Research on Lightweight Technology of New Energy Vehicles

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Abstract. In this paper, the development status of lightweight technology of new energy vehicles is analyzed in detail, and the application of lightweight technology in the field of design and research of new energy vehicles is analyzed in depth, including the application of lightweight new technology and lightweight materials, and the specific problems arising from the application of lightweight technology in the field of new energy vehicles are analyzed. Then, the technical content and raw material demand of lightweight new energy vehicles are elaborated in detail, and the significance of lightweight new energy vehicles is analyzed. Finally, some feasible suggestions are put forward for the development of lightweight new energy vehicles.

1 Introduction

Compared with traditional automobile industry, new energy vehicles are more energy-saving and environment-friendly, so lightweight technology is particularly important in the research and development of new energy vehicles. New energy vehicles, based on batteries, provide support for vehicle power, which can alleviate the problem of resource shortage and fully meet the strategic goal of national sustainable development. Although new energy vehicles have many advantages, compared with traditional vehicles, there is still a big gap in driving speed, which is one of the difficult problems to be overcome in the field of new energy research, and needs to be paid more attention by relevant researchers. The driving speed of new energy vehicles has always been one of the difficult problems to be overcome in the field of new energy research. Customers' demands for new energy vehicles are constantly changing. Based on modern technology, lightweight technology is optimized and innovated, and new energy innovation is continuously innovated, so as to streamline the manufacturing process of new energy vehicles and improve the running speed of new energy vehicles. Lightweight technology plays an important role in cost control, operation quality and safety performance of new energy vehicles. The application of lightweight technology to the design and manufacture of new energy vehicles can optimize the production and manufacture of new energy vehicles. Battery, new materials and laser technology in lightweight technology can be widely used in the design and manufacture of new energy vehicles.

2 Present Situation of Lightweight Technology for New Energy Vehicles

At present, there are still many problems in the actual production of new energy vehicles, such as slow driving speed and weak endurance. If the same energy is used as power, the research shows that the total weight of new energy vehicles is reduced by 10%, and the vehicles can travel 20% more, which reflects the importance of lightweight technology in the research of new energy vehicles. In the field of new energy vehicles, lightweight technology is a new technology with revolutionary significance. It can assist the whole process of R&D and design of new energy vehicles, and can provide good ideas and methods to solve some weak links in new energy vehicles, such as slow speed and high cost. The trend of new energy vehicles approaching to lightweight technology needs to be paid attention to and studied by all relevant personnel in the field of new energy in China and even around the world. New energy vehicles use batteries as power raw materials, and all functions in the vehicles depend on batteries, which can replace the raw materials that pollute the environment in traditional vehicles. New energy vehicles have extremely low environmental pollution and can effectively save material resources and reduce the use cost for users. In order to ensure the battery life, some new energy vehicles will put bigger batteries in their cars, and it is normal for the battery weight to reach several hundred kilograms, which makes the body weight of new energy vehicles increase, slows down the running speed of vehicles, and also consumes more time in the process of charging new energy vehicles, it makes the audience's experience not very good[1].

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3 Concrete Application of Lightweight Technology for New Energy Vehicles

3.1 Lightweight Application of New Technologies and Processes

Lightweight technology is widely used in the design, development and even production of new energy vehicles, among which internal high-pressure forming technology is the most widely used. The general principle of this technology is as follows: firstly, corresponding pipes are selected as raw materials, and then high-pressure liquid is filled into the pipes, so that relatively complex new energy automobile parts can be molded at one time, and the molding method is relatively simple. Generally speaking, in the manufacturing process of frame longitudinal beams of new energy A-type vehicles, the high-pressure forming method will be selected, so that a longitudinal beam of 4.63m can be obtained, and then the circumference of the cross-section structure along the axis direction is controlled to be between 30.8 cm and 53.4 cm, and then the frame longitudinal beams are filled with conical pipes, and then formed after several times of filling. The application of this molding technology in new energy vehicles can increase the material utilization rate by 30% and reduce the quality by 34%. Compared with the traditional stamping technology, the internal high-pressure forming technology can reduce the thickness of parts by 20%, thus reducing the weight of the car body. The hot pressing process uses boron treated steel (boron steel for short) as the main material, and the strength is pressurized under the condition of 1.5kPa. Roll forming technology in lightweight technology is also widely used, which requires multiple rollers to act simultaneously. Then, by continuously adjusting the position of the roller to drive the change of the position of the steel strip, the steel strip is continuously transported forward and formed in turn, so as to obtain the required cross-section shape, as shown in Figure 1:

Fig. 1. Schematic illustration of roll forming technology

3.2 Concrete Application of Lightweight Materials

In the field of R&D and manufacturing of new energy vehicles, lightweight materials including plastic composite materials, magnesium alloys, high-strength steel and aluminum alloys are also widely used. The application of traditional steel materials in the field of new energy vehicles is gradually replaced by aluminum alloy materials. The weight of aluminum alloy materials is relatively light, only 2.68g per cubic centimeter. In the field of new energy vehicles, if the same bending degree

is required, aluminum alloy will be selected instead of traditional steel materials in the selection of raw materials. Aluminum parts in new energy vehicles can effectively reduce weight by 30% at the lowest and 40% at the highest. Aluminum alloy forgings, such as aluminum alloy wheels and suspension brackets, are mostly used for the structural components of new energy vehicles. Choosing aluminum alloy lightweight materials can meet the fatigue resistance and high strength required by these components. Both new energy vehicles and traditional vehicles need to use metal mold castings to make motor casings. High strength steel is generally selected as raw material in the construction of safety parts of new energy vehicles. This material can ensure the safety performance of new energy vehicles and achieve the goal of lightweight vehicles in the design and research process of new energy vehicles. Magnesium alloy can replace traditional steel materials in new energy vehicles, which is lighter in metal structural materials and has a density of 1.74g/cm³. In the field of R&D and design of new energy vehicles, there is a wide range of materials for auto parts. Some enterprises have considered the application of magnesium alloy, and want to recycle and reuse it for environmental protection. However, at present, magnesium alloy is not widely used in the manufacturing process of new energy vehicles in China, and it is mostly used in relatively mature countries and regions such as Korea, Japan and North America. In our country, the application of magnesium alloy in the field of R&D and design of new energy vehicles is only in specific parts. Generally, magnesium alloy materials are used in the manufacturing process of pillar beams and luggage frames of new energy vehicles, while magnesium alloy is not selected in the manufacturing process of other parts[2]. However, the use of plastic composite materials in the research and development of new energy vehicles has increased significantly compared with the past. Plastic composite materials have good corrosion resistance and are particularly easy to be molded, so they are favored by new energy vehicle production and research enterprises. The thermal insulation of plastic composite materials is also better than other materials, and plastic composite materials are also preferred as raw materials for relatively complex parts in new energy vehicles. Plastic composite material is one of the most widely used and cost-effective raw materials in the field of design and development of new energy vehicles, which can reduce the production cost of new energy vehicles to a certain extent.

4 Some Problems in the Application of Lightweight Technology

The realization of lightweight technology of new energy vehicles can effectively improve the ecological environment and reduce the pollution to the ecological environment, but it needs to invest more funds, which is difficult for some enterprises to accept, and it also indicates that lightweight technology can not be applied and popularized at present. At present, China's new

energy automobile industry needs the support of national policies and huge funds, and the equipment and funds in production, R&D and development are not enough, which makes the production and R&D process longer. The increase of R&D time of new energy vehicles needs to consume a lot of manpower and material resources, so it is urgent to research and develop lightweight technologies of new energy vehicles. In the process of R&D of new energy vehicles, it is necessary to increase capital investment and purchase more advanced facilities and equipment to ensure the smooth development of R&D of new energy vehicles, so as to ensure the prosperity and sustainable development of the new energy vehicle industry[3].

5 Lightweight Technology of New Energy Vehicles

5.1 Application of Carbon Fiber Technology in New Energy Vehicle

Carbon fiber is different from other raw materials. It can only be extracted by artificial synthesis, and its access is relatively simple. However, carbon fiber is indispensable in the design and research of new energy field, which is one of the difficult problems to be solved in the field of new energy vehicle design and research at present. Compared with traditional automobile manufacturing R&D enterprises, new energy automobile manufacturing R&D enterprises pay more attention to energy conservation and environmental protection. Carbon fiber technology can replace a part of steel materials, which makes it possible to replace steel with plastic. Compared with other materials, carbon fiber has the advantages of good elasticity and compression resistance, high bearing capacity and light weight, which can meet the requirements of new energy vehicle production. In addition, due to the strong corrosiveness of carbon fiber technology, it can effectively shield electromagnetism, so that the lightweight of new energy vehicles can be met and the weight of new energy vehicles can be effectively reduced[4]. Carbon fiber technology is a modern new technology, which is gradually applied in all walks of life, including new energy production, assisting the design and production of new energy vehicles, which can effectively reduce the power consumption of new energy vehicles and prolong the battery life of new energy vehicles to a certain extent. New energy vehicles manufactured by carbon fiber technology have lower power consumption, which can increase the mileage of new energy vehicles and reduce energy consumption under the same power consumption. However, the research and development and use cost of this new technology is relatively high, so it is not widely used in the research and development of new energy vehicles[5].

5.2 Application of Battery Technology, Laser Technology and New Materials

Battery, laser and new material technology are also widely used in the design and production of new energy vehicles, and they are important components of lightweight new energy vehicles. In the process of design and production of new energy vehicles, it is necessary to select raw materials with lower relative cost, lighter quality and better stability, so as to make the new energy vehicles have better quality and higher cost performance. New energy lightweight technology has higher requirements for scientific and reasonable selection of raw materials for production. At present, the new application materials selected in the field of new energy vehicles include high strength steel, aluminum carbon fiber and so on. Using laser technology to process and process the selected new materials can meet the production needs of new energy vehicles, and the new materials are transformed by laser technology to the greatest extent, which is more in line with the requirements of new energy vehicles for related components. The problem of battery weight of new energy vehicles also needs to be solved as soon as possible. In order to ensure the cruising range, the batteries of new energy vehicles are mostly heavy, even more than 100 kg, which limits the running speed of new energy vehicles. Reducing the battery weight and ensuring the original endurance of the vehicle is one of the difficult problems in the development and production of new energy vehicles at present. As the battery of new energy vehicles, it is not easy to conduct in-depth and comprehensive research and development of lithium batteries. New energy production enterprises need to overcome this problem, analyze and study lithium batteries by using information technology, and study how to improve the battery performance and expand the energy density of the battery system, in order to reduce the battery weight, ensure the original endurance of new energy vehicles, and even improve the endurance[6].

5.3 Effective Use of Lightweight Technology to Realize the Optimization and Reorganization of Automobiles

Lightweight technology in the design and production process of new energy vehicles makes it easy to realize assembly and reorganization. In the design and production engineering of automobiles, it is necessary to constantly upgrade and optimize the internal production structure and external structure, so as to produce automobiles with better quality and better performance. The design scheme of new energy vehicles determines the performance of manufactured new energy vehicles, and ensuring the optimal design scheme is also one of the important means to improve the performance of new energy vehicles. How to effectively prolong the life of new energy vehicles is one of the major problems in the field of design and manufacture of new energy vehicles at present[7]. To solve this problem, modern manufacturing technologies such as CAD, CAM, CAE, etc. are often used to continuously upgrade and optimize

the overall structure and internal parts of new energy vehicles. Paying attention to the application of lightweight technology can maximize the lightweight of new energy vehicles. In the process of designing body weight, new energy vehicle manufacturers need to reform and optimize the body structure and effectively reorganize it to ensure the lightest weight of the designed body. In the design process of new energy vehicles, it is necessary to optimize the quality of automobile parts without affecting the original service time and parts performance. New energy design and production enterprises need to keep the good parts of the original design scheme in the process of optimizing and reorganizing the design scheme, so as to ensure that the restructured and optimized design scheme fully meets the needs of the audience, and does not affect the stability and safety of new energy vehicles while saving energy and protecting the environment[8].

5.4 New Manufacturing Process for New Energy Vehicles

The field of design and manufacture of new energy vehicles is also affected by modern technology. With the continuous improvement of information technology and modern technology, the manufacturing process of new energy vehicles is different from that of the past. While retaining the advantages of traditional manufacturing processes, riveting process and modular assembly process are added. The collision between new materials and new manufacturing processes produces different sparks, which enhances the compressive strength of automobile body. The application of the new manufacturing technology in the production of new energy vehicles can reduce the noise and body weight of vehicles in running and save costs to a certain extent. The application of coating technology in the manufacturing process of new energy vehicles can reduce the production cost of new energy vehicles and reduce the damage to the ecological environment. Coating process is the direct application of composite materials in molds and layers, which can save phosphating cost and electrophoresis technology, and ensure the maximum economic benefits of new energy automobile manufacturers. The new manufacturing technology of new energy vehicles can reduce production cost and improve production quality to a certain extent, which is beneficial to the sustainable development of new energy vehicles[9].

6 The Significance of Lightweight of New Energy Vehicle

In the manufacturing process of new energy vehicles, "three electric systems" including electric drive, battery and electric control are used, which increases the self-quality of new energy vehicles, and affects the power consumption cruising range, passive safety, dynamic performance and braking performance of new energy vehicles. If the quality of new energy vehicles is reduced by 20%, its cruising range will increase by 10~15%, and

the loss and battery cost will be saved by 15%~20%. The heavier the car is, the greater the energy will be consumed[10]. Compared with traditional cars, the new energy vehicles are heavier. Because most of them rely on electricity as power energy, the heavy body of new energy vehicles will consume more energy, and the endurance of new energy batteries will be weaker, which will affect the performance of new energy vehicles and lead to poor audience experience. Automobile lightweight technology can effectively reduce the self-weight of new energy automobile body, thus improving the service performance and increasing the cruising range of new energy automobile, and can also reduce the production cost to a certain extent, enhance the competitiveness of enterprises, and make the new energy automobile industry enter a virtuous circle track.

7 Lightweight Recommendations for New Energy Vehicles

It is urgent to realize the lightweight of new energy vehicles. Even if the research and production of new energy vehicles in our country lags behind foreign countries, we must pay enough attention to the research and comparison of the raw materials for realizing the lightweight of new energy vehicles, such as paying more attention to the research of raw materials such as aluminum-magnesium alloy and polymer, and striving to expand their application scope. In the process of R&D and production of new energy vehicles, China should pay more attention to the application of high-strength steel in the field of new energy vehicles. At the same time, it is necessary to increase the proportion of composite materials, pay more attention to the research of new energy vehicle components and aluminum alloy panels. It is urgent to realize the lightweight of new energy vehicles. Even if the research and production of new energy vehicles in our country lags behind foreign countries, we must pay enough attention to the research and comparison of the raw materials for realizing the lightweight of new energy vehicles, such as paying more attention to the research of raw materials such as aluminum-magnesium alloy and polymer, and striving to expand their application scope. It can also establish a lightweight database of new energy vehicles, which is beneficial for R&D designers of new energy vehicles to track the development trends of lightweight technologies in real time.

8 Conclusion

Relevant personnel in the field of new energy vehicles in China need to participate in the global automotive lightweight technology exchange activities, and effectively optimize the cost performance structure and materials of new energy vehicles, which is conducive to the development and progress of the field of new energy vehicles. In the process of R&D, design and production of new energy vehicles, practitioners should pay more attention to lightweight technology, pay enough attention to lightweight technology and lightweight material

selection, select new energy vehicle manufacturing methods with good performance and low cost, promote the sustainable development of new energy vehicles while protecting the ecological environment, and attach importance to the research of lightweight technology of new energy vehicles, so as to reduce the manufacturing cost and improve the performance of new energy vehicles, and make the new energy vehicle industry enter a benign development track.

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