Pitted surfaces

**Characteristic features**

Formation of craters on castings of SG cast iron, particularly at very hot sections. Can occur in isolation or in wider-area clusters. Graphite degeneration occurs beneath the crater.

**Incidence of the defect**

The defect occurs exclusively in SG iron castings when poured into bentonite-bonded sand, predominantly at the positions in the sand which are subjected to high thermal loading.

**Explanations**

The defect occurs only in the presence of fluorides, which are either introduced into the sand through exothermic feeders or are used for the treatment of the melt. Since oxide formation and graphite degeneration are typical characteristics in the deeper parts of the pits and craters, an oxidizing influence can be assumed.

In our opinion, fluorides destroy the protective magnesium oxide layer on the surface of the molten iron. Water vapour from the green sand mould then reacts on the surface with the residual magnesium content of the melt.

**Possible causes**

**Clay-bonded sand**

- Proportion of exothermic feeder residues too high.
- Insufficient replenishment of moulding sand, consequently fluoride content too high.
- Moisture content too high.

**Metallurgical**

- Residual magnesium content of the melt too high.

**Remedies**

**Clay-bonded sand**

- Reduce the fluoride content in the moulding sand by screening out the feed residues. Use feeders which adhere to the metal, replenish with new sand.
- Use insulating feeders or those with reduced fluoride content.
- Reduce water content through improved bentonite development, reduce bentonite content, use high-quality bentonite with a high montmorillonite content.
- Use highly active lustrous carbon producers with rapid release of gas.

**Gating and pouring practice**

- Reduce the number of exothermic sleeves, use insulating materials.

**Fig. 22**: Heavy SG iron casting. Pronounced surface pitting at so-called “hot spots”. Scale: 10 mm = 6.5 mm
Background information

The defect is barely mentioned in the literature, the mechanism is unknown outside our company. The single reference describes the increased susceptibility of SG cast iron with a high silicon content (3 %).  

Since the actual defect is caused by the reaction of water vapour with the residual magnesium content of the melt after the protective oxide layer has been destroyed by fluorides, any action which reduces the fluoride and water content in the moulding sand will be effective.

Feeder auxiliaries

In order to achieve the reaction

\[ 4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3 \]

all exothermic feeders contain fluorides which destroy the aluminium oxide layer on the aluminium powder. Depending on the binder, the aluminium used and the oxidant, it is possible to work with different amounts of fluoride. The user should know the fluoride content of the feeder.

There is also the option of using sodium silicate-bonded feeder sleeves which adhere to the metal feeder and are removed with it. However, it should be noted that the fluoride content in sodium silicate-bonded feeder sleeves is normally higher. It is often possible to use insulating sleeves that are free of fluoride.

Moulding sand

The higher the water content in the moulding sand, the faster a reaction with the surface of a SG iron casting can occur when a critical fluoride content is exceeded. All measures for reducing the water content, and above all for reducing the bentonite content, are effective. Here, it is recommendable to use bentonite with a high montmorillonite content and a high cohesive capacity. In addition, improved bentonite development will result in a reduction in crater formation.

The use of carbon carriers with a high capacity for forming lustrous carbon also leads to a reduction of crater formation.

Reduction of the water content in the moulding sand as well as suppression of water vapour from the mould cavity could also be beneficial.

References

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