



To increase the efficiency of battery by its modification in working

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ABSTRACT

Electric vehicle can reduce the amount of pollution by proper monitoring and utilisation. But issue is concern with the initial cost and charging time of the battery. Also there is another issue of raw material from which battery is made that the Lithium. Most of the countries have not sufficient amount of Lithium and so they are not going for electric vehicle quickly. But Aluminium battery works is still in experimental stage and if this is going achievement then the major issue will be solved.

For more powerful battery research is going on for Hybrid battery and different combinations with the Ion and Lithium. Also there is possibility of Superconductors that are favourable for fast energy release rate and can give the power at a fraction of time. But the cost of the overall unit will be increased.

Till date some developers have made some batteries with fast charging time but issue concern with the cycle of operation for charging and their sustainability after the period if time. This battery drastically reduces their life as they are charging within the less time. It can be charged very fast but does not have better life cycle span.

Keywords: Electric vehicle, Battery temperature, Charging time, Heat loss, heating of element, Recharge cycle, Ease of Speed gaining with power.

1. Introduction.

High quality fuel is required for better generation of electricity and also this power plant has to provide continuous and emergency power supply to the required place. In metro city and industrial area whenever power requirement is at the topmost condition at that time peak load must be satisfied otherwise production of the plant may be stopped and it will effect on the economical condition of the plant in overall area of the manufacturing unit.

Internal combustion engine is very well known power generating device since many years. Because it can give reliable power and one can drive his car in long way and also so in this car there is possibility of storing large amount of fuel so one can drive his car approximate 1000 km without any refuelling. But issue is that if this kind of internal combustion engines are running in the worldwide they will create large amount of pollution and it will definitely lead to the world in the hub of pollution so that developed countries are trying to make their Mega City with less pollution effect.

Now-a-days batteries are used for the electric vehicles and this kind of batteries is very suitable for the electric vehicle. Companies are trying to make the batteries which are extremely efficient and they can give the higher range at the time of working. Tesla is a very well-known company who is making electric cars from many years but Tesla is also facing number of issues when our company is launching their electric car in the developing countries in the market of Asia.

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Numbers of well known companies who are making electric cars are facing many problems due to the higher range of batteries. In developing countries people cannot afford the car which has higher range so till that they are using old internal combustion engine cars and bikes. Because this kind of internal combustion engines are available at Lawrence compared to the new electric vehicles. Also so old internal combustion engines may be repaired with higher speed compared to the electric vehicles and they don't need any electrical point for the charging. Whenever a person is using any electric car for any electric bike he must have to develop an electric point near the car or bike for the charging and nowadays it will take 7 to 8 hours for full charging of the vehicle.

Nomenclature	
SU	Super heating
Battery tem	Temperature of battery
AC	Alternative current (%)
De-Water	Detraction of water
Ct time.	Charging time
Eff Btn.	Battery efficiency
Vol de	Voltage decrement
S Temp	Temperature of Super conductor .
Cool-Btn =	Battery cooling rate

2. Recent trends in EV batteries

There are number of different batteries used in EV. Each and every car has different batteries. Some batteries give better mileage but they take higher time for getting recharged. At the other side number of batteries are available that are getting charged within 1 hour but they are giving less mileage. In electric vehicle battery is used to store the electrical energy. For that battery has different chemical composition that is capable to store electrical energy and at the time of requirement they release the electric power to the motor and this motor will drive the wheel of cars. Thus electric batteries are the heart of electric vehicle if batteries are not working properly then developer has to pay more cost for efficient working of the battery.

1. Lead acid battery
2. Lithium Ion battery
3. Nickel metal hybrid
4. Ultra capacitor battery
5. Graphene battery

Lead acid battery : Lead acid battery is very reliable and it is used from number of pairs to supply the electric power full stop this battery is capable to supply high power and it is also in the big size. Its construction is heavy and it also contains the higher weight so whenever lead acid battery is used to supply the electric power one has to take in mind that he has to construct a design and frames in such a way that he can put lead acid battery at correct place and all the structure must be capable to sustain the weight of lead acid battery.

Lead acid battery is bulky and not practically fusible for high speed vehicle so it's time to change over to a light weight battery. For that super conductor is best option for energy achieving aspect but cost is increasing in other side of way.

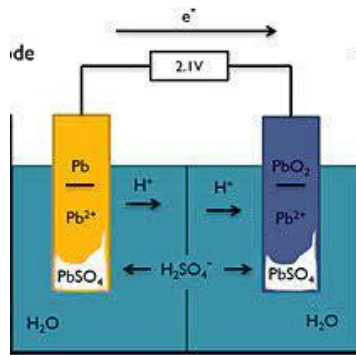


Figure 1 Lead Acid battery

Lithium ion battery: This battery has less weight. So its reliable for small vehicle and also useful where small area is available. It has higher density power ratio, so it is capable to deliver more mileage with less recharge time. It will take less time for charging. Research is still going on this battery for its better efficiency.

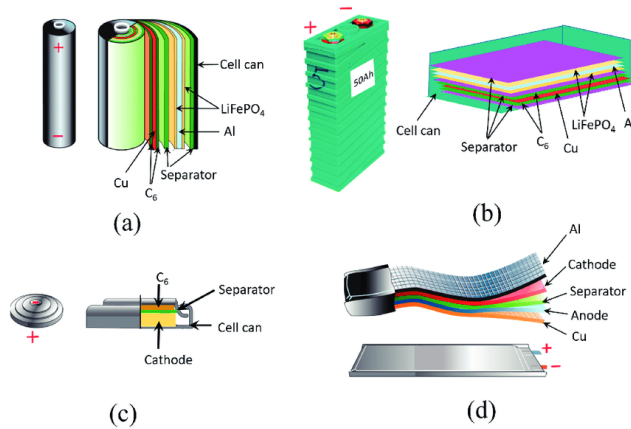


Figure 2 Working of Lithium ion battery

Nickel metal hybrid: This battery has higher capacity to provide electric supply. It is capable to store electric power for long time. So is preferable to use the device which is fully dependent on electrical power for its storing data.

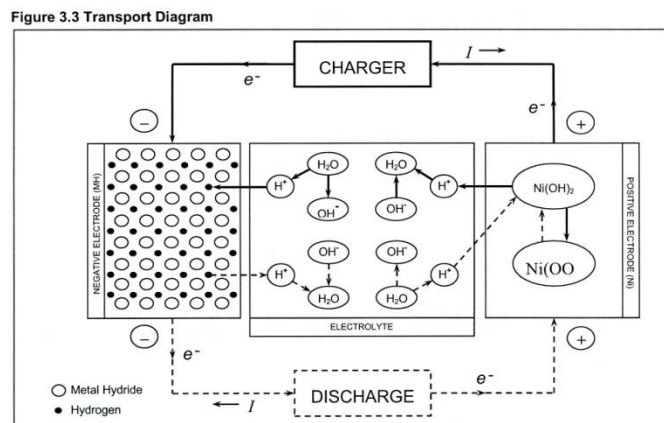


Figure 3 Working of Nickel metal hybrid

Ultra capacitor battery: In lead acid battery or lithium ion battery chemical compositions are used to store electric power in the form of chemical energy. So whenever electrical power is required there is chemical conversion and electrical supply is produced and car is getting power from the battery. In ultra capacitor there is no chemical conversion but it is storing the power in static state and discharge the power rapidly at the time of charging and discharging so it can generate a frequent power compared to the chemical composition batteries like lead acid battery or lithium ion battery full stop there are some issues while using super capacitor because it needs some charging time and it gives the mileage crucially compared to the conventional batteries.

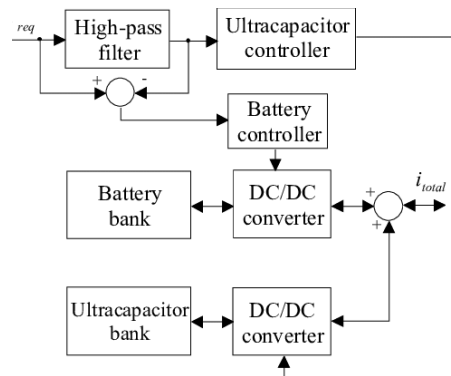


Figure 4 Working of Ultra capacitor battery

There was an experiment that in lithium and batteries they are using a positive and negative electrodes and they are also using one chemical liquid it's known as electrolyte, this is used to separate the both positive and negative electrodes as per the working condition. Whenever better is going to be charged lithium ions are getting in the motion from the negative to the positive directions and then battery will be charged within some time. Whenever there is requirement of power the battery will be discharge and lithium ion will flow from the positive to the negative directions and the battery will be discharged and power will be supplied to the motor and car will be in the running condition.

In superconductors they are not storing the power in the form of chemical reactions. But in this ultra capacitor there are two conducting plates and they are known as electrode and insulating material. Generally insulating material is dielectric material so that whenever electric supply is given there are two plates and one positive and the other is negative so while current is passed they are connected and atoms are separated such a way that positive atoms are arranged at the negative side plate and negative atoms are arranged at the positive side plate therefore charge is created. There is advantage is that super conductor does not require thick separator but it uses a thin layer and separate the whole different metals. When electric current is passed it cells are polarised and charge is created. There are number of issues in hydrogen car and lithium ion cars. In hydrogen cars there is also issue of providing auxiliary power to the auxiliary components so developer needs to use lithium ion batteries. While one developer is selecting the super capacitor as a battery source then there is no need to provide auxiliary power to the auxiliary components for its running at the time of driving.

Graphene battery: It is a new technology that is using different way of providing the electrical power to the electrical vehicles. Nowadays there are a number of issues in the lithium ion battery and also lithium acid battery but Graphene battery is a very effective and powerful battery that uses the internal power and it can long-lasting to the device for improvement of power capacity range.

Graphene is basically made from graphite. Generally graphite is in the 3D modulation but whenever it is transformed to the 2D modulation there is change in the structure and it can be used for the electrical vehicles power source. Whenever the structure of the graphite is changed to the Graphene it can be found that 3D transformation is suddenly changed to the 2D modulation and it is very simpler and strong structure compared to the graphite and it is very effective for the conductance of electricity so now a day 'it can be used to supply the electric power in the electrical vehicles because it has better electrical conductivity.

3. Modification in new area of EV vehicles battery

Lithium acid and lithium ion batteries are used from the number of years but there is some barrier for the application of lithium acid battery in the electric vehicles. Graphene battery is very effective because it is very compact and it contains the less weight compared to the lithium acid batteries, it is also a very best conductor of electric supply for the electric vehicles. It is also getting fast charged within less time compared to the lithium acid battery. So developer is making different kind of combination of Graphene with the lithium. There is one possibility of mixing the lithium with Graphene in the form of thin sheet, for it is also mixed with the composite layer so overall performance of the battery can be increased to the next level.

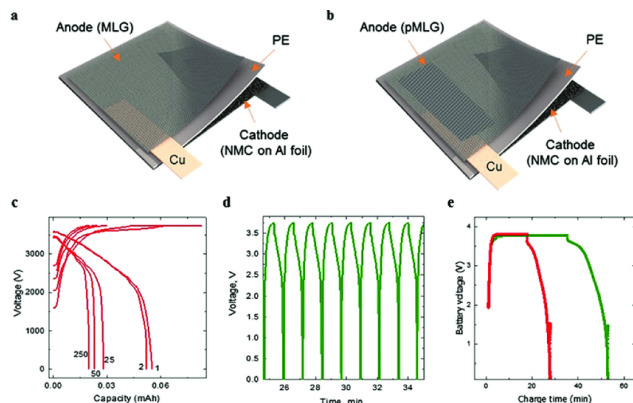


Figure 5 Working of Graphene battery

4. Results and Discussion on EV cells for its better performance

As EV vehicles have battery so charging time must be reduced by new technology of super capacitor embedded method. There is also provision of making some changes in the design of batter to improve its performance. Charging time and heat loss graph should be proper for better efficiency of battery and total efficiency of the EV. Battery swapping is important in the new era for developed as well as developing countries to reduce the charging time and also for ease of operation between the different companies.

5. Conclusion

It is found that lithium acid battery is very effective but there must be some changes in the battery for power to density ratio. Lithium acid batteries are available from the number of years but it has higher weight. For the same power lithium ion battery is effective compared to the lithium acid battery. Secondary it is also very important in lithium-ion battery to exchange the proper way of ion from negative to positive electrodes. Sometimes there are some technical and chemical barriers at the time of transformation of ion from negative to positive electrode so proper power and electrical storage cannot be done in a proper way so that there are some issues for storing the electrical power. Therefore there should be proper exchange of ions take place in the lithium ion battery then and then it can give better performance with best power to weight ratio.

It is also noticeable for the Graphene battery that it can be charged within 20 minutes from 0 to 100%. When our lithium ion batteries are taking the time of one half hour for the full charge so after application of Graphene battery there will be less time and maximum amount of charging can be done therefore it is very useful for the electrical vehicles

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References

- [1]. Y.Lu, Cheng K.W.E., S.L.Ho, J F Pan, "Passivity-Based Control of Phase Shifted Resonant Converter", IEEE Proc. Elect. Power Appl., Vol. 152(6), Nov. 2005, pp.1509 – 1515
- [2] Affanni, A.; Bellini, A.; Franceschini, G.; Guglielmi, Tassoni, C., "Battery choice and management for new-generation electric vehicles", IEEE Trans. on Industrial Electronics, Vol. 52(5), Oct. 2005, pp. 1343 – 1349

- [3] Chan, C.C. The Present Status and Future Trends of Electric vehicles, *Science and Technology Review*, Vol. 23, No. 4, Feb 2005
- [4] G. Jing-Song, F. Wei-Biao, Z. Bei-Jing, A study on the pyrolysis of asphalt, *Fuel* 82 (2003) 49–52, doi: 10.1016/S0016-2361(02)00136-9 .
- [5] J.-F. Masson, L. Pelletier, P. Collins, Rapid FTIR method for quantification of styrene-butadiene type copolymers in bitumen, *J. Appl. Polym. Sci.* 79 (6) (2001) 1034–1041 doi:10.1002/1097-4628(20010207)79:6<1034::AID-APP60%3E3.0.CO;2-4, doi: 10.1002/1097-4628(20010207)79 .
- [6] V. Pandey , S.D. Boyles , Dynamic pricing for managed lanes with multiple entrances and exits, *Transp. Res. Part C: Emerg. Technol.* 96 (2018) 304–320 .
- [7] Patrick DeCorla-Souza , Exploratory Evaluation of a Concept Combining On-Demand Ridesharing with Congestion Pricing., No. TRBAM-21-01571. (2021) .
- [8] D. Ge, Z. You, S. Chen, C. Liu, J. Gao, S. Lv, The performance of asphalt binder with trichloroethylene: improving the efficiency of using reclaimed asphalt pavement, *J. Clean. Prod.* 232 (2019) 205–212, doi: 10.1016/j.jclepro.2019.05.164
- [9] V. Pandey , S.D. Boyles , Dynamic pricing for managed lanes with multiple entrances and exits, *Transp. Res. Part C: Emerg. Technol.* 96 (2018) 304–320 .
- [10] K. Zhao, Y. Wang, F. Li, Influence of ageing conditions on the chemical property changes of asphalt binders, *Road Mater. Pavement Des.* (2019), doi: 10.1080/14680629.2019.1637771 .