Inconsistent Results of Nodulizing Treatment and Nodularity – Reasons

by Ing. G Henderieckx

The inconsistent result of the Mg-treatment (evaluated by the nodularity of the casting material) is due to the following factors:

1. Incorrect testing the initial S-content (spectrometer not properly calibrated). The final S-content should be:
   - 0,005 %, preferred 0,008 – 0,012 % for thick wall castings
   - Preferred 0,010 – 0,015 % for thin wall castings.
2. The incorrect weighting of the tapped amount of metal for treatment.
3. He incorrect weighing of the FeSiMg addition, which depends on the calibrated weight scale and the operator. This is less dangerous for wire nodulizing.
4. The varying amount of Mg in the FeSiMg alloy. Most alloys do have a tolerance of ± 0,5 %, but some (cheaper ones) have a tolerance of ± 1 %. The Mg-content differs per batch and in a badge, can be different depending on the size (especially dust).
5. The varying amount of RE in the FeSiMgRE alloy. RE have a similar effect as Mg for removing the oxygen and Sulphur. If the alloy is

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ordered and delivered without specifying the RE-content, the nodulizing result will be different.

6. The inconsistent type of addition of FeSiMg. The covering of the alloy in case of sandwich-treatment, use of oxidized treatment alloy, incorrect wire addition due to varying speed…

7. The time between nodulizing and end of pouring. During the transport (especially for a non-covered ladle, and the pouring itself, there is also a loss of Mg by forming MgO during contact with the air, especially if the distance between ladle and mould is large. This extra time of transport and “less correct” pouring can vary a lot, so the final result of nodulizing does.

8. The Mgr (residual Mg-content) content is not always properly tested (with an optimal spectrometer) and reported. This is due to the poor calibration of the spectrometer and the fact that the tested Mg content, called Mgt is:

Mgt = Mgactive + MgMgS + MgMgO + MgMgZnO3 + MgMg2SiO4 + MgMgSiO3

Mgt - total Mg-content measured (can be spectrometer)

Mgactive - free Mg

MgMgS - Mg-part of the MgS compound

MgMgO - Mg-part of the MgO inclusion (very low)

MgMgZnO3 - Mg-part of the Zn-compounds

MgMg2SiO4 - Mg-part of the dross

MgMgSiO3 - Mg-part of the dross

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- Only Mgactive is countable / effective for the nodularity. If the nodulizing slag (MgS) is not properly removed or the sample is taken too early after treatment, there can be a large difference in result. And although Mgt is correct, the Mgactive can be too low. Equally, this can happen if the Zn-content (galvanised steel raw material) is changing a lot.

9. During very turbulent pouring and mould filling, a lot of dross can be formed (Mg_2SiO_4 and $MgSiO_3$), which decreases again the amount of Mgactive inside the casting. The nodularity will be less, and dross will appear.

- This indicates that it is not correct to have a constant Mg-addition. Constant means independent of the initial S-content, the ladle transport type and time, the type of pouring and the shape and section of the casting.

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