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Hot Cracking Susceptibility Evaluation of the Advanced UNS S31035 Austenitic Stainless Steel by Varestraint Weldability Testing

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Abstract : Sandvik Sanicro 25, UNS S31035, is an advanced high temperature austenitic stainless steel that potentially can be used in super-heaters and reheaters in the next generation of advanced ultra-super critical power plants. The material possesses both high creep strength and good corrosion resistance at temperatures up to 700°C. Its high temperature properties are positioned between other commercially available high temperature austenitic stainless steels and nickel-based alloys. It is, however, well known that an austenitic solidification mode combined with a fully austenitic microstructure exacerbate susceptibility towards hot cracking. The problem increases even more for thick walled material in multipass welding and could compromise the integrity of the welded component. Varestraint weldability testing is commonly used to evaluate susceptibility towards hot cracking of materials. In this paper, Varestraint test results are evaluated for base material of both UNS S31035 steel and are compared to those of the well-known and well-characterized UNS S31008 grade. The more creep resistant alloy, UNS S31035, is metallurgically more complicated than the UNS S31008 grade and has additions of several alloying elements to improve its high temperature properties. It benefits from both solid solution hardening as well as precipitation hardening. This investigation therefore attempts, based on the Varestraint weldability test, to understand if there are any differences in cracking mechanisms between these two grades due to the additional alloying elements used in UNS S31035. Results from Varestraint testing and crack type investigations will be presented and discussed in some detail. It is shown that hot cracking susceptibility of the UNS S31035 steel is only slightly higher than that of UNS S31008 despite the more complicated metallurgy. Weldability of the two alloys is therefore judged to be comparable making the newer alloy well suited also for critical applications.

Keywords : austenitic stainless steel, hot cracking susceptibility, UNS S31035, UNS S31008, varestraint weldability testing
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