EPOXY PRIMER COATING FILLED MICROCRYSTALLINE CELLULOSE TREATED WITH SILANE COUPLING AGENT ON METAL SUBSTRATE

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(Mohamad Hafizie bin Abd Kudus)

ABSTRACT

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In this study, epoxy resin was successfully incorporated with microcrystalline cellulose (MCC) in the production of the primer coating on metal substrate. Various sonication times were applied for the purpose of determining the ideal sonication period that provides the best barrier performance. The MCCs were also treated with various loadings of 3-Aminopropyltriethoxysilane (APTES) in order to improve the mechanical and corrosion resistance properties. Fourier Transform Infrared (FTIR) Spectroscopy analysis was carried out to examine the chemical interactions and diffusion between MCC, APTES, and epoxy resin. The coating's mechanical attributes were assessed using pencil hardness testing. It was discovered that at 30 minutes of sonication had enhanced the coating materials' hardness to the optimum level of 5H. Moreover, there is an increase in hardness from 5H to 6H with the addition of 7% and 9% of APTES respectively. As of immersion test, after nine days of immersion in a 5% sodium chloride (NaCl) solution, the ideal sonication period was found to be at 30 minutes, with no corrosion occurring aggressively and no flaking or blistering appears on the coating. The mechanical strength and anti-corrosive qualities of the primer coating were eventually enhanced by the addition of MCC modified with APTES. The addition of APTES had improved the interaction between MCC and epoxy, hence achieving better compatibility and promoting a uniformly dispersed MCC throughout the epoxy resin matrix. The Tafel polarization results found that the addition of APTES up to 9% gave the lowest corrosion rate at 0.004 mm/year and the highest polarization resistances at 198.69 kΩ. This is explained by the fact that enough MCC-APTES can serve as a physical barrier and obstruct the paths used by corrosive species to diffuse. Therefore, the MCC-Epoxy treated APTES coupling agent proof has great potential in inhibit the corrosion properties of epoxy primer coatings.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

The corrosion of metals exposed to the atmosphere is determined by the corrosive interaction of the metal with the corrosion resistance of the aqueous electrolyte to the material on the surface of the material (Popoola et al., 2014). This effect is so severe that the annual cost of corrosion is about half the annual cost of all types of metal corrosion. Corrosion is a dangerous and extremely costly problem. Because of it, buildings and bridges can collapse, oil pipelines break, chemical plants leak, and bathrooms flood. Corroded electrical contacts can cause fires and other problems, corroded medical implants may lead to blood poisoning, and air pollution has caused corrosion damage to works of art around the world. The International Measures of Prevention, Application, and Economics of Corrosion Technology (IMPACT) report, issued today by National Association Corrosion Engineers International (NACE), estimates the global cost of corrosion to be US$2.5 trillion, or nearly 3.4 percent of the global Gross Domestic Product (GDP) (Koch et al., 2016).