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Abstract

Pipelines may experience high longitudinal strains from seismic events, frost heave, thaw settlement, unstable slopes, and mine subsidence, etc.. Those strains could be well beyond the elastic limit of the materials and the strain based design (SBD) criteria must be used. Most work on the SBD in recent years has been focused on the straight long seam pipes. The application of the SBD principles to the spiral pipes has not been examined. Spiral-welded pipes are widely used for long-distance transmission pipelines. These pipes have a demonstrated history of satisfactory service. However, the performance of the spiral pipes under large longitudinal strains is not well understood. The focus of this paper is the tensile strain capacity of spiral pipes. The crack driving forces of flaws in spiral welds under longitudinal tension strains were analyzed for X80 pipes. Unlike the girth weld flaws which see primarily mode-I crack driving forces, the spiral weld flaws see mode-I and mode III mixed crack driving forces. The mode-I and mode-III driving force components vary with the spiral angles and pressure conditions. It is found that the application of the internal pressure can greatly increase the mode-I component and the total crack driving forces.

Keywords

Strain-based design, Tensile strain capacity, Spiral pipe