Effect of heat input on dissimilar welds of ultra high strength steel and duplex stainless steel: Microstructural and compositional analysis

H. Tasalloti, P. Kah, J. Martikainen

PII: S1044-5803(16)30900-7
DOI: doi: 10.1016/j.matchar.2016.11.014
Reference: MTL 8454

To appear in: *Materials Characterization*

Received date: 14 May 2016
Revised date: 7 November 2016
Accepted date: 12 November 2016

Please cite this article as: Tasalloti H, Kah P, Martikainen J, Effect of heat input on dissimilar welds of ultra high strength steel and duplex stainless steel: Microstructural and compositional analysis, *Materials Characterization* (2016), doi: 10.1016/j.matchar.2016.11.014

Effect of heat input on dissimilar welds of ultra high strength steel and duplex stainless steel: Microstructural and compositional analysis

H. Tasalloti*, P. Kah, J. Martikainen

Lappeenranta University of Technology (LUT), School of Energy Systems, Welding Laboratory, P. O. Box 20, 53851 Lappeenranta, Finland

hamed.tasalloti.kashani@student.lut.fi
paul.kah@lut.fi
jukka.martikainen@lut.fi

Abstract. The effect of heat input on the microstructure and compositional heterogeneity of welds of direct-quenched ultra high strength steel (Optim 960 QC) and duplex stainless steel (UNS S32205) was studied. The dissimilar welds were made using GMAW with a fully austenitic filler wire. In addition to grain coarsening in the heat affected zone (HAZ) of the ferritic side, it was found that an increase in heat input correlatively increased the proportional volume of bainitic to martensitic phases. Coarse ferritic grains were observed in the duplex HAZ. Higher heat input, however, had a beneficial effect on the nucleation of austenite in the HAZ. Heat input had a regulatory effect on grain growth within the austenitic weld and more favorable equiaxed austenite was obtained with higher heat input. On the ferritic side of the welds, macrosegregation in the form of a martensitic intermediate zone was observed for all the cooling rates studied. However, on the duplex side, macrosegregation in the fusion boundary was only noticed with higher cooling rates. Microstructural observations and compositional analysis suggest that higher heat input could be beneficial for the structural integrity of the weld despite higher heat input increasing the extent of adverse coarse grains in the HAZ, especially on the ferritic side.

Keywords: Direct-quenched ultra high strength steel; Duplex stainless steel; Dissimilar welding; Microstructural analysis; Chemical composition analysis; Macrosegregation

* Corresponding author.