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ABSTRACT Ceocor 2017

Corrosion kinetics behind pipeline IR-free potentials

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Cathodic protection effectiveness is validated based on IR-free potential and current density at a coating defect. In practice both parameters are very difficult to measure properly especially when high resistance coated pipelines are involved.

The IR-free and current density is a result of the thermodynamic and kinetic mechanisms occurring at the steel surface which in turn are dependent on AC and DC polarization level, the environmental conditions, formed deposits on the steel surface and geometry of the coating defect.

Many research has been performed to quantify the corrosion rate of buried steel in laboratory set-ups and on coupons in the field. However the challenge to extrapolate these experimental data to real pipeline corrosion conditions remains difficult because not all mechanisms that occur at the steel surface can be measured, nor can be differentiated from each other to reveal which reaction leads to a given IR-free and corrosion rate.

This article demonstrate results from an advanced computational model that calculates IR-free potential, current density of partial electrochemical reactions, mass and charge transfer, formation of corrosion and calcareous deposits and passive film while keeping into account the diffusion in the soil electrolyte within the coating defect of given geometry. Simulation results will be compared with experimental data found in literature.