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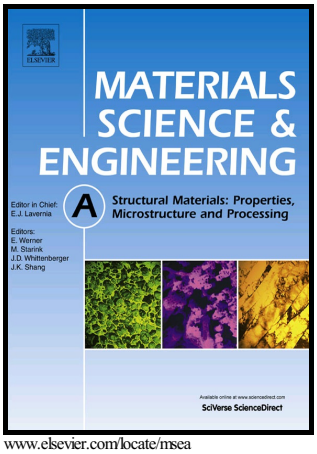

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PII: S0921-5093(17)30754-2
DOI: http://dx.doi.org/10.1016/j.msea.2017.06.002
Reference: MSA35139

To appear in: *Materials Science & Engineering A*

Received date: 14 March 2017
Revised date: 31 May 2017
Accepted date: 1 June 2017

Cite this article as: Nabeel Jahanzeb, Ji-Hwan Shin, Jaiveer Singh, Yoon-Uk Hec and Shi-Hoon Choi, Effect of microstructure on the hardness heterogeneity o dissimilar metal joints between 316L stainless steel and SS400 steel, *Material Science & Engineering A,* http://dx.doi.org/10.1016/j.msea.2017.06.002

Effect of microstructure on the hardness heterogeneity of dissimilar metal joints between 316L stainless steel and SS400 steel

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Abstract

The dissimilar weld joints between 316L austenitic stainless steel and SS400 ferritic steel were used to investigate the effect that microstructure exerts on hardness heterogeneity in weld joints. In order to identify the constituent phases and deformation mechanisms in the dissimilar weld joints, microstructure characterization of undeformed and deformed specimens was conducted via optical microscope (OM), electron back-scattered diffraction (EBSD), and transmission electron microscopy (TEM) techniques. Micro-hardness measurements across the different weld regions and mini-tension testing combined with digital image correlation (DIC) were conducted to evaluate the mechanical properties of the base metals (BMs), the weld zone (WZ), and the heat-affected zone (HAZ). Local strain heterogeneity on deformed specimens was also explained by microstructure heterogeneity in terms of grain morphology and constituent phases. Non-uniform enhancements of the strain distributions were distinct in the WZ, which consisted of a dendritic structure with a irregular morphologies. Uneven patterns of a martensite transformation from γ to α' in the 316L contributed to localized heterogeneity in the strain distribution.

Keywords

Dissimilar weld joints, micro-hardness, TIG welding, tensile testing, EBSD