Burnt-on sand

Characteristic features
Thin sand crusts firmly adhering to the casting. The defect occurs to a greater extent in the case of thick-walled castings and at high temperatures.

Incidence of the defect
Where there is a heavy-section casting, but also in the proximity of the gate and at high casting temperatures, the moulding sand sinters on the casting in the form of a thin crust due to low thermal resistance. The tendency of the molten metal to penetrate into the sand pores results in the firm adherence of the crust to the surface of the casting. It is difficult to remove, even by shot-blasting, and usually has to be ground off.

Explanations
The high temperature to which the sand is subjected causes sintering of the bentonite and silicate components. In addition, the always present iron oxides combine with the low-melting-point silicates to form iron silicates, thereby further reducing the sinter point of the sand. Sintering and melting of the impurities in the moulding sand enable the molten iron to penetrate even faster, these layers then frequently and firmly adhering to the casting surface.

Possible causes
Clay-bonded sand
- Lustrous carbon content too low
- Proportion of low-melting-point substances too high
- Oolitization too high

Moulding plant
- Uneven mould compaction

Gating and pouring practice
- Uneven distribution of inflowing metal with resultant over-heating
- Temperature of liquid metal too high

Remedies
Clay-bonded sand
- Increase proportion of lustrous carbon producer. This increases the amount of coke as well as the amount of lustrous carbon, which then results in positive separation between mould and metal.
- Use purer silica sands or, if necessary, add new sand. Reduce dust content. If necessary, reduce the amount of bentonite.
- Reduce oolitization by adding new sand.

Moulding plant
- Ensure uniform compaction. If necessary, increase heat removal from the moulds.

Gating and pouring practice
- Even out incoming metal flow
- Reduce pouring rate
- Reduce liquid metal temperature

Description of defects: Burnt-on sand

Fig. 1: Sand grains on the surface of a grey iron casting with insufficient lustrous carbon.
Scale: 10 mm = 0.08 mm

Fig. 2: Thin-wall grey iron casting with closely adhering sand layer.
Scale: 10 mm = 8.1 mm
Background information

Adhering sand layers primarily form when the lustrous carbon-producing capacity of the moulding sand is too low. With grey iron castings, the lustrous carbon content in the sand should lie between 0.2 and 0.6 %, according to other authors between 0.2 and 0.4 %.

Due to the difficulty in precisely determining the lustrous carbon in the sand, the "active carbon content" is measured and should be between 0.35 and 0.65 %.

If sand adherence is experienced, this can be eliminated either by using a higher proportion of or a more "active" lustrous carbon producer.

Improved coke formation will likewise reduce the formation of adhering crusts, but not as much as increasing lustrous carbon production.

It is important to limit impurities in the moulding sand. Silicates and oxides can lead to excess consumption of lustrous carbon producers due to oxidation.

Lowering the sinter point of the sand also increases the risk of burning-on, with simultaneous penetration of metal into the adhering layer.

Likewise, intensified burning of sand onto grey iron castings has been observed with the use of more highly oolitized moulding sands. It is therefore recommended to add an appropriate amount of new sand to that in circulation. According to our previous experience, the added amount should not significantly exceed 100 kg of new sand per t of molten iron.

Russian authors report that, when pouring molten steel into sodium silicate bonded moulds, burning-on is drastically reduced where the surface tension is increased through the use of additives.

Boosting the AFS number by using finer new sands similarly reduces adherence of sintered crusts because the casting surface is smoother.

The moulds should be well and uniformly compacted. There is a greater risk of metal penetration at locations where compaction is low, and thus of the formation of adhering crusts.

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