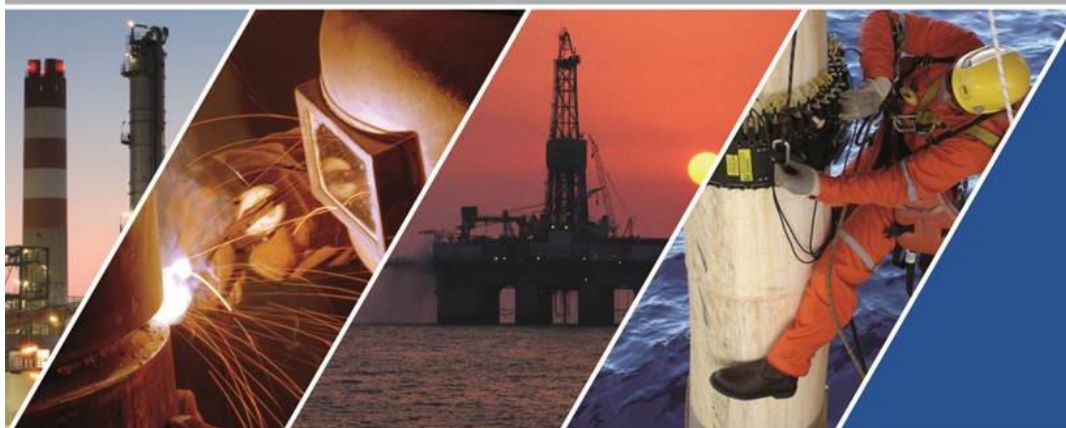




"CRA Plastic Strain" Corrosion Resistant Alloys: Simulating Strain at Welds for Cracking Resistance Qualification Testing



**PUBLISHABLE
SUMMARY**

20110

Background

Plastic straining occurs in pipe and pipelines during pipe reeling and laying operations, cold field bends, and other installation operations, and during service operation (buckling, upheaval). When corrosion resistant alloys (CRAs) are plastically strained, this affects their mechanical and corrosion properties, and may reduce their resistance to environmentally-assisted cracking (EAC). The Sponsor Group's primary interest was understanding the performance of supermartensitic stainless steels (SMSS) and superduplex (SDSS) stainless steels although duplex (DSS) and CRA clad pipe represented additional materials of interest to industry in this context.

Overall, the need for improved understanding of the development of strain within welded pipe was clear. There was a need to collate, and generate, data on the effect of strain on CRA materials. With the prospect of the use of strain-based design, this knowledge needed to be developed to ensure full advantage could be taken of the properties of welded CRA materials. The results of the study may be used to provide guidance on determining safe engineering limits for the use of strained, welded CRA material.

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Objectives

- Created a database of the effect of strain on welded supermartensitic stainless steels (SMSS), the nickel-based Alloy 625 and superduplex stainless steel (SDSS) used in oil and gas exploration and production applications.
- Produced full-scale strain and EAC test data that can be used to validate a small-scale test method for reliable qualification of plastically strained welded CRA pipe with respect to EAC, including strain from reeling or in service.
- Provided guidance on the recommended approach to determine safe engineering limits, in terms of materials, welds, applied strain and environment, hence ensuring freedom from EAC in strained material.

Project Outcome

Progress reports were issued every six months, prior to Sponsor Group meetings. The reports produced included all experimental procedures and data.

At the close of the project a final report, which was the main deliverable of the experimental programme, detailed:

- Guidelines for full-scale qualification testing of plastically strained welded CRA pipe.
- All test details and data.

Reports were issued in PDF format and made available on a secure website.

Benefits

Provided improved confidence in the safety, design and material selection for plastically strained welded CRA pipelines for aggressive service.

Participants

The Sponsor Group comprised:

- Tenaris NKK Tubes;
- Petrobras;
- Nippon Steel Sumitomo Metal Corp.

Scope of Work

- Creation of database of effect of prior strain on material properties
- Full-scale straining of 2 types of welded CRA pipe (SMSS and SDSS) including measurement of strain
- Measurement of effect of strain on mechanical and metallurgical properties of extracted specimens
- Examination of material-specific effects for the 2 different CRA grades (SMSS, SDSS)
- Full-scale environmentally-assisted cracking (EAC) testing of the 2 types of material (SMSS and SDSS)

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Project Budget

The project had a duration of five years and a budget of £210,000. There were three Sponsors each making a contribution of £70,000. TWI also financially supported this project.

The fee for additional companies buying back into the project results is £70,000

Further Information

For further information on how a Joint Industry Project (also known as a Group Sponsored Project) runs please visit:

<http://www.twi-global.com/services/research-and-consultancy/joint-industry-projects/>

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