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Process improvement by optimal use of feeding systems

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1. Abstract

The development of feeding technology has improved very much in recent decades. This development started with very simple- shaped sand-molded natural risers, the shape was modified over the years to increase the feeding performance of these so-called natural risers. Another important big step was the introduction of exothermic material to increase the performance of the riser, the development continued with introduction of the mini-riser technology end of the 1970´s.

Modern foundries are facing demands for castings with great complexity and high requirements for process reliability. A few examples of such challenges affecting many foundries are reduction of emissions, elimination of casting defects, and supply of consistently high quality, very often combined with the pressure of cost savings. These requirements can be met by qualified, motivated personnel and outstanding technologies, driven by top-level research and development focusing on the elaboration of efficient and ecofriendly solutions, without loss of performance. A good example of this is the mini-riser technology that combines several patents and offers unique efficiency to foundries.

Reliable support for the foundry industry to maintain its strong position and competitiveness on the global markets by refining feeding systems on a continuous basis is the objective of the foundry suppliers.

Keywords: *Feeding, miniriser, yield optimization, reduced fettling costs.*

2. Introduction

From time immemorial, the shrinkage of metal during the cooling-down from casting temperature to ambient temperature has had to be corrected to ensure the casting quality.

3. The basic of feeding

3.1 Solidification and feeding direction

The solidification of a casting starts at the coldest point of the casting geometry and runs towards the hotter zones. This is called “aligned solidification”.

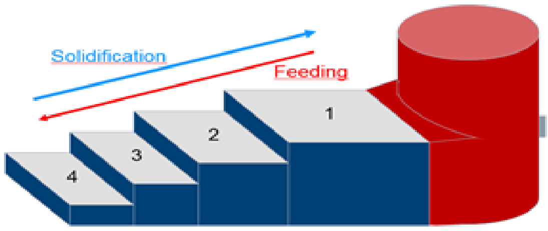

Fig. 1 Solidification and feeding directions

3.2 Modulus and feeding volume

To get an idea of the solidification times of the different sections and the risers applied, the calculation of the modulus was developed.

4. Development of feeding systems

4.1 Natural risers

The easiest way to feed a casting is to set a cylindrical riser on top of or next to the hottest zone of the casting.

4.2 Exothermic solutions and riser sleeves

By using the exothermic reaction of the thermite process, also called the Goldschmidt method, it has been possible to introduce additional heat to the riser.

4.3 Mini-risers – optimal use of feeding systems

The development of the mini-risers was a big step towards improving the performance of the riser and optimizing the yield of the castings. The basis of this development was the knowledge, that the wall thickness of an exothermic riser sleeve has a big influence on the behavior of the shrinkage in the riser.

Besides the main purpose of the riser to avoid shrinkage defects in the casting, the reduction of fettling costs acquired increasing significance over time.

5. Increased productivity for green sand molding lines

5.1 Accurate breaker edge through the implementation of metal necks

To make the application easier, a new kind of mini-riser with a loose metal neck was developed. The hole in the top was closed by a special plastic cap.

Fig.2 Riser with pin before and after compaction

5.2 Avoiding of the spring back effect

When using metal necks which are positioned outside the riser the compaction forces can cause elastic deformation of the metal neck, and thereby mold fissures can appear

This defect can be eliminated completely with the loose metal neck.

5.3 Influence of the metal neck on the riser performance

The installation of the metal neck into the inside of the riser has the positive effect that the metal neck is mainly not exposed to any forces during the compaction.

5.4 Elimination of disruptive riser particles in the mold

During the compaction process, rigid pins usually destroy the riser and the crumbling riser particles can fall into the mold. The introduction of risers which are fitted with a cover of non-friable material solves this problem.

6. Process improvement by using the precise riser composition

6.1 The riser composition

Improvement of the riser compositions is an essential part of achieving better production processes and finding modern and environmentally friendly feeding technologies.

6.2 Fiber-free composition

Conventional sleeves encountered mainly in steel casting contain fibers and rice husks which could cause casting defects and contaminate the casting with fibers through erosion.

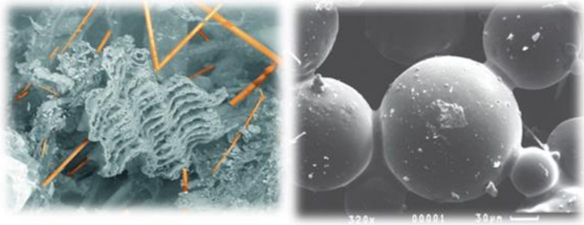

Fig.3 rice husk and fibers (left), low density aluminum silicate ceramics (right)

6.3 Fluorine-free composition

A further step to expand the feeding technology was done by introduction of a new fluorine-free riser composition.

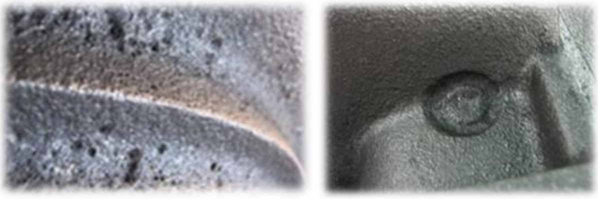

Fig.4 Fluorine-induced surface defects

7. Environment, health and safety (EHS)

The reduction of fluorine by using fluorine-free risers can have a remarkably positive effect on the ecological footprint of the foundry industry.

8. Conclusion

The challenges for foundries in today's highly competitive world markets are not only driven by economic aspects but also by current expectations of eco-friendly solutions.

Modern riser solutions involving new riser geometries and modern riser compositions are the outcome of the long-term cooperation between riser-producer and the foundries.

The suppliers of the foundry industry are not simply dealers any longer. The suppliers are also partners in development and improvement of the casting processes, partners who do not cease in their activities to provide the foundries with high-end solutions in order to ensure their prominent positions on the markets.

References

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