Research on Improvement of Temperature Rise of New Energy Vehicle Generator

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Abstract: New energy vehicles have gradually become one of the key parts in the development of the automotive field under the background of the new era. It is also to comply with the requirements for environmental protection. Therefore, this article analyzes the reasons for the excessive temperature of the generators of new energy vehicles, and proposes targeted improvement strategies in combination with the actual situation. While ensuring that the output torque of the new energy vehicle generator itself can be effectively increased, it can ensure that the basic requirements of the new energy vehicle to the greatest extent.

1. Introduction
In recent years, with the continuous deepening of energy conservation and environmental protection concept, brand new requirements have been put forward for the various industries. Cars have gradually become an essential part of people’s daily life. However, the increase in vehicle exhaust emissions has caused serious pollution effects on the ecological environment. It is also under this situation that new energy vehicles are being developed. Compared with conventional vehicles, the most obvious difference between new energy vehicles is that new energy vehicles have added high-voltage drive systems. The drive system has always been regarded as one of the indispensable and important parts. Since the system itself is the main unit of the power output of the entire vehicle, it can also be directly referred to as the “electric vehicle” “hear” part. From this it can be seen that the importance of this system. The system itself occupies a relatively large position in the entire new energy vehicle as one of the core components. Once the motor has problems such as excessive temperature during operation, it will inevitably directly affect the power performance of the entire vehicle. It will directly affect the overall driving experience, and it may also cause serious accident in severe cases.

2. Temperature rise of new energy vehicle generators
In order to analyze the temperature rise problem of new energy vehicle generator in more detail, this paper combines with the generator installation of a new energy vehicle. As a case study, the generator is usually installed directly between the front compartment of the car, the engine and the gearbox, as shown in figure 1.
When analyzing the installation of the generator of a new energy vehicle, it is not difficult to see if the clutch between the motor and the gearbox is frequently disconnected and engaged. Or the engine will produce very serious heat energy when gasoline burns. The entire ambient temperature of the front cabin is generally higher. When the motor realizes normal operation, its own overall working environment is relatively harsh, and it is also affected by space constraints. Although it combines the analysis with the actual situation, it is found that the heat sink is designed outside the motor itself, and the external heat dissipation is appropriately increased.

However, in practice, since the ventilated cooling is not used forcibly, the channels and capacity emitted by the motor itself will be severely restricted. Over time, the temperature of the stator and rotor inside the motor will generally rise. If the motor temperature is too high or overheated, it will inevitably lead to lower power performance. The overall comfort will be very poor, and the hybrid mode will gradually lose its due effect and function. When the motor temperature rises to about 140 degrees Celsius, the layer controller will directly enter the state of continuously reducing power. The battery power corresponding to it will gradually decrease, and in serious cases, it may directly lead to many problems such as high voltage power failure.

When combined with the current status of the use of new energy vehicle generators, it is found that the generators are directly processed by NdFeB in most cases. When this type of material is actually used, its most obvious feature is that the magnetic energy product is relatively high and the volume is relatively small. However, since this type of material is relatively sensitive to temperature, it is easy to generate a very serious inrush current. Due to the impact of the impact current, the armature reaction produced by itself will directly cause its own irreversible demagnetization, and the overall magnetic loss is relatively large. When performing combined analysis with the actual situation, it is necessary to ensure that the motor itself can work under the Curie temperature point. Normally, if the motor is in the range of 150 degrees Celsius, it can be regarded as being in the normal operating range. The permanent magnet material itself is bound to be affected by temperature, and the final result is that the magnetic energy will gradually decrease, and the overall efficiency of the motor cannot be improved. The output energy of the battery itself cannot make up for the entire consumption. Over time, the SOC will become lower and lower, and the entire output torque of the motor will be severely restricted, resulting in excessive energy consumption. During the construction and specific application, if its own power operation cannot be effectively guaranteed, the overall power of the air conditioner will become lower and lower. If the user feels that the air conditioner is no longer cooling, it means the high voltage of the
motor has suffered a serious power failure, and the car even will stop.

3. Causes

3.1 Control
When combined with the analysis of the temperature rise of the new energy vehicle engine, it is not difficult to see that in practice, the engine and the clutch cannot achieve accurate measurement and effective control in terms of heat generation. Therefore, when predicting the working temperature of the front compartment of the car in advance, it is about 85 degrees Celsius. The entire working temperature of the motor is set scientifically and reasonably, and the protection threshold of the entire working temperature is controlled at 120 degrees Celsius. However, it is found that the actual working temperature of the entire front compartment has reached 105 degrees Celsius, and the temperature protection threshold can be effectively increased in the later stage, generally to 140 degrees Celsius [1]. It is necessary to effectively adjust the idling power generation speed, generally starting from 1000r/min and increasing it to 1400r/min. Although the power generation operating point of the entire motor will be affected to a certain degree, and the power generation efficiency will be effectively improved, the frequent power failure has not been effectively dealt with in practice.

3.2 External working environment
It is well known that when the engine is in the working state, the clutch will show a frequent state of absorption. This state of heat can not be avoided. The generator is usually at the bottom of the radiator, and the car will enter the corresponding front cabin after the hot air of the radiator. Under this situation, the working environment temperature of the generator will continue to rise, the space of the front cabin is too compact, and the whole heat dissipation improvement space of various types will also be seriously restricted. It can be seen that because the external working environment is seriously affected and threatened, it is impossible to optimize the structure of the front cabin to improve the external working environment of the motor.

3.3 Electromagnetic design
If the motor is running at low speed, its whole operation efficiency is generally low. However, when combined with the actual situation, it is not difficult to see that the motor system in the whole operation can meet the basic requirements of the current vehicle in the driving. It can be seen that one of the main reasons for the heating up of new energy vehicles is the lack of scientific and reasonable electromagnetic design, which leads to overheating and many other problems.

3.4 Magneto-resistive material for stator punch
Combined with the actual situation, it is found that the stator silicon steel sheet material of motor can be replaced in practice. It can change from the B35AV1900 to the B274AHV1500t0 deal with the corresponding iron consumption reduction treatment. However, the calorific value of the motor at low speed does not show obvious control effect [2]. It can be seen that there are many reasons for the heating up of new energy vehicle generators at present, so it is necessary to take targeted measures to achieve good improvement effect.

4. Solutions
It is time-sharing combined with the current temperature rise problem of the generator of a new energy vehicle. It can deeply understand many existing reasons, and analyze many problems such as the poor internal electric heating capacity of the motor. In view of these problems, it can continuously strengthen the thermal conductivity of the heat dissipation channel to achieve improvement and optimization, so that the effective control of the internal temperature of the motor can be ensured to the greatest extent.

First of all, the end positions of the stator windings, as well as the corresponding stator slots, iron cores, etc., are properly poured with thermally conductive glue. The fundamental purpose is to ensure
that the thermal conductivity of the heat conduction path can be strengthened [3]. The vacuum drying process is to be carried out immediately. The fundamental purpose of this is to ensure that the air gap in the slot can be effectively controlled to the greatest extent, so that the contact area between the winding and the stator silicon steel sheet can be effectively increased, which is beneficial to ensure that the heat conduction efficiency of the winding in the slot.

Secondly, when dealing with the temperature rise problem of the generator of a new energy vehicle, the stator armature winding should be effectively controlled, and the number of coil conductors should be appropriately increased to ensure that the cross-sectional area of the coil can be effectively increased to the maximum extent. This is to ensure effective control of the winding resistance in practice and try to avoid the increase in heat generation.

It can be seen that various different types of methods are reasonably introduced and applied. Based on the existing improvement measures, the prototypes are made reasonably, and a total of 4 sets are produced for targeted testing and analysis. The final improvement measures and the overall test results are shown in table 1 and table 2.

Table 1. Implementation of 4 prototypes and improvement measures

| Prototype | Implementation of improvement measures |
|-----------|----------------------------------------|
| Prototype 0 | Original machine before improvement |
| Improved prototype 1 | On the basis of prototype 0, the thermal conductivity of motor end is 0.6. |
| Improved prototype 2 | The new prototype is made by immersion, the heat conduction coefficient glue is 1.6 |
| Improved prototype 3 | On the basis of the glue filling of the prototype 0, the motor adds 2 wires per turn coil and 44 wires per slot |
| Improved prototype 4 | Water cooling prototype, increase heat dissipation channel |

Table 2. Statistical table of test results of prototype

| rotation rate (r/min-1) | prototype0 (N·m) | prototype1 (N·m) | prototype2 (N·m) | prototype3 (N·m) | prototype4 (N·m) |
|------------------------|------------------|------------------|------------------|------------------|------------------|
| 1000                   | 32               | 42               | 44               | 47               | 53               |
| 1500                   | 33               | 36               | 40               | 42               | 53               |
| 2000                   | 30               | 36               | 41               | 42               | 47.75            |
| 3000                   | 33               | 40               | 40               | 42               | 31.8             |
| 4000                   | 33               | 35               | 35               | 36               | 23.8             |
| 5000                   | 28               | 28               | 28               | 29               | 19.1             |

According to the test results in table 1, it can be seen that during the entire operation of the motor, its own power reduction has been optimized to varying degrees [4]. In particular, prototype 4 has the most obvious improvement effect in water-cooled prototype. On this basis, there is no high-voltage power failure in the test of the whole vehicle. It can be seen that the overall application effect of these improvement measures in practice is generally good.

5. Conclusion

Although new energy vehicles are currently the most important way in the automotive field. However, if its own generator heating problem cannot be effectively dealt with, it will inevitably directly affect the operating state. Therefore, in practice, it is necessary to combine realistic requirements and pass a series of test verification to effectively deal with the generator power reduction and provide guarantee for the stable operation of new energy vehicles.

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