Predicting Corrosion Rates of L80, P110, and 2205 Stainless Steel in harsh Environments of middle east oil fields by ANFIS Approach

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Abstract : The corrosion of steel poses significant economic and safety concerns, necessitating accurate predictive models to mitigate potential risks. This study presents a comprehensive investigation into the prediction of corrosion rates across diverse environmental conditions through the application of Adaptive Network-based Fuzzy Inference Systems (ANFIS). The experimental protocol encompasses testing of 127 samples of three materials P110SS, L80, and 2205 Duplex steel, each subjected to varying conditions, including temperature, H2S partial pressure, CO2 partial pressure, salinity, and moisture content. The corrosion rate serves as the essential indicator in this research. The ANFIS model is intricately constructed with six neurons in the input layer representing temperature, H2S partial pressure, CO2 partial pressure, salinity, moisture content and material type, while the output layer consists of one neuron for the corrosion rate. Results demonstrate the efficacy of the 6×18×1 ANFIS model in dynamically predicting the corrosion rate of the three materials used. A comparative analysis with Response Surface Methodology (RSM) underscores the superior predictive performance of the ANFIS model, as evidenced by lower Absolute Maximum Error (AME) and higher R2 values 0.81. The developed model, alongside empirical correlations, presents a promising tool for corrosion engineers, facilitating efficient corrosion rate determination without the need for extensive AI model training.

Keywords Corrosion rate; Artificial Neural Networks; Response surface methodology; Corrosion prediction.

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