economic based on knowledge and innovation 1.2.04.

Multi national cooperation for Europena or bilateral sicentific/industrial projects



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