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A Review on Fast Charging System for Electric Vehicles

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Abstract: Even with today's advances high technology, the popularity of vehicles (electric) is remains limited and it is unable to become a mainstream made of transportation. The basic reason for this is because the battery pack's flows or limitations, such as its bulkiness, high weight (heavy) and slowness charged with s short lifespan and high toxicity risk. Among them are - As a result of these issues, slow charging speed become the most important factor to consider. When it comes to buying an electric vehicle there are a few things to consider. Therefore, various charging techniques must be thoroughly investigated in order to find the appropriate answer to these issues. In today's competitive battery charging method, many charger manufacturers claim to be able to charge the batteries in as little as 1 hr or less. Various charging methods, such as constant voltage, constant current and pulsed charge, have been investigated and compared in order to the maximize the performance. Charging time varies depending on the type of battery pack.

Keywords: Lithium-Ion Battery: Electrical Vehicle: Charging Methods: Fast Charging.

I. INTRODUCTION

Global warming and its implication are currently a major source of concern for society. Road transportation accounted for 18.8% of total EU-28 greenhouse gas emission in 2015 . Agreements between EU countries aim to reduce these figures by 80%bt 2050, and Battery Electric vehicles (BEV) are a potential option for decarbonizing the light duty vehicle feet[1].

Effort to mitigate the consequences of climate change and local air pollution have accelerated the development of lithium-ion (LI-ion) battery –powered electric vehicles in recent years (EV's), customer's adoption of EV's particularly battery electric cars (BEV's) that are not hybridized with internal combustion engines (ICE's), is still restricted, even as manufacturers race to add electrified options to their lineups. Range anxiety and long charging times when compared to gasoline car refuelling are frequently cited as major barriers to EV adoption. As a result, fast charging capabilities has become one of the major attributes sought by the battery and electric vehicles industries. High rate charging, on other hand, has been proven to hasten battery degradation causing both capability and power capability to decreases[2].

A ion battery is simple to charge, however charging it quickly can cause issue. These issues include battery lifespan cycles, heat dissipation, battery ventilation and charging circuit efficiency. Completed research shown that many different sorts of quick charging strategies have been studied throughout the years. In order to improve this situation improvement and optimization of lithium ion batteries are now a significant factor and choice foe EV power sources.

As a result, quick EV charging processes and solution must consider a variety of factors in addition to high output power. This document addresses some of these special applications aspects, providing a more comprehensive look at the subject[1].

Charging Process-

By increasing the value of the current used at the CC stage to reduce battery charging time, however large current might shorten the life of the cell or cause irreparable damage[3]. A simple analysis based on a rudimentary battery model like the one shown in fig. As a result of the internal resistance of the battery cell, higher current result in higher losses. These losses are primarily manifested as a rise in cell temperature as described[4]. As a result, quick charging necessitates proper thermal management in order to keep the battery temperature within its acceptable operating range.

Another kay issue to consider while fast charging is determining the appropriate time to finish the CC stage of the charging process. A large current means a high voltage drop at the battery's internal resistance, implying that the cell's real voltage is still much below its maximum. This cause the CV stage to start sooner than expected, lengthening the overall charging time. Extending the CC Stage time, on the other hand, it may cause the cell to over voltage, which is an undesirable state[1].

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II. METHODS OF CHARGING

In one charging profile, a new generation of fast charging systems may have –

- Constant Voltage (CV)
- Constant Current (CC)
- Constant Voltage – Constant Current (CV-CC) Method.
- Pulse Charging Method
- Negative Pulse Charging Method

Suit the requirements for quick charging of Lithium- ion Batteries.

1] Constant Voltage (CV) Method -
In this method, such a constant voltage charge must be given at the highest (peak) voltage ever applied to a certain battery type. As a result, the charging current will be reduced. Steadily, as the battery's importance has grown it has been reached. This appears to be a helpful metric. Despite the fact that low voltages are used, even though temperature. This has not always been the case and yet long charging and time period are a real issue[5].

2] Constant Current (CC) Method -
This method maintains a steady current across the battery while allowing the voltage to gradually rise[6]. As soon as the full charge voltage is reached, the charger is tuned off. Despite that the adapted constant current is within the rated current[5].
It is normally available from producers of battery cells. This modelling can only be used with constant current characteristics. Since it uses constant characteristics appropriate for steady-state condition[7].

3] Constant Current And Constant Voltage Method -
Constant Current And Constant Voltage (CC-CV) method has become a valid method for battery charging, using another charger has become a effective. Until the battery is fully charged a continuous current period which a certain voltage potential exists. In which case the both voltage and current decreases until full charge is committed.
It is the traditional method of charging batteries, however it is limited in Fast- Charging applications since battery polarization has become a concern. Despite being observed, the Constant Current –Constant Voltage (CC-CV) method was modified to include numerous Constant Current (CC) stages. Continuing to work on improving battery charging. In this method revelled offer significant improvements in charging time, efficiency, temperature and slight improvement as compared to other charging methods[5].

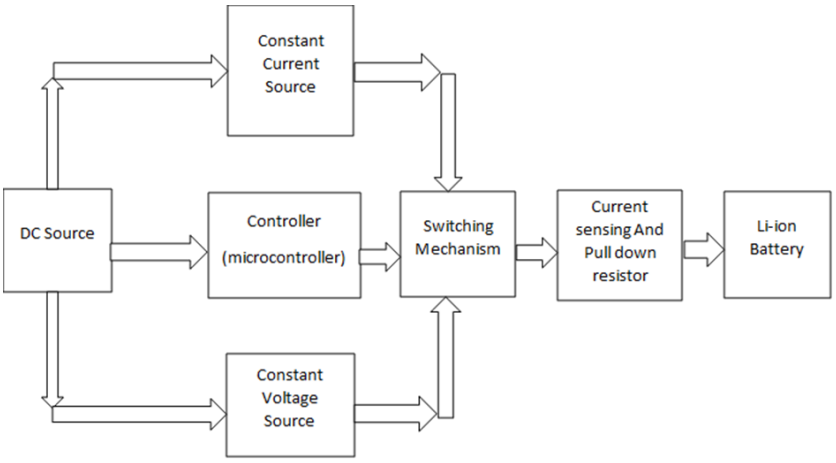

Fig. 1 Constant Current And Constant Voltage

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4] Pulse - Charging Method -
Pulse charging method is a common fast charging method for Li-ion battery packs in electric vehicles. Charge current is delivered to the battery pulses using pulsed chargers. The charging rate (based on avg. Current) can be accurately regulated by adjusting the pulse width, which is normally about one sec[8].
A short rest interval of 20-30 milliseconds between pulses during the charging process allows the chemical processes in the battery to be stabilized by comparing the voltage. The relation spreads throughout the electrodes bulk restarting the charge[9].
This methodology can also prevent the undesirable chemical process such as gas production, crystal development and passivation at the electrode surface. At this point, it is feasible to charge the battery faster while avoiding gas damage[6].

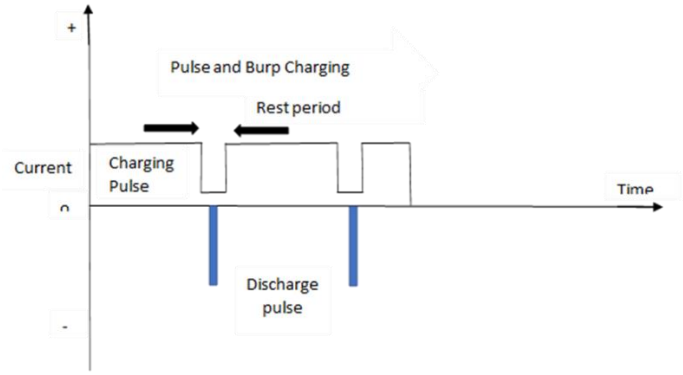

Fig. 2 Pulse -Charging Method

5] Negative Pulse Charging -
This method should be used in conjunction with the pulse charging technique. Very short duration discharge pulses occur during the charging rest interval (2 to 3 times of the charging current magnitude) are applied in order to depolarize the cell[6].

III. CONCLUSION

Fast charging for electric vehicles is achievable, but additional study is needed to optimize the current chargers on the market for greater efficiency. In the future, efficient and safe charging for electric vehicles will be available. Thermal management should be the focus of future study. It must be controlled in the same way that the electric vehicle's interior can bring out the collection of high temperatures Conduction of heat. The approach and ventilation should be well planned to Improve the battery's performance. As the temperature rises, as the temperature rises, the voltage level falls, resulting in the battery's performance is poor.
Other factors that can cause a battery to slow down charging, such as charging method, battery internal resistance, and chemistry processes, require more research. We can extract them and optimize the charging process.

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