English Summary

It is known that nickel and nickel alloys are important materials for the design vessels in different industrial processes. Nickel electrode is also used in different energy producing cells in which aqueous or non-aqueous solutions are used as electrolytes. In such aspect, the corrosion and corrosion inhibition of nickel in different media become very interesting and important owing to its wide applicability in industry and domestic life.

The purpose of the present investigation is to study the corrosion and corrosion inhibition of nickel in carbonate and chromate solutions in absence and presence of some analytical organic compounds such as (methyl red, methyl orange and methyl violet).

This thesis comprises four main chapters:-

Chapter (I) is concerned with an introduction reviewing concisely the relevant literature related to the project of investigation.

Chapter (II) deals with experimental part, which includes, types of electrodes that are used in different techniques, methods of preparation of materials of various solutions used. Also experimental techniques contain the instruments and the procedures used for corrosion measurements, using the chemical technique (open circuit potential method) and the electrochemical techniques (galvanostatic polarization method and potentiodynamic method).

Chapter (III) is divided into three parts: Part one is concerned with potential-time curves for the nickel electrode in different concentrations of sodium carbonate and sodium chromate. It is found that, the steady

state potential is shifted to more negative values with increasing concentrations of these solutions.

Part two: contains the effect of additions of corrosive salts (NaCl, KBr, KI and $Na_2S_2O_3$) on the passive behavior of Ni in carbonate and chromate solutions. The presence of corrosive salts lead to breakdown of the passive layer on the metal surface and formation of pitting corrosion.

Part three: displays the effect of the addition of some analytical organic indicators compounds such as methyl red, methyl orange and methyl violet on the potential-time curves of the nickel electrode in 0.1M K_2CO_3 or 0.01M Na_2CrO_4. It is found that the steady state potential is shifted to more positive values with increasing the concentration of the above additives where the order of the positive shift is decreased in the following order:

methyl red > methyl orange > methyl violet

Chapter (IV): includes three sections:

Section (A)

This section deals with the galvanostatic polarization of the nickel electrode in different concentrations of K_2CO_3 solutions. Increase of K_2CO_3 concentration was accompanied by:

i) Change of anodic and cathodic Tafel slopes.

ii) The corrosion potential is shifted to more negative values.

iii) The corrosion current density increases.

The effect of methyl red, methyl orange, methyl violet on the galvanostatic polarization curves of the nickel electrode in 0.1M K_2CO_3 studied. It is clear that, as the concentration of additives increases:

i) The corrosion potential is shifted to more positive values.

ii) The corrosion current density decreases and consequently, the inhibition efficiency increases. This indicates an obvious inhibiting effect of such compounds.

The adsorption of the inhibitor molecules on the nickel surface obeyed Freundlich adsorption isotherm according to the following equation:-

$$\theta = KC^n$$

Section (B)

1) Includes a discussion of the potentiodynamic anodic polarization curves of nickel in different concentrations of K_2CO_3 or Na_2CrO_4 solutions. It was found that corrosive ions such as (Cl^-, Br^-, I- and $S_2O_3^{2-}$) cause the destruction of the passivating oxide film and initiate the pitting corrosion. The pitting corrosion potential is shifted to more negative values with increasing the concentrations of corrosive anions.

2) Trials were made to inhibit the pitting corrosion using analytical organic indicators compounds such as methyl red, methyl orange and methyl violet. These compounds shifted the pitting potential to more positive values, indicating the inhibiting effect of these compounds and the order of these inhibitors was as shown above.

Section (C)

Comprises the relation between chemical structure of inhibitors and corrosion inhibition, where the order of inhibition efficiency is decreased in the following order:

methyl red > methyl orange > methyl violet