UNIVERSITI TEKNOLOGI MARA

MECHANICAL, ADHESION AND CORROSIVE PROPERTIES OF UNSATURATED POLYESTER-GRAPHENE COATING TREATED WITH SILANE COUPLING AGENT ON METAL SUBSTRATE

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

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ABSTRACT

Graphene treated with silane based unsaturated polyester resin was successfully prepared for primer coatings application via mechanical stirring and sonication process. The objectives of this study was to investigate the mechanical, adhesion and corrosive properties of various graphene loading (0, 2, 4, 6 wt%) filled unsaturated polyester reinforced on metal substrate and determine the effect of silane treatment on graphene reinforcement in unsaturated polyester-graphene coating for primer application with different graphene-silane loading (0, 1, 3, 5 wt%). Mechanical properties via hardness test has been conducted, whilst for adhesion properties via pull out test and contact angle measurement were performed. Immersion test and Tafel Polarization method were conducted to determine the corrosive properties of primer coating. In hardness testing, UPE-GR/GPS regardless of its loading give the highest value of scratch resistance at 5H. While as for pull out test, UPE/GR and UPE/GR-GPS show the same scale which is scale 5. This is attributed to the properties of graphene itself high in strength since it does not affected when the pull-out test was carried out. 3 % of UPE/GR-GPS gives optimum value for advancing which is 153.544° and receding is at 127.254° compared to others samples. On the other hand, immersion test in two medium which is NaCl and seawater solution show an improvement of corrosion when addition of silane regardless of % loadings was implemented on graphene due to the presence of less corrosion at day 6 as compared to control sample that started to corrode at day 3. As for Tafel polarization, 3 % UPE/GR-GPS showed the optimum polarization resistance which is 185.56 Ω and the lowest corrosion rate which is 0.148 mmpy. Overall, the incorporation of graphene/silane into composite improved the mechanical, adhesion and corrosive properties and the optimum coating formulation was found at 3 % UPE/GR-GPS.

TABLE OF CONTENT