Corrosion Inhibition of Pipeline Steel X-70 in Sour Brine by an Imidazoline Derivative under Flow Assisted Conditions

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The corrosion behavior of a pipeline steel API 5L X-70 was tested under flow assisted conditions in a sour brine solution containing kerosene in the presence of an imidazoline derivative. Inhibitor film provided efficiencies in the range of 70-99% at 200 ppm with initial corrosion rates in the range of 125-134 mpy (3.2-3.4 mm/y). In the absence of inhibitor, chemical species of cubic maghemite (Fe₂O₃) predominated with an apparent decrease in orthorhombic marcasite (FeS₂) on the steel surface when angle was increased from 30° to 90°. In the presence of inhibitor, maghemite (Fe₂O₃) and marcasite (FeS₂) prevailed as a mixture of oxides and sulfides at the impingement angles. Mackinawite appeared with and without the presence of corrosion inhibitor at every angle tested. As flow rate and angle are increased, inhibitor efficiency decreased due to partial film formation. Imidazoline derivative is efficient albeit a periodic replenishment is required after a 3-4 hour period. DFT molecular simulation of imidazoline derivative emphasized nitrogen polarity and capability of interacting with another molecular species.

Keywords: Flow assisted corrosion, sour brine, jet impingement, API X-70.

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