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A study on the corrosive performance of acrylic-epoxy based coatings: The significance of its electrochemical impedance evaluations

Abstract:

Since few decades, researchers have continuously devoted significant efforts to develop coatings as an alternative approach to protect corrosion. Herein, a series of coatings containing various ratios of acrylic and epoxy resins were developed to investigate the corrosion protection on mild steel substrates. In addition, 1 wt.% polydimethylsiloxane (PDMS) solution was incorporated as a modifier to enhance the corrosion protection performance and the hydrophobicity of the coatings. The chemical structures, degree of transparency and surface wettability of the fabricated coatings were evaluated by the Fourier-Transform Infrared Spectroscopy (FTIR), ultraviolet-visible (UV-Vis) spectroscopy and water contact angle (WCA) instrument respectively. In addition, Cross hatch test (CHT) method was employed to analyze the coating surface adhesion in accordance with the ASTM D3359 B standard. Furthermore, the electrochemical impedance spectroscopy (EIS) was employed to evaluate the corrosion protection performance of the coatings. Among all the coating samples, the EIS results revealed that the T1, T5, and T7 coating samples containing higher ratios of acrylic resin exhibited pronounced impedance modulus (|Z| _(0.01 Hz)) values exceeding 10^10 Ω cm ^2 throughout 60 days of exposure to the corrosive medium, 3.5 wt.% NaCl solution. Moreover, this finding was supported by the breakpoint frequency measurement which showed that the T1 and T5 coating samples performed at a full capacitive region even after 60 days of immersion. From this investigation, it was concluded that the T5 coating sample exhibited optimum results, thus enhancing the overall corrosion protection performance.

Biography

Assoc. Prof. Ir. Ts. **Dr. Sachin Sharma Ashok Kumar** is a material scientist experienced in the development of graphene and graphene oxide nanomaterials incorporated with reinforced composites, supercapattery, batteries, solar cells, fuel cells, hydrogen storage, polymer nanocomposites, corrosion coatings and 3D composites for numerous engineering applications. He received both of his BSc. degree (Hons.) and MSc. (Hons.) in Mechanical Engineering minor in Materials Science from Wichita State University, USA in year 2011 and 2012, respectively. He received his Ph.D. in Advanced Materials Science Engineering in University Malaya in year 2023. His current research involves the synthesis of super-hydrophobic graphene-based polymer nanocomposite coatings for corrosion applications. He has published over 50 articles in various high-ranked ISI/WoS- and Scopus-listed journals, participated in international conferences as a keynote speaker and has received several excellence awards at international/national exhibitions pertaining to his research and inventions. He is currently a member and a Professional Engineer registered with the Board of Engineers Malaysia (BEM) and Institution of Engineers Malaysia (IEM) and a Professional Technologist with Malaysia Board of Technologists (MBOT).