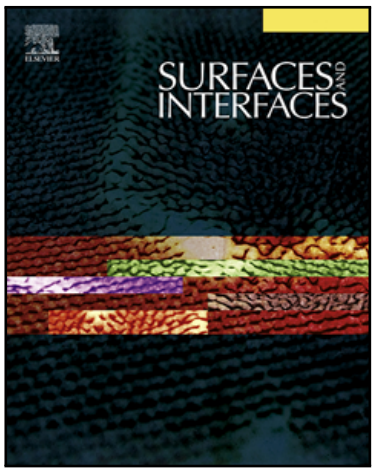

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Microstructural and Electrochemical behavior of 2205 Duplex Stainless Steel Weldments

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Abstract

The paper describes the joining of rolled plates of 2205 Duplex stainless steel (DSS) by Gas tungsten arc welding (GTAW) and shielded metal arc welding (SMAW). The development of different phases upon welding without any post heat-treatment – especially in the heat affected zone (HAZ) - and their consequent different corrosion resistance were investigated through optical microscopy, scanning electron microscopy (SEM), X-ray diffraction (XRD) method and potentiodynamic Tafel scan in aqueous NaCl solution. Comparison of mechanical properties and fracture surface morphology of the welded joints were also made. GTAW weldment was found more effective towards corrosion resistance due to the presence of relatively larger amount of secondary austenite (γ_2) i.e. acicular austenite in HAZ – when compared with the HAZ of SMAW.

Key Words: Duplex stainless steel 2205, gas tungsten arc welding, shielded metal arc welding, potentiodynamic Tafel scan, corrosion.

1. Introduction

Duplex stainless steel (DSS) is an important class of stainless steel bearing a dual microstructure of primary ferrite (α_1) and primary austenite (γ_1) in approximate equal volume fractions. These steels possess resistance to corrosion, especially in chloride containing environments due to the phase balance between γ_1 and α_1 [1]. The welding is the most widely accepted fabrication technique and it is also utilized for DSS. Rapid thermal cycles during welding unbalances the γ/α phase ratio from 1:1 in either fusion zone (FZ) or HAZ thereby affecting negatively chemical and mechanical properties of DSS [2, 3]. High heat input together with slow cooling rate in DSS preserves the desired γ/α phase 1:1 balance in welding zone (WZ) and HAZ but it also produces coarse grains and undesirable deleterious phases like