Corrosion Behavior Of Coppe In Nitric Acid

Hossam Dsoky Abd El-Magied Sabaa

Cu is consider as one of the most popular metal which occupy avital position in our daily life owing to its wide application in Copper provide superior properties in many of the applications.They are widely used in valve systems. They are mostly used inelectrical industry, rails, lock bodies, door knobs etc.The aim of the present work is to study the corrosion behavior of Cu in.1 M HNO3 solution.The thesis contains three chapters; the first one deals with thefollowing fields of interest:(1) Corrosion definition, classification of corrosion and corrosion mechanism.(2) Literature survey of the corrosion behavior of Cu.(3) Aim of the present work.Chapter two It deals with the experimental part. It includes the chemical composition of the investigated Cu, preparation of nitric acid solution, preparation of amine derivatives and the procedures used for the corrosion measurement such as the potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques. The results obtained and their interpretations are shown in chapterthree under five separated parts (1, 2, 3, 4 and 5) 020Summary Part 1: Include the results of potentiodynamic polarization measurements forCu in 0.1 M HNO3 solution in the absence and presence of different concentrations of amine derivatives. The polarization curves indicated that the investigated compounds influence cathodic processes; the order of decreased inhibition efficiency of the additives is as follows: dibutyl amine diethyl amine diphenyl amine.Part 2The effect of temperature on the corrosion rate of Cu in 0.1 M HNO3 solution in the absence and presence of the investigated amine derivatives has been also studied. Arrhenius plots of the corrosion current density (log jcorr) against reciprocal of absolute temperature (1/T) were found to be linear and obeyed the following equation: logjcorr = log λ – (Ea* / 2.303 RT) (3.13)Thermodynamic parameters (ΔH* and ΔS*) were also calculated and discussed. Also the percent inhibition is decreased with increasing the temperature; this indicated that, these compounds are physically adsorbed on the surface of Cu. The results showed that the adsorption of these compounds obeyed Temkin adsorption isotherm. The results were treated to obtain the free energy of adsorption ΔG°ads and the binding constant K using the kinetic model and Temkin isotherm. Summary Part 3: Include AC impedance spectroscopy measurements for Cu in 0.1 M HNO3in the absence and presence of different concentrations of the investigated amine derevativs.from the impedance data, we conclude that: i-The value of Rct increases with increase in the concentration of the inhibitors and this indicates an increase in the corrosion inhibition efficiency in acidic solution.i-The value of double layer capacitance decreases by increasing the inhibitor concentration. This is due to the adsorption of these compounds on the electrode

surface leading to a film formation on the Cu surface. iii -The %IE obtained from EIS measurements are close to those deduced from polarization. The order of decreasing inhibition efficiency of the additives is as follows:dibutyl amine diethyl amine diphenyl amine. Part 4:The EFM is a nondestructive corrosion measurement technique that can directly give values of the corrosion current without prior knowledge of Tafel constants like EIS; it is a small AC signal. Intermodulation spectra obtained from EFM measurements; however, two sine waves (at different frequencies) are applied to the cell simultaneously. from the impedance data, we conclude that: i-The corrosion current densities decrease by increasing the concentration of investigated amine and the inhibition efficiencies increase by increasing investigated amine concentrations. ii-Values of causality factors indicate that the measured data are of good quality. The standard values for CF-2 and CF-3 are 2.0 and 3.0,respectively. The %IE obtained from EFM measurements are close to those deduced from polarization and EIS. The order of decreasing inhibition efficiency of the additives is as follows: dibutyl amine diethyl amine diphenyl amine. Part 5: Include the calculation of some quantum chemical parameters for the investigated amine derevatives, such as highest occupied molecular orbital (EHOMO), lowest unoccupied molecular orbital (ELUMO), energy gab (ΔE) and dipole moment (μ) using semi-empirical PM3 method. The theoretical results obtained have been compared with the experimental data and the relations between the inhibition efficiency and quantum parameters have been discussed. It is clear that the inhibition efficiency increases with decreasing the energy gap (ΔE) and with increasing EHOMO. So, the order of decreasing inhibition efficiency is as follows: dibutyl amine diethyl amine diphenyl amine This thesis contains also references, Arabic and English summaries.