Application of Nanotechnology in New Energy Batteries

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Abstract: With the progress of human science and technology and the development of society, more and more high and new technologies have been studied and developed, what's more, the research in the field of new energy is also deepening. In recent years, from environmental protection and energy saving, the development and application of new energy batteries are very rapid, and more and more new materials and technologies are used in the manufacture of new energy batteries. As one of the innovative technologies with remarkable application advantages, nanotechnology has been applied more and more widely and diversified in new energy batteries. Based on the current domestic and international research on the application of nanotechnology in new energy batteries, this paper mainly analyses the application of nanotechnology and nanostructured materials in solar new energy batteries, aiming to provide more inspiration for the development of new energy battery industry and the innovative application of nanotechnology in China.

1. Introduction

With the change of social production environment and the deepening of technological development and economic progress, the demand for petroleum, coal, electricity and other resources in daily life has gradually increased. However, the environmental problems caused by the continuous consumption of such non-renewable resources and fuel energy are warning us that more green, environmentally friendly and energy-saving energy needs to be developed and used. In such a demand for energy and environmental development, the application of nanotechnology in new energy batteries has brought us new thinking about the application of new energy batteries.

2. Overview of Nanotechnology

2.1 Concepts of Nano-Materials and Nanotechnology

Nano-materials are ultrafine materials with grain sizes ranging from 10 to 9 M. In terms of physical and chemical properties, the structure of Nano-materials determines that they are quite different from large-scale materials. These differences make Nano-materials have many specificities. When the particle size of the material is in nanometer scale, some new characteristics will appear in the magnetic, thermal, acoustic, optical and electrical properties of the material, such as macroscopic quantum tunneling effect, small size effect, quantum size effect, etc.[1]. The aggregation of these effects results in the specificity of the properties of Nano-materials. Nanotechnology is a kind of technology that combines these characteristics with the manufacturing content according to the characteristics of Nano-materials, which belongs to the very advanced type of science and

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technology at present.

2.2 Advantages of Nanotechnology in New Energy Batteries

In the new era of production concept of green environmental protection and energy conservation, new energy batteries have begun to be applied so as to solve the problems of our daily life and social infrastructure development. The characteristics of new energy batteries, such as low consumption, high efficiency and energy saving, are in line with the pursuit of sustainable development of human beings, so they are widely favored. On the road of application optimization of new energy batteries, Nano-technology provides convenience for material application and technology optimization of new energy batteries. Nanotechnology and Nano-materials are widely used in new energy batteries such as Nano solar batteries, crystal silicon solar batteries, Silicon-based multi-interface solar batteries and so on. The application of nanotechnology in new energy batteries can not only improve the energy supply efficiency of new energy batteries, but also reduce the manufacturing and production costs of new energy batteries. Excellent performance in efficiency and economy. Because of the remarkable advantages of nanotechnology, it is necessary to explore its application in new energy batteries.

3. Overseas Research on the Application of Nanotechnology in New Energy Batteries

With the help of the development of science and technology, nanotechnology has been more and more widely used in new energy batteries. Relevant researchers at home and abroad are constantly exploring the innovative development of nanotechnology in the application of new energy batteries. In the United States, researchers at the University of California, Los Angeles, have studied the preparation of a composite nanomaterial by adding nanoparticles into magnesium and zinc alloy solutions and fully fusing them. With the advantages of light weight, strong ruggedness, good ductility and high temperature resistance, this material can be used in the manufacture of new energy batteries. In Stanford University, researchers used nanotechnology to develop technologies that could prevent the explosion of lithium-ion batteries. With this technology, lithium-ion batteries can be shut down and restarted in repeated heating and cooling cycles without affecting battery performance. Moreover, Nano-solar batteries designed by scholars and researchers at the University of Maryland as a kind of high-efficiency new energy battery, under the support of nanotechnology, the efficiency of the battery can be increased by 40% compared with traditional batteries. What's more, the process of using this technology is not complicated, and only a small single device is needed to realize the power conversion. The research and development of nanotechnology and Nano solar cells is a breakthrough and subversion to the new energy industry of solar energy. After putting nanostructured solar batteries into use in natural environment, 35.5% efficiency can be achieved with proper built-in focusing. These innovative applications of nanotechnology and Nano-materials in solar batteries and lithium-ion batteries have brought important inspiration to the innovative development of new energy batteries. The application of nanotechnology in new energy batteries has made breakthroughs both at home and abroad.

4. Application of Nanotechnology in New Energy Batteries

Among many new energy batteries, crystalline silicon solar batteries have a wide range of effects and applications. The important applications of nanotechnology are mainly manifested in the following aspects.

4.1 Promoting Spectral Absorption of Crystalline Silicon Solar Batteries

Crystalline silicon solar batteries are widely used in new energy batteries. Solving the problem of light absorption has always been the key to improve the photoelectric efficiency of these new energy batteries. Using nanotechnology to optimize such crystalline silicon solar cells, silicon nanoparticles can be dispersed in isopropanol, and then dispersed in solar cells. With the evaporation of alcohol, silicon Nano-materials will adhere to the surface of solar cells with the

gradual decrease of isopropanol. With the help of this nanotechnology, silicon nanoparticles will adhere to the surface of solar batteries. It can effectively enhance the output power of the converted power in the ultraviolet spectrum range, and achieve about 60% improvement of the output power of the power when the technology is mature. At the same time, it can realize the heat in the conversion process and effectively prolong the service life of solar cells.

4.2 Improving the Anti-Reflection Capability of Crystalline Silicon Solar Cells

Improving the anti-reflection capability of new energy batteries, such as crystalline silicon solar batteries, is the key to upgrading the technology of new energy batteries. Nano-crystalline coating technology in nanotechnology can absorb sunlight in all directions by coating Nano-crystalline polymer on the surface of crystalline silicon solar cells. It can even replace the solar tracking system in the case of reasonable use. In order to enhance the anti-reflective ability of crystalline silicon solar batteries, the coating is a kind of anti-reflective coating made of polyurethane material. In addition to enhancing the anti-reflective ability of new energy batteries, it can also increase a certain amount of battery power.

In addition, Nano-materials also have great application value in silicon-based multi-interface solar cells. In the past, most of the conductors used in new energy cells such as crystal silicon solar cells are silver conductors. After nanotechnology and Nano-materials are put into use, new Nano-materials can be used to make Nano-wires, which greatly reduces the cost. The production cost of new energy batteries is very important for the popularization and use of new energy batteries. It overcomes the problem of high production cost of new energy batteries and provides a good basis for the development of new energy batteries in the future.

5. Conclusion

To sum up, nanotechnology has a wide range of applications in new energy batteries. In the future research and upgrading of new energy battery technology, more in-depth research should be conducted on the innovative application of nanotechnology, so as to make the wide production and use of new energy batteries possible.

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References

[1] Gao Yumeng. Application of Nanostructured Materials and Technologies in Solar Batteries. [J].Information Recording Materials, 2018, 19(12): 44-45.

[2] Liu Chunna. Application of Nanotechnology in New Energy Batteries [J]. Power Supply Technology, 2016,40 (02): 239-240.

[3] Zhang Yucheng, Pang Hongjie, Guo Qunchao, Wang Lingyun, Zhang Bingqing. Application of Nanotechnology in Crystalline Silicon Solar Batteries [J]. New Material Industry, 2011 (12): 49-52.