Application of Metal Wear Self-repair Technology in Automobile Engine Maintenance

Changrun Liu

Unit 32288 136000

Abstract: This paper analyzes the structural composition of the engine, combined with the relevant content of metal wear self-repair technology. Such as technical definition, working principle, technical characteristics, etc. Through the study of common fault performance of automobile engines, including failure to start, abnormal color of exhaust gas, abnormal noise, etc. As well as the specific application of metal wear self-repair technology in the case of cylinder wear is not serious, cylinder and piston ring damage is serious, pull cylinder failure, etc. The purpose is to improve the engine repair efficiency and extend the service life of the car engine.

1. Introduction

As an important power support for keeping the car running normally, the engine quality will directly affect the stability of the car. There are many reasons for engine failure, which also increases the difficulty of maintenance for maintenance personnel. Traditional overhaul technology will cause certain damage to the engine and shorten the service life of the engine. The application of metal wear self-repair technology can effectively solve this problem. By studying the relevant application content of this technology, it has positive significance for improving the speed of vehicle engine maintenance.

2. Structural Composition of the Engine

Figure 1 Engine Structure Diagram
As shown in Figure 1, the car engine is mainly composed of generator, tensioner, crankshaft pulley, official chain, flight camshaft sprocket, exhaust camshaft, exhaust manifold, intake camshaft, intake manifold, and section. Valves, spark plugs, intake valves, pistons, crankshafts, oil sump, connecting rods, etc., each type of structure is responsible for different tasks, such as intake valves, throttles, intake pipes, etc., mainly responsible for the car engine In and out of the gas is controlled to ensure adequate combustion of the internal structural fuel, thereby reducing emissions of contaminated waste. The spark plug and the generator are interconnected structures. When the internal fuel injector sprays the misty oil body, the spark plug directly releases a small amount of voltage, thereby introducing a fuel mist, and the generated heat will drive the piston to start moving, that is, convert the heat. For kinetic energy, the movement of the piston drives the connecting rod to move, thus driving the vehicle forward, that is, converting kinetic energy into mechanical energy.

3. Overview of Metal Wear Self-repair Technology

3.1. Technical Definition
Metal wear self-healing technology is a revolutionary technology in the field of surface engineering. The repair material used is an ore powder with a particle size of <10μm, usually mixed with grease or oil. Among them, serpentine (3MgO·2SiO2·2H2O) is the main component, followed by nephrite, accounting for 10 to 40%; sub-graphite is 1 to 10%. After the repairing material is pressed, it reaches the metal friction surface, thereby forming a strong bonding force and forming a cermet protective layer. Since the material has no chemical reaction with the oil, it does not affect the viscosity and properties of the oil. At the same time, the material is environmentally friendly and harmless to the environment and the human body. The use of this technology allows the engine to work properly, and can extend the life of the engine, improve its accuracy, reduce the friction coefficient, and reduce downtime. This technology can complete the self-repair of mechanical equipment without disassembling equipment. Improves the smoothness and hardness of the friction surface by creating a protective film on the friction surface. At the same time, it can reduce the noise generated by mechanical vibration, and achieve the purpose of saving energy and extending the service life of equipment.

3.2. Working Principle
The metal abrasion self-healing material is derived from some natural ore materials, the main component being a micron-sized particle composition composed of complex components of hydroxysilicate. The particles of these compositions are very stable in chemical properties at normal temperature, have no toxic effects, are insoluble in lubricating oil, and do not chemically react with lubricating oil. Therefore, the grease or lubricating oil can be used as a carrier to bring the particles of the above materials into the mechanical friction interface, and the physical and chemical changes of the particles and the metal friction surface will occur under the action of the grinding. This reduces the coefficient of friction and achieves the goal of ultra-fine grinding. The microprotrusions on the metal surface break under the action of superfine grinding, and a chemical displacement reaction occurs on the metal surface, and the magnesium atom reacts with the iron atom to form a protective layer of iron-based silicate on the surface of the iron-based metal. In the mechanical work, there is wear between the parts, when the wear is serious, it will cause unevenness, even the temperature is too high. The heat generated by the wear provides continued energy for the displacement chemical reaction, thereby repairing the wear site and improving the surface finish. At the same time, it can effectively reduce the friction coefficient. If the frictional heat energy is reduced and the energy required to repair the stratification reaction cannot be met, the displacement reaction will also terminate and the repair will stop [1].

3.3. Technical Characteristics
First, there is no need to break down the engine. When the traditional repair technology repairs the
engine failure process, because the engine failure is generally concentrated in the interior, the engine needs to be disassembled, the decomposition process will take part of the time cost, and in the process of completing the repair and re-assembly, it consumes most of the time, and at the same time, when reassembled, it is easily affected by the operation ability of the maintenance personnel, causing secondary damage to the engine. In the application process, the metal wear self-repair technology directly adds materials to the system self-circulation process, and can complete the established repair operation without disassembling the structure, which effectively improves the engine maintenance efficiency [2]. Second, the damage gap can be filled. The metal wear self-healing technology works by grinding it with materials to restore the surface structure to its original application. At the same time, in the process of material grinding, the remaining material is automatically filled into the structure gap, and a fine protective layer is formed on the surface of the wear material, thereby effectively improving the smoothness and comprehensive hardness of the repaired material. Third, save resources. When the traditional overhaul technology is used to repair the engine, the engine needs to be dismantled. Therefore, after finding the faulty part, the maintenance personnel will directly replace the new parts, which will cause a certain amount of waste of resources for parts that are only partially damaged. The metal wear self-repair technology is a technology for repairing the worn surface by means of repair materials. After the repair is completed, the engine can continue to be used, which can effectively improve the utilization of parts and prolong the service life of the engine [3].

If the above fault phenomena are found in the engine, the corresponding technical measures should be taken to determine whether the wear self-repair technology is suitable.

4. Car Engine Common Fault Performance

4.1. Unable to Start
In the event of a car engine failure, failure to start is a very common failure performance. The main causes of this phenomenon are fuel system failure, ignition system failure, and mechanical system failure. When the fault location is determined, the odor can be used for the determination, because if an operation failure occurs in the engine room, the fuel may be incompletely burned, resulting in system odor. Sometimes, due to the failure of the mechanical system, the overall temperature of the engine is too high, and other connected parts are scorched under the action of high temperature, which causes odor. In addition, in the process of maintenance during maintenance, maintenance personnel sometimes add some grease during the maintenance process to lubricate the various components, but the melting point of the oil is lower, at higher temperatures. Under the circumstance, the structure is spontaneously ignited, resulting in the generation of odor [4].

4.2. Exhaust Color is Abnormal
The fuel injected into a car engine is usually diesel or gasoline. Both oils are polyalkane oils, so in normal combustion, the combustion products are carbon dioxide and water. If in the incomplete combustion state, some of the carbon is reduced to carbon, and when it is mixed into the product, it will cause black smoke. When the engine operating condition is checked, the determination can also be made by the color of the exhaust gas. First, if the vehicle exhaust is in a colorless state, it indicates that the internal fuel combustion of the engine is very sufficient, and the working state of the engine at this time is in a normal working state. Second, if the car exhaust color is white, this indicates that the water vapor generated by the engine is condensed, that is, the reaction temperature is problematic and needs to be carefully examined. Third, if the car exhaust is black. This indicates that the combustion of the fuel in the engine is very insufficient, and many carbon elements are mixed into the exhaust gas. During the subsequent maintenance, the maintenance personnel need to pay attention to the connection state of the inlet and outlet pipes. Fourth, if the automobile exhaust is blue, this phenomenon indicates that the automobile oil is mixed into the automobile engine. In the subsequent maintenance process, it is necessary to pay attention to the pipeline leakage [5].
4.3. Abnormal Noise
In the normal operation of a car engine, it is often accompanied by the generation of sound. According to the law of noise emission, the initial judgment of engine operation failure can be made. For example, during the normal operation of the engine, the sound frequency is very stable, and the sound is small and there is no harsh feeling. If there is a problem with one of the components in the engine, the sound from the engine will be high and low frequency, accompanied by a harsh sound. If it is not processed in time, it will not only increase fuel consumption, but also shorten the life of the engine.

5. Application of Metal Wear Self-repair Technology in Automobile Engine Maintenance

5.1. Cylinder Wear is Not Serious
Under normal circumstances, the cylinders of automobile engines may experience different degrees of wear due to human operation or natural wear and tear. For such cases, if the damage of the cylinder is not particularly serious and does not reach the critical value of cylinder wear, then it can be repaired by metal wear self-repair technology. In the specific application process, the following steps should be followed: First, the choice of metal wear self-healing materials, after determining the type of repair material, using the relevant equipment to push the material into the cylinder at a constant speed, it should be noted that in the push process, it is necessary to avoid contact with the repair material at the top of the piston. At the same time, the fuel supply system of the engine is cut off, and the start command is executed for the motor. The start time of each time is controlled within five seconds, and the start time interval cannot exceed ten seconds. Second, in order to ensure the accuracy of the material delivery position, the technician can directly transport the material to the set position during the process of the piston's variable load movement. And the material needs to be diluted before injecting the material, which ensures that the material can reach the repair location quickly and start repairing the target position. Third, the implementation criteria for all addition processes need to meet the established operational requirements of the country. For example, when the compressor power is reduced to 90%, the concentration of the added diluent is kept at about 45 ml/L; if the compressor power is reduced to 80%, the concentration of the added diluent should be kept at about 65ml/L; if the power of the compressor is reduced to 70%, the concentration of the added diluent should be kept at about 85ml/L. It should be noted that in order to ensure the efficiency of the repair, the relevant personnel need to periodically change the oil filter, and the second maintenance time needs to be carried out after the repair is completed, and the car is driven again for about 500 kilometers.

5.2. Cylinder and Piston Ring are Seriously Damaged
During the operation of the engine, if there is serious damage to the cylinder and piston, it can also be treated by metal wear self-repair technology. The specific treatment process is as follows: First, the maintenance personnel need to replace the damaged piston in time. The service personnel also need to replace the engine valve oil seal components to ensure the stability of the infrastructure. In the process of replacement, the maintenance personnel also need to deal with the carbon deposit inside the piston ring, and replace the damaged structure in the ring, and add the cylinder liner externally. Secondly, the assembled parts are reassembled, the assembly process needs to strictly comply with the corresponding operational requirements, and the cylinders need to be treated during the installation process, such as adding a layer of repair material on the cylinder wall surface for subsequent work. Going smoothly. Finally, after all the structures have been assembled, the cylinder can be treated with metal wear self-repair technology. The specific process flow refers to the relevant application steps mentioned in 4.1.

5.3. Pull Cylinder Failure
During the long-term use of the automobile engine, it is affected by the stability of the road structure and the driver's habits. It is easy to cause the cylinder to malfunction. In the case of such a situation, it
can also be treated by metal wear self-repair technology. The process is as follows: First, the maintenance personnel need to replace the damaged cylinder parts in time, and during the replacement process, the maintenance personnel also need to process the carbon deposit inside the piston ring, and replace the damaged structure inside the ring. Add a cylinder liner. Second, reassembling the replaced parts, the assembly process needs to strictly comply with the corresponding operational requirements. Finally, the cylinder is processed by metal wear self-repair technology. The specific processing procedure refers to the relevant application steps mentioned in 4.1.

6. Conclusion
In summary, metal wear self-repair technology is an innovative technology in the development of technical systems compared to traditional automotive engine repair technology. The biggest application advantage of this technology is that it can save maintenance time, and the economic cost of maintenance is low, and the engine repair can be completed without disassembling the engine, thereby effectively improving the maintenance efficiency and prolonging the service life of the engine itself. Because the technology has a short time to develop, there is still a very large space for development. Based on this, technological innovation research has a positive significance for improving the application value of technology.

References
[1] Li Shuangbiao. Application of metal wear self-repair technology in automobile engine maintenance [J]. Modern Manufacturing Technology and Equipment, 2018 (10): 175+179.
[2] Sun Jian. Application of metal wear self-repair technology in automobile engine maintenance [J]. Automotive practical technology, 2018 (14): 222-224.
[3] Jin Jian. Application effect of metal wear self-repair technology in automobile engine maintenance [J]. Automobile and driving maintenance (repair version), 2018 (05): 112.
[4] Ge Jing. A brief analysis of the application of metal wear self-repair technology in automobile engine maintenance [J]. Southern Agricultural Machinery, 2018, 49 (07): 156.
[5] Zou Mingsen. Application analysis of metal wear self-repair technology in automobile engine maintenance [J]. Automotive practical technology, 2018 (19): 191-192+204.