Galvanostatic Deposition of Polyaniline on Mild Steel and Its Corrosion Performance in Na_2SO_3 Medium

Dipak Kumar Gupta* and Amar Prasad Yadav

Central Department of Chemistry, Tribhuvan University, Kirtipur, Kathmandu, Nepal
**** E-mail:*** **deepakguptas2012@yahoo.com**

Abstract Polyaniline (PANI) is extensively researched as a corrosion protection coating for mild steel (MS) against acidic and neutral media. Corrosion inhibition performance of PANI coating on MS depends on the electrolytic solution employed for polymerization. In this study, the galvanostatic deposition of PANI on MS using sodium potassium tartrate (Na-K tartrate) and benzoic acid in the alcohol-water (BAW) medium is reported. The influence of current density on the development of a homogenous and adherent PANI coating on MS was explored at various current densities. The obtained PANI coatings were characterized for its morphology by using scanning electronic microscopy (SEM), optical microscope and corrosion performance by using potentiodynamic polarization in 0.4 M Na_2SO_3 solution simulating an industrial environment. The results revealed a sequential process of dissolution, passivation of MS followed by oxidation of aniline monomer and subsequential nucleation and growth of PANI coating. The inhibition efficacy of PANI coating was affected by the applied current density It was found that the PANI coating obtained in Na- K Tartrate at 0.5 mA cm^{-2} results in better coating producing corrosion inhibition efficiency (IE) of approximately 90%. Similarly, inhibition efficiency of the PANI coating obtained in BAW at 100 µA cm^{-2} results 96 %. The PANI film obtained in BAW showed stability in 0.4 M Na_2SO_3 solution at a higher anodic potential than PANI obtained in Na- K tartrate. The IE of PANI coating obtained in BAW by the galvanostatic method was higher than PANI obtained in Na-K Tartrate. PANI coating obtained in BAW electrolyte was superior in all the electrolytes.

Keywords: Electropolymerization; Mild Steel; Benzoic acid in alcohol-water; Polyaniline

Reference

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