Oral Presentation

Study of Structural, Thermal & Electrical Properties of Metal-Doped Polyaniline (PANI) and its Application as Coating Development on Steel Substrate

M Priyanka[1], Sukanta Badaik[2], Priyaranjan Mohapatra[1], Suryakanta Nayak[3], Tapan Kumar Rout[3,*]

[1]Department of Chemistry, Veer Surendra Sai University of Technology, Burla, India-768018
[2] Department of Chemistry, National Institute of Technology, Jamshedpur, India-831014
[3]Surface Engineering Research Group, Tata Steel Limited, Jamshedpur, India-831001

[*]Corresponding author

ABSTRACT

Polyaniline (PANI) has emerged as a promising conducting polymer owing to its chemical stability, controllable electrical conductivity, and suitable for surface modification applications. The present research focuses on the synthesis of metal-doped polyaniline and a systematic investigation of its structural, thermal, and electrical properties, with special emphasis on its application in corrosion-resistant coating development. Metal doping is employed to improve charge transport behaviour, thermal stability, and barrier properties of the polymer matrix, thereby enhancing its protective performance when applied as a coating on metallic substrates. The structural characteristics of metal-doped polyaniline are analysed using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) to confirm successful incorporation of metal ions and their interaction with the polymer backbone. Thermal stability and decomposition behaviour are examined through thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC), while electrical conductivity is evaluated using appropriate electrical measurement techniques (using LCR meter). The corrosion protection performance of the developed coatings is assessed using Salt Spray Test (SST) and electrochemical techniques such as potentiodynamic polarization and electrochemical impedance spectroscopy (EIS). The results demonstrate that metal doping significantly enhances the electrical conductivity, thermal stability, and corrosion resistance of doped-polyaniline-polyimide coatings. The improved performance is attributed to synergistic effects between the metal dopants and polyaniline, leading to effective passivation and barrier protection of the underlying metal. This study aims to establish metal-doped polyaniline as an efficient, environmentally friendly, and multifunctional coating material for advanced corrosion protection applications.

Keywords: Corrosion; Polyaniline; Metal Doping; Polyimide; Coatings; Electrical Conductivity

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