

Research on Quality Inspection and Monitoring of Electric Vehicles under Green Energy Vision

Dengli Feng¹

¹Dongguan City University, Dongguan, Guangdong 523419, China

Abstract. With the global energy transition and green energy vision, the development of electric vehicles (EVs), as an important carrier of clean energy, is receiving increasing attention. Quality inspection and monitoring, as a key link to ensure the safety, performance, and user experience of electric vehicles, and it is crucial to the healthy development of the electric vehicle market. This article firstly outlines the development history, working principle and structural characteristics of electric vehicles, and compares them with traditional fuel vehicles. Then, the article discusses in depth the importance of quality inspection of electric vehicles, existing standards and methods, and the current situation and challenges of quality monitoring. On this basis, the article looks forward to the future development trend of electric vehicle quality testing and monitoring, including technological innovation, policy and regulatory support, and industry chain synergy. It is expected that in the future development, we can see a more perfect quality testing and monitoring system, more advanced technical means and more strict policies and regulations, which will jointly promote the green and sustainable development of the electric vehicle industry.

1 Introduction

With the acceleration of industrialization and the uninterrupted growth of energy consumption, the world is facing increasingly serious energy crisis and environmental problems. In this context, global energy conversion has become an urgent need to achieve sustainable development. The vision of green energy is put forward, aiming at achieving efficient use of energy and environmental protection by promoting clean, renewable and low-carbon energy. Driven by this vision, electric vehicles, as an important carrier of green energy transformation, are gradually changing the traditional mode of transportation. With its advantages of zero emission, low noise and low maintenance cost, electric vehicles have become an important choice for future bus travel. However, with the rapid development of the

electric vehicle market, quality problems are gradually exposed. In order to ensure the safety, performance and user experience of electric vehicles, quality inspection and monitoring has become a key link. Quality inspection Testing can ensure that electric vehicles meet the relevant standards and requirements in the process of production and use, while quality monitoring can find and deal with potential quality problems in time.

2 Overview of electric vehicles

2.1 Development course of electric vehicles

The history of Electric Vehicles (EVs) can be traced back to the end of 19th century. At that time, due to the initial development of power technology and the germination of environmental protection concept, some pioneers began to try to manufacture vehicles powered by electricity. However, due to the limitations of battery

technology at that time, such as short cruising range and long charging time, electric vehicles have not been widely used in business. In the 20th century, with the maturity of internal combustion engine technology and the extensive development of petroleum resources, fuel vehicles gradually occupied the dominant position in the market, and the development of electric vehicles fell into a trap.

There was a long silence. However, with the increasingly serious environmental problems and the intensification of the energy crisis at the end of the 20th century, electric vehicles have attracted people's attention again.

In the 21st century, with the continuous progress of battery technology and the improvement of charging infrastructure, electric vehicles have begun to usher in the opportunity of rapid development. Many governments and enterprises have increased their investment in R&D and industrialization of electric vehicles, which has promoted the continuous innovation of electric vehicle technology and the rapid expansion of market scale [1].

2.2 Working principle and structure of electric vehicle

The working principle of electric vehicle mainly depends on the battery pack to provide electric energy, and the vehicle is driven by the motor. Compared with traditional fuel vehicles, the power system of electric vehicles has undergone fundamental changes. Electric vehicles are mainly composed of battery packs, motors, control systems and charging facilities. Battery pack is the energy source of electric vehicles. At present, the commonly used battery types include

Lithium ion battery, nickel metal hydride battery, etc. The capacity and performance of battery pack directly affect the cruising range and performance of electric vehicles. Motor is the power output device of electric vehicle, which converts electric energy into mechanical energy and drives the vehicle to run. According to different types of motors, electric vehicles can be divided into AC motor drive and DC motor drive. Control system is the brain of electric vehicle, which is responsible for monitoring and controlling the working state of battery pack, motor and other systems to ensure the safe, stable

and efficient operation of the vehicle. Charging facilities are an important guarantee for the operation of electric vehicles, including charging piles and charging stations, which provide convenient charging services for electric vehicles.

3 Importance of quality inspection of electric vehicles

3.1 Definition of quality inspection and its role in electric vehicle industry chain

Quality inspection, as its name implies, is to measure, inspect, test and measure the quality characteristics of products or services to determine whether they meet the predetermined requirements or standards. In the electric vehicle industry chain, quality inspection plays a vital role. It runs through the R&D, production, sales and use of electric vehicles to ensure that every electric vehicle meets the relevant quality standards and regulatory requirements.

The role of quality inspection in the industrial chain of electric vehicles is mainly reflected in the following aspects: first, quality inspection is an important link in the research and development process of electric vehicles, which provides a basis for product improvement and optimization through performance testing of prototype vehicles and parts; Secondly, in the production stage, quality inspection can ensure that every electric vehicle on the production line meets the established quality standards and reduce the generation of defective and unqualified products; Finally, in the stage of sales and use, quality inspection can provide consumers with safe, reliable and stable products, and protect users' rights and experiences [2].

3.2 Quality inspection plays an important role in ensuring the safety, security of electric vehicles, the influence of energy and user experience.

As a new type of transportation, the safety and performance of electric vehicles are very important for the safety of users' lives and property. Quality inspection can find and eliminate potential safety hazards and

performance problems in time by strictly testing and evaluating the performance indicators of electric vehicles, and ensure the safety performance of vehicles in use. In addition, quality inspection can also improve the performance of electric vehicles. By testing and optimizing the performance of key components such as motors, batteries and charging facilities, quality inspection can ensure the stable and efficient performance of electric vehicles and provide users with a smoother and more comfortable driving experience.

In terms of user experience, quality inspection also plays an important role. High-quality electric vehicles can not only meet the needs

The travel needs of households can also bring users a more convenient, environmentally friendly and energy-saving experience. Quality inspection is the key link to ensure the quality of electric vehicles, which provides users with more reliable, safe and comfortable products through comprehensive inspection and evaluation of products.

3.3 Quality Inspection for the Healthy Development of Electric Vehicle Market

Promote the role of

Quality inspection is also of great significance to the healthy development of the electric vehicle market. First of all, quality inspection can promote the technological progress and innovation of the electric vehicle industry. Through the continuous exploration and application of new technologies and processes, quality inspection can promote the performance improvement and cost reduction of electric vehicles and promote the sustainable development of the industry. Secondly, quality inspection helps to maintain market order and consumer rights. By formulating and implementing strict quality standards and testing procedures, quality testing can prevent unqualified products from entering the market and protect consumers' rights and interests. Finally, quality inspection can also enhance the international competitiveness of the electric vehicle industry. With the continuous expansion of the global electric vehicle market and the intensification of competition, quality inspection has become an important indicator to measure the level of electric vehicle industry in a country or

region. By strengthening quality inspection and technological innovation, the electric vehicle industry can gain greater competitive advantage and development space in the international market.

4 Quality inspection standards and methods of electric vehicles

4.1 Overview of international and American electric vehicle quality inspection standards

The quality inspection standard of electric vehicles is very important to ensure the safety, reliability and performance of vehicles. On a global scale, many international organizations and countries have formulated corresponding quality inspection standards for electric vehicles. These standards not only involve the mechanical and electrical properties of vehicles, but also include environmental adaptability, electromagnetic compatibility and functional safety.

At the international level, authoritative organizations such as International Electrotechnical Commission (IEC) and International Organization for Standardization (ISO) have issued a series of international standards related to electric vehicles. For example, IEC 61851 series standards relate to the safety requirements of electric vehicle charging system, while ISO 12405 standards stipulate the test method of electromagnetic compatibility of electric vehicles. These international standards provide a unified reference for the quality inspection of electric vehicles worldwide.

In the United States, the quality inspection standards for electric vehicles are mainly formulated by the National Highway Traffic Safety Administration (NHTSA) and the Society of Automotive Engineers (SAE). NHTSA has formulated a series of safety performance standards for electric vehicles, including the safety of battery system and vehicle dynamics. While SAE focuses on the work of electric vehicles.

Energy and reliability standards provide detailed test guidelines for automobile manufacturers and suppliers.

4.2 Main quality inspection methods and technologies

The quality inspection of electric vehicles involves many aspects, including mechanical performance test, electrical performance test and environmental adaptability test. In order to ensure the accuracy and reliability of detection, it is necessary to adopt a series of advanced quality detection methods and technologies. In terms of mechanical performance testing, the commonly used methods include Vibration test, impact test, durability test, etc. These tests can simulate various mechanical stresses that electric vehicles may encounter in actual use, and evaluate the structural strength and durability of vehicles. The electrical performance test mainly focuses on the performance of key components such as battery system, motor and electronic control system of electric vehicles. Commonly used electrical performance testing methods include battery charging and discharging performance testing, motor efficiency testing, electronic control system stability testing and so on. These tests can ensure that the electrical system of electric vehicles can run stably and efficiently under various working conditions. Environmental adaptability test mainly evaluates the performance of electric vehicles under different environmental conditions. For example, performance tests under harsh environmental conditions such as high temperature, low temperature, high humidity and salt spray, as well as environmental adaptability tests such as waterproof and dustproof. These tests can ensure that electric vehicles can maintain good performance under various environmental conditions [3].

4.3 Establishment of inspection process and quality control system implement

The quality inspection process of electric vehicles usually includes sample preparation, pre-test inspection, performance test, data analysis and reporting. In each step, it is necessary to strictly abide by the quality inspection standards and procedures to ensure the accuracy and reliability of the test results. In order to ensure the quality stability of electric vehicles, it is very important to establish and implement a perfect quality

control system. This includes making a detailed quality inspection plan, establishing a quality inspection database, and implementing regular quality audit and evaluation. By continuously improving and optimizing the quality control system, it can be ensured that electric vehicles always maintain a high quality level in the process of production and use.

5 Present situation and challenges of electric vehicle quality monitoring

5.1 Main means and practice of quality monitoring of electric vehicles at present

In the vehicle production stage, the manufacturer has adopted advanced automatic production lines and strict quality control procedures. This includes using high-precision testing equipment and algorithms to test the performance of key components such as batteries and motors to ensure that every electric vehicle that leaves the factory meets the preset quality standards. At the same time, real-time monitoring and data analysis are carried out for every link in the production process, so as to find and correct the potential quality in time.

Secondly, in the vehicle use stage, manufacturers and third-party service providers continuously track the performance and safety of electric vehicles through remote monitoring systems. This remote monitoring system can collect vehicle running data in real time, such as battery status, mileage and fault information, and evaluate and predict vehicle status through big data analysis technology. Once an abnormal situation or potential risk is found, the system will immediately send an early warning message to the owner or service provider, so as to take timely countermeasures. In addition, in order to further improve the quality monitoring level of electric vehicles, some innovative technologies have also been applied. For example, intelligent sensors and embedded systems based on Internet of Things (IoT) technology can monitor the key parameters and performance indicators of electric vehicles in real time, and transmit the data to the cloud platform for analysis and processing. This technology not only improves the efficiency and accuracy of data

collection, but also helps to achieve more accurate quality prediction and fault early warning.

5.2 Technology, management and politics Challenge in quality control

Although some achievements have been made in the means and practice of electric vehicle quality monitoring, it still faces many technical, management and policy challenges.

Technically, the quality monitoring of electric vehicles needs to process a large number of real-time data, which puts forward higher requirements for data processing and analysis. At the same time, with the continuous development and innovation of electric vehicle technology, new quality problems and challenges are constantly emerging, and it is necessary to constantly update and optimize quality monitoring methods and technologies. In terms of management, the quality monitoring of electric vehicles involves many links and departments, and it is necessary to establish a perfect cooperation mechanism and communication channels. In addition, the training and management of quality control personnel is also an important task, and it is necessary to continuously improve their professional quality and skill level. In terms of policy, the quality monitoring of electric vehicles needs the support and guidance of the government and relevant departments. For example, formulate and improve the quality standards and testing specifications of electric vehicles, promote the implementation of relevant laws and regulations, and provide a strong legal guarantee for the quality monitoring of electric vehicles.

6 Future development trend of quality inspection and monitoring of electric vehicles

6.1 Technological innovation: the application prospect of new technology in quality inspection and monitoring

Technological innovation is an important driving force to promote the development of quality inspection and monitoring of electric vehicles. In the future, with the

continuous development of artificial intelligence, big data, Internet of Things and other technologies, these advanced technologies will play a more important role in the field of electric vehicle quality inspection and monitoring. The application of artificial intelligence technology will promote the intelligence of quality inspection and monitoring. Through depth study Learning, machine learning and other technologies can realize accurate prediction and intelligent diagnosis of the performance and safety of electric vehicles. This will greatly improve the efficiency and accuracy of quality inspection and monitoring, and reduce the possibility of human intervention and misjudgment^[4].

The application of big data technology will promote the digitalization of quality inspection and monitoring. By collecting and analyzing a large number of vehicle operation data, the real-time monitoring and early warning of the performance and safety of electric vehicles can be realized. This will help to discover potential quality problems and safety hazards in time and provide more comprehensive and accurate quality information for manufacturers and users.

The application of Internet of Things technology will promote the intelligence and networking of quality inspection and monitoring. Through the Internet of Things technology, real-time communication and data transmission between electric vehicles, detection equipment and monitoring platform can be realized. This will make quality inspection and monitoring more convenient and efficient, and improve the experience of manufacturers and users.

6.2 Policies and regulations: the government's quality of electric vehicles support and guidance of detection and monitoring

The government plays an important role in promoting the quality inspection and monitoring of electric vehicles. In the future, the government will introduce more perfect policies and regulations to support the development of quality inspection and monitoring of electric vehicles.

The government will increase its support for the research and development and application of electric vehicle quality inspection and monitoring technology. By providing preferential policies such as funds and taxes,

enterprises are encouraged to increase investment in technological innovation and promote the continuous progress of electric vehicle quality inspection and monitoring technology. The government will strengthen the supervision and management of quality inspection and monitoring of electric vehicles. By formulating strict quality standards and inspection specifications, the standardization and standardization of quality inspection and monitoring of electric vehicles will be promoted. At the same time, strengthen the supervision and evaluation of quality inspection and monitoring institutions to ensure their fairness and accuracy. The government will promote international cooperation and exchanges in the field of quality inspection and monitoring of electric vehicles. By participating in international standardization organizations and technical cooperation agreements, we will strengthen the docking and cooperation with the international advanced level and promote the global development of electric vehicle quality inspection and monitoring technology.

6.3 Industrial chain coordination: cooperation between enterprises and information sharing the role of enjoyment in quality inspection and monitoring

Industrial chain coordination is an important way to promote the development of electric vehicle quality inspection and monitoring. In the future, with the continuous improvement and maturity of the electric vehicle industry chain, cooperation and information sharing among enterprises will play a more prominent role in quality inspection and monitoring.

Manufacturers, suppliers and third-party service providers will strengthen cooperation and information sharing. By establishing close cooperation and information sharing mechanism, we will jointly promote the development and application of quality inspection and monitoring technology for electric vehicles. This will help reduce the quality inspection.

Measure and monitor the cost and risk, and improve the competitiveness and sustainable development ability of the whole industrial chain. At the same time, industrial chain coordination will also promote the standardization and popularization of electric vehicle quality inspection

and monitoring services. By formulating uniform service standards and norms, we will promote the popularization and convenience of quality inspection and monitoring services for electric vehicles. This will help to improve user experience and satisfaction and promote the healthy development of the electric vehicle market ^[5].

Conclusion and prospect

From the perspective of green energy vision, this paper deeply discusses the importance of quality inspection and monitoring of electric vehicles and the challenges and opportunities they face. The research results show that quality inspection and monitoring play a vital role in ensuring the safety, performance and user experience of electric vehicles. Especially in America, a big country in the electric vehicle market, with the government's increasing attention to clean energy and sustainable transportation, the quality of electric vehicles has become the focus of public attention ^[6].

Looking forward to the future, the quality inspection and monitoring of electric vehicles will usher in unprecedented development opportunities. With the continuous integration of cutting-edge technologies such as artificial intelligence and big data, the level of intelligence and accuracy of quality inspection and monitoring will be greatly improved. At the same time, the US government's support policies and legal standards for the electric vehicle industry will be continuously improved, providing a more solid institutional guarantee for quality inspection and monitoring.

Declarations: This article is the interim achievements of the 2023 Major Research Project at Dongguan City College titled "Research on the Integration of Xi Jinping's Socialism with Chinese Characteristics in the New Era and Chinese Traditional Culture" (2023YZD003R), as well as the 2023 Higher Education Characteristic Innovation Project at the Guangdong Provincial Department of Education titled "Research on the Citations of Chinese Traditional Cultural Classics in Xi Jinping's Important Speeches" (2023WTSCX160).

References:

1. Yu Zhou Lin. Study on layout planning method of urban electric vehicle charging facilities [D]. Chang'an University, 2023.

2. Zou Mengjiao. Traceability mechanism and value transmission strategy of green electricity consumption of electric vehicle aggregators [D]. North China Electric Power University (Beijing), 2022.
3. Zhang Jinxi. Research on composite policy guidance mechanism and optimization strategy based on production decision of electric vehicle enterprises [D]. Chang 'an University, 2022.
4. Wang Zhongyuan. Interior acoustic quality evaluation and electromagnetic noise analysis of electric vehicles [D]. shenyang ligong university, 2023.
5. Study on Quality Management of New Energy Electric Vehicles in Hong Xu GS Company [D]. shenyang ligong university, 2023.
6. Wang Yanliang. Service-quality based pricing approach for charging electric vehicles in smart energy communities[J].Journal of Cleaner Production.2023 (420) .