

Project Report



Application No. 2016
Short title Hydrogen embrittlement of quenched and tempered steels

Objectives: short, medium and long term (<250 words)

Slow strain rate tests (SSRT) under different hydrogen charging conditions, on high strength quenched and tempered low-alloy steels for HE (hydrogen embrittlement) evaluation.

Brief summary of work carried out:

Two low alloy Cr-Mo steels in quenched & tempered (Q&T) conditions having similar strength level, but different Ni additions were tested under slow strain rate tests conditions in different environments. - In presence of N₂. This inert environment is use as a reference measurement (only mechanical properties, no corrosion, and no hydrogen embrittlement). - In a solution composed of NaCl 5%, CH₃COOH 0.5%, adjusted at pH 2.70, with a cathodic polarization at -1V versus the reference.

Main achievements intended for publication <250 words

The results show a clear difference between inert condition (N₂ gas), were there is no sign of embrittlement and all the other conditions where evidences of HE were observed in terms of reduction of area, lower failure time and presence of secondary cracks. Nevertheless, there is a difference between the environments generating HE. The environment saturated in H₂S is the most aggressive for both references. The Ni enriched steel shows higher HE resistance compared to base steel under cathodic polarization conditions. However, in H₂S environment, beside the fact that there is an important degradation of the properties due the HE, the situation is opposite, with base steel showing better behavior compared to Ni enriched steel.

A delay in the project execution occurred due to the fact that corrosion testing is taking long time. This fact was since the beginning of the project.

Further comments:

Interaction with Tecnalia R&I through e-mail and teleconferences was very good, so there was no need for a visit.