

About the application status and development trend of new energy vehicle power battery

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Abstract—Power batteries are one of the technological cores of new energy vehicles, and have been fully valued at home and abroad in the current stable development of new energy vehicles. Automotive manufacturing companies are constantly exploring the use of new materials or technologies to improve existing batteries, and the development of new batteries has become a major focus in the field of new energy vehicles. In the context of the full development of modern information technology, artificial intelligence, big data and new energy have become the development direction of the new era, and the reform of power batteries has become inevitable. The following analysis of different power batteries for new energy vehicles, and explore the application status, development trends of power batteries, to provide theoretical reference for relevant practitioners.

Index Terms—Power Battery; application status; New energy vehicles; Development trends

I. INTRODUCTION

In new energy vehicles, conventional and unconventional vehicle fuels, as well as new types of on-board power devices, are mainly used as power sources. This type of vehicle is a transportation tool that integrates advanced technology principles, advanced structure and fields such as driving and power control. In terms of new energy types, new energy sources such as combustible ice, wind energy and electric energy are gradually being developed and used. Among them, the application of electric energy is the most extensive and in-depth in new energy vehicles. At present, electric vehicles have been put into the market and produced on a large scale, revolutionizing the automotive industry and providing more choices for people's car use, contributing to the development of environmental protection.

II. DIFFERENT POWER BATTERIES FOR NEW ENERGY VEHICLES

A. Lithium-ion battery

This type of battery is characterized by its high energy density and voltage, and its widespread application in both national defense and social life [1]. Lithium-ion batteries can be distinguished based on their electrolytes, which can be either polymer or liquid electrolytes. Among the widely used polymer batteries, they can be classified as ternary lithium, lithium manganese, or lithium cobalt, based on the polymer used. The advantages of this type of battery are its high specific energy, light weight, low pollution, low memory effect, and relatively long lifespan. Compared with nickel-hydrogen batteries of the same weight, the energy storage capacity of lithium-ion batteries is 1.5 times higher [2]. Theoretically, only a quarter of the total electricity of this type of battery has been

developed, indicating its vast development potential. As a truly pollution-free battery, it is very beneficial to the development of energy conservation and environmental protection.

B. Lead-acid battery

This type of battery has a history of a century and is mainly used in internal combustion engine vehicles as a starting power source. It is a mature type of battery used in electric vehicles [3]. In terms of lead-acid batteries, they have a large volume but low energy density, short battery life, and relatively high frequency of battery replacement. Therefore, this type of battery is considered to be more polluting and technologically outdated compared to other power batteries. However, this type of battery also has its own advantages, such as cheap and easily obtainable raw materials, high reliability, and recyclability. Currently, this type of battery is mainly used in electric tricycles or bicycles, and its market share is extremely high.

C. Nickel-metal hydride battery

The nickel-metal hydride battery is an alkaline battery with a long service life, high discharge power, and low memory effect, but it is relatively expensive. In terms of the development status of this type of battery in China, there are two types of nickel-metal hydride batteries with capacities of 100A·h and 55A·h. Compared with foreign companies that produce this type of battery, the technical level of the products in China is relatively low, with a specific energy of around 65Wh per kilogram. This type of battery is generally used in the field of electric tools, but with the gradual development of lithium-ion batteries, this type of battery used in automobiles has gradually been phased out by the market.

D. Fuel battery

This type of battery is not a device for storing electrical energy, but rather a relatively sophisticated, small-scale power generation system. In terms of fuel selection, it generally uses ethanol, hydrogen, methanol, or methane, and converts chemical energy into electrical energy through chemical reactions between various substances within the battery. However, regardless of the type of fuel cell, its core is the two elements of hydrogen and oxygen in the fuel. From a chemical principle, hydrogen and oxygen will produce water after the reaction, so like lithium batteries, this type of battery has low pollution and emissions and is an ideal power source, which is recognized by the industry as a high-quality energy source for automobiles in the future world. As early as the late 20th century, the United

States, Japan and other countries attached great importance to the development of this type of battery, and have now developed demonstration vehicles. However, the development of this type of battery in China started relatively late, and the technology is relatively less advanced. Compared with countries such as the United States and Japan, which have achieved achievements in fuel cell development, China is still in a stage of development. In recent years, with the increasing attention of the country to fuel cells, relevant preferential policies have been continuously introduced. It is believed that with the support of technology, policies, and relevant experience, the gap between China and other countries in fuel cell research and development will gradually narrow, providing more stable and advanced power battery choices for new energy vehicles.

III. THE CURRENT APPLICATION STATUS OF POWER BATTERIES FOR NEW ENERGY VEHICLES

Based on the development process of new energy vehicles, it can be seen that Japan was the first country to carry out research and development and promotion of such vehicles, using hybrid electric vehicles to tap into the market for new energy vehicles [4]. Since then, US new energy vehicle research and manufacturing factories, such as Tesla, have introduced lithium battery electric vehicles after drawing on Japan's related experience. The introduction of such new vehicles has focused the attention of European countries on new energy vehicles, hoping to improve the pollution caused by diesel vehicles. Looking at the development and manufacturing of such vehicles in China, it can be seen that China only began this work in the early 21st century. For example, in 2008, with the support of relevant policies in China, new energy vehicles ushered in their first year of development and their market vitality continued to grow. In recent years, with the promotion of such vehicles by various countries, domestic automobile companies in China have also introduced oil-electric hybrid new energy vehicles, and some non-automobile companies have also realized the development prospects of new energy vehicles in this field and have joined in to build their own enterprise brands. However, these vehicles rely heavily on power batteries, and the development of the automobile industry depends on the development and changes of these batteries. Looking at the current production status of power batteries in China, although there are over a hundred production enterprises, the overall degree of production automation is limited, resulting in limited production efficiency and relatively low product quality, which has a constraining effect on the development of the power battery and new energy vehicle industries [?]. Further technological research and development and upgrading are needed.

IV. DEVELOPMENT TREND OF NEW ENERGY VEHICLE POWER BATTERY

A. Cost reduction due to scale

During the process of producing power batteries, reducing production costs is an important issue that companies pay

attention to. In terms of battery manufacturing, the main ways to reduce costs can be divided into: first, using technological upgrades to optimize battery systems and increase their actual service life to reduce costs; second, changing the battery production system to achieve large-scale battery production and reduce production costs per unit using economies of scale. Regarding large-scale production, relevant companies have already reduced battery production costs by more than one-third through large-scale production. This point is worth learning from for domestic companies based on their actual situation. Third, doing a good job of resource recycling. This point can help manufacturers to fully reduce production costs and increase profit margins. However, looking at the development situation in China, the recycling system for power batteries still needs to be improved. For example, in the recycling of lithium batteries, the cost is high, the technology for secondary development is not well developed, and the development of the industry chain is insufficient. Relevant companies need to further study and optimize the recycling system.

B. The manufacturing method tends to be intelligent

In the rapidly developing environment of the internet industry, the production of power batteries has also undergone certain changes, becoming increasingly intelligent. For example, we can use big data technology to mine, integrate and analyze relevant information about the research and development, production, sales, and final use of power batteries, providing valuable information for subsequent battery production upgrades. As an important path for upgrading and transforming modern manufacturing industry, the realization of intelligence can enable battery manufacturing companies to achieve automated production, use intelligent control systems to command production machines, improve production efficiency and scale. While saving more manpower and resource costs for the enterprise, the standardization and mechanization of intelligent production can reduce production errors, bringing more production benefits to the enterprise. In addition, intelligent manufacturing, due to its association with computer technology, also has the characteristics of visualization, informatization, and unmanned operation. Companies can monitor data during battery development, testing, manufacturing or after-sales processes, further improving the stability and reliability of the battery.

C. Cooperative development of development model

The maturity of the production chain and a sound capital chain are the driving forces behind the development of a particular technology. They signify the innovation and further development of a business model. Looking at the current development situation, it is possible that multi-party cooperation will become the mainstream for the development of various industries in the future. In the field of power batteries, a decentralized and integrated cooperation concept can be utilized to support the operation and development of small and micro enterprises, organize multiple manufacturers to undertake various battery production functions, and finally

assemble and test the production parts of each enterprise. This approach can split the production chain, guarantee further improvement in production efficiency, and reduce operational risks for enterprises. In addition, the participation of multiple enterprises in production can mobilize the enthusiasm and creativity of each enterprise and provide impetus for the further development of the power battery industry. Each enterprise needs to have a cooperative production mentality, adjust and reform their management and production strategies, in order to respond to the challenges and opportunities that the power battery industry will face in the trend of the development of new energy vehicles.

V. CONCLUSION

Combining the above, the current domestic field of power batteries in China is in a stage of continuous development, with the technology model still being continuously improved, and the market saturation is also relatively low. The core concept of power battery development lies in environmental protection, performance safety, and energy density. Therefore, power batteries produced from this concept will undoubtedly contribute to the development of the new energy vehicle industry. Based on the above exploration, an ideal power battery should be lightweight and small in size, fast-charging with high energy density, low in price and long in service life, recyclable with stable performance, and energy-saving and environmentally friendly. With the continuous transformation of domestic manufacturing technology, power batteries will inevitably develop towards the ideal state, and make unique contributions to the transformation of the automotive industry and the development of environmental protection.

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