Electropolymerization of 2-Methoxyaniline: Kinetic Studies, Mechanism, Characterization of the Polymer and Applications as Corrosion Protection for Mild Steel in Acid Medium

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Abstract:

Electropolymerization of 2-methoxyaniline on platinum electrode in acid medium was carried out under different reaction conditions as temperature, current density, hydrochloric acid, and monomer concentrations with reaction duration time. The initial rate of the electropolymerization reaction is small and the orders are found to be 1.18, 1.25, and 0.88 with respect to current density, HCl, and monomer concentrations, respectively. The apparent activation energy (Ea) is found to be 56.87 kJ/mol. The obtained polymer films are characterized by 1H-NMR, elemental analysis, and IR spectroscopic studies. The mechanism of the electropolymerization reaction has also been discussed. The thermogravimetric analysis (TGA) was used to confirm the proposed structure and determination of the number of water molecules associated with each polymeric chain unit. X-ray and scanning electron microscopic analysis were used to investigate the surface morphology. The corrosion behavior of uncoated and coated mild steel electrode with poly (2-Methoxyaniline) in 1 M HCl at 25°C was investigated potentiodynamically. The various electrochemical parameters (Icorr, Ecorr, and P%) were calculated from Tafel plots for uncoated and coated electrodes. The influence of some coating conditions as duration time, current density of the electropolymerization, and monomer concentrations were investigated. The data reveal that the presence of

coated polymer films on the electrode surface increase the cathodic and anodic polarization compared to the uncoated sample.