

The Analysis on the Principle and Advantages of Blade Battery of BYD -- A Domestic New Energy Manufacturer

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ABSTRACT: Human development has accelerated the consumption of resources, and the lack of energy is a problem that human beings have to face. With the progress of science and technology and the development of the economy, and the launch of electric vehicles from various manufacturers, the technology and safety of batteries are the most concerned issues [1]. As a new battery product, blade battery has gradually improved its competitiveness at home and even abroad. How do its raw materials, cells, modules, management system and safety design stand out among many manufacturers are of great importance [2]. By studying some advantages of blade batteries, it can further infiltrate some BYD technologies into other battery manufacturers and finally, achieve common technological progress. By comparing examples and using research data, this paper studies BYD's blade batteries and batteries of other manufacturers. Through research, people can find that BYD's blade battery does have obvious advantages over other manufacturers in technology and safety. However, the temperature control of the battery can be further improved.

1. INTRODUCTION

Due to the lack of fuel and the severity of pollution, various manufacturers have launched their own pure electric models, and the use of batteries is particularly critical. Many new power manufacturers have no ability to produce batteries and can only use second-party batteries. At present, lead-acid batteries, nickel-metal hydride batteries and lithium-ion batteries are widely used,[3] but the problem of a spontaneous combustion caused by battery temperature control and battery energy consumption remains to be solved. It is the massive burning of fossil fuels that leads to energy shortage and air pollution that makes electric vehicles slowly come to the stage. The emergence of electric vehicles is to solve these problems, but the problem of batteries was not taken into account in the early stage. Although the emergence of blade batteries can not completely solve these problems, it can greatly improve the original problems. This paper specifically studied the battery and market situation of domestic new energy manufacturers, the principles of new energy manufacturers and BYD blade batteries, and the advantages of blade batteries over other batteries in technology and safety. This paper uses the methods of cases comparison and data citation to study the blade battery. The awareness of green development is also deeply rooted in the hearts of the people. The future is an era of all-around electrification. The use of batteries should not only ensure almost no pollution but also ensure the minimum safety problems. On this basis, blade battery technology can also be used for reference by more

manufacturers and finally applied to products and even research in other fields.

2. THE MARKET ANALYSIS OF BATTERY OF DOMESTIC NEW ENERGY MANUFACTURERS

In recent years, since responding to the national call, electric vehicles have stepped onto the stage. After seeing Tesla's success, all manufacturers want to take a share in the field of electric vehicles. Dazzling products make it difficult for consumers to make choices. Consumers can only choose through sales and word-of-mouth. Over time, the sales volume of electric vehicles has increased exponentially every day, every month and even every year, but in fact, the majority of sales volume is still occupied by several manufacturers. From this table of global sales of electric vehicles, it shows that Wuling Hongguang Mini EV is ahead of the two brothers of Tesla by a large margin. The car sells only about 30000 yuan. Although its battery capacity is very small and its range is very short, its compact body, low price and lovely appearance meet most of the travel needs of Chinese people, so it has dominated the list for a long time. Although the price of the Tesla brothers is much higher than that of other models in the list, their mature technology and reputation for so many years have made Tesla stop. Followed by BYD Han, which is equipped with blade batteries. Although its price is not cheap, BYD is best known for its cost performance, leapfrog configuration and a satisfactory market answer given the balanced and excellent performance of blade batteries, sufficient mileage and excellent energy

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consumption control. In fact, the models sold by BYD are also very popular, including Qin plus, Song pro, etc. Although these models with relatively low prices have not used blade batteries, it is believed that in the near future, after the popularity of blade batteries, consumers can buy electric vehicles with blade batteries at different price segments. Through this table or in your daily life, people can find that as a large automobile country, most of the sales of electric vehicles in China are occupied by independent brands. A few joint venture brands and even imported brands are still brands with good reputations. Therefore, in the field of electric vehicles, the advantages of independent brands are obvious. At present, foreign businessmen are also actively cooperating with our domestic manufacturers. The sales of electric vehicles of various brands will rise in the future.

Pl.	Global Models	Jan
1	Wuling HongGuang Mini EV	36 762
2	Tesla Model 3	21 589
3	Tesla Model Y	9 597
4	BYD Han EV	9 298
5	GW ORA Black Cat	6 092
5	GAC Aion S	6 092
7	Chery eQ	5 772
8	Li Xiang One EREV	5 379
9	SAIC Roewe Clever EV	5 176
10	BMW 530e/Le	4 327

Figure 1 List of global electric vehicle sales in January 2021[4]

3. ANALYSIS ON THE PRINCIPLE OF THE BATTERY OF THE DOMESTIC NEW ENERGY MANUFACTURERS

3.1. Principle of BYD Blade Battery

Blade battery, also known as lithium iron phosphate battery, seems to be no different from lithium iron phosphate battery in terms of name, but it is named because of its long shape and thin thickness. The endurance mileage of electric vehicles is actually the endurance capacity of power batteries for electric vehicles. Simple analysis from top to bottom, the first level: if you want to improve the endurance of the same car with the same weight, you need to increase the battery capacity. level 2: improve battery capacity from two perspectives: one is to stack battery modules, the other is to improve energy density. The former brings an increase in weight and a discount in endurance, so improving energy density is the key. The third level: the key to improving energy density lies in the selection and proportion of cell materials, the optimization of the layout of battery internal space and the whole package space, and the "slimming" of the weight of the whole module or pack. The blade battery is to make the cell into a blade shape. The cell adopts laminated structure + ceramic coating technology.

Through structural innovation, the "module" can be skipped in the group, that is, more batteries can be placed in the unit space. The blade battery is a sublimation of lithium iron phosphate. From the second law of improving energy density, the layout of the internal space and the whole package space of the battery is optimized [5]. In the Figure 2, the right one is the whole structure of BYD blade battery.



Figure 2 The structure of BYD blade battery [6]

3.2. Principles of Batteries from Other New Energy Manufacturers

In the early days of electric vehicles, people often used lead-acid batteries. The positive pole of the lead-acid battery is lead dioxide, the negative pole is sponge lead, and the electrolyte is a sulfuric acid aqueous solution. The diaphragm (diaphragm) uses microporous rubber diaphragm, microporous plastic diaphragm or other materials according to different types of lead battery, and the battery shell is made of hard rubber, engineering plastic, FRP and other materials. The positive pole of the lead-acid battery is lead dioxide, the negative pole is sponge lead, and the electrolyte is a sulfuric acid aqueous solution. The diaphragm (diaphragm) uses microporous rubber diaphragm, microporous plastic diaphragm or other materials according to different types of lead battery, and the battery shell is made of hard rubber, engineering plastic, FRP and other materials. Two groups of plates of a lead-acid battery are inserted into a dilute sulfuric acid solution to produce voltage due to chemical changes. When direct current is applied (charging), the lead oxide on the positive plate turns into brown lead dioxide (PbO₂), and the lead oxide on the negative plate turns into gray velvet lead (Pb, also known as sponge lead). When the lead-acid battery is discharged, the active substances on the positive and negative plates absorb sulfuric acid and undergo chemical changes, gradually becoming lead sulfate (PbSO₄). When the active substances on the positive and negative plates become the same lead sulfate, the voltage of the battery will drop to the point that it can no longer discharge. At this time, the battery needs to be charged to restore it to the original lead dioxide and fluffy lead, so that the battery can continue to discharge. Another kind of battery is nickel-metal hydride battery. The positive active material of Ni MH battery is Ni (OH)₂ (called NiO electrode), the negative active material is metal hydride, also known as hydrogen storage alloy (called hydrogen storage electrode), and the electrolyte is 6mol / L potassium hydroxide solution. The electrode material of active material is mainly composed of sintered, pulping, nickel foam, nickel and infiltration. The

electrodes produced by different processes have great differences in capacity and discharge performance. The electric pool is generally produced according to different conditions. Most civilian batteries such as communications are made of the negative electrodes and positive nickel foam [7].



Figure 3 The structure of lead-acid battery [8]

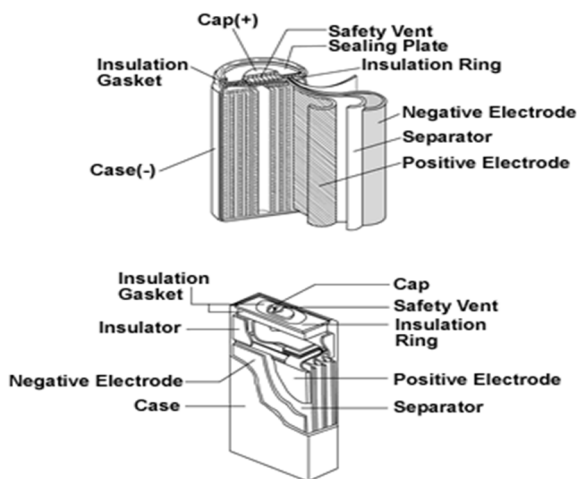


Figure 4 The structure of Ni MH battery

4. ANALYSIS OF THE ADVANTAGES OF BYD BLADE BATTERY

4.1. The Advantages of Blade Battery over Other Batteries in Technologies

The reason why blade battery is used is that it has its advantages in technology. Firstly, the blade battery greatly improves the volume utilization, and finally achieve the design goal of installing more cells in the same space. Compared with the traditional battery pack, the volume utilization rate of "blade battery" has increased by more than 50%, that is, the mileage can be increased by more than 50%, reaching the same level of high energy density ternary lithium battery [7].

For electric vehicles, in addition to safety, what people are most concerned about is the mileage. At present, the NEDC mileage indicated by many electric vehicles can

only reach 70% - 80%, and even less than half of the mileage in winter, which limits the travel range of electric vehicle users and the imperfect matching of charging piles, so they are more durable. The battery with higher mileage is what people need, and the blade battery can well solve the anxiety of most people. For instance, BYD Han EV with a blade battery has a range of 605 kilometers under comprehensive working conditions.

The cost of the blade battery is much cheaper than the ternary lithium battery. Because there is no nickel and cobalt, the cost of lithium iron phosphate is relatively low. In the future, there is more room for price reduction and endurance improvement of blade batteries. Even at the current level, the use of blade batteries is much cheaper than ternary lithium batteries, and the cost savings can bring great help to car enterprises.

The competition for electric vehicles is becoming increasingly cruel. Whoever can better control the cost, who can sell more cars, sell the products directly to consumers at a lower price at the cost saved by the battery, or upgrade the configuration will be the major selling points of new products [10].

4.2. The Advantages of Blade Battery over Other Batteries in Safety

Although the range is important for electric vehicles, the safety of batteries is the most important. People often see the spontaneous combustion of electric vehicles. These are the problems of battery temperature control. Blade batteries perform well in this regard. Why did lithium iron phosphate battery rise again after returning to the market? Because the lithium iron phosphate batteries has good stability, although the energy density of ternary lithium battery is high, it also brings a fatal weakness: poor stability, which is often referred to as safety.

The lithium iron phosphate battery has better thermal stability and higher safety. For cars, if the safety of consumers is not guaranteed, people are panic when driving a car. The blade battery is also a lithium iron phosphate battery, but why is its safety factor higher? Here is the answer: Acupuncture Experiment. Ternary lithium battery can hardly pass the acupuncture experiment because its thermal stability is poor, so the result of acupuncture experiment is often smoke, fire or even explosion [5]. After needling, an ordinary lithium iron phosphate battery has no open fire and smoke, and the surface temperature is 200 °C - 400. BYD blade battery has no open fire and is smokeless after acupuncture, and the surface temperature is only 30-60 °C. Acupuncture test removes all the publicity and packaging so that the authenticity and safety of the battery can be naked in front of consumers. No one wants an unstable explosive battery sitting under their ass. Blade battery became famous in the first World War of acupuncture test, and promoted its gifted safety ability to a unique position in the Jianghu through the acquired scientific and technological blessing [11].

Table 1 Acupuncture experiment of three kinds of batteries [11]

NCM Lithium Battery	Lithium iron phosphate block battery	BYD Blade Battery
severe burning	No fire,smoke observed	No fire,no smoke
The surface temperature exceeds 500 degrees	Surface temperature 200 to 400 degrees	Surface temperature 30 to 60 degrees

5. CONCLUSION

The advantages of blade battery in technology and safety are obvious compared with other batteries. The cost of electric vehicles must be reduced, and the endurance of electric vehicles must always be reduced to the mass market. So the blade battery is standing right on the air outlet. However, the blade battery has won a short victory. At present, the blade battery is the best scheme, but the problem of waste battery treatment has not been properly handled. In addition, the charging and discharging performance is poor at low temperatures. In the coming period of time, ternary lithium battery and blade battery will occupy a large part of the market respectively. The technology is constantly innovating, and the blade battery will continue to evolve, upgrade and be used more widely. Even when the battery development meets the bottleneck period, there will be new technologies, new batteries will be applied to various fields, and electric vehicles still have a long way to go, In order to solve environmental problems, the government and manufacturers should comply with the changes of the times. Green development is the theme of the times. Electric vehicles are adapting to this theme, developing continuously and looking to the future.

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