

Impedance Study of Polyaniline Coated Mild Steel In 0.5m NaCl Solution

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Structured Abstract

Background: Conductive polymers, such as polyaniline (PANI), polypyrrole (PPy), and polythiophene (PTH), are corrosion-resistant and environmentally safe.

Methods: In this study, PANI coatings were electrochemically synthesized on mild steel using cyclic voltammetry in oxalic acid. The coating's barrier properties against corrosion were evaluated in a 0.5 M aqueous sodium chloride solution at various immersion times using electrochemical impedance spectroscopy (EIS).

Results: PANI exhibited an oxidation peak at +0.25 V to +0.40 V (Ag/AgCl). FTIR revealed the presence of N-H stretching at 3272.6 cm^{-1} , confirming the formation of PANI. FESEM showed a fibrous morphology, resulting from PANI self-assembly. EIS measurement indicated the highest impedance at 5-hours exposure time in 0.5M NaCl solution, with values for R_c , R_{ct} , R_{diff} , CPE_c , CPE_{dl} , and CPE_{diff} obtained as 1.257 ohm.cm^2 , 20.14 ohm.cm^2 , $0.6138\text{E-}03\text{ F.cm}^2$, $22.6\text{E-}03\text{ F.cm}^2$, $2.411\text{E-}03\text{ F.cm}^2$ respectively.

Conclusion: In conclusion, successful electrochemical synthesis of PANI coating on mild steel in oxalic acid using cyclic voltammetry was achieved. The oxidation process of aniline monomer led to rapid formation of a polymer-like film with a greenish colour covering the steel surface.

Keywords: Conductive polymer, Coating, Polyaniline, Electrochemical Impedance Spectroscopy

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