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Future Automobile Market and Role of Lithium ION Batteries in it

Niraj Sunil Kulkarni

ABSTRACT

Automobile sector is going through a vast nature of changes from the start of 2015. The new norms of BS6 in India and updated Euro norms have increased difficulties in the business of the automobile sector. Nearly 25% cost increase is seen to fulfill the requirements of an BS6 engine. Many of the automotive giants have stopped the manufacturing of diesel engines and many are planning to do so in future. While the crude oil market is not so preferable by government authorities, a new technology like Lithium Batteries supporting E-Vehicles has been seen in the last few years. The cost per kilometre of the vehicles have made a vital impact on the public. While the traditional vehicles are softly getting shifted over electric ones, the new technology also lacks at some points. Chemistry is playing an important role in the automobile sector. The use of different kinds of fuel has made an obstacle to traditional fuel companies. This paper discuss the design, advantage, disadvantage and future scope of electric vehicles.

Keywords: lithium ion battery, e-vehicles, design of lithium ION battery.

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ABSTRACT

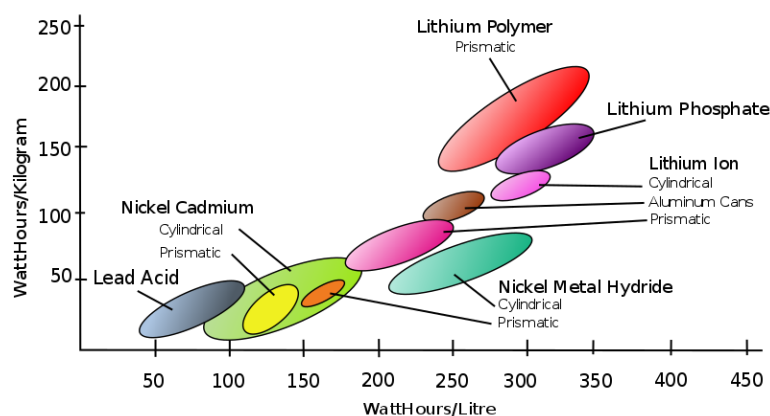
Automobile sector is going through a vast nature of changes from the start of 2015. The new norms of BS6 in India and updated Euro norms have increased difficulties in the business of the automobile sector. Nearly 25% cost increase is seen to fulfill the requirements of an BS6 engine. Many of the automotive giants have stopped the manufacturing of diesel engines and many are planning to do so in future. While the crude oil market is not so preferable by government authorities, a new technology like Lithium Batteries supporting E-Vehicles has been seen in the last few years. The cost per kilometre of the vehicles have made a vital impact on the public. While the traditional vehicles are softly getting shifted over electric ones, the new technology also lacks at some points. Chemistry is playing an important role in the automobile sector. The use of different kinds of fuel has made an obstacle to traditional fuel companies. This paper discuss the design, advantage, disadvantage and future scope of electric vehicles.

Keywords: lithium ion battery, e-vehicles, design of lithium ion battery.

Author: (Research & Development Engineer, Bachelor of Mechanical Engineering, MGM's Jawaharlal Nehru Engineering College, Aurangabad, Maharashtra, India.

I. LITHIUM ION BATTERIES

Primarily used in mobile phones, the Lithium Ion batteries are now getting place of traditional Lead acid batteries that used to drive the electric automobile world. Being nearly 1/4th of lead acid batteries with same output and long lasting capacity, lead acid batteries are losing their market. Lithium batteries are lightweight and provide more energy per kwh than lead acid batteries. Primarily, lithium batteries were used to be in pouch type. But, for automobiles the prismatic type of lithium ion batteries are developed making it easier to mount and formulate the required voltage inside an battery pack. The tech giant Tesla company made its own choice and went through the another type of lithium ion battery type for its vehicles i.e. cylindrical type of lithium ion battery.



Being smaller, the 18650 and 21700 lithium ion cells are easily arranged in small plastic cases. This made the batteries of various sizes available according to the cabinet size provided inside an vehicle. Because of cylindrical lithium ion batteries, the manufacturing of various size cabinets and achieving different voltage and current levels is possible. The 48V, 60V,96V batteries are popularly used in automobiles. Along

with their sizes, the batteries are classified into different chemistries like Lithium Ion Batteries (LFP), Lithium Nickel Iron Batteries (NMC), Lithium Ion Titanate Batteries (LTO), etc. The classification can also be made according to the energy output of the cell types used. Basically the 18650 cell has first 2 digits 18 equals the diameter of cell i.e. 18mm and later two digits 65 means the height of the cell i.e. 65mm.

II. ROLE OF LITHIUM ION BATTERIES IN AUTOMOBILE



Lithium batteries mainly used in automobiles are of 48V or 60V in general. Later 72V and 96V batteries are proposed to capture the market. The lithium ion batteries provide a better output to the vehicles consuming less space. These batteries are made as per the voltage and current requirement in electric vehicles.

III. DESIGN OF 48V18AH LITHIUM ION BATTERIES

Considering and LFP battery cell 18650 of 3.7V2.6Ah capacity for design of 48V18Ah battery pack, the series combination equals: $48/3.7$ i.e. 12.97 which equals 13 cells in series.

Parallel combination equals: $18/2.6$ i.e. 6.92 which equals 7 cells in parallel.

So, for an 48V18Ah battery pack: 13x7 numbers of cells are required i.e. 91 numbers of cells will be

required. The same numbers can be calculated for any other battery pack. The conducting and connecting material also plays an important in energy output of lithium ion batteries.

Advantages of Lithium Ion batteries

Higher energy density than lead acid battery.

- Lightweight .
- Can be easily fit into a small region.
- Rechargeable and reusable.
- Higher life cycle than any other battery type.
- Disadvantages of Lithium Ion batteries:
- Initial cost is higher.
- Technology is not yet proven.
- Import of lithium is required for many countries.
- Storage at certain 25°C temperature is required.

Future Scope:

- Lithium Ion batteries might drive aeroplanes and submarines.
- Hydrogen fuel cell technology might prove a challenge for lithium technology.
- Vehicle to vehicle wireless transmission of electric pulses to charge another battery of lower charge.
- Battery swapping technology taking over petrol pumps.

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