Erosion

Characteristic features
Sand erosion principally occurs in the proximity of the gate and is frequently combined with slag inclusions. Thickening of the casting occurs in this area.

Incidence of the defect
Where the sand grains are insufficiently bonded together by bentonite, the particles are loosened by the metal flow. The defect occurs largely where moulds have dried out quickly (high sand temperatures), or have been poorly prepared and contain too little water or bentonite. The defect is more frequently observed in the proximity of the gate and where a long pouring time has been applied.

Explanations
Erosion defects occur as a result of moisture loss where moulds have been standing for long periods without pouring. The defect has arisen with increasing frequency since the introduction of high-pressure moulding plants, as sands of lower compactability are used.

The binder is not able to hold the silica grains in the mould surface. They are flushed out and dispersed to remote regions of the casting.

Possible causes
Clay-bonded sand
- Content of active bentonite too low
- Insufficient cohesion of the bentonite. Can be caused by inadequate bentonite quality or insufficient development of the bentonite
- Too high a proportion of inert dust to be bonded in the sand
- Sand temperature too high. The sand dries out and loses its cohesion
- Sand too coarse, therefore too small a contact surface. Bonding of the grains in the mould surface is insufficient
- Lustrous carbon content in the moulding sand too low. Molten metal wets the sand grains and detaches them from the mould surface
- Salt content in moulding sand too high. The binding capability of the bentonite is reduced

Moulding plant
- Low compaction of mould parts

Gating and pouring practice
- Pouring rate too high. Parts of mould become too hot and are eroded.
- Volume of metal flowing through too great. Severe local overheating of the mould takes place
Background information

The tendency to erosion in bentonite-bonded moulding sand depends largely on the proportion and quality of the bonding agent, the development of the bentonite and the tendency of the moulding sand to dry out.

If the bentonite content decreases while the compactability of the moulding sand remains the same, susceptibility to erosion increases. The tendency of the sand grains to be flushed out from the mould surface depends on the cohesive forces, which can be determined by measuring the green tensile strength. Bentonites with a higher montmorillonite content have a lower inert material content. This results in a higher ratio of green tensile strength per percentage of bentonite in the moulding sand, which will reduce the risk of erosion. Erosion defects are frequently caused by using sands with low compactability.\(^1\) Even slight loss of water vapour will lead to insufficient bonding of the silica grains in the mould surface. In cases of erosion, Levelink recommends that the clay content be increased and finer sands be used.\(^1\) According to measurements recorded by IKO, the use of finer sands leads to a considerable reduction in water vapour loss at the mould surface, thus counteracting the loss of cohesion. The use of carbon carriers containing process carbon and bentonites has a similar effect. A higher and more uniform packing density for the sand grains is achieved during moulding. Water evaporation is considerably reduced.

Better anchoring of the sand grains and reduction in water evaporation are the reasons for the reduction in defects.

Finally, it should also be noted that the design of the gating system is important for the incidence of erosion, particularly where it occurs in the gate or near to it. Excessive quantities of molten metal should not be allowed to flow across any one part of the mould. Impingement of inflowing metal onto parts of the mould should also be avoided.

### Remes

**Clay-bonded sand**
- Increase the amount of bentonite.
- Check that quality of the bentonite is in accordance with VDG (Verein Deutscher Gießereifachleute) Data Sheet P 69. If possible, use bentonite with lower proportion of inert material.
- Improve development of bentonite. Increase moisture, increase mixing times. If necessary, introduce pre-moisturization of used sand.
- Lustrous carbon producers with process carbon, above all, specially prepared bentonite / process carbon systems such as Quickbond, improve development of the sand.
- Reduce sand temperature to below 40°C. Improve cooling of sand. If necessary, improve moisturization of used sand.
- Use finer sand.
- Increase lustrous carbon carrier in moulding sand or change over to more active materials.
- Increase addition of new sand when the salt content in the sand is too high. If necessary, introduce partial desalination of water.

**Moulding plant**
- Improve and homogenize compaction in mould. Endeavour to achieve more homogeneous mould filling.
- Carbon carriers containing process carbon and bentonite improve flowability during compaction.

**Gating and pouring practice**
- Reduce pouring rate
- Modify the gating system to achieve uniform distribution of heat in the sand.

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**Fig. 7**

However, the bonding of the silica grains in the mould is also improved when using finer sand.

The temperature of the moulding sand has a considerable influence on the mould surfaces drying out and the consequent risk of erosion. With ready-to-use sands, the temperature should not exceed 40°C. The preparation of a moulding sand should be as good as possible, as water evaporation is then minimal. The degree of mulling is defined according to Levelink.\(^2\)

When using bentonites containing process carbon, the moulding sand is developed more quickly. Water evaporation and thus the tendency to erosion can also be reduced in this way.\(^2\) Higher lustrous carbon-producing materials reduce the risk of erosion through the formation of separating lustrous carbon layers.

Under-compacted regions of the mould are susceptible to erosion defects. Levelink has highlighted the decline in the tendency to erosion with greater mould hardness.\(^1\)
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