

# Development Status and Application Research of Rare Earth Permanent Magnet Motor

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**Abstract:** Since entering the new century, the efficient use of energy has become the key to the development of every country in the world, so it is an inevitable trend to create a resource-saving society. So many fields are also actively exploring new environmental protection technology, and in the development process of China's industrial industry, the further use of rare earth permanent magnet motor can better realize the full use of energy. Therefore, this paper will analyze the development of rare earth permanent magnet motor and the overall application trend.

**Keywords:** Rare Earth Permanent Magnet Motor; Development Status; Application Research

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China is very rich in rare earth resources, especially the annual output of rare earth resources is the first in the world. Rare-earth permanent magnet motors are characterized by high efficiency, compact appearance and stable operation. They cover almost all kinds of motors in the market. Therefore, the comprehensive development of rare earth permanent magnet motor will do good to our country's resources protection and development of many industries.

## 1. Analysis of operation principle of rare earth permanent magnet motor

### 1.1 Introduction of the whole structure of rare earth permanent magnet motor

In view of the current development of China's industry, the rare earth permanent magnet motor (REPM) is a newly developed and deeply applied specialized facility in the new century. Therefore, the understanding of the structure of REPM motor should be strengthened, which is the important foundation for the development direction of rare earth permanent magnet motor. The core of the rare earth permanent magnet motor is to operate with the magnetic field as the core. The rare earth permanent magnet motor can realize the effective conversion of mechanical energy and electrical energy, rare earth permanent magnet motor (REPM) is an advanced electromagnetic device in modern industrial facilities. The general type of rare earth permanent magnet motor is shown in **Figure 1** below.

There are some differences between the rare earth permanent magnet motor and other facilities. As shown in **Figure 2** below, it is the rare earth permanent magnet motor internal structure profile. The rare earth permanent magnet motor first converts the air gap magnetic field related to industry into the air gap magnetic field which needs permanent magnet to produce, and then enters the motor's winding current from the inner layer. The core function of the device is to provide energy to effectively maintain the normal movement of the current, so the whole motor is often composed of two independent modules which are stator and rotor respectively. In this case, the stator is the fixed part of the operation process of the motor. The stator is formed by the symmetrical arrangement of two modules.

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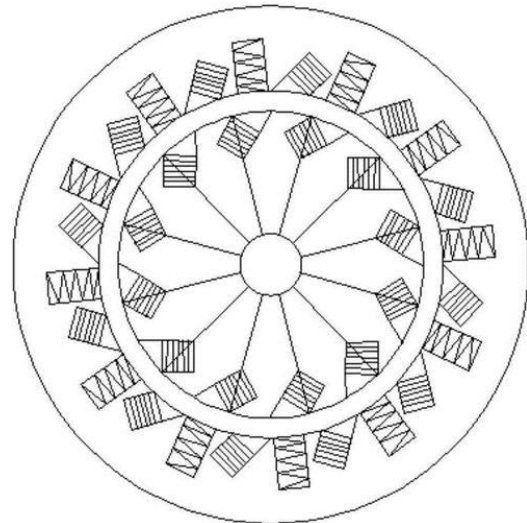
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**Figure 1.** Appearance display of rare earth permanent magnet motor.



**Figure 2.** Internal structure profile of rare earth permanent magnet motor.

## 1.2 Introduction of operation principle of rare earth permanent magnet motor

Compared with the traditional industrial facilities, rare earth permanent magnet motor is a relatively new facility, and it can provide very excellent energy, The biggest difference from the traditional motor is that the core of the operation of the rare earth permanent magnet motor is a kind of electromagnetic force which is perpendicular to each other. This kind of electromagnetic force is produced by the interaction between the magnetic field of the stator and the rotor. This kind of electromagnetic force core is the vertical function which unfolds in the plane, and the function unfolds may maintain the normal operation of the motor better. The electromagnetic force is formed by the interaction of the magnetic field and the electric current in the magnetic array. Especially when the electromagnetic torque suppresses the inertia of the rotor itself and the permanent magnet rotor also produces damping torque, the motor will start to operate.

## 2. Development status of rare earth permanent magnet motor

### 2.1 Characteristics of high efficiency, environment friendly and energy saving

China's rapid economic development brings about the biggest negative effect is the serious loss of energy, and China's industry needs to further comprehensive development, so rare earth permanent magnet motor is born. The emergence of rare earth permanent magnet motor and its deep application have laid a solid foundation for the green development of China's industry. Compared with other traditional motors, rare-earth permanent magnet motors are endowed with unique advantages. The overall operating efficiency of the rare earth permanent magnet motor is higher than that of the motor of the same level, and the operation of the rare earth permanent magnet motor is more environmentally friendly. The core of rare-earth permanent magnet motor is to operate by electricity, so it can be said to be the more efficient green product at this stage.

### 2.2 Relatively high performance

As for the rare earth permanent magnet motor, compared with the similar motor, it not only has the advantages of energy saving and high efficiency, but also has the characteristics of high efficiency. High efficiency can be said to be an advantage that can never be ignored in the development of rare earth permanent magnet motors, especially for some traditional motors with older technology whose overall operation can not fully meet the basic needs of China's current industrial production. If large-scale production is carried out, it will often cause great energy consumption, and also

invisibly trigger the related enterprise's input cost to further increase. When rare earth permanent magnet motors are used in some fields, their speed regulation is nearly 10,000 times higher than that of traditional motors. Meanwhile, the precision of operation is well guaranteed, and the total error is usually not less than 0.1% .

### **2.3 Architectural diversity**

The performance of rare earth permanent magnet motor is not only very good in the efficiency link. Because of its diversified overall structure, rare earth permanent magnet motor can be used in different fields of industrial production. Compared with the traditional motor, the rare earth permanent magnet motor is more widely used due to its multiple structure characteristics.

## **3. Research on the application of rare earth permanent magnet motor**

### **3.1 Use of household appliances**

It is well known that rare earth permanent magnet motors have been widely used in the field of aerospace in China. Besides, rare earth permanent magnet motor has been fully applied in the daily use of the most frequent household appliances. It can be said that the use of rare earth permanent magnet motor has gradually entered into people's daily life. For example, the brushless DC motor of rare earth permanent magnet motor can be used as a new generation of variable speed refrigeration technology. Now many countries at home and abroad use rare earth permanent magnet motor as an important basic refrigeration component that is used in household appliances such as refrigerators and air conditioners.

### **3.2 Application in the shipping area**

Besides the in-depth use in the daily household appliances, rare earth permanent magnet motor has also played a better role in the ship field at the same time. At present, the worldwide shipping industry also uses rare earth permanent magnet motors to carry out its daily operation. This is because rare earth permanent magnet motors are a kind of ship propulsion system with high efficiency. Most of the usual ship propulsion systems are driven by full-speed power, and with the appearance and further development of rare earth permanent magnet motors, however, the ship propulsion mode of rare earth permanent magnet motors is more efficient and energy-saving, at the same time, the overall technology is also increasingly mature.

## **4. Conclusion**

Although rare earth permanent magnet motor is the product of scientific development in the new century, its overall technology has been very perfect and mature, and still has a very high room for improvement. It can be said that rare earth permanent magnet motor is a landmark product. So in the future development process of rare earth permanent magnet motor, we need to further effectively integrate it into more industry areas, so as to better achieve the dual effects of efficient operation and environmental protection.

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