Duplex World 2020 Abstract

Name:
Kenta Yamada[1]*, Daisuke Motoya[1], Hisashi Amaya[1], Kazuhiro Ogawa[2]
Kasra Sotoudeh[3], Usani Ofem[3], Briony Holmes[3], Hongbiao Dong[4]

Company name:
Nippon Steel Corporation[1,2]
The Welding Institute Ltd[3]
University of Leicester[4]

Address:
Nippon Steel Corporation, Wakayama Works, 1850, Minato, Wakayama City, 640-8555, Japan[1]
Nippon Steel Corporation, Technical Research & Development Bureau, 1-8 Fuso-cho, Amagasaki City, 660-0891, Japan[2]
TWI Ltd, Granta Park, Great Abington, Cambridge, CB21 6AL, UK[3]
Department of Engineering, University of Leicester, University Road, Leicester, LE1 7RH, UK[4]

E-mail Address: yamada.dn3.kenta@jp.nipponsteel.com

Presentation title: Effect of Welding Parameters on Microstructure of Weldments of Newly Developed Duplex Stainless Steel (UNS S82551)

Key words: Duplex stainless steel, Weldability, Ferrite ratio, Flow line,

Abstract
Martensitic and duplex stainless steels (DSS) have been exploited by a wide range of industrial sectors for many years because of their availability, workability, strength, toughness and corrosion resistance.
Girth welded joints in super martensitic stainless steel (13Cr SMSS) are susceptible to stress corrosion cracking (SCC). Post weld heat treatment (PWHT) is effective at preventing SCC, but PWHT could have a negative impact on the efficiency of laying operations.

On the other hand, standard duplex stainless steels (e.g. UNS S31803) and super duplex stainless steels (e.g. UNS S39274) have been utilised in the as-welded condition by the oil & gas industries for many years. However, these higher grade DSS incur greatly increased cost because of the expensive alloying chemistry necessary to obtain these excellent properties.

Recently, a new DSS containing 25Cr-5Ni-1Mo-2.5Cu has been developed (UNS S82551), which can be used in the as-welded condition in slightly sour conditions and has a lower cost than the conventional duplex grades because of its lower molybdenum content. Therefore, this new material improves upon the drawbacks of 13Cr SMSS and conventional DSS in terms of productivity and cost.

In this study, the effect of welding parameters such as heat input and interpass temperature on intermetallic precipitation behavior and phase balance of UNS S82551 will be discussed. Test welding was carried out by gas tungsten arc welding (GTAW) using AWS ER2594 filler wire on 10mm, 20mm and 30mm pipe wall thickness. A heat input range of 0.4-3.0kJ/mm, which is consistent with that used for flow line application was investigated. The weld pool and HAZ thermal cycles and resulting cooling times and rates were determined by immersed (inside the weld pool) and attached thermocouples.

Microstructure analysis and ferrite measurement using Feritscope® and point counting methods were performed to understand the metallurgical phase transformation for UNS S82551 during welding.