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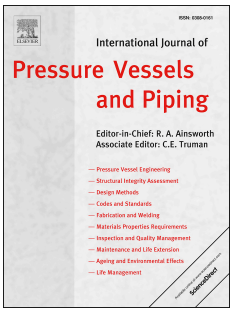

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A finite element based model for prediction of corrosion defect growth on pipelines

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ABSTRACT

Growth of corrosion defects has been identified as the primary mechanism resulting in pipeline perforation and leaking. In this work, a finite element model was developed to simulate and predict the time-dependent growth of corrosion defects on pipelines in a near-neutral pH bicarbonate solution trapped under disbonded coating. The synergism of stress and local corrosion reaction was determined quantitatively. It is demonstrated that a mechano-electrochemical effect developed at the defect is critical to growth of the defect, resulting in formation of a crack-like flaw at the defect center. The time dependence of the local stress and corrosion current density at the defect is featured with three stages, i.e., a linear increase of local elastic stress and the negligible corrosion enhancement under the testing condition, a slow increase of both local stress and corrosion current density under mild plastic deformation, and a rapid increase of local stress and corrosion current density under a high plastic deformation.

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