# Water Zinc-Ion Battery Electrode Protection Coating

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**Abstract.** The purpose of this paper is to analyze the water zinc ion battery and put forward the improvement plan. Related to the current environmental issues and people's common goals, new energy vehicles into the public's vision, in contrast, water-zinc batteries in the current electric vehicle industry occupies an important position, its high performance, safety, rechargeable, cost advantages and environmental sustainability and other characteristics make it an ideal power choice for electric vehicles. With the development of science and technology, electric vehicle technology is more and more advanced, this paper focuses on the analysis and prospect of water-zinc battery coating technology, such as battery protective film technology can improve battery life, safety and battery performance. We think the future direction of the technology may include higher temperature resistance, better fire- and flame-retardant performance, lower cost and longer service life, so that electric vehicles will also be more environmentally friendly and more efficient.

**Keywords:** Electric vehicles, Water-based zinc battery, Electrode protection coating.

## 1. Introduction

Nowadays, people's attention to the environment is deepening, electric vehicles have gradually become daily travel tools, and the demand for lithium batteries related to electric vehicles has increased significantly, which has brought great development prospects for related industries, and at the same time, the shortage of lithium resources is also increasing [1]. In order to alleviate the cost increase caused by the shortage of lithium resources, new battery technologies are gradually paid attention to [2]. Water zinc-ion batteries have received special attention because of their good cost advantage and environmental friendliness. However, the negative electrode corrosion, battery gas production, dendrite growth and other problems in water zinc-ion batteries seriously affect the cycle stability and service life of water zinc-ion batteries, and cannot meet the needs of industrialization.

At present, the methods for inhibiting the growth of zinc dendrites and side reactions are mainly from the aspects of electrolyte modification and coating modification [3]. Among them, the modification cost of the negative coating is low, the process is simple, and the pollution is low. However, the negative coating protection often brings about problems such as low ionic conductivity and increased interface polarization, which damages the practicality of the battery.

## 2. New Energy Use and Environmental Impact

### 2.1. Fuel Status and Impacts

The burning of fossil fuels produces a large number of greenhouse gases, the most important of which is carbon dioxide, which will lead to global climate change and environmental pollution. The rise of global temperature will cause a series of impacts such as sea level rise and extreme weather, which will affect the stability of human society and ecosystem. Environmental pollution can also directly harm human health and ecosystems. For some countries and regions, dependence on fossil fuels may also lead to problems of energy security and economic stability, fuel vehicles have been the means of travel that people rely on in the past, and large amounts of fuel consumption and greenhouse gas emissions have brought great pressure to the environment. Industrial and transportation activities produce large amounts of greenhouse gases and other pollutants, which seriously affect air quality and climate change. These pollutants, including carbon dioxide, nitrogen oxides, sulfur oxides and particulate matter, are harmful to human health and ecosystems and

contribute to global climate change, increasing the frequency and intensity of climate disasters and extreme weather events. Industry and urbanization have also led to massive land destruction, deforestation and biodiversity loss. In order to support the development of industry and urbanization, large-scale land transformation and urban construction have been carried out in many regions, resulting in a large amount of land destruction and ecosystem imbalance.

### 2.2. Some New Energy Vehicles

With the continuous development of China's automotive field, fuel vehicles are no longer the only choice for people, the new energy industry has developed rapidly in recent years, and has constantly become a new target for people, and hydrogen energy vehicles are also a new energy, he replaced the original fuel and electric drive through hydrogen energy as the main power [4].

#### 2.2.1. Hydrogen electric vehicles

The advantages of hydrogen electric vehicles. First of all, hydrogen energy as a visible fuel energy, so it can be as fast and convenient as refueling a fuel vehicle, can be as simple as refueling, and not like electric vehicles need to look for charging piles everywhere, not only the charging time is long, and there may even be a variety of queues and charging pile damage. Energy saving and environmental protection is also a key point of hydrogen energy vehicles, through the design ideas of hydrogen energy operation displayed by scientific research institutions, we can understand that hydrogen fuel in all the operation process, only consumes oxygen air this gas resource, and will not exhaust gas like fuel vehicles, causing air pollution, and will not consume additional resources in other aspects. It can be said that the four-word policy of energy conservation and emission reduction has been truly achieved. At the same time, there is a more important factor is that the engine ideas of hydrogen energy vehicles and normal fuel vehicle engines are consistent, the biggest advantage in this regard is that the fuel engine can be directly converted into a hydrogen engine to adapt to hydrogen energy after a simple modification, which can greatly improve the transformation and input costs of the original automobile companies, and the price is more friendly to the people [5].

This kind of new energy vehicle also has its disadvantages. Although hydrogen energy can be seen everywhere in our lives, it is not so easy to obtain, and it needs to be obtained by a large number of chemical methods, so the technology in this area still needs scientists to tackle the problem, if the ordinary electrolytic method is used, then the loss in this area is very large, and the loss is not worth the loss. Secondly, the production of hydrogen batteries is insufficient, in this respect, it is not to say that the production cannot be produced, but the special substance of the catalyst for hydrogen energy batteries is relatively scarce, that is, metal platinum, which has led to the development of hydrogen energy batteries has been limited to a certain extent, and some vehicle manufacturers can not large-scale production.

#### 2.2.2. Methanol vehicles

Methanol vehicles are also the current hot new energy vehicles, replacing petroleum fuel with methanol has been applied in foreign countries for many years, and the control system technology of methanol vehicles has been very mature. Like ethanol, methanol has a low calorific value, but it has a high-octane number and also contains oxygen, and special engines are needed to burn methanol. However, unlike ethanol, methanol itself is toxic, has a corrosive effect on non-ferrous metals, and has a swelling effect on rubber parts, so it is necessary to design the engine and the fuel distribution system on the car, which also leads to the complexity of the process compared with electric and hydrogen energy, and the popularity is relatively low, at the same time, the process is also applied to ships. This specially designed vehicle for burning methanol fuel is called a methanol vehicle.

High calorific value, high energy efficiency, high explosive power and low carbon dioxide emission is the advantages of methanol. The calorific value ratio of methanol and gasoline is about 2.2:1, which is more than twice higher. Compared with gasoline vehicles, the energy efficiency of methanol vehicles can be increased by about 21%, while the carbon dioxide emission can be reduced by about 26%. Unlike hydrogen, methanol is liquid at room temperature and pressure, making it safer

and more convenient in storage, transportation and use. The disadvantage is that 80% of methanol comes from coal, which cannot be said to be absolutely environmentally friendly and has limited resources. In the domestic methanol production capacity, coal methanol production capacity accounts for 80%.

### 2.3. The Importance of New Energy Vehicles

The first is environmental protection, traditional fuel vehicles use fossil energy, emit a lot of greenhouse gases and air pollutants, causing serious pollution to the environment. The use of clean energy (such as electric energy, hydrogen energy, etc.), zero emission or low emission, can significantly reduce exhaust emissions and air pollution, reduce the impact on the atmosphere and ecological environment, is conducive to improving air quality, reduce greenhouse gas emissions, and protect the ecological environment. Second is energy security, the energy that new energy vehicles rely on mainly comes from renewable energy, such as solar energy, wind energy, etc., and does not rely on imported oil and gas and other non-renewable energy. This will help reduce dependence on foreign energy, improve the stability and sustainability of energy supply, and enhance national energy security. At the same time, the development of new energy automobile industry can promote the development of green economy, drive the development of the corresponding industrial chain, and create more job opportunities. At the same time, the promotion and use of new energy vehicles can also reduce the demand for oil, reduce the pressure on oil imports, reduce the trade deficit, and contribute to the sustainable development of the national economy. New energy vehicles are the combination of traditional vehicles and advanced technology, which has promoted the innovation and development of electric technology, intelligent technology, autonomous driving technology and other fields. The rise of the new energy automobile industry has promoted the breakthrough and progress of related technologies, which is of great significance to enhance the country's scientific and technological innovation ability and competitiveness. In short, the promotion and application of new energy vehicles is not only the need for environmental protection, but also an important means to promote economic transformation, improve energy security and promote scientific and technological innovation. On the road to sustainable development, new energy vehicles play a vital role [6].

## 3. Water Zinc-ion Battery

Since the 20th century, with the arrival of the industrial revolution and the scientific and technological revolution, the rate of energy consumption is rising exponentially, of which the most widely used field is electric energy. However, compared with the power stability of thermal power stations, the power of hydraulic, wind and solar power stations are unstable, vulnerable to natural factors and uncontrollable, seriously affecting the application of the above energy, large-scale energy storage power stations have become one of the solutions. Water zinc-ion battery (AZIB s) is composed of metal zinc negative electrode, water electrolyte and positive active material, as shown in fig.1[7]. Due to its advantages of low price, safe use and high energy conversion efficiency, it is expected to become a solution for large-scale energy storage power stations in the future.

The water-based zinc battery is a kind of energy storage battery composed of zinc negative electrode, manganese dioxide positive electrode and saturated $NaClO_4$ aqueous solution. It uses water as a medium to react, does not contain any heavy metal elements, is an environmentally friendly energy storage battery. In a water-based zinc battery, the negative zinc electrode gradually dissolves while a reduction reaction occurs on the positive manganese dioxide electrode, splitting water into hydrogen and oxygen. These electrons form a current that passes through an external circuit to output electrical energy.

The characteristics of water-based zinc batteries are mainly reflected in the following aspects. Water-based zinc batteries have a high energy density, which is 2 to 3 times higher than traditional dry batteries. Water-based zinc battery is a lightweight and environmentally friendly energy storage device because it uses water as a medium and does not contain harmful substances. The life of water-

based zinc batteries is very long, which can reach more than 5 years. The manufacturing cost of water-based zinc batteries is lower and the price is more affordable. Because of the above excellent performance of water-based zinc batteries, they are widely used in mobile electronic equipment, vehicle electronic equipment and military equipment.

Specifically include the following aspects. Lithium-ion batteries have been widely used in power tools, such as electric drills, electric hammers, chainsaws and so on [8]. Water-based zinc batteries can be used as an alternative to car batteries, playing an important role in car starting, power supply and so on. Water-based zinc batteries are used in a wide range of military equipment, such as submarines, missiles, rockets, etc. In short, the water-based zinc battery is a kind of energy storage battery with the advantages of high energy density, lightweight and environmental protection, long life and low cost, and is widely used in various fields.

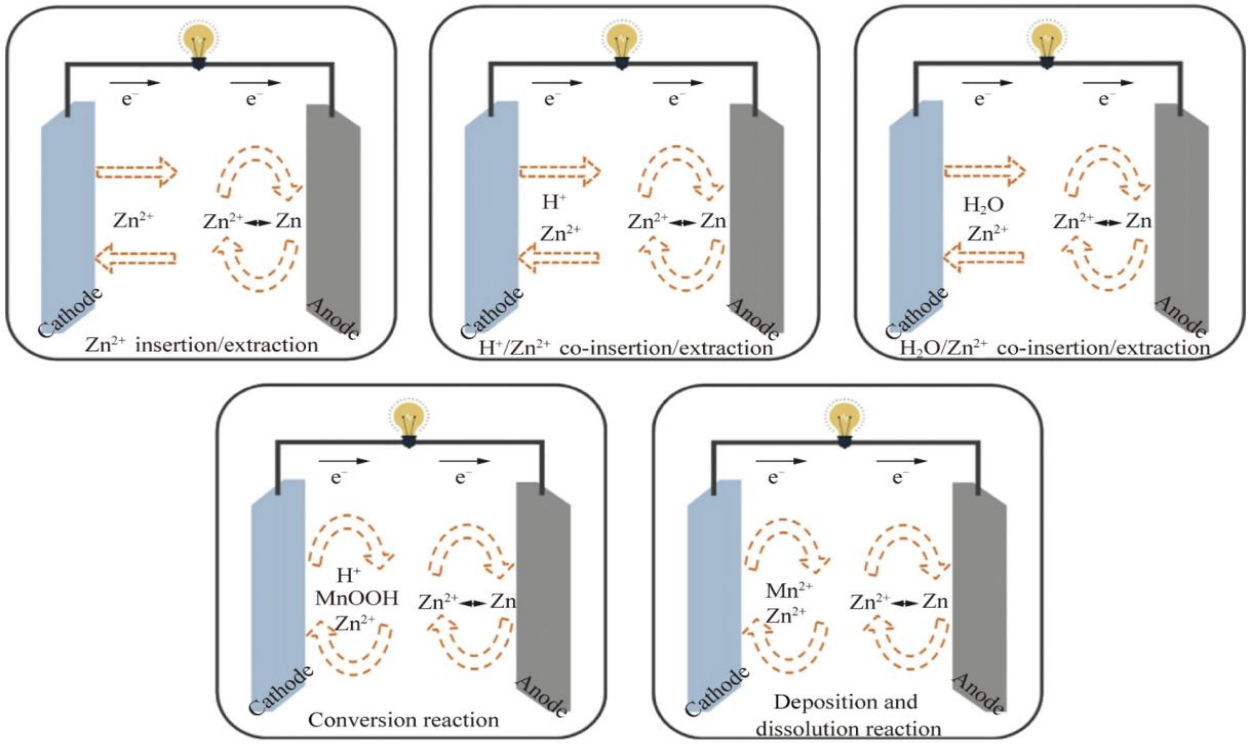


**Figure 1.** Water zinc battery working principle [9]

## 4. Diaphragms of Zinc-ion Batteries

The current diaphragms used in zinc-ion batteries (such as glass fiber diaphragms) are easy to fail under dendrite destruction, and their thickness of up to hundreds of microns will seriously reduce the volume energy density of the battery, while extending the ion transport distance, increasing the internal resistance of the battery and resulting in poor battery rate performance [10]. In contrast, the diaphragm thickness of commercial lithium-ion batteries is only about 25 μm. Therefore, it is urgent to develop ultra-thin membranes suitable for zinc-ion batteries, but how to avoid the failure of ultra-thin membranes caused by zinc dendrites is still a challenge.

### 4.1. Improved Method

At present, the improvement of the water zinc battery protective coating is mainly concentrated in the following aspects. The traditional zinc battery protective coating generally uses organic substances, but its corrosion resistance and stability are relatively poor. In recent years, some research institutions have begun to try to use inorganic materials, such as oxides, phosphates, etc., to improve the durability and stability of protective coatings. By adjusting the structure of the protective coating, its barrier properties and conductive properties can be improved, thereby slowing down the self-

corrosion and electrode reaction speed of the zinc battery. Common structural optimization methods include nanocomposite coating and multilayer thin film structure. In addition to the basic corrosion protection function, the future water zinc battery protection coating may also introduce other functions. For example, increasing superhydrophobicity makes the battery better able to cope with wet environments; Add antibacterial ingredients to prevent bacterial growth; Control dissolution rate, extend battery life, etc.

### 4.2. Goal of development

The future development of water zinc battery protection coating may be in the following directions. High performance: Improve the corrosion protection performance and stability of zinc battery protection coating, so that it can be used under harsher environmental conditions, and extend the battery life. Choose more environmentally friendly materials and minimize environmental pollution. For example, using degradable materials or recycling waste protective coatings reduces resource waste. Develop a protective coating with self-healing ability, that is, when the coating is damaged, it can automatically repair, delay or reduce further corrosion and damage. By optimizing the coating preparation process, improve production efficiency, reduce production costs, and promote the application and promotion of the water zinc battery protective coating.

In short, the improvement and development of the future water zinc battery protective coating will focus on the exploration of improving performance, environmental protection and sustainability, self-healing function and cost reduction, and will be widely used for zinc batteries.

## 5. Conclusion

The future outlook of the electric vehicle industry is very broad, with the continuous progress of science and technology, the technology of electric vehicles is also constantly improving. In the future, it is expected that more efficient battery technologies will emerge, such as all-solid-state batteries, super capacitors and so on, which will significantly improve the range of electric vehicles, shorten the charging time, and enhance the safety performance. At the same time, the development of intelligence will also become an important trend in the electric vehicle industry, such as autonomous driving technology, remote monitoring and so on. The increasing awareness of climate change and environmental protection will drive the continued growth of the electric vehicle market demand. The government's support policies for electric vehicles will also be further strengthened, such as reducing restrictions on car purchases and increasing subsidies. In addition, the performance and price of electric vehicles will gradually approach or exceed that of traditional fuel vehicles, attracting more consumers to buy. In the future, the scale and perfection of the electric vehicle industry chain will be further expanded and optimized. From battery production to charging infrastructure construction, the entire industry chain will be more perfect. At the same time, the relevant supporting services and subsequent markets will also usher in rapid development, such as the construction of electric vehicle charging network, second-hand electric vehicle trading. Regarding the future outlook of water zinc battery protective film technology, it can be expected that with the rapid development of the electric vehicle industry, the requirements for battery technology will become higher and higher. Battery protective film technology plays an important role in improving battery life, safety and performance. Future directions may include higher temperature resistance, better fire- and flame-retardant performance, lower cost and longer service life. However, the specific technological development path needs to be determined according to market demand and research and development progress.

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