Ain Shams University
Faculty of Engineering
Structural Engineering Department

CORROSION BEHAVIOR OF MMFX STEEL IN COMPARISON OF CONVENTIONAL REINFORCING STEEL

By

Eng. Hazem Mohamed Mohamed Moharram

A Thesis

Submitted in Partial Fulfillment for Requirements of
the Degree of the Master of Science in Structural Engineering

Supervisors

Prof. Dr. Mohamed M. H. Attabi
Professor of Structural Engineering
Ain Shams University

Prof. Dr. Osama H. Abd Alwahed
Professor of concrete Structures
Ain Shams University

Prof.Dr. Tarek Kamal Hassan
Professor of structural Engineering
Ain Shams University

Cairo 2013

EXAMINING COMMITTEE

FOR MASTER

In

STRUCTURAL ENGINEERING

CORROSION BEHAVIOR OF MMFX STEEL IN COMPARISON OF CONVENTIONAL REINFORCING STEEL

Signature

Prof. Ibrahim Galal Ibrahim Shaaban ……

Director of projects management unit

Ministry of higher education

Prof. Abdel Wahab Ahmed El Ghandour ……

Professor of Reinforced Concrete Structures

Faculty of engineering – Ain Shams University

Prof. Mohamed M. Hussein Attabi ……

Professor of Reinforced Concrete Structures

Faculty of engineering - Ain Shams University

Prof. Osama Hamdy Abd Alwahed ……

Professor of Reinforced Concrete Structures

Faculty of engineering - Ain Shams University

Date: 19 January 2013

STATEMENT

This thesis is submitted to Ain Shams University for the degree of Master of Science in Engineering (Structural)

This work was carried out by the author at concrete unit laboratory in the faculty of engineering, Ain Shams University.

No part of this thesis has been previously submitted for obtaining a degree or a qualification before

Date: ***January 2013***

Name: ***Hazem M. M. Moharram***

Signature:

ACKNOWLEDGMENT

Firstly, and mostly, I thank ALLAH for His Mercy and Grace, Which enabled me to complete this work .

I would like to thank Professor ***Mohamed Mohamed Hussein Attabi*** *for his invaluable support, guidance, and constructive suggestions throughout this research*

Great gratitude and sincere appreciation go to Professor ***Osama Hamdy Abd Alwahed*** *forhis helpful suggestions, corilnents, accessibility, and for reviewing thismanuscript.*

Great gratitude and sincere appreciation go to Dr. ***Tarek Kamal Hassan*** *forhis direct supervision, valuable advice, continuous support and for hisreviewing of manuscript.*

*I would like to thank Dr****. Khaled Helal****, , Dr.* ***Ibrahim abd Allatif*** *and Eng.* ***Mohammed Omar*** *and Eng* ***Fared Elgabas*** *for their sincere help and encouragement. I would like to thank my father, my mother, my wife Doaa, my son Ziead and my two daughters Riem and Arwa , for their love, support, patience, and encouragement, especially in difficult times, which enabled me to continue this work and to whom I owe everything. And last, but not least, I would like to deeply thank my brothers, my sisters, my father in law and my mother in law for their support and encouragement The experimental work was carried out at the concrete Laboratory, Structural Engineering Department, Faculty of Engineering, Ain Shams University. The help and assistance of the laboratory staff are gratefully appreciated*

AUTHOR

Name	:	Hazem Mohamed Mohamed Moharram
Date of birth	:	13 / 8 / 1977
Place of birth	:	Cairo
Academic degree	:	B.Sc. of Civil Engineering
University	:	Minia
Date	:	1999
Grade	:	Good
Current job	:	Civil Engineer

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Corrosion, the cancer of steel, makes concrete deterioration as increasing of steel cross section occurred and longitudinal cracks appear after that decreasing of steel cross section occurs due to corrosion mechanism. All of above lead to weak interfacial layer and then reduction of load carrying capacity. Numerous researches investigate corrosion mechanism, corrosion prevention, corrosion rate measurements and predict the time for corrosion initiation which is based on diffusion rates of CO2 gas or CL- ions. Little information is available in the literature concerning the effect of the presence of flexural cracks on the corrosion rate after corrosion initiation. MMFX steel micro-composite multi-structural formable reinforcing steel is a new technology model of steel based on nanotechnology, MMFX steel has high resistance of corrosion and also has high strength. This thesis

gives spot light on corrosion and semi updated researches about MMFX steel and studies the corrosion behavior of both conventional steel and MMFX steel under flexural effect to give structural engineer information and new horizon in reinforced concrete sections.