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Application of Ferrite Ductile Iron on a Casting

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Abstract: In this paper, the ferrite ductile iron was used as the research object, the traditional 450-10 material production process of mechanical properties and metallographic test results can not meet the technical requirements of the problem, from requirements of component material standards, successful test of ferrite material of castings, stable performance can meet the requirements of metallurgical testing requirements, these have been mass production, and these have obtained good economic benefits.

Keywords: **ferrite ductile iron, carbon equivalent, silicon content, pouring temperature**

1 Introduction

QT450-10 is the most commonly used brand in nodular cast iron. But in production, even the same kind of casting production by the same ingredients, casting the same detection position, performance and metallographic examination results have great differences, the reason is that the mechanical properties of nodular cast iron mainly depends on the microstructure of as cast, low grade ductile iron matrix is mainly composed of ferrite and pearlite.

There are two main difficulties of this type of casting production: casting body detection, the pearlite content is less than 25%, the hardness of HBW160 ~ HBW200. Our company according to the conventional QT450-10 materials in the initial production of R & D, found that sampling test, the tensile strength, yield strength and elongation have reached the requirements of the situation, the hardness and the pearlite content can not meet the technical requirements, the hardness and the qualified pearlite or exceed the standard unqualified and the phenomenon of low hardness. In order to solve this problem, the production process of silicon solution strengthening ferritic ductile iron was finally achieved.

The development of solid solution strengthened ferritic ductile iron is introduced in this paper.

2 casting process

2.1 production conditions

A hybrid integrated casting package can realize sealing, spheroidization and casting, avoid its cooling, energy consumption is greatly reduced; in order to meet the KW line production line beat, invented double tundish spheroidizing patented technology, good sealing effect, can improve the magnesium absorption rate, the spheroidizer quantity is only 0.8-0.9%; double position automatic pick and place the bag cover, the realization of the two spheroidisation station rapid transformation, to ensure that the ball efficient production, fully meet the requirements of production line KW.

2.2 EAF burden

Ductile iron scrap 0.40-0.60 (using the company with grades of scrap castings, riser and pouring system), briquetting scrap 0.60-0.40, adding high temperature graphitization carburant and developed by the silicon carbide based composite modifier. The main technical indexes of sic based compound modifier are shown in table 1.

Table 1 technical indexes of composite modifier

project	C(%)	Si（%）	ash content （%）	Average content of volatile matter （%）	S（%）	H2O （%）	N（%）
index	≥70	≥20	≤0.4	＜0.1	0.03	＜0.5	＜ 0.005

2.3 Spheroidizing inoculation treatment

Pregnant for two times, a birth, with particle size of 5-10 mm 75 ferrosilicon bag inoculation, inoculation of 0.1-0.2%; pouring stream inoculation, inoculant size is 0.2-0.7 mm, the standard does not exceed 5% of the total, main component is calcium barium, amount is 0.05-0.08%.

Table 2 main technical indexes of special TR2 type low rare earth magnesium silicon spheroidization agent

project	Mg%)	Ce（%）	Mn（%）	Ca （%）	Si（%）	Fe
index	6.5-7.5	1.5-2.5	3-5	1.8-2.5	42-46	

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2.4 Hot metal composition

The high silicon solid solution ferrite nodular iron needs strict control of final silicon content. The total amount of silicon added in the process of adding molten iron and inoculant to the molten iron is controlled by quantity and controllable. In order to ensure the final silicon content in the process control range, the composition of the hot metal after spheroidizing is detected in each package, and the results of component detection are shown in table 3:

Table 3 composition of molten iron and spheroidization of molten iron

Sample name	C %	Si %	Mn %	P%	S%	Cr %	Cu %	Ce %	Sn %	Ti %	Mg %
Hot metal in electric furnace	3.356	2.734	0.428	0.026	0.015	0.046	0.122		0.006	0.007	
The first package	3.27	3.293	0.423	0.023	0.014	0.045	0.126	0.008	0.005	0.009	0.047
The Second package	3.26	3.31	0.435	0.027	0.014	0.047	0.117	0.009	0.006	0.009	0.047
The third package	3.28	3.324	0.407	0.026	0.016	0.043	0.12	0.007	0.006	0.009	0.048
The fourth package	3.282	3.34	0.413	0.03	0.019	0.045	0.117	0.010	0.007	0.01	0.047
The fifth package	3.31	3.25	0.434	0.025	0.012	0.048	0.119	0.009	0.007	0.009	0.045

3 Detection results and analysis

3.1 Testing of mechanical properties of casting body

The test rods and hardness samples were tested on the high silicon solid solution ferrite ductile iron casting body,. From the test results, test the tensile strength, yield strength, elongation and hardness of the value range is very small, the high silicon solution ferrite production process to produce castings can meet the requirements of manufacturers of technology.

3.2 Metallographic examination of casting body

According to "EN ISO 945-1-2008 cast iron microstructure", the first part: through the visual analysis of Graphite classification, the metallographic specimen is tested, the testing equipment is OLYMPUS GX 71 type metallographic microscope.

The results show that the size of the graphite ball is 6, and the pearlite content is 5-15%, and that of the graphite ball is 90%. Figure 6 and Figure 7 are graphite spheroidization photographs and matrix tissue photographs of the product. From the view of the photos, the type of graphite spheroidization is basically 6, the size and distribution of graphite are very uniform, the diameter of graphite ball is 6, the content of pearlite is 15%, and there is no cementite eutectic of phosphorus, which meets the technical requirements.

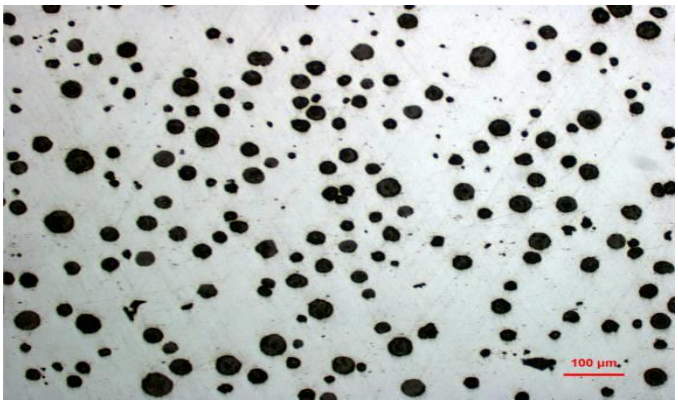

Figure 1 graphite spheroidization picture 100 times (non corrosion)

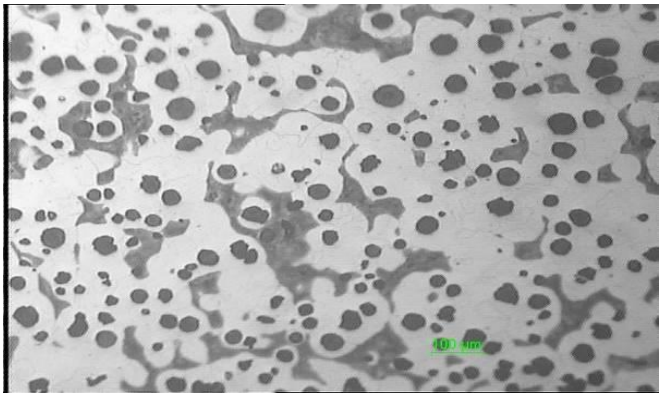

Figure 2 matrix organization picture 100 times (after corrosion)

4 Summary

(1) Strict control of raw iron carbon equivalent of CE = 4.30%, the carbon content of the ingredients and final silicon content control must reference the main casting wall thickness. The deterioration of high carbon equivalent graphite morphology, have serious color difference in castings with thick area or riser neck overheated location processing, based on the

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analysis of existing regional sampling test of exploded graphite or a large number of abnormal graphite.

(2) There are silicon carbide deoxidation, can purify molten iron, reduce shrinkage

(3) The low Mg and low rare earth spheroidization agent can ensure good morphology and roundness of graphite. In the early stage of the test, 3-8 rare earth magnesium ferrosilicon was used, the graphite roundness was poor, and the graphite morphology was not good. Later, the special low magnesium and low rare earth spheroidization agent was developed together with the spheroidizing agent to ensure the spheroidization effect.

(4) The inoculation amount is controlled at 0.1-0.2%, and the inoculation amount is controlled at 0.05-0.08%. The inoculation quantity is too large or insufficient, which has a great influence on the stability and uniformity of the performance.

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