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Microstructure and Corrosion Properties of Pulsed Current Gas Metal Arc Welded Narrow Groove and Ultra-Narrow Groove of 304 LN Austenitic Stainless Steel

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Abstract : Two different groove sizes 13.6 mm (narrow groove) and 7.5 mm (ultra-narrow groove) of 304 LN austenitic stainless steel (ASS) plate was welded using pulse gas metal arc welding (P-GMAW). These grooves were welded using multi-pass single seam per layer (MSPPL) deposition technique with full assurance of groove wall fusion. During bead on plate deposition process, the thermal cycle was recorded using strain buster (temperature measuring device). Both the groove has heat affected Zone (HAZ) width of 1-2 mm. After welding, the microstructure studies was done which revealed that there was higher sensitization (Chromium carbide formation in grain boundary) in the HAZ of 13.6 mm groove weldment as compared to the HAZ of 7.5 mm weldment. Electrochemical potentiokinetic reactivation test (EPR) was done in 0.5 N H_2SO_4 + 1 M KSCN solution to study the degree of sensitization (DOS) and it was observed that 7.5 mm groove HAZ has lower DOS. Mass deposition in the 13.6 mm weld is higher than 7.5mm groove weld, which naturally induces higher residual stress in 13.6 mm weld. Comparison between microstructural studies and corrosion test summarized that the residual stress affects the sensitization property of welded ASS.

Keywords : austenitic stainless steel (ASS), electrochemical potentiokinetic reactivation test (EPR), microstructure, pulse gas metal arc welding (P-GMAW), sensitization
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