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A Review on Electric Car Batteries

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***Abstract*—The battery can be used in various fields, such as automobile industry, electronic industry. Nowadays as there is an increase in pollution, the automobile industry as now started to take interest in battery operated vehicles. This type of electric vehicle can help to reduce the pollution. The electric vehicle mainly includes power battery system, motor drive system, vehicle control system and some other electrical parts. The data of power battery system mainly includes the total voltage of battery system and the total current, the SOC state, the cell voltage, the battery pack characteristic point temperature.**

***Index Terms*— Electric car battery, AVL cruise software, electric battery vehicle.**

I. Introduction

Battery powered electric vehicle have possibility to be one of the most disruptive technologies of early 21th century and can potentially alter two of the largest and most influential industry of the world economy automobile and petroleum. Battery in today's society and so prolific and easy to use. That it is easy to dismiss the effect they have on convenience, comfort and technology advancement. They have enabled the cellphone industry, portable electronics and computing, robotics and electric car industry

II. Battery Used In Modern Vehicles

Most commonly used battery in current vehicle is lead-acid battery. Lead acid battery have long shelf life and inexpensive, reliable, easily recyclable and safe when properly handled and maintained. The lead acid battery, developed in 1859 by French physicist Gaston Plate, was the first rechargable battery. One of the greatest limitation of lead acid battery is its considerably poor specific energy compared to modern technologies. The lead battery have specific energy of 30-40 W.h/kg and gasoline has 13000 w.hr/kg.

The Nickel metal hydride (NiMH) battery was the next rechargable battery widely produced for commercial applications in hybrid electric vehicles. Toyota released its Prius HEV in 1997 to Japanese market and to the rest world in 2000 it used Nickel metal hydride battery. It has specific energy 60 w.h/kg which is greater than Lead acid battery.

The next step in progression of battery technology and its implementation to HEV and battery electric vehicle was the Lithium ion battery. The limiting factor for vehicle in size and weight as a result the automobile industry constantly seek a battery that has greater specific energy than other battery i.e. 200 w.h/kg.

Comparison of specific energy and energy density is given below:

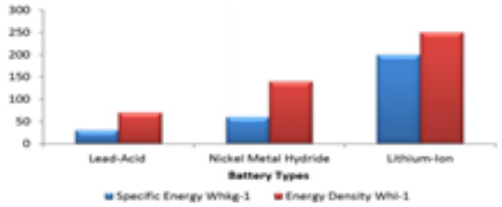

Fig. 1. A comparison of electricity storage characteristics of Lead-Acid, Nickel-Metal Hydride and Lithium-Ion Batteries

III. Methodology Used in Simulation of Battery

TABLE I
General Parameter of Electric Battery

Name	Value For Battery Type				Unit
	Li-Ion	Na-$Nicl_2$	Ni-MH	Li-S	
Maximum Charge	75	84	85	80	Ah
Nominal Voltage	323	289	288	305	V
Stored Energy	24.2	24.2	24.2	24.2	kWh
Max/Min Voltage	339/308	275/304	274/302	290/320	V
Initial Charge	100	100	100	100	%
Number Of Cell Per Cell Row	12	12	20	26	-
Number Of Cell Rows	17	30	20	1	-
Internal Resistance Charge /Discharge	1/1	1/1	1/1	1/1	Ω
Operating Temperature	33	270	36	30	^{0}C
Specific Heat Transition	0.4	6	0.4	0.08	W/K
Specific Heat Capacity	795	950	677	1650	J/Kg*K
Mass Of Battery	318	457	534	173	Kg
Battery Price	300	500	400	250	€

The step used is defines the algorithm of computerized simulation process. The figure below shows the phase consisting developing the virtual electric vehicle in AVL cruise.

AVL uses simulation package which has possibility to simulate alarge variety of vehicle and battery propulsion system in order to study the evolution of energy utilized in vehicle and battery.

IV. Result of Methodology

The result of four battery type was obtained from AVL cruise simulation are presented below.

TABLE II
AVL Cruise Simulation Result

Name	Value For Battery Type				Unit
	Li-Ion	Na-$Nicl_2$	Ni-MH	Li-S	
Electrical Consumption (VW Data)	12.7	-	-	-	kWh/100km
Electrical Consumption (Real Test Drive)	18.2	-	-	-	kWh/100km
Electrical Consumption (AVL Cruise)	14.7	12.6	15.8	17.2	kWh/100km
Electrical Vehicle Autonomy (VW Data)	190	-	-	-	Km
Electrical Vehicle Autonomy (Real Test Drive)	130-190	-	-	-	Km
Electrical Vehicle Autonomy (AVL Curise)	165	192	153	140	Km
Total Output Energy	6826	5927	7006	7979	KJ
Total Input Energy	184	222	184	159	Kj

The electrical consumption (Kw.h) were obtained on Nardo ring (12.6 km), each simulation being done in identical condition after analysing the result it was observed that lowest energy consumption was achieved while using $NaNiCl_2$

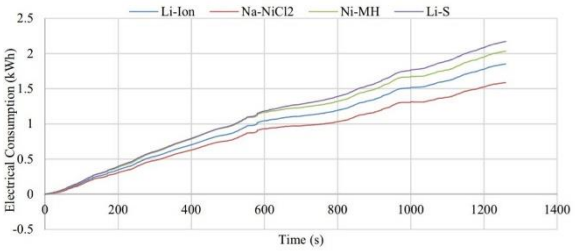

Fig. 2. Electrical consumption nardo ring (12.6 km)

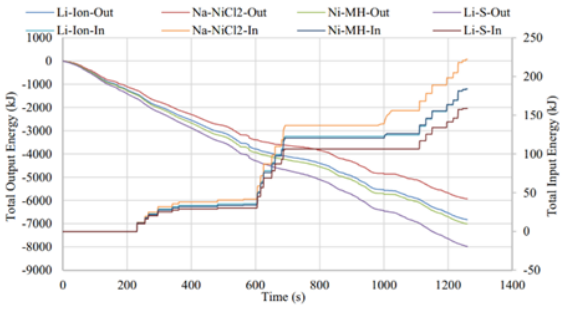

Fig. 3. Total output energy and total input energy

The electrical power (kw) result, obtained after each simulation are presented in Fig. 4. The power developed by the electric engine is similar for all battery type, significant difference only occur while changing the operating mode of electric engine depending on altitude profile of the root.

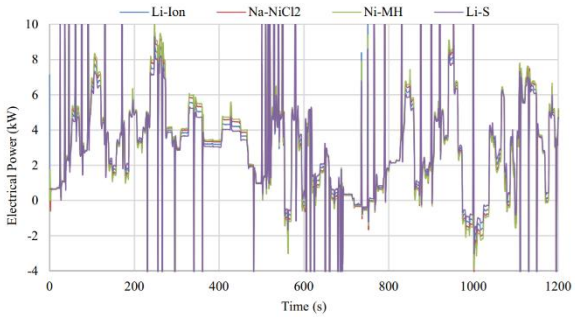

Fig. 4. Electrical power

V. Analysis

From AVL cruise simulation it is found that Na-NiCl2 batteries have proven to be best choice from an energy consumption point of view (12.6kwhr/100km).Beside that their low price, increased life cycle or great functioning under normal parameter. Been that high energy consumption (17.6kw.hr/100km) is accomplished by Li-S batteries. However due to their low weight, increased energy storage capacity and low price they might be one of best solution for system with high energy. NiMH batteries, despite having a reasonable energy consumption (15.7kw.hr/100km) they are inefficient, having an increased energy density. Now a days Li-ions batteries have biggest market segment in equipping electric vehicles. Moderate energy consumption, continuous decline of the cost price, advanced manufacturing technology increased cycle life low weight and high energy storage.

VI. Conclusion

To summary advancement in battery development in particular over the past few decades, has the implementation of modern EV, HEV technology to augment the auto market .This will help consumer to save money and fossil fuel, be energy independent, have a lower impact on environment, pollution and greenhouse gases and have enjoyable driving experience.

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