

Chen Y., Summary of an ASME/DOT Project on Measurements of Fatigue Crack Growth Rate of Pipeline Steels in Gaseous Hydrogen, ASME Pressure Vessels and Piping Division Conference, Anaheim, California, July 20-24, 2014

Abstract

The National Institute of Standards and Technology has been testing pipeline steels for about 3 years to determine the fatigue crack growth rate in pressurized hydrogen gas; the project was sponsored by the Department of Transportation, and was conducted in close collaboration with ASME B31.12 Committee on Hydrogen Piping and Pipelines. Four steels were selected, two X52 and two X70 alloys. Other variables included hydrogen gas pressures of 5.5 MPa and 34 MPa, a load ratio, R , of 0.5, and cyclic loading frequencies of 1 Hz, 0.1 Hz, and a few tests at 0.01 Hz. Of particular interest to ASME and DOT was whether the X70 materials would exhibit higher fatigue crack growth rates than the X52 materials. API steels are designated based on yield strength and monotonic tensile tests have historically shown that loss of ductility correlates with increase in yield strength. The X70 materials performed on par with the X52 materials in fatigue. The test matrix, the overall set of data, implications for the future, and lessons learned during the 3-year extensive test program will be discussed.