

INVESTIGATION OF RUST FORMATION ON STEEL EXPOSED IN HEAVY INDUSTRIAL ENVIRONMENT

ROSLY PENGIRAN (99301634)

A thesis submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering (Hons) Mechanical

BACHELOR OF ENGINEERING (HONS) MECHANICAL UNIVERSITI TEKNOLOGI MARA (UITM)

OCTOBER 2002

"I declare this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree"

> Signed : _____ Date : _____

> > Rosly Pengiran UiTM I/D : 99301634

TABLE OF CONTENTS

| CONTENTS | PAGE | | | | |
|------------------|------------------------------|---|--|--|--|
| | | | | | |
| ACKNOWLE | i | | | | |
| TABLE OF C | ii | | | | |
| LIST OF TAI | viii | | | | |
| LIST OF FIG | ix | | | | |
| ABSTRACT | | | | | |
| | | | | | |
| | | | | | |
| СНАРТЕК | a 1 introduction | 1 | | | |
| | | × | | | |
| 1 1 1 4 4 | | 1 | | | |
| I.I Introd | luction | l | | | |
| 1.2 Objec | ctive Of The Project | 2 | | | |
| 1.3 Scope | e Of The Project | 2 | | | |
| 1.4 Signif | Significance Of The Project | | | | |
| | | | | | |
| СНАРТЕН | R 2 CORROSION | 4 | | | |
| | | | | | |
| 2.1 Introd | luction | 4 | | | |
| 2.2 Classi | Classifications Of Corrosion | | | | |
| 2.2 Clubb | Machanisms Of Corrosion | | | | |
| 2.5 101011 | Chamical Comparison | 5 | | | |
| 2.3.1 | Chemical Corrosion | 0 | | | |

| | | 2.3.2 | Electrochemical Corrosion | | | 7 |
|--|-----|----------------------|---------------------------------|------------------------------------|-----|----|
| | | 2.3.3 | Corrosive | | 7 | |
| | 2.4 | Corrosion Principles | | | | 8 |
| | | 2.4.1 | Corrosion Rate | | | 9 |
| | | | 2.4.1.1 | Weight Loss | | 9 |
| | | | 2.4.1.2 | Depth of Penetration | | 9 |
| | | | 2.4.1.3 | Acceptable Rates | | 10 |
| | | 2.4.2 | Electrochemical Aspects | | | 11 |
| | | | 2.4.2.1 | Electrochemical Reactions | | 11 |
| | | | 2.4.2.2 | Polarization | | 12 |
| | | | 2.4.2.3 | Passivity | | 13 |
| | | 2.4.3 | Environmental Effects | | | 15 |
| | | | 2.4,3.1 | Effect Of Oxygen And Oxidizers | | 15 |
| | | | 2.4.3.2 | Effects Of Velocity | | 16 |
| | | | 2.4.3.3 | Effect Of Temperature | | 18 |
| | | | 2.4.3.4 | Effects Of Corrosive Concentration | l . | 18 |
| | | | 2.4.3.5 | Effect Of Galvanic Coupling | | 19 |
| | | 2.4.4 | Metallurg | | 19 | |
| | | | 2.4.4.1 | Metallic Properties | | 19 |
| | 2.5 | Forms | | 20 | | |
| | | 2.5.1 | Uniform Attack | | | 21 |
| | | 2.5.2 | Galvanic Or Two-Metal Corrosion | | | 21 |
| | | 2.5.3 | Crevice Corrosion | | | 22 |
| | | 2.5.4 | Pitting | | | 22 |
| | | 2.5.5 | Intergranular Corrosion | | | 23 |
| | | 2.5.6 | 2.5.6 Selective Leaching | | | 24 |
| | | 2.5.7 | 5.7 Erosion Corrosion | | | 24 |
| | | 2.5.8 | Stress Co | rrosion | | 25 |
| | 2.6 | Corro | Corrosion Prevention | | | |
| | 2.7 | Conclusion | | | | 27 |

ABSTRACT

The purpose of this project is an exposure for engineering students to perform on site investigation and analytical jobs regarding rust formation on steel structures exposed in heavy industrial environment. It also gives and understanding about the aggressiveness of the industrial environment against metal, especially steel.

Investigation and observation was done within Shah Alam industrial area, where the result and findings are tabulated. An analysis was done base on the result and findings, and further analysis was done with relates all the findings with the related source that quite similar with the field of studies.

From the site investigation, many steel structures was found rusted and it is mainly caused by the industrial emission and other factors. The environmental data and others information regarding the Shah Alam industrial area, very much assist in an investigation of rust formation on steel exposed in an industrial environment. Corrosion map have been mapping for future references and applications, where applicable.

4