

Study on CO₂ Corrosion in Oil Producing Well

by

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Dissertation submitted in partial fulfilment of
the requirements for the
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(Mechanical Engineering)

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CERTIFICATION OF APPROVAL

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Approved by,

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

MOHD NOOR HAZMAN BIN MANSOR

ABSTRACT

The purpose of this project is to study the CO₂ corrosion in oil production wells and the focus of the study will be on the tubing component of the production string. The main objectives of the project are; a) To study the material used in a well production string. b) To determine the average CO₂ corrosion rate of a typical well production string. As for the problem statement of this project, in oil and gas industry, CO₂ corrosion has been a recognized problem in production and transportation facilities for many years e.g. in the tubing string of an oil producing well. The corroded tubing will cause leakage and tubing failure hence, disrupt oil production. The scopes of study for this project consist of identifying the rate of CO₂ corrosion during the production life time of the tubing string and determine the factors leading to the CO₂ corrosion. In order to provide a reliable prediction on the behavior of CO₂ corrosion on tubing steel, the project's methodology used Weight Loss Method using Autoclave Machine and Linear Polarization Resistance Method (LPR) to simulate the actual environment in the tubing during the oil production and analyze the CO₂ corrosion rate. The laboratory experiments are conducted on API L 80 type steel. The Weighted Loss Method is conducted in stagnant condition using 3 wt% NaCl over a series of parameters which includes pressure = 10 bar, 40 bar and 60 bar, pH=5 and temperature at 25 °C. The LPR method is conducted in flowing solution using 3 wt% NaCl over a series of parameters which includes temperature = 25 °C, 40 °C and 60 °C, pH = 5 and pressure at 1 atm. All data were collected and analyzed using Weighted Loss Method, LPR, SEM, OM and Hardness (Vicker) Test to determine the CO₂ corrosion rate and the effects on the L 80 steel. As for the findings, the average CO₂ corrosion rates in API L 80 steel yield from the laboratory test ranges from 1.3 mm/yr to 4.7 mm/yr.

Keywords

CO₂ corrosion rate, FeCO₃ film layers, Weighted Loss Method, LPR Method, API L-80 steel, SEM, Vicker Test

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