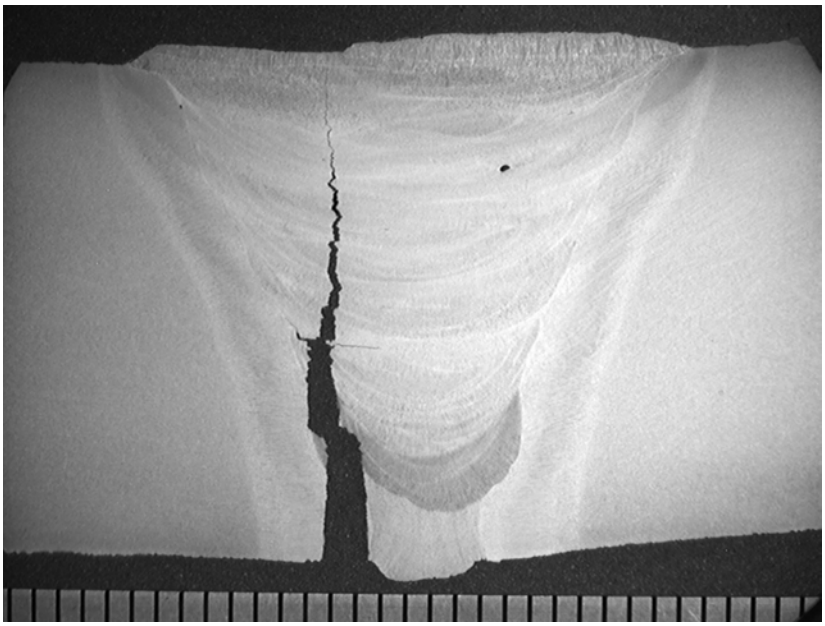
PROJECT OUTLINE TWI

PR8707 **DECEMBER 2004**

Raising the Acceptance Level for Ni in C-Mn Welds for Sour Service

For: A Group of Sponsors



Presently ISO15156-2:2003 (MR0175) requires demonstration of acceptance for welds with more than 1%Ni in the deposit. Suitable data for the range 1-2.5%Ni, could allow the standard to be changed and eliminate the need for repeat testing, providing cost savings via reduced lead times for weld qualification without reduction in safety. Beyond this, exploration of the limits for Ni to just above 3.5% consumables, may allow a wider range of low temperature toughness consumables to be considered for sour service where operational integrity at low temperatures is also required to assure asset integrity and plant safety. This programme will assess performance of weldments manufactured from consumables in both ranges to develop acceptance data for concentrations greater than 1%Ni in the weld metal.

BACKGROUND

Presently ISO15156-2:2003 (MR0175) requires demonstration of acceptance for welds with more than 1%Ni in the deposit. However, DNV OS-F101 ("DNV2000") allows sour service application using consumables with up to Ni<2.2%. Suitable data for the range 1-2.5%Ni,

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could allow ballot to ISO15156-2 to eliminate need for repeat testing, providing cost savings to industry and reduced lead times for weld qualification without reduction in plant safety.

Beyond this, exploration of the maximum limits for Ni to just above 3.5%, which is a typical content for commercial consumables, for use in sour service applications will be beneficial to industry. This may allow a wider range of low temperature toughness consumables to be considered for sour service where operational integrity at low temperatures is also required to assure asset integrity.

BENEFITS

- Avoid design and fabrication restrictions related to overly conservative limitations on Ni content up to 2.5%, without compromising safety.
- Savings will be obtained through avoidance of repeat testing on each individual project and by reducing the weld qualification time required for sour service applications.
- Extension of acceptance to high Ni content 2.5-3.5% consumables, will provide a wider range of options to allow optimised design, fabrication and repair.

OBJECTIVES

- Define the sour service limitations for welding consumables with nickel contents of 1-2.5%.
- Explore sour service performance of alternative consumables with nickel concentrations used in C-Mn consumables for low temperature service (up to typically 3.5%).
- If the Sponsor Group so desire, submission to ISO15156 to ballot for changes to this international standard.

APPROACH

In conjunction with the Sponsor Group, a range of materials and consumables will be selected for testing. It is expected that the materials and welds for testing will cover both girth welds and longitudinal seam welds, in pipeline and process pipework thus:

SAW in pipe material rated for sour service (or demonstrated as acceptable) up to API5L Grade X65.

Mechanical GMAW girth welds in linepipe material, and manual welds in process pipework. Materials will be sour grade qualified.

It is presently expected that the materials and welds will be supplied via the project sponsors. Materials will be tested to confirm their mechanical properties, microstructure and hardness.

Testing will be modified from the guidelines in EFC16 and ISO15156 based on the justification that failure is necessary in the weld metal to determine influence of variables associated with the consumable composition and welding process. If ballot to ISO15156 is desired, testing and materials will need to be reviewed against the requirements of this standard.

The following approaches are recommended for review and agreement by the Sponsor Group:

- Transverse weld bend specimens are the most common geometry, but do not reflect service stress orientation, and more importantly, the SSC may well initiate in the HAZ or parent steel.
- K_{1SSC} testing of welds will allow the failure to be generated in the weld metal via the pre-crack. This test however, will not address the initiation stage of SSC.
- Longitudinal weld metal bend specimens will similarly encourage

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weld metal cracking, closely represent service stress geometry, but require very large quantities of weldments for testing.

The test environment will be agreed with the Sponsor Group, but it is expected that baseline data will be generated using a solution saturated by H_2S at ambient pressure with a composition in accordance with NACE TM0177 Method A solution. Where necessary, for example where some welds fail, the influence of the environment on SSC in these low temperature toughness welds will be assessed using less severe conditions from Region 2 of ISO15156-2:2003 or EFC16.

DELIVERABLES

Regular progress updates will be provided by e-mail and the detailed work reported prior to progress meetings at six month intervals. A final meeting will be held to present the overall project findings.

If the Sponsor Group so desire, the results will be submitted for ballot to change ISO15156-2:2003.

PRICE & DURATION

It is expected that a two-year programme will be required to address the scope of work described above.

The anticipated budget per company is £27.5k per annum for two years. It is expected to commence the project addressing an agreed programme of study with an initial Group of Sponsors, e.g. three or four, dependent upon material supply.

To discuss the proposal please contact Stuart Bond.

LAUNCH MEETING

Date: 16 March 2005
Time: 10.30
Venue: TWI Ltd, Granta Park, Great Abington, Cambridge

FURTHER INFORMATION:

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