SUMMARY

Corrosion is a major issue for the increase of service life and reliability of metallic materials. A detailed understanding of the mechanisms of corrosion helps us to solve existing corrosion problems and to prevent future problems. This work discusses the corrosion inhibition of copper in nitric acid solution.

This work contains three chapters:

Chapter one "Introduction"

This chapter includes different theories of corrosion, causes of corrosion, forms of corrosion, corrosion inhibition and types of inhibitors, and literature survey on corrosion of copper in acid medium.

Chapter two" Experimental Techniques"

It includes the chemical composition of the investigated material, preparation of the used nitric acid solution, and procedures used for the corrosion measurements such as a weight loss and electrochemical techniques.

Chapter three" Results and Discussion"

It deals with the results obtained and their discussion and this chapter is divided into three sections:

First Section:

1) The inhibition efficiency of quinazoline compounds toward the corrosion of copper in 2MHNO_3 was calculated using weight loss method measurements. The inhibition efficiency of there compounds increases with increasing the inhibitor concentrations. The order of inhibition efficiency decreases in the following order:

5 > 4 > 3 > 2 >1.

2) The degree of surface coverage (θ) for the inhibitors on the metal surface increases with increasing the concentration in the corrosive medium. The action of the inhibitors in the aggressive acid was assumed to be due to their adsorption at the metal /solution interface. The adsorption process obeys Frumkin's isotherm.

3) The effect of temperature on the corrosion inhibition of copper in 2M nitric acid was determined over the temperature range 30-50^0 C using weight loss measurements. The rate of corrosion increases with increasing the temperature together with decrease in inhibition efficiency indicating that the inhibition occurs through physical

adsorption of the additives. Thermodynamic functions of activation were calculated in presence of $13x10^{-6}$ M of quinazoline compounds.

4) Synergistic effect of quinazoline compounds with KBr or KCl on copper corrosion inhibition in 2M nitric acid was studied. The results indicate that the inhibition efficiency increased in presence of 10^{-4} M of each of these anions. The adsorption ability on the copper surface was decreases in the following order KBr > KCl.

Second Section:

The effect of quinazoline compounds on the anodic and cathodic polarization of copper electrode in 2M HNO_3 solutions was investigated. The corrosion rate (I_{corr}) was found to decreased with increasing of concentration of the additives. The polarization curves indicate that these compounds influence both anodic and cathodic processes (i.e. mixed inhibitors). The order of inhibition efficiency decreases in the following order

5 > 4 > 3 > 2 > 1.

Third Section:

In this section potentiodynamic anodic polarization curves of copper electrode in 2M HNO_3 at different concentrations of NaCl solution was

studied. It was found that the Cl^- ions cause the destruction of the passivating oxide film and initiate of pitting corrosion. The pitting corrosion potential is shifted to more negative values with increasing chloride ion concentrations.

Trials were made to inhibit the pitting corrosion using organic compounds such as quinazoline compounds. These compounds shifted the pitting potential to more positive values, indicating the inhibiting effect of these compounds.

The influence of the chemical structure of the used quinazoline compounds on their inhibition efficiencies was discussed, the order of these inhibition efficiencies depends mainly upon the number and the electron density of adsorption active centers, skeletal representation of the molecules supported this explanation.

In conclusion, the weight loss measurements, galvanostatic and potentiodynamic support that the assumption that corrosion inhibition primarily takes place through adsorption of the inhibitors on the copper surface. Agreement among these different independent techniques indicates the validity of the obtained results.

This thesis contains also references, Arabic and English summaries.