

**THE EFFECT OF ELECTROCHEMICAL CORROSION ON  
METALS RELATED TO PETROLEUM INDUSTRY AND ITS  
ENVIRONMENTAL IMPACT**

**by**

**Ali Gomaa Ali Abd El-Aziz**

B.Sc. in Electric Power Engineering, Ain Shams University, 1980

M.Sc. in Environmental Science (Engineering Department),  
Ain Shams University, 2005

**A thesis submitted as Partial fulfillment  
of  
The Requirements for the Doctor of Philosophy Degree  
in  
Environmental science**

**Department of Environmental Engineering  
Institute of Environmental Studies and Researches  
Ain Shams University**

**2011**

## **APPROVAL SHEET**

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This Thesis Towards a Doctor of Philosophy Degree in Environmental  
Science has been Approved by:

| <b>Name</b>  | <b>Signature</b> |
|--|------------------|
| <b>1- Prof. Dr. Mohamed Yousef Al-Kady</b> .....                         |                  |
| Prof. of Chemistry – Ain Shams University                                |                  |
| <b>2- Prof. Dr. Saad El-Deen Mohamed Desouky</b> .....                   |                  |
| Prof. of Petroleum Engineering, Egyptian Petroleum Research<br>Institute |                  |
| <b>3- Prof. Dr. Ibrahim El Desouki Helal</b> .....                       |                  |
| Prof. of Electric Power Engineering – Ain Shams University               |                  |
| <b>4- Prof. Dr. Ali Ahmed El-Bassoussi</b> .....                         |                  |
| Prof. of Chemistry, Egyptian Petroleum Research Institute                |                  |

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**Under the supervision of:**

**1-Prof. Dr. Ibrahim El Desouki Helal** .....

Professor of Electrical Power Engineering, Faculty of Engineering,  
Ain Shams University

**2-Prof. Dr. Ali Ahmed El-Bassoussi** .....

Professor of Chemistry, Egyptian Petroleum Research Institute

**3-Mohamed Saaïd Abd-Elhaliem** .....

Professor of Chemistry, Faculty of Engineering, Ain Shams University

**4-Prof. Dr. Ismial Abd-Alrahanan Aiad** .....

Professor of Chemistry, Egyptian Petroleum Research Institute

**2011**

# **DEDICATION**

To my son....Shady

One day....Hopping that this modest thesis will encourage you to precede a magnificent and superior work.

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## **Abstract**

In our present study we are concerned with the electrochemical behavior of the steel alloy in the formation waters which delivered from different areas in the western and eastern desert in Egypt.

Two different types of steel samples, which utilized in the pipeline manufacture, were used in our experimental studies. On the other hand, six formation water samples were under test, three from the eastern desert and the other three from the western desert.

Our study was divided into three parts. In the first part the Open Circuit Potentials (OPC) were measured against standard calomel electrode (SCE). The variation in the OCP from cathodic to anodic and vice versa, explains the active behavior of the corrosion at the interfacing layer between the metal and solution.

In the second part, we studied the variations of the weight loss for the two coupons corresponding to the time of immersion. The obtained data showed three stages, the first was characterized by the increase in weight loss by time, the second clarified sharp decrease in weight loss by time, and the third stage revealed sudden increase in weight loss.

In the third part of the study, the measurements of the potentiodynamics were completely carried out and the obtained data clarified that the coupons immersing for long time leads to rapidly corrosion and formatted  $\text{Fe}(\text{OH})_2$  which responsible for the corrosion rates. Therefore, one important reason for the increasing of corrosion rate value attributed to the initial formation of pits on the surface of the steel.

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