Study on CO_2 Corrosion in Oil Producing Well

by

Mohd Noor Hazman bin Mansor

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

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Universiti Teknologi PETRONAS
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Approved by,

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January 2009

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.

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MOHD NOOR HAZMAN BIN MANSOR

ABSTRACT

The purpose of this project is to study the CO_2 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 CO_2 corrosion rate of a typical well production string. As for the problem statement of this project, in oil and gas industry, CO_2 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 CO_2 corrosion. In order to provide a reliable prediction on the behavior of CO_2 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 CO_2 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℃. 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 CO_2 corrosion rate and the effects on the L 80 steel. As for the findings, the average CO_2 corrosion rates in API L 80 steel yield from the laboratory test ranges from 1.3 mm/yr to 4.7 mm/yr.

Keywords

CO_2 corrosion rate, $FeCO_3$ film layers, Weighted Loss Method, LPR Method, API L-80 steel, SEM, Vicker Test

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