شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائق الاصلية تالفة

بالرسالة صفحات لم ترد بالاصل

Suez Canal University
Faculty of Petroleum and Mining Engineering
Metallurgical and Materials Engineering Department

EFFECT OF DIFFERENT ENVIRONMENTS ON THE CORROSION OF REINFORCING STEEL IN CONCRETE

A Thesis
Submitted to
Metallurgical and Materials Engineering Department
Faculty of Petroleum and Mining Engineering
Suez Canal University

For
M.Sc. Degree
In Metallurgy & Materials Engineering

By

SAMIR AHMED MOHAMED ALI
(B.Sc. in Mechanical Engineering, 1982)
(Diploma In Corrosion Engineering 1989)

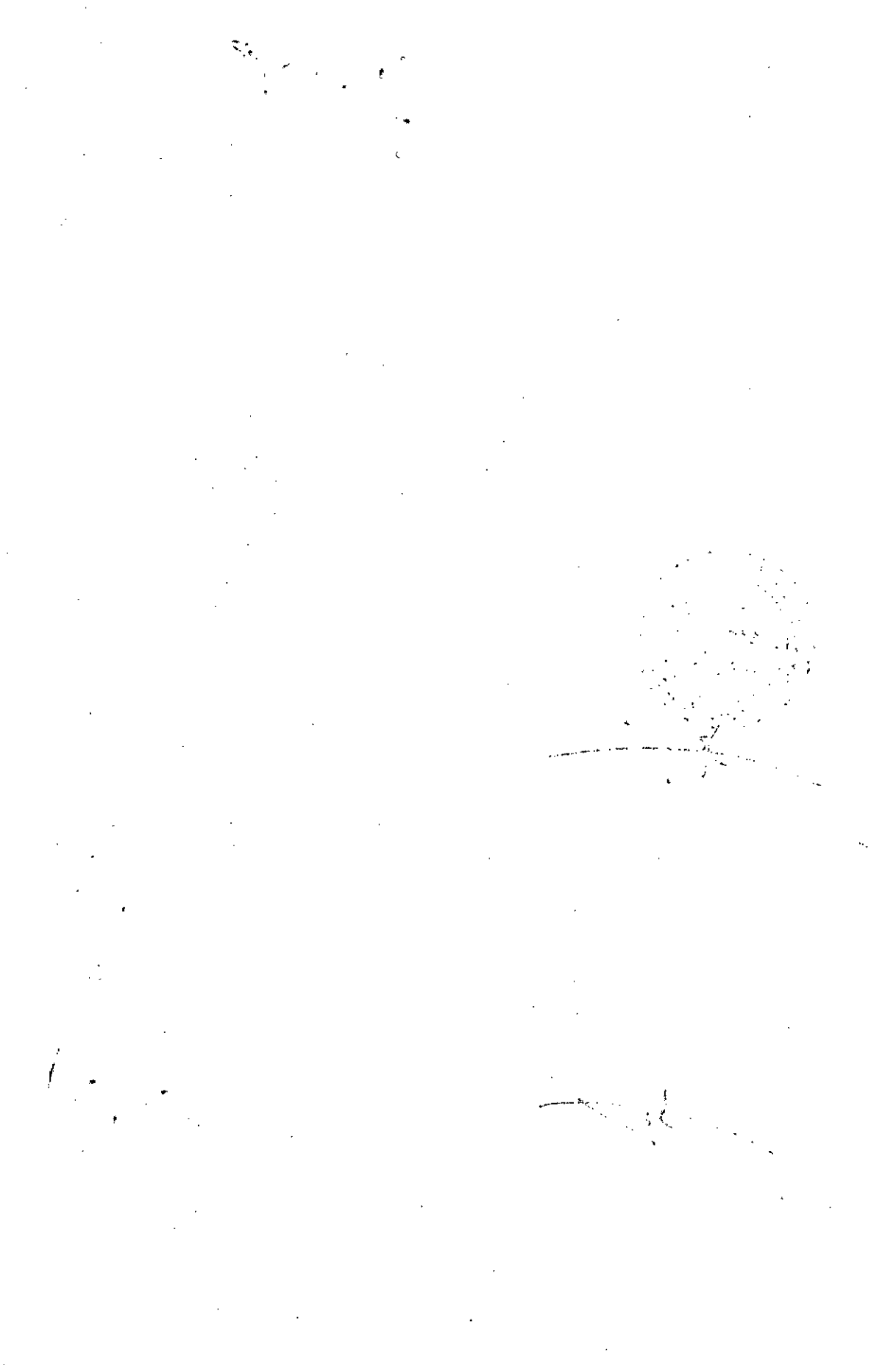
Supervised By

***Prof. Dr.* Mohamed A. Shahin**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

***Prof. Dr.* Mohamed M. Sayed. Ahmed**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

***Dr.* Hamed A. Nagy**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

2003



Suez Canal University
Faculty of Petroleum and Mining Engineering
Metallurgical and Materials Engineering Department

EFFECT OF DIFFERENT ENVIRONMENTS ON THE CORROSION OF REINFORCING STEEL IN CONCRETE

A Thesis
Submitted to
Metallurgical and Materials Engineering Department
Faculty of Petroleum and Mining Engineering
Suez Canal University

For
M.Sc. Degree
In Metallurgy & Materials Engineering

By

SAMIR AHMED MOHAMED ALI
(B.Sc. in Mechanical Engineering, 1982)
(Diploma In Corrosion Engineering 1989)

Approved by

***Prof. Dr.* Ibrahim Hamed M. Aly**
Chemical Engineering Dept.
Faculty of Engineering
Elminia University

***Prof. Dr.* Mohamed A. Abdel-Hadi**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

***Prof. Dr.* Mohamed A. Shahin**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

***Prof. Dr.* Mohamed M. Sayed. Ahmed**
Metallurgical & Materials Engineering Dept.
Faculty of Petroleum and Mining Engineering
Suez Canal University

2003

Author	Samir Ahmed Mohamed Ali
Title	Effect of Different Environments on The Corrosion of Reinforcing Steel in Concrete
Faculty	Faculty of Petroleum and Mining Engineering
Department	Metallurgical and Mining Engineering Department
Location	Suez - Egypt
Degree	Master degree of science
Date	
Language	English
Supervision Committee	Prof. Dr. Mohamed A. Shahin, Prof. Dr. Mohamed S. Ahmed, and Dr. Hamed A. Nagy

English Abstract

The aim of this work is to investigate the corrosion of reinforced steel 52 in concretes of two different types of cement in different environments simulating the natural media attacking the concrete structures especially underground.

The study was done on waters of different concentrations of NaCl (1%, 2%, 3.5%, 5%) simulating the different saline environment fluctuated from open lakes through sea water reaching the brackish water of highest salinity. Also, we use other concentrations of 1% ammonium sulphate, and 1% ammonium nitrate and both of them together, simulate the different types of agricultural environments, we also use the tap water as a datum environment to compromise with it.

The two different types of cement used were the Ordinary Portland Cement of ordinary alumina and Sea Water Resisting Cement of high alumina. We use three tests to determine the behaviors of every type in every environment. These tests were open circuit potential of steel in the concretes in the environment we determined, the chloride profile on the concrete after two years in the environment and the last test is the rust covering ratio on the surface of the steel rebar through all the period of test (two years).

The results showed the cement of high alumina has the best behavior in sea water and the lowest in sulphate environment. The highest values of potentials and rust with NaCl saline water were at the concentration of 3.5% NaCl.

Key words	**Corrosion, Concrete, Sea Water Cement, Ordinary Portland Cement, Reinforcing Steel in Concrete**

Acknowledgment

First of all, I thank Allah, the merciful for helping me to complete this work.

I wish to express my gratitude and sincere appreciation to **Prof. Mohamed Abdel-Khalek Shahin, Prof. Mohamed Mahmoud Said ahmed, and Dr. Hammed A. Naggy,** *Metallurgical and Materials Engineering Department, Faculty of Petroleum & Minning Engineering, Suez Canal University.*

I am very grateful to both all of managers and engineering staffs in : El-masria Co. for Cement, Suez Co. for Cement, El-Ezz Co. for reinforcing Steels, Semadco for Chemical Industries and S. T. M. Co. for contracting and Building for conducting the experimental part of this investigation in their labs. In Suez and for their experimental data they gave me.

ABSTRACT

The aim of this work is to investigate the corrosion of reinforced steel 52 in concretes of two different types of cement in different environments simulating the natural media attacking the concrete structures especially underground.

The study was done on waters of different concentrations of NaCl (1%, 2%, 3.5%, 5%) simulating the different saline environment fluctuated from open lakes through sea water reaching the brackish water of highest salinity. Also, we use other concentrations of 1% ammonium sulphate, and 1% ammonium nitrate and both of them together, simulate the different types of agricultural environments, we also use the tap water as a datum environment to compromise with it.

The two different types of cement used were the Ordinary Portland Cement of ordinary alumina and Sea Water Resisting Cement of high alumina. We use three tests to determine the behaviors of every type in every environment. These tests were open circuit potential of steel in the concretes in the environment we determined, the chloride profile on the concrete after two years in the environment and the last test is the rust covering ratio on the surface of the steel rebar through all the period of test (two years).

The results showed the cement of high alumina has the best behavior in sea water and the lowest in sulphate environment. The highest values of potentials and rust with NaCl saline water were at the concentration of 3.5% NaCl.