Electrochemical and Surface Studies of Thiourea-formaldehyde as corrosion Inhibitor for N80 Steel in Chloride Media

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Effective Thiourea formaldehyde (TF) inhibitor was synthesized and used for the corrosion mitigation of N80 steel in 3.5% NaCl solution containing CO₂. The electrochemical impedance spectroscopy (EIS) and Tafel polarization were investigated to evaluate the inhibition efficiency of the inhibitor. Surface studies including Fourier transform infrared (FTIR) spectroscopy, scanning electrochemical microscopy (SECM), atomic force microscopy (AFM) and scanning electron microscopy (SEM) techniques were performed to get a clear picture of the metal-inhibitor mechanism and to compare the surface condition with and without inhibitor. Theoretical computations were evaluated to support the experimental results. The impedance figures showed the increase in diameter in presence of inhibitor thereby increasing efficiency. Shift towards anodic and cathodic regions suggested that the TF inhibitor belongs to mixed type category. Scanning electrochemical microscopy (SECM) revealed the action of protection by inhibitor acting as an insulator. The surface analysis through AFM and SEM for N80 specimens showed the smooth surface in existence of inhibitor than in its absence. Theoretical parameters also well supported the results from other techniques.

Keywords: Thiourea formaldehyde; SECM, SEM, AFM, FTIR, N80 steel

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