

Industrial Member Report Summary – Key Findings for Industry

Formation Mechanisms of Weld Root Flaws in Duplex Stainless Steels and their Effect on Corrosion Resistance

TWI Core Research Programme

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Industrial need

Many subsea oil and gas fields are currently under development, leading to increased uses of duplex and super duplex stainless steels (DSS and SDSS) for applications such as, valves, piping, flow lines, tensioning systems, pumps, separator pressure vessels, etc.

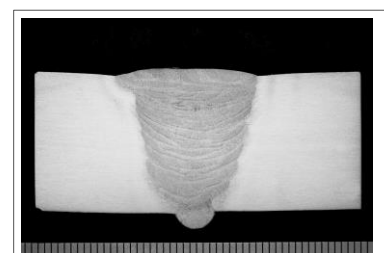
There are reported concerns from some TWI industry Member companies in the oil and gas sector about issues with the qualification of welding procedures for DSS and SDSS, particularly the failure and relevance of the G48 corrosion test. Recent research works carried out by TWI have revealed the presence of micro-crack like flaws at the root toes of DSS and SDSS welds when conventional welding processes were used. The research findings suggest that the on-set of localised corrosion may be linked to this defect, leading to poor G48 test results. There is therefore a need for an authoritative and independent investigation into these issues.

Key findings

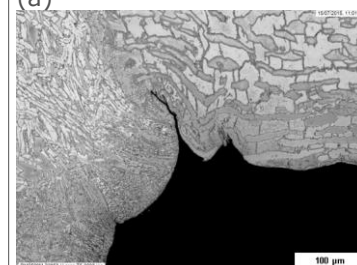
- Micro crack-like flaws are likely to be formed on SDSS welds that have root toe angles less than 140° and root penetration depth greater than 2mm irrespective of whether a qualified weld procedure was used.
- The flaws heights were $\leq 70\mu\text{m}$ for the single-sided V butt welds and $\leq 350\mu\text{m}$ for the single-sided U butt welds geometry investigated.
- The presence of the flaws could lead to G48 test failures of SDSS welds by acting as nucleation site for localised corrosion.

How to benefit from this work

- As an Industrial Member of TWI, you have free access to the [full report](#)
- If you are not an Industrial Member of TWI, find out how your company could benefit from Membership www.twi-global.com/membership
- Contact usani.ofem@twi.co.uk to learn more.



(a)



(b)



(c)

(a) Macrograph of SDSS weld
 (b) Micrograph showing root flaw at the weld toe
 (c) Micrograph of post G48 tested weld showing localised corrosion at the weld toe