Angular blowholes

Characteristic features

Cavities in the corners of thick-walled castings, the surfaces of which cavities may be smooth or dendritic.

Incidence of the defect

The defect occurs principally at overheated sand edges which occur at changes in the edge thickness of the casting; also on sand cores. It may occur in both moulds and cores.

Explanations

At highly heated sand edges, the metal remains molten for a long time. Here, a cavity may be generated due to the shrinkage of the molten mass. Core or mould gases can be sucked in due to reduced pressure. If the volumetric deficit (shrinkage cavity) exerts a greater influence, the surface of the cavity is dendritic. If the sucked-in gases exert a greater influence, the surface may be smooth.

Possible causes

Clay-bonded sand

- Excessive generation of gas
- Over-rapid formation of gas
- Poor gas permeability

Moulding plant

- Edges in the mould too sharp

Resin-bonded sand

- Poor removal of core gases
- Excessive formation of gas in cores

Gating and pouring practice

- Pouring temperature too high
- Insufficient secondary feeding

Remedies

Clay-bonded sand

- Reduce and slow down formation of gas; reduce moisture content; if necessary, reduce bentonite content in moulding sand; improve fusion of moulding sand; reduce amount of lustrous carbon producers; perhaps use more active material
- Increase gas permeability; reduce content of inert fines; use bentonites with increased montmorillonite content; use coarser new sand

Moulding plant

- Increase radii on patterns to avoid hot spots during casting

Resin-bonded sand

- Use coarser core sands to increase gas permeability and reduce amount of binder; provide better removal of core gases; use binder with slower gas release
- Avoid sharp corners and edges on cores (see “Moulding plant”)

Gating and pouring practice

- Reduce pouring temperature
- Improve secondary feeding at particularly risky hot spots

Fig. 54: Grey iron casting. Blowhole at a hot spot with an internally oriented cavity.
Scale: 10 mm = 8 mm
Background information

At hot spots (sand edges), the melt stays molten longer. During solidification, material is drawn in from the remaining melt. At the same time, the pressure of heated gas from the mould acts on this spot. Depending on the gas pressure, there then occurs a shrinkage cavity with a dendritic surface, or a blowhole with a smooth surface.

The main factor in the occurrence of hot spots is the poor thermal conductivity of the sand. In the case of silica sand, heat conductivity decreases with increasing temperature, whilst in the case of zircon and chromite sand, it increases.\(^1\) Heat conductivity can be improved by adding ferrous oxide and other substances.\(^2\)

In order to avoid the formation of angular blowholes at hot spots, it is also important to reduce the amount of gas generated and to improve its removal. The use of coarser sands and the reduction of fines reduces the risk of angular blowholes.

Movements in the mould wall (expansion) also increase the risk of shrinkage cavities or blowholes at hot spots. Countermeasures for this can be found under the defect “Swelling”.

The mould design has a significant influence on this defect. If pattern radii are too small, intense heating causes the sand edges to act like channels, from which gases can continue to be discharged into the melt for a long time.

Sharp edges are also to be avoided when making cores. Core venting is often improved by using coarser sands. At critical spots, heat conduction is again improved by using chromite sand, ferrous oxides, etc.

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