

## Industrial Member Report Summary – Key Findings for Industry

### Effect of Back Purging Oxygen Content on Weld Discolouration and Corrosion Resistance of Autogenous Tungsten Inert Gas Welds in Duplex Stainless Steel Pipes.

TWI Core Research Programme

Author: Usani Ofem

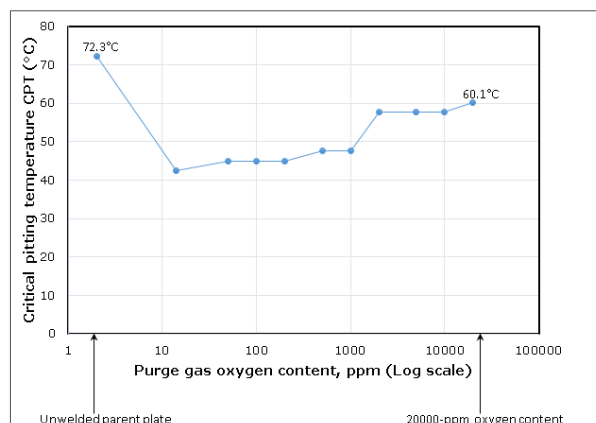
#### Industrial need

There is a general concern amongst contractors and fabricators that acceptable weld discolouration requirements by industry for duplex stainless steel (DSS) welds are often too stringent or conservative, particularly for oil and gas applications. In addition, there are no single widely recognised standard on acceptable levels of weld discoloration for DSS welds for this industry, which consumes a large tonnage of these steels.

There are concerns that the presence of weld discolouration on the root surface of DSS welds could contribute to poor ASTM G48 Method A pitting corrosion test performance during weld procedure qualification test. This study provides an authoritative and independent investigation into the effect of weld discolouration on the pitting corrosion resistance of autogenous TIG welds on thin-walled DSS and super duplex (SDSS) stainless steel pipes.

#### Key Findings

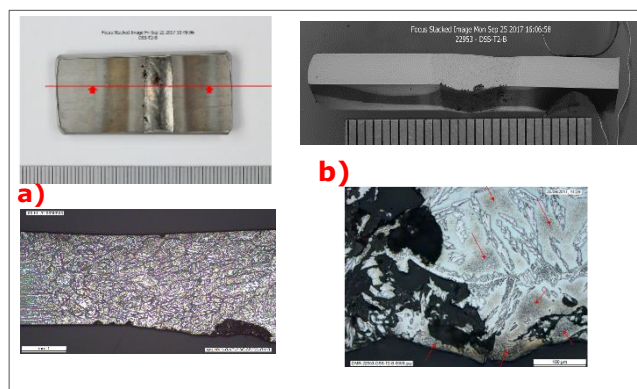
- All the root surfaces were less resistant to pitting than the unwelded DSS and SDSS parent pipes, with the latter showing more significant decrease
- The pitting resistance decreased even for the lowest purge gas O<sub>2</sub> content used, suggesting that welding and associated microstructure dominates the pitting behaviour of the welds rather than weld discolouration.
- The critical pitting temperature (CPT) of the DSS and SDSS welded pipes were relatively constant between the lowest purge gas O<sub>2</sub> content to 1000ppm.
- For the purge gas O<sub>2</sub> content above 1000ppm up to 20000ppm, the oxide scales produced appear to give improved pitting resistance than the lower O<sub>2</sub> contents.



Plot of CPT vs oxygen contents for SDSS welds

#### 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](http://www.twi-global.com/membership)
- Contact [materials@twi.co.uk](mailto:materials@twi.co.uk) to learn more



Examination of corrosion pits on a DSS weld sample, a) Post G48 corrosion tested sample, b) Cross section through sample showing corrosion pits, c) Microstructure of the WM and HAZ revealing pitting locations, d) Higher magnification image of the corrosion pit (encircled in red in c) showing preferential pitting attacks around the ferrite grains