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Article

Discussion on Environmental Pollution Prevention and Resource Recycling of New Energy Vehicle Power Batteries

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Abstract: The issue of trashed power batteries in the market has gotten worse as the new energy vehicle sector continues to grow. Power batteries have entered a phase of rapid expansion. The national environmental protection sector has focused a lot of attention on the pollution that wasted batteries produce and the methods for preventing and controlling it. This study examines the risks that spent power batteries pose to the environment and public health, provides an overview of the fundamentals of spent battery creation and treatment, and focuses on assessing potential uses for spent batteries in recycling and in safe treatment systems. In an effort to offer more information and suggestions, it also projects the potential uses and real-world applications of power batteries in future energy vehicles.

Keywords: new energy vehicles; waste power batteries; environmental pollution prevention and control; resource recycling and utilization; prevention and control strategies

1. Introduction

New energy vehicles have become an important direction for addressing the emission and energy issues of traditional fuel vehicles. As the core component of new energy vehicles, power batteries play a key role in storing and releasing energy. However, as the new energy vehicle market expands, the issues of power battery recycling and reuse are also becoming increasingly prominent. In order to minimize environmental pollution, reduce resource waste, and support the development of sustainable energy transportation, this study intends to explore and investigate the recycling and reuse technologies of new energy vehicle power batteries. It offers solid support for further research in the area of power battery recycling and reuse by carrying out a thorough analysis of the physical properties, chemical makeup, technological difficulties, and solutions in the recycling and reuse process. (Mu et al., 2021).

2. Overview of Research on Power Batteries for New Energy Vehicles

The main mainstream power batteries in China used to be lead-acid batteries (LAB), lithium iron phosphate batteries (LFP), ternary lithium batteries, and fuel cells. LAB has the longest application history and features stable performance and high reliability; LFP batteries have experienced explosive growth in recent years, with a service life of about 5 years in electric vehicles. Lithium-ion batteries (LIBs) are currently the most popular type of new energy vehicle power battery because they combine several useful performance characteristics, including safety, recyclability, rechargeability, low-cost, high-energy conversion efficiency, and advanced manufacturing technology. Hydrogen fuel cells are an ideal clean energy source. Because they are non-polluting and have high energy density, they are considered an ideal solution for new energy vehicles. However, the technology is not yet mature, and it has not been widely promoted or applied currently.

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3. Environmental Pollution Prevention and Control of New Energy Power Batteries

3.1. Environmental Pollution from Waste New Energy Power Batteries

When used power batteries are disposed of improperly, pollution of the environment may result. Carbon in the anodes, organic materials in the electrolytes, and heavy metal components like Ni, Co, and Mn present in spent batteries can all have an adverse effect on the environment. Through leaching, heavy metals from spent power batteries can contaminate land and water sources before finally making their way into the human body and endangering health. Power batteries' electrolytes readily react with water to create toxic gasses like HF. Explosions or fire incidents may result from overcharging or other inappropriate use. Used battery disposal is expensive, and hand disassembly pollutes the environment greatly. An excess of pure hydrogen is given to the anode during fuel cell operation, and some unreacted H2 is left behind after the electrode reaction. It will pollute the environment, waste energy, and pose safety risks if it is released into the atmosphere directly. (Li and Ma., 2006) Therefore, from the perspective of environmental management and resource utilization, dismantling and recycling batteries from used new energy vehicles can not only reduce environmental pollution but also improve battery utilization efficiency and lower the cost of new energy vehicles.

3.2. Issues in the Prevention and Control of Pollution from Waste Power Batteries

(1) The implementation of full-process management of waste batteries is not feasible due to the lack of a well-established collection mechanism. (2) The methods for managing storage and transportation are insufficient. Waste battery storage and transportation pose serious environmental hazards, hence appropriate mechanisms for both storage and transportation management must be put in place. (3) The

management methods for recycling, ecologically safe treatment, and disposal are not reliable. The danger of environmental contamination can be increased by poor management in this sector, which can result in significant resource waste and possible pollution problems. To guarantee successful execution, management regulations necessitate collaboration between the supervisory, regulatory, and policy departments. They should also have the required management facilities and highly skilled staff. At present, the management and operational mechanism for waste batteries has not yet been formally established and put into operation. (Liu, Y and Xia, B. C,2003)

3.3. Analysis of Countermeasures for Pollution Prevention of Waste Batteries

For the sake of resource conservation and environmental preservation, spent batteries must be disposed of safely and used completely. Regulations for recycling management and useful implementation guidelines for discarded batteries must be developed. Waste battery recycling and reuse management should take into account a number of aspects, including the economy, industry development, technical advancement, and the environment. It is necessary to create management guidelines and particular workable implementation guidelines that take into account the national circumstances of China. From production to ultimate disposal, the full lifecycle of batteries encompasses the following stages: first, control at the source through management of the battery production process; second, transportation and storage management of waste batteries; and third, recycling and environmentally safe disposal of waste batteries. (Nie and Niu, 2000)

4. Recycling and Utilization of New Energy Power Batteries

4.1. New energy battery recycling technology

Power battery recycling technology is now dealing with a number of obstacles and development hurdles. First off, in terms of secondary utilization technology, only lithium iron phosphate batteries are currently capable of continuing to be utilized. The primary cause is that lithium iron phosphate batteries are not appropriate for new energy vehicles because to their relatively poor energy density and cycle life, but they

are appropriate for other applications like energy storage. But as the times have changed, ternary material batteries have progressively taken over the market for new energy vehicles, and their high energy density allows them to function well in the energy storage space. As a result, creating solutions for the repurposing of retired ternary material batteries will be a key area of future study. Second, increasing recycling efficiency and guaranteeing the purity of resource recovery are currently major concerns for technology pertaining to disassembly and recycling. Strict procedures and equipment support are needed for power battery disassembly in order to guarantee the effective and safe extraction of renewable resources. Disassembly technologies now require further development to increase processing efficiency and lower costs. (Lv, 2023)

4.2. Continuous technological innovation to extend battery life

Energy crises and environmental pollution issues can be significantly reduced by the creation and application of new energy power batteries. The environmental strain brought on by the widespread disposal of power batteries can be significantly reduced by technological advancements in automobile power battery research, such as prolonging battery life. Manufacturers of new energy power batteries should keep a careful eye on both local and global power battery trends, study new energy cars in-depth, and increase their efficiency and capacity to prolong battery life.

4.3. Improve the recycling and utilization system

To continually improve the recycling and utilization system for new energy power batteries, government departments should make focused and forward-looking policy suggestions based on the industry's development demands. To speed up the development of an effective recycling network, they should encourage battery manufacturers to adopt universal, standardized, and easily disassembleable product designs, make it easier for recycling service outlets for new energy vehicle power batteries to be shared, and set up standardized recycling protocols. Clear sanctions should be outlined, and industry oversight should be reinforced to stop small workshops from illegally recycling, reselling, and disassembling used power batteries, which could pollute the environment.

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5. Conclusion

The creation of new energy vehicle power batteries is happening quickly, and recycling used batteries and preventing pollution are essential for the long-term growth of the economy, society, and environment. There are still many problems with preventing environmental pollution, especially with regard to management regulations, implementation rules, processing technologies, and power battery recycling models, even though China's research on recycling waste new energy power batteries has greatly improved in terms of content, depth, and breadth and many policy supports have been given. Power batteries in cascade use, disassembly and recycling technology, increasing recycling efficiency, and guaranteeing the purity of recovered resources remain major challenges in resource recycling. For each of these problems, this report suggests appropriate actions. Thus, in general, China's new energy vehicles are still in the early stages of development and have a lot of room to grow. True 'zero-carbon' green travel is achievable in the near future with the ongoing development and enhancement of regulations for the recycling of new energy vehicle power batteries, continuous advancements in battery research and development technology, and the ongoing improvement of environmental protection measures.

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