Analysis of Corrosion Prediction Software for Detection Corrosion in Oil and Gas Evironment Containing Acetic Acid, CO_2 and H_2S Gases

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Abstract. Corrosion Prediction models are important tools in determining materials selection and managing corrosion control strategies. The models can also be used as input in the Corrosion Design Basis Memorandum (CDBM). However, most of the corrosion prediction models have limited parameters as inputs in calculating corrosion rate. They emphasize only for specific environmental conditions. Thus, the models will be inaccurate in evaluating the corrosion rate when multi species and complex corrosion mechanisms exists. This research studied models developed by industries and academia which are ECE, Cassandra, Norsok, and Freecorp. This paper evaluated prediction model based on their theoretical backgrounds in CO_2 environments pipelines which transports oil/gas/water by comparing with literatures and data's experiments. Corrosion experiments were carried out to propose a model prediction using semi empirical approach.

Introduction

Models to calculate the corrosion rate in CO_2 gas environments have many different approach. Each model predicts corrosion rate in a different manner. They used parameters and formula based on literatures and their own experiences. During the last decade, the models were developed by involving limited variables. Recently, new variables are indicated having contributions in corrosion models. For examples, it has been demonstrated that flow can enhance the corrosion process. Based on that theory, the models tried to cover these factors [1]. The other factors, still in investigations, are effects of scaling product, effects of oil properties, inhibitors, and other species contaminants (H_2S, HAc, and naphthanic acid). The work done by De Wared and Milliams [2] is satisfied with a condition where CO_2 gas is the dominant element. They developed an equation to calculate maximum CO_2 corrosion rate in a stagnant condition with assuming no carbonate film formed. In subsequent model predictions, researcher [3] consider many factors for correction factors such as gas fugacity, formation of protective iron carbonate films, effect of ferrous ions on the pH, the presence of oil, and the effect of condensing water. However, mostly, existing models have shown different results in predicting the same corrosion cases. Thus, evaluating corrosion rate requires not only chemical/physical factors but also theoretical background and simultaneous interaction among variables must be well understood.

Experimental Set Up

Electrodes

A three-electrode set-up was used in all electrochemical experiments combined with rotating cylinder electrode to simulate flow condition. The working electrodes were carbon steels which have chemical compositions as can be seen in Table 1. It was used a cylinder rod of 1.2 cm^2 in