UNIVERSITI TEKNOLOGI MARA

ADHESION FAILURE OF RUBBER/METAL COMPOSITES UNDER CHLORIDE ENVIRONMENT

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, thereby, acknowledged that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Maintaining a good adhesion between rubber to substrate bond in rubber composite structures is very crucial and of high importance to ensure a satisfactory and efficient products performance in service. The bond durability are influenced by factors of the environments such as moisture, chlorides and corrosion. Bond durability in bonded rubber components exposed in marine environment has been the main subject of study, focusing mainly on understanding the mechanisms resposible for its failures. The main objective of this work is to determine the adhesion failure mechanisms of rubber/metal composites exposed in a simulated chloride containing environment. The experimental works were divided into five major parts including salt spray test, alkaline exposure test, cathodic disbonding & anodic undermining tests, de-adhesion test in water and Linear Polarization Resistance (LPR) & Electrochemical Impedance Spectroscopy (EIS) tests. Characterization of the adhesion failures were conducted using Scanning Electron Microscopy (SEM) with Energy Dispersive X-rays Spectrometry (EDX) technique. The results found that the adhesion behaviour of the bonded rubber to metal exposed in salt environment is primarily controlled by cathodic disbonding induced by corrosion reaction. The disbondment front being cathodic due to the oxygen reduction reaction is alkaline in nature in which the alkaline media attack the 205 primer. The results were supported by cathodic disbonding, alkaline exposure and Fourier Transform Infrared Spectroscopy (FTIR). EIS analysis indicated the changes of the 205 primer barrier properties and concluded that the oxygen uptake within the water become a rate determining step towards attributing to the adhesion failure. The other results found that neither the oxidation reaction nor the water displacement are dominating the adhesion failure.

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