Available online www.jsaer.com

***Journal of Scientific and Engineering Research*, 2025, 12(2):270-273**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

Research on The Development of Secondary Utilization of Power Batteries in New Energy Vehicles

Mengchao Guo

Henan Polytechnic University

Abstract: In recent years, with the rapid rise of the global new energy vehicle industry, the recycling and treatment of retired power batteries has become an unavoidable key node in the journey of sustainable development. The effectiveness of their disposal is directly related to the depth of resource recycling and the intensity of environmental protection. If these batteries cannot be properly recycled and treated, it will cause serious waste of resources, and the rough operation in the recycling process will lead to environmental risks such as heavy metal leakage out of control, posing a serious threat to the balance of the ecosystem. Currently, battery secondary utilization is regarded as an important way for sustainable resource utilization, but disorderly recycling channels and non-standardized treatment methods still exist. The emerging blockchain technology, with its outstanding traceability, closely monitors the entire life cycle of batteries, providing solid support for optimizing the recycling network and standardizing the treatment process, and jointly building a resource-conserving and environment-friendly society.

Keywords: Power battery, supply chain, secondary utilization

1. Introduction

In recent years, to alleviate the huge pressure of environmental pollution and the shortage of petroleum energy, countries around the world have been vigorously developing the new energy vehicle industry. Among them, new energy vehicles driven by electricity as an alternative to traditional fuel vehicles will become the mainstream of the transformation and development of the automotive industry in various countries [1]. By the end of 2023, the global sales of new energy vehicles reached 13.69 million units, among which China's production and sales of new energy vehicles have ranked first in the world for nine consecutive years, and the number of new energy vehicles in use has reached 20.41 million. It is estimated that by 2030, the number of pure electric new energy vehicles in China will reach 80 million [2].

Power batteries are a key component of new energy vehicles. With the explosive growth in the number of electric vehicles, a large number of power batteries will be retired. It is estimated that by 2030, the total amount of retired power batteries in China will reach 7.08 million tons [3]. The recycling and disposal of these used power batteries will be a huge challenge. If the retired power batteries are not properly handled, it will cause serious waste of resources and environmental pollution [4]. Under normal circumstances, when the initial capacity of the power battery of new energy vehicles decays to about 80%, the battery needs to be replaced. Considering that the retired batteries contain a large amount of precious metals and still have considerable economic value, the batteries with higher remaining capacity need to be unpacked, sorted and reorganized into battery modules to be made into secondary utilization products and applied in fields such as communication base stations. It can be seen that the recycling and processing industry of retired power batteries of new energy vehicles has a huge market prospect, especially the secondary utilization industry of retired power batteries [5].

2. Interpretation of The Connotation of Battery Recycling in New Energy Vehicles

Overview of the Battery Lifecycle

The lifecycle of a new energy vehicle battery encompasses the entire process from production to use and ultimately to retirement. During the normal operation of the vehicle, the battery's performance inevitably declines gradually with the increase in the number of charge and discharge cycles. When the battery capacity drops to a critical value that cannot meet the vehicle's power performance requirements, it enters the retirement stage. It is worth noting that at this point, the battery still holds potential value that can be exploited and utilized.

Tracing the Concept and Analyzing the Principles of Battery Recycling

Battery recycling in new energy vehicles is a resource reuse method that precisely matches batteries with remaining performance to other specific scenarios. Specifically, this process involves comprehensive testing, meticulous screening, and scientific reconfiguration of retired batteries, aiming to enable these batteries to continue functioning in new application fields such as energy storage. The core principle lies in the significant differences in battery performance requirements across various application scenarios. Compared to the high demands for energy density and power density in automotive power systems, other applications like energy storage have relatively lower requirements, thus creating objective conditions and potential space for the secondary utilization of retired batteries.

3. A Scan of The Current Development Status of Battery Recycling in New Energy Vehicles

The scale of retired batteries continues to rise

In recent years, the new energy vehicle industry has witnessed explosive growth, accompanied by a sharp increase in the scale of retired power batteries. According to statistics, the total amount of retired power batteries worldwide reached approximately 685,000 tons in 2023. As a major country with a large number of new energy vehicles, China's share of retired batteries is considerable. As a major country with a large number of new energy vehicles, China's share of retired batteries is considerable. In 2023 alone, the scale of retired power batteries in China exceeded 250,000 tons. If these retired batteries are not properly disposed of, they will not only lead to the waste of rare metals such as lithium, cobalt, and nickel, but also pose a potential threat to the environment due to the heavy metals and electrolytes in the batteries. The emergence of these retired batteries has not only provided abundant raw materials for the secondary utilization industry but also presented severe processing challenges.

The application practice of cascading utilization in multiple fields

In the field of communication, enterprises such as China Mobile and China Tower actively cooperate with battery recycling companies to use retired power batteries as backup power sources for communication base stations. Although these batteries cannot meet the power demands of new energy vehicles, they can fully leverage their residual value in base station scenarios where energy density requirements are relatively low and charging and discharging frequencies are stable, effectively reducing the operating costs of base stations. In the field of energy storage, some regions use retired batteries to build distributed energy storage systems, participating in peak shaving and valley filling of the power grid and enhancing the stability of the power grid. Additionally, in the field of low-speed electric vehicles, some enterprises use retired batteries that have been screened and reorganized for sightseeing vehicles, sanitation vehicles, etc., expanding the application scope of secondary utilization.

The development trends of related enterprises and cutting-edge technologies

CATL has established a comprehensive battery recycling and secondary utilization system. By leveraging its technological advantages, it conducts efficient detection and classification of retired batteries. As a professional recycling enterprise, GEM constantly optimizes its recycling processes to achieve high-value recovery and utilization of resources. In terms of cutting-edge technologies, advanced non-destructive testing techniques can more accurately assess the remaining life and health status of batteries; intelligent management systems can realize real-time monitoring and optimal control of secondary utilization battery packs, enhancing safety and service life; and new repair technologies aim to restore some of the performance of retired batteries, further tapping into their potential value and propelling the secondary utilization industry to new heights.

4. Challenges Faced by The Secondary Utilization of Power Batteries in New Energy Vehicles

Multidimensional Challenges of Technological Bottlenecks

In the secondary utilization of power batteries for new energy vehicles, there are many technical challenges. The first is the lack of precise means for battery condition assessment. Due to different usage conditions, the performance of retired batteries varies greatly. Current detection technologies are difficult to accurately determine the remaining life and health status. For instance, the battery management systems of different car manufacturers vary greatly, and data is difficult to be shared and integrated, making it hard to establish a unified and effective assessment model. Some small-scale recycling enterprises, when handling retired batteries, due to the lack of precise assessment capabilities, tend to misjudge the value of batteries, which affects the efficiency of secondary utilization. Secondly, the battery pack reconfiguration technology is still not mature. Retired batteries need to be recombined into battery packs suitable for new scenarios, but the individual differences among batteries make matching difficult, easily leading to battery consistency issues, which reduces the overall performance and lifespan. For instance, in some projects that attempted to apply retired batteries to energy storage systems, due to the inadequate battery pack reconfiguration technology, frequent faults occurred during operation, with high maintenance costs, seriously hindering the process of secondary utilization.

Multiple Obstacles in the Market Dilemma

In terms of the market, the secondary utilization of batteries is confronted with the problem of chaotic recycling channels. A large number of retired batteries flow into informal small workshops, which lack professional recycling technology, pose significant safety risks, and disrupt the market order. Taking some regions in China as an example, a large number of retired batteries are purchased at low prices by individual traders. After simple disassembly, they are randomly piled up, which not only causes environmental pollution but also makes it difficult for formal recycling enterprises to obtain sufficient retired batteries, thus affecting their large-scale development.

In addition, the lack of unified market standards is also a major obstacle. Different enterprises have different standards for the performance and quality of second-life batteries, resulting in uneven product quality. In the energy storage market, some second-life battery products lack unified standards and regulations, making it difficult for consumers to distinguish quality and raising doubts about their safety and reliability. This affects market acceptance and hinders the market expansion of the second-life battery industry, restricting its further development and growth.

5. Prospects for the Development of Secondary Utilization of Power Batteries in New Energy Vehicles

Technological innovation leads to the new trend of development

With the continuous advancement of technology, technological innovation in the secondary use of power batteries will become a key driving force. In terms of battery detection technology, non-destructive testing technology is gradually maturing and can more accurately assess the remaining life and health status of retired batteries. For instance, although the Israeli company Better Place has gone bankrupt, it made many explorations in battery detection technology. The intelligent algorithm it adopted, combined with sensor technology, can monitor the internal parameters of batteries in real time, providing a reliable basis for the screening of batteries for secondary use. In the future, if this technology can be further optimized, it will significantly enhance the safety and reliability of batteries used in secondary applications. In terms of battery repair and reconfiguration technology, new materials and processes are constantly emerging. Some domestic enterprises have developed new repair fluids that can effectively restore the capacity of some retired batteries. Combined with advanced battery pack reconfiguration processes, the consistency of battery packs has been significantly improved, extending their service life, reducing costs, and opening up broader space for secondary utilization.

Market Changes Drive New Industrial Development

The changes in market demand will drive the development of the secondary utilization industry of power batteries. In the field of energy storage, with the popularization of distributed energy, the demand for energy storage devices from households and businesses has increased significantly. Some foreign companies have assembled retired power batteries into household energy storage systems, which not only meet the daily electricity needs of users but also provide emergency power during power outages, and have received a good market response. The market for backup power supplies of communication base stations also offers a broad

stage for the secondary use of batteries. China Tower has cooperated with many battery enterprises to adopt a large number of retired batteries as backup power supplies for base stations, effectively reducing operating costs and improving resource utilization. With the accelerated construction of 5G networks, the demand for backup power supplies continues to grow, and secondary use batteries are expected to occupy a larger market share in this field.

Policy Optimization Facilitates Industrial Take-off

Policy support is crucial for the secondary utilization industry of power batteries. China has introduced a series of policies to encourage battery recycling and secondary utilization, clearly defining the extended producer responsibility system, which requires car manufacturers and battery enterprises to take responsibility for battery recycling, promoting the standardized development of the industry. The government also encourages enterprises to increase investment in technological research and development and industrial layout through measures such as subsidies and tax incentives. For instance, tax reductions are granted to enterprises engaged in battery recycling to lower their operating costs and enhance their market competitiveness. Internationally, the European Union has formulated strict battery recycling directives, promoting member states to establish a complete recycling system and creating a favorable development environment for the secondary utilization industry. The coordinated optimization of policies among various countries will attract more capital and talents to enter this field, accelerate the maturation of industry, and enable the secondary utilization of power batteries to achieve sustainable development on a global scale. It will become an indispensable part of the new energy industry and contribute to the realization of energy transition and green development goals.

6. Conclusion

The secondary utilization of power batteries in new energy vehicles, as a key link in the field of resource recycling, holds an irreplaceable strategic significance for the sustainable development of the global new energy vehicle industry and environmental protection. Despite numerous severe challenges in technology, market and policy at present, with the breakthroughs in technology, the gradual improvement of the market and the continuous optimization of policies, its development prospects are broad. We must deeply recognize the important value of the secondary utilization of power batteries, actively respond to challenges, firmly seize development opportunities, and fully promote this industry to develop vigorously in a high-quality and sustainable direction, achieving a harmonious coexistence of resources and the environment, and making positive and outstanding contributions to China's economic and social development. In this process, all parties including the government, enterprises and research institutions should form a close cooperative alliance, pool the wisdom and strength of all parties, and jointly write a magnificent chapter in the development of the secondary utilization industry of new energy vehicle power batteries, allowing every retired battery to shine on a new stage and become a powerful driving force for green development.

References

[1]. Li, J., Ku Y., Liu, C., Zhou, Y. (2020). Dual credit policy: Promoting new energy vehicles with battery recycling in a competitive environment? Journal of Cleaner Production, 243: 118456.

[2]. Chuan, Z., Yuxin, T., Menghong, H. (2022). Recycling mode selection and carbon emission reduction decisions for a multi-channel closed-loop supply chain of electric vehicle power battery under cap-and-trade policy. Journal of Cleaner Production, 375: 134060.

[3]. Wu, Y F., Yang, L Y., Tian, X. (2020). Temporal and spatial analysis for end-of-life power batteries from electric vehicles in China. Resources Conservation and Recycling,155:104651.

[4]. Wang, Y., Hu, F., Wang, Y. (2023). Revolutionizing the Afterlife of EV Batteries: A Comprehensive Guide to Echelon Utilization Technologies. ChemElectroChem,11(4):1.

[5]. Lai, X., Huang, Y., Gu, H. (2021). Turning waste into wealth: A systematic review on echelon utilization and material recycling of retired lithium-ion batteries. Energy Storage Materials, 40: 96-123.