THE STUDY OF WET ADHESION BEHAVIOR OF THE ORGANIC COATING ON MILD STEEL SUBSTRATE

MOHD FAUZI BIN ABDULLAH

BACHELOR OF SCIENCE (Hons.) APPLIED CHEMISTRY
FACULTY OF APPLIED SCIENCE
UNIVERSITI TEKNOLOGI MARA

OCTOBER 2001

ACKNOWLEDGEMENT

IN THE NAME OF ALLAH, THE MOST GRACIOUS AND MOST MERCIFUL.

I would like to acknowledge with gratitude the helpful, guidance, comments, suggestions and encouragements to those who had given me an invaluable support in the preparation of this research project. My deepest gratitude to my thesis supervisor, Assoc. Prof. Dr. Mohd Kamal b. Haji Harun for his assistance and guidance throughout the duration of my research.

Special expression towards my beloved family who support and motivated me, all my friends especially Rafedah bt. Rakal, Abdul Halim b. Abu Yaziz, Zul Hazizi b. Khasbulloh and all my lecturers. I really appreciated your kindness, hospitality and your sincerity.

Finally, my appreciation to those had been directly and indirectly involved in the preparation and accomplishment of my thesis project. May Allah bless all of you.

Thank you for all commitment and cooperation.

TABLE OF CONTENTS

ABSTRACT

"THE STUDY OF WET ADHESION BEHAVIOR OF ORGANIC COATING ON MILD STEEL SUBSTRATE"

Wet adhesion behavior of organic coating play an important role to determine the performance of organic coating. In this project, three types of non-pigmented organic coatings; alkyd, polyurethane and epoxy polyamide on mild steel substrate were studied. Water immersion and adhesion pull-tape test were carried out to determine the water uptake capacity and adhesion failure grade for each system. From the result obtained, it shows that as immersion time increase, the water uptake capacity will be increase but the failure grade will decrease. The rate of adhesion failure grade for alkyd was faster than epoxy polyamide and polyurethane. Average water uptake capacity for alkyd was the greatest, which was about 0.0029 kg/cm^2 and average water uptake capacity for epoxy polyamide and polyurethane was only 0.0008 kg/cm^2 and 0.0005 kg/cm^2, respectively.

CHAPTER 1

INTRODUCTION

Paint performance under adverse conditions such as high humidity has always been a subject of interest in the science of adhesion. Issues like wet adhesion or water disbondment behavior of different organic polymers on a substrate, wet adhesion or water disbondment behavior of same polymer on different substrates and wet adhesion or water disbondment performance of coatings with respect to water uptake characteristics are often discussed.

Water disbondment is a consequence of the formation of the metal/coating interface of a discontinuous or, in some cases, a continuous water film several to many molecular layers in thickness. Water migrates into the coating both through capillaries or pores in the coating. Osmotic force, temperature differences and chemisorption or physisorption of water on the metal oxide at the interface are among the mechanisms that may lead to the accumulation of water at the interface. Disbondment of organic coatings by water is usually considered to be initiated by a direct interaction of water molecules with adhesive bonds at the metal/coating interface. These water volumes grow laterally along the metal/coating interface because of the continuing condensation of water molecules. Lateral disbondment occurs because of the stress caused by water condensation at the interface (Spadafora, 1988). The peeling stress exceeds the adhesive bond strength. If the