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Cylinder Block Die Casting Process of Automobile Engine and Combination with Automation

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Abstract

With the development of modern science and technology, the automotive industry is also making progress, and the manufacture of automotive engines is no exception. In the current manufacturing process of automobile engine, die casting is an important process, and aluminium alloy cylinder block is an important part of the die casting. In this paper, the die-casting process of aluminium alloy cylinder block for automobile engine is improved, and its impact on improving automobile performance is discussed. On this basis, this paper introduces the improved die casting process and its principle, and gives the specific implementation method. Finally, the paper also discusses the development prospects and future applications of combining with automation.

Keywords

Aluminium alloy cylinder block, Die-casting process, Improved performance, Realization method, Automation, Effective combination.

1. INTRODUCTION

1.1. Aluminium alloy cylinder block die-casting process

In the traditional aluminium alloy cylinder block die casting process, the die casting machine needs to pour the aluminium alloy melt directly into the die casting mould, so as to get the aluminium alloy cylinder block. However, in the actual manufacturing process, this process has some problems. First of all, due to the better fluidity of aluminium alloy, it is easy to produce problems such as flying edge and poor quality of gate in the die casting process. These problems will directly affect the appearance quality and strength performance of the aluminium alloy cylinder block. Secondly, the traditional die casting process needs to use a large amount of molten material, which will cause greater pollution to the environment. In addition, this process also needs to consume a large amount of energy, which is also a waste of resources. Finally, the traditional die casting process also requires high labour cost and equipment cost. This is also an important factor that restricts the application of this process.

In order to obtain high-quality die castings, advanced processing technology is needed. For example, high-speed cutting, high-precision grinding and other technologies can be used to improve the machining accuracy and surface quality of parts. In addition, automated machining equipment, such as robots, can be used to achieve high efficiency and high precision machining. Improvements were made in this paper.

1.2. The improved die-casting process adopts the following measures

(1) Aluminium alloy preheating technology was adopted. Preheating technology refers to heating pretreatment of aluminium alloy before melting to improve its fluidity and uniformity.

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This technology can effectively avoid problems such as flying edges and poor gate quality of the aluminium alloy cylinder, so as to obtain a more dense cylinder surface.

(2) Adopted die-casting materials with higher strength and stiffness. Choose materials with good mechanical properties, wear resistance, corrosion resistance and other properties. Select materials with high performance-price ratio to reduce production costs. Choose materials that are easy to process and mould to improve production efficiency.

(3) Adopted advanced die-casting mould design technology. In order to improve the performance and appearance quality of aluminium alloy cylinder, this paper adopts advanced die-casting mould design technology. This technology can effectively control the structure and size of the mould, so as to obtain a more dense cylinder surface. In addition, the design of the mould also needs to take into account the reasonable pouring system and cooling system to ensure that the manufacturing process of the cylinder block is more reliable.

(4) Automation control technology is adopted. In the die-casting process, automation control technology can effectively avoid human error and manufacturing fluctuations. By adopting the automation control technology, it can ensure that the manufacturing process of the cylinder block is more stable and precise, so as to improve the performance and appearance quality of the cylinder block.

1.3. Realisation methods

Realisation method of preheating technology. In order to realize the preheating technology of aluminium alloy, it is necessary to use professional preheating equipment. This kind of equipment can rapidly increase the temperature of aluminium alloy to an appropriate range, so as to improve its fluidity and uniformity. When using the preheating equipment, attention needs to be paid to controlling the preheating time and temperature to ensure that the preheating effect reaches the expected goal.

High strength and stiffness material method: in order to obtain higher strength and stiffness, can choose high strength aluminium alloy or magnesium alloy as die-casting material. These materials have high specific strength and specific modulus, which can reduce the weight of parts, while maintaining sufficient strength and corrosion resistance. In addition, surface strengthening technology, such as nitriding, boron penetration, etc., can be used to further improve the strength and wear resistance of the parts. [1]

Advanced die-casting mould design technology realization method. In order to achieve advanced die casting mould design technology, need to use professional CAD software and equipment. For example, floating core, continuous pouring system, multiple gate system and other technologies can be used to reduce the defects of parts and improve the accuracy of parts. In addition, digital design and manufacturing technologies, such as CAD/CAM, can be used to achieve rapid design and manufacturing of moulds and shorten the production cycle. By using these software and equipment, mould design and optimisation can be carried out easily. In the mould design process, a reasonable pouring system and cooling system need to be considered to ensure a more reliable manufacturing process of the cylinder block. [2]

The realisation method of automation control technology. In order to realise automation control technology, professional automation control equipment and software need to be used. By using these equipments and software, the manufacturing of cylinder block can be carried out conveniently .

2. AUTOMATION AND AUTOMOBILE ENGINE COMBINATION

With the rapid development of the automotive industry, the application of automation technology has become an inevitable trend in the future automotive industry.[3] The

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automobile engine is the heart of the car, its operation is directly related to the car's power and economy.

2.1. How to combine automation technology and automobile engine effectively

Sensor technology can be used to monitor the running status of the automobile engine in real time. Through sensor technology, the temperature, pressure, speed and other parameters of the automobile engine can be monitored in real time, and these parameters are transmitted to the controller. By analysing and processing these parameters, the controller realizes the automatic control of the automobile engine, including start-stop control, idling control, acceleration control and so on. Through automatic control, we can improve the efficiency and stability of the automobile engine and reduce energy consumption and emissions. Secondly, we can use controller technology to achieve adaptive control of the automobile engine. Adaptive control refers to the automatic adjustment of control parameters according to the actual operating state to adapt to different operating environments and working conditions. For example, when the vehicle starts, it needs higher engine speed and power output; while when driving on the motorway, it needs lower engine speed and power output. The controller can automatically adjust the engine output power and speed according to the actual needs of the vehicle to ensure the comfort and economy of the vehicle.

Artificial intelligence technology can also be used to provide intelligent control of the vehicle engine. Artificial intelligence technology refers to the use of computer technology and mathematical methods to achieve the intelligence and adaptive ability of the machine. [3] In automotive engine control, artificial intelligence technology can predict future operating states and conditions through the analysis and modelling of historical data, and automatically adjust control parameters to achieve more intelligent and efficient control. For example, through AI technology, it is possible to achieve automatic vehicle driving, automatically find the best speed and gear, and reduce fuel consumption and emissions.

2.2. Main problems faced by the combination of automation technology and automobile engines

(1) Gas tightness problem. In the process of engine operation, due to vibration, temperature changes and other factors, it will lead to a small gap between the bonding surfaces, thus affecting the airtightness.

(2) Contact fatigue problem. After the combination of engine and automation, due to the different materials of the two contact surfaces, the heat and stress generated exceeds the fatigue limit of the material, which leads to the damage of the bonding surface.

(3) Temperature change problem. The engine generates a large amount of heat during the working process, and this heat will be transferred to the automation bonding surface, resulting in an increase in the temperature of the bonding surface. If the material of the bonding surface is not resistant to high temperature, it will produce deformation, wear and other problems.

(4) Problems of installation accuracy. After the combination of engine and automation, the installation precision of the bonding surface requires high accuracy, and there can not be the slightest deviation. If the installation precision is not enough, it will lead to a decline in the sealing of the bonding surface, and even oil leakage, air leakage and other problems.

3. SOLUTION

(1) The use of more advanced sealing materials, the use of higher precision processing technology, etc. Silicone rubber has excellent resistance to high and low temperatures, can maintain its sealing performance in extreme temperatures. In automotive engines, silicone rubber sealing materials can be used to seal the gap between the cylinder head and cylinder

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block to reduce air and oil leakage. [4] Laser welding technology can achieve high-precision and high-efficiency sealing connections. Compared with the traditional spot welding and glue bonding, the laser welded joints are stronger and have better sealing performance.

(2) Selecting more wear-resistant materials, adopting higher precision machining processes, and using cushioning materials, etc. Alloy materials have high hardness and wear resistance, and these materials can maintain high hardness at high temperatures, as well as good oxidation and corrosion resistance. Precision casting can produce castings with high precision and high dimensional stability. The use of precision casting process can produce high-precision engine block, cylinder head and other parts, so as to improve the performance and reliability of the engine. Sealing materials in the engine cylinder head, cylinder block and other parts of the use of sealing materials between the engine can prevent leakage of gas, oil leakage and other phenomena, to ensure that the engine's normal operation. Shock-absorbing materials in the engine block, cylinder head and other parts of shock-absorbing material between the engine block, cylinder head and other parts of the use of shock-absorbing materials to reduce the impact of the force, protect the parts from damage. Protect the parts from damage.

(3) The use of high-temperature-resistant materials, the use of cooling measures, etc.Water cooling by transferring the heat of the engine to the water in the tank to reduce the temperature of the engine. Air cooling by blowing air into the engine to reduce its temperature. Usually used in small engines and racing engines, they can utilise air flow to carry away heat. Forced-air cooling is used in some high-temperature environments where the engine needs to be cooled quickly. Forced-ventilation cooling is used to accelerate heat transfer by blowing coolant or cooling fans directly into the interior of the engine block. [1]

(4) Use high-precision installation tools and equipment, adopt locating bars and other measures. Wrenches: used for removing and installing engine machine parts. Sockets and socket wrenches: used for removing and installing engine machine parts. Jacks: used to support engine parts for disassembly and maintenance. Positioning bars: used to determine the installation position of engine components to ensure their accuracy and reliability. Its length and width are precisely calculated and designed. When installing the locating bar, it is necessary to mark the position of the locating bar on the engine parts first, and then insert the locating bar into the installation position of the parts. This ensures accurate installation of the engine components and improves the reliability and service life of the engine. [2]

4. CONCLUSION

Aluminium alloy cylinder block die casting can improve the strength and stiffness of the engine, reduce weight, reduce friction, improve heat dissipation performance, reduce noise, and thus improve the performance and reliability of the engine. Effective combination of automation technology with automotive engines can improve the efficiency and stability of automotive engines, reduce energy consumption and emissions, and improve the comfort and economy of vehicles. Effective maintenance of automated machinery can also improve the wear resistance, precision and performance of the engine, while providing a guarantee for the safe driving of the car. In the future, with the continuous development of artificial intelligence, Internet of Things and other technologies, the combination of automation technology and automotive engines will also become more intelligent and efficient.

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