METALCASTING E-SMARRT

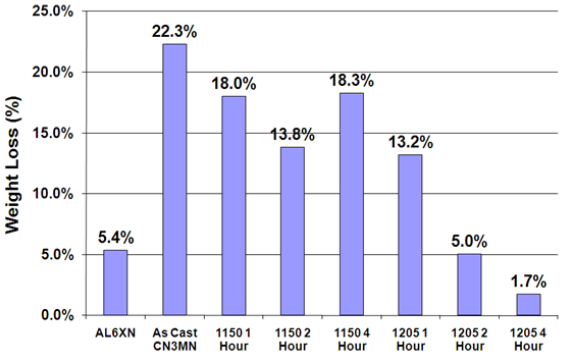
Energy-Saving Melting and Revert Reduction Technology

New Heat Treating Schedules Lead to Dramatic Improvements in Corrosion Resistance of Cast Stainless Steels

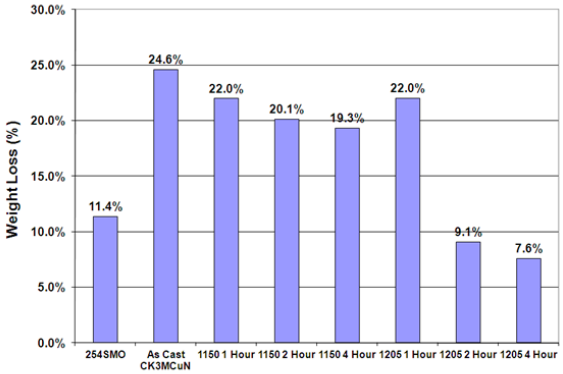
Program Overview & Objective: High alloy stainless steels are used in many applications where there is a need for components to have good corrosion resistance and high impact toughness. Fabrication of such components by casting is often desirable from an economic standpoint, since complicated shapes can be made in fewer steps with reduced costs compared to other manufacturing processes. However, the use of cast stainless steel components is often limited by poor corrosion resistance relative to counterpart wrought alloys. The objective of this project was to develop heat treatments for cast stainless steels that could provide dramatic improvements in corrosion resistance. Successful design of such heat treatments would pave the way for increased use of cast stainless steel alloys in demanding applications.

Problem: High alloy stainless steels can contain significant amounts of segregation in the as-cast condition that reduces corrosion resistance. Current heat treatment standards were not effective at eliminating the segregation. Thus, there was a need to determine if new heat treatments could be designed that would eliminate segregation and restore corrosion resistance.

Graphs explanation: *Variation in weight loss due to corrosion as a function of sample condition for (A) CN3MN and (B) CK3McuN. Comparison is made with the matching wrought stainless steel alloys – AL6XN and 254SMO.*



A



B

SUCCESS STORY

Solution: Two commercial versions of high alloy cast stainless steels (CN3MN and CK3McuN) were subjected to a wide variety of heat treatment times and temperatures, and then used for corrosion testing. Comparisons were made with the matching wrought stainless steel alloys (AL6XN and 254SMO). The results showed that dramatic improvements in corrosion resistance were possible to the point where the corrosion resistance of the cast alloys was equivalent to that of the matching wrought materials.

Benefits: These dramatic improvements in corrosion resistance will open the door to new applications for cast stainless steels in applications that were previously not possible. As a result of this work, the heat treatments in several ASTM standard specifications for castings (which includes Standard A351/A351M, A743/A743M, and A744/A744M) are being modified.

> ***"When the results of the work at Lehigh University became available, the heat treatment was modified accordingly. The use of the revised treatment has resulted in only 5% of the lots failing the initial corrosion test – and none of these lots have required re-heat treatment"***
>
> -- Ron Bird, Stainless Foundry & Engineering, Milwaukee, WI

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