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The effects of Defect Depth and Bending Stress on Magnetic Flux Leakage Signals

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Abstract

Oil and gas pipelines are normally buried. They are inspected, while they are in service, by pumping tools through the pipelines. Inspection tools based on magnetic flux leakage (MFL) measurement are most economical method used for detecting metal loss, such as corrosion pits. For these measurements, the steel pipe walls are magnetized by using permanent magnets. If a defect is present in the pipe wall, some of the magnetic flux lines leave the wall to avoid the void and cause an increase in magnetic flux lines outside the material in the immediate vicinity of the defect. A hall probe or an inductin coil is usually used to detect this leakage field. MFL signals are very sensitive to the depth of the defect and applied stress. In the present work, MFL signal has been studied from three far side defects of depths 30%, 50% and 80% of the wall thickness and under various bending stresses. The magnitudes of the MFL signals are found to increase with increasing defect depth. The circumferential bending stress reduces the MFL signals by more than 40%. These stress-induced changes in MFL signals are due mainly to shifts in the direction of the magnetic easy axis of the steel and changes in 180 domain wall population.

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