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Abstract

Pipelines in certain regions are expected to survive high longitudinal strains induced by seismic activities, slope instability, frost heave, and mine subsidence. Material properties, of both pipes and girth welds, are critical contributing factors to a pipeline's strain capacity. These factors are examined in this paper with particular focus on the modern high strength pipes (grade X70 and above) usually made from microalloyed control-rolled TMCP steels. The examination of the tensile properties of pipes includes some of the most basic parameters such as yield strength, strength variation within a pipe, and newly emerging issues of strength and strain hardening dependence on temperature. The girth weld tensile properties, particularly yield strength, are shown to be dependent on the location of the test specimen. There are strong indications from the tested welds that strain hardening of the welds is dependent on test temperature. The effects of strain aging on pipe and girth weld properties are reviewed. This line of reasoning is extended to possible strain aging effects during field construction, although experimental evidence is lacking at this moment. The paper concludes with considerations of practical implementation of the findings presented in the early part of the paper. Recommendations are made to effectively deal with some of the challenging issues related to the specification and measurement of tensile properties for strain-based design.

Keywords

Pipeline construction, Linepipe specification, Strain-based design, Tensile property, Girth weld strength