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FRAME DEFECTS REDUCTION BY CRACKS DUE TO CHANGES IN THE GATE SYSTEM DESIGN

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Abstract
The growth of requirements for the properties of steel, as a rule, outstrips the development of technological techniques aimed at improving the purity of the metal. In the castings manufacture, regardless of the technology, the production of a mold is one of the most common defects that significantly reduce the quality of castings, which are defects of shrinkage origin. The global causes of their formation may be errors in the design of technology, as well as disruption of production processes. During the research, several types of defects occurred. The article considers only defects with shrinkage origin. Most machines, machines and parts are subjected to cyclic loads during operation. Therefore, the problem of endurance of materials is relevant for railway, automotive, aviation, shipbuilding, machine tool, energy and other industries.

Keywords: exothermic inserts, side frames, bearing systems, shrinkage shells, casting properties, formation process, mechanical properties, operational properties, shrinkage defects, production technology.

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1. Introduction

The production of high-quality and especially responsible castings with low cost is the main task of foundries. In the manufacture of castings, regardless of the technology, the production of a mold is one of the most common defects that significantly reduce the quality of castings, which are defects of shrinkage origin. The global causes of their formation may be errors in the design of technology, as well as disruption of production processes. During the research, several types of defects occurred. In this work, only defects with shrinkage origin were considered. Shrinkage defects are usually formed in the thickened areas of the casting, which harden last, and in fact this is a different degree of development of the same shrinkage defect.

The shape of the resulting shrinkage defects depends on the nature of the crystallization of the alloy in the casting, which in turn is determined by the time, thermal parameters of the casting formation process.

To compensate for such defects, traditional production technology with several profits is used for the production of "Side Frame" castings at foundries, which leads to a marriage of gas shell casting and a low yield of suitable.

The problem of increasing the competitiveness of machinery today is largely determined by the quality of manufacturing large-sized cast blanks for their bearing systems. Many factors are involved in the process of forming the service properties of the casting. Each factor is important in its own way and affects the quality of the resulting casting.

2. Methods

In the foundry, a filter is used to ensure volumetric shrinkage. Profit is a part of the gate system, which serves to power the castings in time for crystallization in order to prevent the formation of shrinkage shells. After the casting is formed, the profit is separated from it, as well as the entire gating system, and disposed of.

Since the increase in the efficiency of profits, it can be classified into the following groups:

- Improving the efficiency of the geometric shape of profit;
- Use of atmospheric and superatmospheric pressure gains;
- Thermal insulation of profits;
- Exothermic heating of profits.

Considering the above, in order to increase the efficiency of feeding profits, it is recommended to use telescopic exothermic inserts, as a result of which it is possible to reduce the amount of profit by up to 50%. At the same time, it was also decided to evaluate the economic profitability when using telescopic exothermic inserts (Figure

1).

Figure 1 - General view of exothermic inserts with shaped rod

3. Results and Discussion

Researches using exothermic inserts in the production of "Side frame" were carried out in two stages.

At the first stage, the casting process was simulated using the ProCAST program, which consisted in filling a mold with liquid metal and solidifying it (Figure 2).

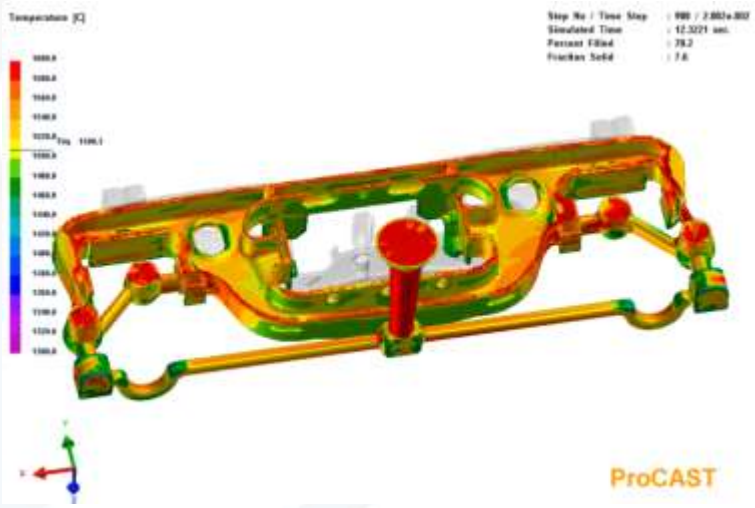

Figure 2 - Modeling of the casting process of the "Side frame" casting

After pouring the mold and cooling the castings, they were cut into two parts according to the location of the formation of shells found during the modeling process. After that, mechanical processing was carried out with layer-by-layer milling of both the casting and the profit itself. In practice, it was confirmed that the choice of an exothermic insert was determined correctly, as evidenced by the dense structure of the metal in the places of formation of shrinkage shells in the casting and solidification of the profit with the theoretically correct formation of the shrinkage direction (Figure

3).

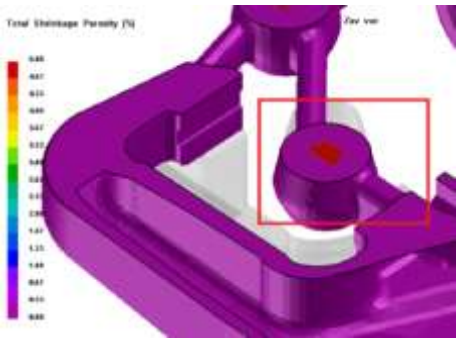

Figure 3 - Formation of shrink shells in the casting

As already noted the use of exothermic inserts on the one hand allows increasing the productivity of steel casting production, by reducing the volume of profits, increasing the yield of suitable casting, increasing the quality of casting and reduce scrap. Thus, it is possible to compare the cost of an exothermic insert in terms of the mass of the saved metal to the cost of liquid steel in a simplified way. Based on this assumption, it is possible to evaluate the effectiveness of the use of exothermic inserts.

On the basis of complex semi-industrial research, a rational technology of casting production with the use of exothermic inserts in the production of large steel castings of a particularly responsible purpose has been developed and mastered.

4. Conclusion

As the experiments have shown, when replacing the usual profit with exothermic inserts, the labor intensity for pruning and stripping of profit installation sites decreased, the metal consumption of the mold and material costs for charge materials decreased by 8.7% and 7.7%, respectively. The use of the proposed technology allowed increasing the yield of suitable casting by 7%.

The work was carried out in coordination with the foundry and mechanical plant (Tashkent, Uzbekistan). The research results are the basis for the modified technology of production of the casting "Side frame".

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