

**THE CHARACTERISATION OF COATED
BOLT AND NUT FOR OIL AND GAS
INDUSTRY**

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UNIVERSITI MALAYSIA PAHANG

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AND NUT FOR OIL AND GAS INDUSTRY**

NURUL IZZATI BINTI AHMAD

Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Applied Science (Honours) Material
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SUPERVISORS' DECLARATION

I hereby declare that I have checked the thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Applied Science (Honor) Material Technology.

Signature

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Date : DECEMBER 2016

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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DEDICATION

My biggest dedication goes to my family; Mr Ahmad Sulaiman, Mrs Javiah Suleiman, Abang Izzy, Izzatul, Izzat and Aiman for their understanding towards my research, and for the non-stop support from the beginning towards the end of this research.

“ To enjoy the rainbow, first enjoy the rain ”

-M-

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LIST OF SYMBOLS

\sim	-	approximately
%	-	percent
η	-	coulombic efficiency
2θ	-	Bragg angle
$^{\circ}\text{C}$	-	degree celcius
\AA	-	angstrom (10^{-10})
g	-	grams
h	-	hour
t	-	time

LIST OF ABBREVIATIONS

SEM	Scanning Electron Microscopy
H ₂ S	Hydrogent Sulfide
PVC	Pigment Volume Concentration
VOC	Volatile Organic Compounds
PSPC	Performance Standard for Protective Coatings
IUPAC	International Union of Pure and Applied Chemistry
NaCl	Sodium Chloride
KCl	Potassium Chloride
Ag	Argentum / Silver
ZnO	Zinc Oxide
Zn	Zinc
Co	Copper
M	Molarity

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ABSTRACT

Corrosion is a common problem encountered in the oil and gas industry. Oil and gas pipelines, refineries and petrochemical plants have serious corrosion problems. Internal corrosion in oil and gas industry is generally caused by water, carbon dioxide (CO₂) and hydrogen sulfide (H₂S), and also can be aggravated by microbiological activity. In this research the investigation of the effectiveness of different layer of zinc spray coat in different salinity to protect the metal are investigated. The sample are sprayed into different layers of zinc spray and immerse into different concentration of Sodium Chloride (NaCl). The test done toward the sample are adhesion test by knife, adhesion test by tape and hardness test by pencil . The study shown that the 5 layer of zinc coated sample are the most effective compared to the other 4 different layers. In this research, the comparision between fluorocarbon coated and zinc coated also were investigated. the final result show that fluorocarbon coated sample is better to protect the pipeline in the oil and gas industry compared to the zinc coated sample due the better performance of fluorocarbon coated sample.

ABSTRAK

Hakisan karat adalah masalah biasa yang dihadapi dalam industri minyak dan gas. Perpaipan untuk minyak dan gas, kilang penapis dan loji petrokimia mempunyai masalah hakisan yang serius. Hakisan dalaman dalam industri minyak dan gas biasanya disebabkan oleh air, karbon dioksida (CO_2) dan hidrogen sulfida (H_2S), dan juga boleh menjadi lebih teruk dengan kewujudan aktiviti mikrobiologi. Dalam kajian ini penyiasatan keberkesanan lapisan yang berbeza terhadap lapisan semburan zink dalam kemasan yang berbeza untuk melindungi logam telah disiasat. Sampel telah disemur dengan lapisan semburan zink yang berbeza dan ditenggelamkan ke dalam kepekatan Natrium Klorida (NaCl) yang berbeza. Kajian yang dilakukan terhadap sampel adalah ujian lekatan dengan pisau, ujian lekatan dengan pita dan ujian kekerasan menggunakan pensil. Kajian ini menunjukkan bahawa sampel yang bersalut dengan 5 lapisan zink adalah yang paling berkesan berbanding dengan yang lain 4 lapisan yang lain. Dalam kajian ini, Perbandingan antara sampel semburan fluorocarbon dan sampel semburan zink turut disiasat. Keputusan akhir menunjukkan bahawa sampel semburan fluorocarbon berbanding sampel semburan zink dalam melindungi paip untuk industri minyak dan gas kerana prestasi yang lebih baik daripada sampel semburan zink.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF RESEARCH

The application of paint on iron substrates is a very efficient method of anti corrosion protection. They are used in many aggressive media such as sea water, marine and industrial environment (Nadia.H, 2011). It is a common fact that in order to achieve a long-life coating system, a zinc primer needs to be applied as the first coat. For solvent-based zinc-rich paints (ZRPs), it seems to be established that, at least at the beginning of immersion, zinc particles provide a cathodic protection of the steel substrate (Nadiah.H, 2011) (C.M. Abreu, 1996). Then, a long term protection develops due to the formation of zinc corrosion products, reinforcing the barrier effect of the paint (Nadia.H, 2011) (Morcillo, 1990). The metallic zinc content in the dry film is a very important parameter to be emphasized in the technical specifications of zinc-rich paints.

The objectives this research is to find out the effectiveness of different thickness of zinc paint in different salinity. However, as observed by Lindquist et al., (Lindquist, 1985) this parameter is not the only factor determining the performance of this kind of paint. For example, Fragata (Fragata, 1987) Del Amo (Amo, April 1990) and Pereira (Pereira, 1990) verified that the chemical nature of the binder and the zinc particle size are also very important.

1.2 PROBLEM STATEMENT

Many manufactures industries now depend on paint and coatings for the long lasting strength, protection and improvement to increase pipeline safety and reduce incidents and related costs for many years and, in fact, have made significant improvements to corrosion detection, assessment, and mitigation technology. Serious attacks appears in warm coast regions, where high salinity and high relative humidity increases the development of filiform corrosion. Filiform corrosion is only present in the atmosphere and occurs especially at a relative humidity of 85% to 95%. Hence it is important to use coating at the outer and inner layer of the pipelines.

1.3 OBJECTIVES OF RESEARCH

Objectives of this research are:

1. To investigate the suitable thickness of the layer which is the most be effectiveness of different thickness spray paint in different salinity.
2. To determine the best coating material between fluorocarbon-coated or zinc-coated to be used in oil and gas industry.

1.4 STATEMENT OF CONTRIBUTION

The approach for this research is based on a comprehensive examination of effectiveness the suitable thickness of the layer which is the most effectiveness in order to protect coated metal in high salinity.

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