

## Sour Corrosion Fatigue Behaviour of Girth Welded Clad Pipe



**PUBLISHABLE  
SUMMARY**

**17304**

### **Background**

Corrosion resistant alloys (CRA) or clad products are known to exhibit improved behaviour in sour environments compared to C-Mn steels. However, only limited data are available to quantify the sour service performance of these materials under conditions of cyclic loading.

This project aimed to build on the results of a previous Group Sponsored Project (14134) that examined corrosion fatigue behaviour of both superduplex and clad welds in a sour environment. Tests within the earlier project were carried out in a standard, ambient temperature test environment, and endurance testing of clad specimens proved to be problematic. Care was needed to ensure that all areas of exposed C-Mn material were masked from the test environment, and localised shot-peening of specimen edges was used to discourage failures remote from the weld. The current programme built on this experience to provide more endurance data for clad material in a sour environment.

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## Objectives

- To develop test procedures for generating sour endurance data for girth welded clad pipe.
- To quantify the fatigue endurance behaviour of girth welded clad pipe in a sour test environment.

## Project Outcome

Test procedures developed and used within this project were on the whole successful.

Materials investigated were:

- X65 internally clad with alloy 825
- X65 internally clad with alloy 316 stainless steel
- Simulated transition joint

All materials displayed an environmental reduction factor (ERF), which was quantified. From the results of this project, it was recommended that an ERF is used for sour applications, even where corrosion resistant alloy is employed for corrosion resistance.

## Benefits

- Enhanced safety by reducing the risk of premature corrosion fatigue related failure through quantification and understanding of fatigue in sour environments.
- Availability of a reliable test technique for determining the corrosion fatigue performance of clad material in sour environments.

## Participants

The Sponsor Group Comprised:

- BP
- ENI SPA
- Saipem SpA
- Statoil
- Chevron
- Petrobras
- Serimer Dasa

## Scope of Work

The project followed on from a previous Group Sponsored Project (14134) that examined the corrosion fatigue behaviour of both C-Mn and CRA welds in a sour environment. Tests within the former project were limited to one standard test environment at ambient temperature. The current programme built on this experience by carrying out further tests using strip specimens taken from circumferential butt welds in both 825 clad pipe (10¾ and 12 inch outside diameter and 23mm wall thickness) and 316 clad pipe (24 inch outside diameter and 20.5mm wall thickness) in a variety of environments to determine the observed endurance behaviour. Tests on a transition joint (clad to un-clad carbon steel) were also carried out.

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## Price and Duration

The project had a duration of four years and a budget of £630,000. It was funded by 7 Sponsors each contributing £90,000. The fee for additional companies buying back into the project results is £90,000.

## Further Information

For further information on Joint Industry Projects (JIP) and their operation, please visit:

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

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