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Initiation and inhibition of pitting corrosion on C-steel in oilfield-produced water under natural corrosion conditions

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ABSTRACT

The initiation and inhibition of the localized pitting corrosion on the C-steel surface in oilfield-produced water are investigated by pitting corrosion current measurements. The current-time curves are characterized by the appearance of an induction period, τ followed by a rapid rise in the pitting corrosion current till reaches the limiting value, I_L, due to propagation of pitting corrosion. The I_L value reaches 5.0 μA cm^{-2} in 99% diluted oilfield-produced water and 260 μA cm^{-2} in pure oilfield-produced water. The presence of HPO_4^{-2}, WO_4^{-2}, and MoO_4^{-2} anions suppresses the initiated current by elongation of the induction time, τ. Such anions acted as inhibitors towards the pitting corrosion of the C-steel. The inhibition efficiency, η, of the studied inhibitors increases in the following order: Na_2WO_4 < Na_2MoO_4 < Na_2HPO_4. The inhibition mechanism is assumed to take place through an adsorption process obeying Langmuir's model. The thermodynamic parameters for the adsorption process K_{ads} and ΔG°_{ads} are calculated and discussed.

Keywords: Oilfield-produced water; C-steel; Pitting corrosion; Inorganic passivator; Adsorption

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