SPONSORED RESEARCH

PROJECT TITLE: ***Welding Alloy and Process for Al-Cu Sand Castings***

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IMPACT: Improved welding performance in copper-containing alloys will reduce scrap and energy cost to produce replacement castings.

Technical Need

Current practices to weld 206 alloy castings, particularly for the repair of through wall defects or defect depths of greater than 0.25" result in unsatisfactory welds that often do not meet ASTM alloy property specifications. Both 206 and 2319 weld rods are typically used for repair welding of 206 castings.

Project Goal

The key objectives of the project are to develop new weld wire alloy, develop improved repair welding practices, establish the effect of welding parameters on weld quality, determine the effects of homogenizing post-weld heat treats, and to determine the effect of weld repair on tensile properties of A206 sand castings.

Technical Approach

A cast A-206 plate was used with approx. 6"x12" dimensions, with artificial defects machined into the plate for weld repair.

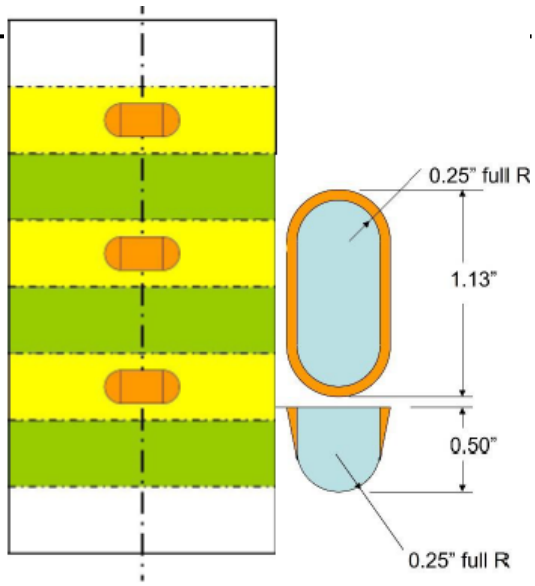

Figure 5. Welding test plate and geometry of machined defects.

Findings and Conclusions

- The use of 206 welding rod yields better properties when welded correctly, but it has a narrower process window to produce sound welds than the alternative 2319 alloy.
- 2319 welding rod is easier to use than 206 welding rod. It has a higher Cu content than 206 which reduces its liquidus making it easier to puddle in the weld. However, the higher Cu content also reduces its incipient melting temperature, making weld interfaces more prone to defects if overheated.
- Alternate welding rod chemistries used in this study did not show useful advantages over 206 or 2319 and in many cases led to greater amounts of defects and lower mechanical properties.
- The most important factors in welding 200 series alloys, particularly for large defects is the control of preheat and the interpass temperature during welding. This must be controlled to a greater extent than in aluminum-silicon alloys.
- Preheat temperatures of around 250°F and interpass temperatures of no more than 550°F will produce acceptable welds using 2319 filler rod that result in mechanical properties complaint with ASTM specifications for aluminum 206 alloy.

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