ASSESSMENT OF HYDROGEN EMBRITTLEMENT OF NATURAL GAS PIPELINE STEELS

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Molecular Hydrogen is widely proposed as an important energy carrier in the future sustainable energy society as a means to de-carbonize and green the energy economy. This increased use of hydrogen requires an extensive distribution system. For this reason, transport of molecular hydrogen and natural gas mixtures via existing and refurbished gas pipelines is currently being explored.

However, there exists material durability concerns over pipeline storage and distribution of hydrogen. The main materials of natural gas transmission pipelines are carbon steels which are susceptible to hydrogen embrittlement, especially at high hydrogen concentrations and pressures. Thus, hydrogen embrittlement can cause irreparable damage and serious consequences to natural gas pipelines which are long-lived and hard to replace infrastructures.

In this work, hydrogen embrittlement is studied in model pipeline steels (X42 and X70) in order to predict material durability, i.e., its long-term behaviour in hydrogen environment. Accelerated testing of hydrogen embrittlement is performed using electrochemical experiments and natural testing is performed in gaseous hydrogen. The paper is reporting on susceptibility of pipeline steels to hydrogen embrittlement for the hydrogen concentrations in the range of 2-30 vol.% and total pressures of 5 to 15 MPa.