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Melting Technology of High Strength HT250 Gray Cast Iron

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Abstract: HT250 gray cast iron is a kind of material with high strength, excellent wear resistance and corrosion resistance, which is widely used in automobile, machinery, chemical industry and other fields. With the continuous development of industrial technology, higher requirements have been put forward for the melting technology of HT250 gray cast iron. The traditional melting method often has the problems of high energy consumption, low production efficiency and high cost, so the research of a high efficiency, low energy consumption and environmental protection melting technology has become an important topic at present. The purpose of this study is to optimize the smelting process of HT250 gray cast iron and improve the production efficiency, explore an environmentally friendly, efficient and low-cost smelting technology, and provide theoretical support and practical guidance for the actual production.
Keywords: High strength; Gray cast iron; Smelting technology

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Introduction:

High strength HT250 gray cast iron is a low carbon cast iron material with a pearlitic type structure. It has the characteristics of medium and high strength, medium toughness and plasticity, high comprehensive performance, good wear resistance and vibration damping, and excellent casting process performance. At the same time, it can change its properties through various heat treatments. Under certain working conditions, the corrosion resistance of high strength HT250 gray cast iron is also high. This material is usually used in the manufacture of pump shells, containers, towers, flanges, filler box body and gland, carbonization tower, nitrification tower and other equipment, as well as parts that need to be surface quenched and machine bed, column, cylinder, gear, etc.

1. Determination of chemical composition and charge ratio of high strength HT250 gray cast iron

1.1 Determination of chemical composition

The chemical composition of HT250 gray cast iron mainly depends on its strength requirements and working environment. In general, the main alloying elements are carbon (C), silicon (Si), manganese (Mn), phosphorus (P), sulfur (S) and so on. Here are the functions of some key elements:

Carbon (C) : is the main element of strengthening cast iron, can increase the fluidity of hot metal, improve the amount and size of graphite, thereby improving the strength of cast iron. However, too high carbon content will lead to reduced toughness and corrosion resistance of cast iron. Generally, the carbon content of HT250 gray cast iron is between 3.0-3.5%.

Silicon (Si) : can improve the fluidity of hot metal, contribute to the formation of graphite, and can strengthen the matrix structure. However, too high silicon content will cause the viscosity of hot metal to increase, which is not conducive to the cutting of exhaust pipes and sand cores. Generally, the silicon content of HT250 gray cast iron is between 1.5-2.5%.

Manganese (Mn) : can promote the formation of pearlite, improve the strength and hardness of cast iron. However, the high manganese content will lead to the toughness and corrosion resistance of cast iron will be reduced. Generally, the manganese content of HT250 gray cast iron is between 0.6-1.2%.

Phosphorus (P) : helps to form graphite and improve the strength of cast iron. However, high phosphorus content will lead to the reduction of toughness and corrosion resistance of cast iron. Generally, the phosphorus content of HT250 gray cast iron is between 0.2-0.4%.

Sulfur (S) : contributes to the formation of graphite, but high sulfur content can lead to porosity and sand clamping defects. Generally, the sulfur content of HT250 gray cast iron is between 0.1-0.2%. In addition, depending on the specific working environment and performance requirements, other alloying elements may also need to be added, such as chromium (Cr), molybdenum (Mo), etc. These elements can further improve the strength, hardness and corrosion resistance of cast iron.

1.2 Determination of the ratio of charge

The ratio of charge is another important factor in melting HT250 gray cast iron. Generally speaking, the charge consists of pig iron, scrap steel and return charge. Pig iron can provide carbon and some alloying elements in cast iron; Scrap can provide iron and other alloying elements; The return charge can provide alloying elements already present in the casting. For HT250 gray cast iron, the ratio of pig iron and scrap is usually between 1:1 and 3:1, and the ratio of return charge is usually between 20-30%. The specific ratio depends on factors such as the required chemical composition, cost and environmental requirements. For example, if higher strength is required, the proportion of pig iron can be increased; If a lower cost is needed, the proportion of scrap steel can be increased; If a more environmentally friendly production method is required, the proportion of return charge can be increased. In addition, in order to obtain high-quality cast iron, it is also necessary to control the cleanliness of the charge. Any impurities or contaminants may cause the performance of cast iron to decline. Therefore, clean charge should be used as far as possible, and appropriate desulfurizers and slag removers should be used in the smelting process.

2. Smelting operation

The smelting technology for high strength HT250 gray cast iron consists of the following steps. First, prepare the ingredients. It is necessary to prepare high-quality pig iron, scrap steel and suitable casting auxiliary materials. Pig iron should have sufficient purity and alloying element content, and scrap steel should be sorted and cleaned to remove impurities. Casting auxiliary materials include graphite, vulcanizing agent, deoxidizing agent, etc. Next, according to a certain ratio of pig iron, scrap steel and casting auxiliary materials are put into a blast furnace or electric furnace for melting. In the smelting process, it is necessary to control the furnace temperature and the atmosphere in the furnace to ensure that the raw material is fully melted and reacted. At the same time, an appropriate amount of desulfurizer and deoxidizer should be added to remove impurities and oxides in the hot metal. After the smelting is completed, the molten iron in the furnace is poured into the casting mold for casting. During the casting process, the casting temperature and speed need to be controlled to ensure the quality and shape of the casting. At the same time, attention should also be paid to avoid inclusions and bubbles in the hot metal into the casting. After the casting is completed, after the casting is cooled to room temperature, the subsequent processing processes such as sand removal and rust removal are carried out. Finally, the castings are heat treated to improve their mechanical properties and wear resistance. During the heat treatment process, the temperature and holding time need to be controlled to ensure that the organizational structure of the casting is optimized.

In summary, the melting technology of high strength HT250 gray cast iron involves many links such as raw material preparation, melting operation, casting process, follow-up treatment and heat treatment. Gray cast iron with high strength and good mechanical properties can be obtained by scientifically and reasonably controlling the parameters and technological conditions of each link.

3. Melting technology analysis of high strength HT250 gray cast iron

HT250 gray cast iron is a kind of metal material with high strength, wear resistance and oxidation resistance, which is widely used in the manufacture of gear, cylinder block, pump housing and other heavy machinery parts. In order to obtain high quality high strength HT250 gray cast iron, reasonable melting technology is very important.

3.1 Selection of raw materials

Raw material is the first step in the preparation of HT250 gray cast iron, which mainly includes pig iron, scrap steel and inoculant. Pig iron should be selected with higher carbon content and lower phosphorus and sulfur elements to ensure the strength and toughness of cast iron. The types of scrap steel with low phosphorus and low sulfur should be selected to reduce the influence of phosphorus and sulfur elements on the quality of cast iron. The inoculant should be selected with good inoculation effect and reduce the tendency of white mouth, such as silicon barium inoculant.

3.2 Melting technology

The melting process has a decisive influence on the quality of HT250 gray cast iron. First of all, to control the proportion of charge, the proportion of pig iron, scrap steel and inoculant should be reasonably adjusted according to actual needs. Secondly, the melting temperature should be controlled in the range of 1420 ~ 1450 ° C to ensure that the pig iron is completely melted and there is no overburning phenomenon. In addition, the pouring temperature should be in the range of 1300 ~ 1360 ° C to avoid shrinkage holes, cold insulation and other defects.

3.3 Chemical composition

Chemical composition has an important effect on mechanical properties and wear resistance of HT250 gray cast iron. The carbon element in cast iron can increase strength and hardness, but too high carbon content will lead to increased brittleness. Silicon can increase the tensile strength and yield strength of cast iron, and improve the wear resistance. Manganese can increase the yield strength of cast iron, but too high manganese content will cause cracks in castings. Therefore, in the smelting process, the content of each element should be adjusted according to the actual demand.

Conclusion:

In summary, the smelting technology of high strength HT250 gray cast iron needs to be comprehensively considered from the aspects of raw material selection, melting process and chemical composition. High quality HT250 gray cast iron with high strength, good wear resistance and oxidation resistance can be obtained by selecting suitable raw materials, controlling melting process parameters and adjusting chemical composition. The implementation and application of these technologies are of great significance for improving the production efficiency and product quality in the machinery manufacturing industry.

References:

[1] PEI Guoqiang, Sun Fan, Yan Xuetao et al. Selection of Gray Cast Iron Smelting Materials using Double Melting Technology [J]. China Foundry Equipment and Technology, 2019,55(03):62-66. (in Chinese)

[2] Zhao S M. Research on synthetic cast iron melting technology [C]// China Foundry Industry and Trade Association Activities Preparatory Office. Proceedings of 2018 China Foundry New and Old Kinetic Energy Conversion Forum and Lost Mold V Process Casting Technology Innovation Conference,2018:125-134.

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