

**ANTI-CORROSION PERFORMANCE OF ELECTROCHEMICALLY
SYNTHESIZED POLYANILINE-GRAPHENE NANOCOMPOSITE**

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Polyaniline (PANI) is known as one of the best candidates for corrosion protection. In its conductive emeraldine salt form, it provides anodic protection by passivating the metal surface and promoting the formation of the metal oxide layer. However, the corrosion protection performance of PANI is constrained by its limited electrical conductivity. Therefore, further enhancing the anti-corrosion performance of PANI is a challenge. Graphene is an advanced carbon material having good electrical conductivity. Therefore, to improve the electrical conductivity and thereby ensure improved electron transfer for better anti-corrosion performance, a graphene-PANI nanocomposite was synthesised. In this study, a facile electrochemical approach was proposed to synthesize the nanocomposite. This method involved electrochemical polymerization of aniline using cyclic voltammetry (CV) by applying ten cycles in 0.1 M H₂SO₄ in the presence of electrochemically synthesized graphene. Synthesised material was structurally characterized using UV-visible and FTIR spectroscopy. The UV-visible data showed a characteristic band at ~265 nm, confirming the presence of graphene, and FTIR analysis confirmed the presence of PANI. The electrochemical characterization was carried out in 0.1 M HCl to illustrate the anti-corrosion performance. Potentiodynamic polarization data showed that corrosion potentials significantly shifted to the anodic region by 280 mV in the presence of PANI-graphene nanocomposite compared to bare stainless steel, indicating enhanced corrosion protection. The corrosion rate decreased significantly from 0.36 mm/yr for the bare stainless steel to 0.02 mm/yr. The electrochemical measurements, therefore, indicated that the inhibition efficiency for PANI-graphene nanocomposite was 95% compared to bare stainless steel. Electrochemical impedance spectroscopy data showed improved anticorrosive performance for nanocomposite. These findings indicate that the PANI-graphene nanocomposite synthesised via a facile method demonstrates significant anticorrosion performances. Therefore, the PANI-graphene nanocomposite is an ideal candidate for anti-corrosion application having enhanced barrier protection with improved electrical conductivity.

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