reversible potential, $a_{n.p}$ is the activity of components, and $S_{n.p}$ is the real area of the component "n" in the phase "p", $a^b{}_n$ is the activity of the bulk phase, and E_I is the initial potential. $C^s{}_n$ and $C^b{}_n$ are the surface and bulk concentrations of the metal ion species in the electrolyte.

Equation (24) assumes that the dissolution and deposition processes are interfacially controlled by charge transfer and heterogeneous chemical interaction with mass transport coupling through the surface concentration term for solution species. The double layer charging currents may be neglected, since the scan rates employed are extremely low, except when the film thickness is only about a monolayer. The charging current corrections for monolayers are usually complicated, since the double layer processes are not separable a priority(41). The terms, $a_{n,p}$, $E^{rev}{}_{n,p}$, and $S_{n,p}$ will depend on whether the electrodeposited alloy is of the eutectic, solid solution, or intermediate phase type.

Electroplating of Tin:

Tin is soft, ductile, corrosion-resistance in a variety of atmospheres and easily solderable. It has a clean, attractive appearance and is non-toxic in contact with food stuffs(42). In view of these attributes, it is not surprising that tin has been used for many centuries as coating of other metals. Therefore, intensive studies were carried out to obtain tin electroplates suitable for above purposes from, for example, sulphamate(43), flouborate(44,45), stannous sulphate(46-48), stannic hydroxide(46) stannous chloride (46), stannous flouborate(46), and sodium or potassium stannates(46).

The electrodeposition of tin from stannous acid bath in the presence of polyethoxylated additive (TX-102) was studied by ***R.E. Gana et al.***(50). It was fond that, the additive causes a substantial increase in the overpotential for the discharge of Sn(II) ions. Below 0.12 gm dm^{-3} the additive has little effect on the quality of tin deposits. Periodic oscillations in the voltage of the cell were observed, which were associated with the initial growth of whiskers. For high concentrations of additive, the deposits were smooth and homogenous and no growth of whiskers and no voltage oscillation were observed.

S.S. Abd El Rehim et al. (51), studied the electrodeposition of tin on steel substrate from solutions containing sodium stannate and sodium hydroxide. The effect of the increasing of the halid ions concentrations on cathode polarization, cathodic current efficiency, throwing power, quality and structure of the deposits was investigated. It was found that, the cathodic polarization increases with increasing of both hydroxide and halid ion concentrations. Also, sodium hydroxide markedly reduces the cathodic current efficiency but addition of halides slightly improves it.

Tin metal has been electroplated from baths containing stannous sulfate, sodium gluconate and potassium sulfate onto steel substrates under different conditions of bath composition, pH, current density and temperature (49). A detailed study has been made of the effect of these parameters on potentiodynamic cathodic polarization, cathodic current efficiency, microstructure and morphology of the deposit. The throwing power of these baths has been examined under the effect of these parameters. The presence of gluconate ions in the bath improved the quality of the deposits and the throwing power of the bath. The deposits consisted of one phase (β-phase) with tetragonal structure.

Electroplating of Nickel:

Nickel electrodeposition is one of the oldest protective and decorative metallic coating for steel, brass and other basis metals. Therefore, intensive studies were carried out to obtain nickel electroplates suitable for different purposes from, for example, chloride(54), sulphamate(55), fluoborate(56), chloride-sulphate(57), and acetate baths(58). Nickel electroplates are extensively studied from Watts-type baths in the presence of organic brighteners(59,60).

The influence of additives on the electrodeposition of nickel from a Watts bath has been studied by ***T. Mimani et al***(61). The influence of the additives on the cathodic and anodic reactions show the importance of careful bath preparation of a quality controlled product.

According to ***S.S. Abd El-Rehim et al***(58)., the operating conditions to obtain a mirror-bright nickel plate from acetate baths. are : i = 2A dm^{-2}, t = 10 min and pH 5.25 at 25°C. Electroplating in the presence of 1g gelatin l^{-1} and, or 1g toluene 4-sulphonic acid l^{-1} as organic additives was also studied.

Nickel electrodeposits on a poly crystalline iron substrate has been studied by ***K. Kamei***(62), the study was done by using transmission electron microscopy. The nickel deposits grow heteroepitaxially even at high current density on a chemically cleaned substrate iron.

J.P. Hoare(63) investigated the role of boric acid in the Watts bath using Pt microelectrdes in various solutions of nickel ions. The data indicated that at a Pt surface in a solution of $NiSO_4$ hydrogen was evolved before the metallic layer was laid down. The presence of boric acid lowers the overvoltage on Ni deposition.

Relevant work about the mechanism of electrocrystallization of nickel in acidic solution was studied by ***I. Epelboin and R. Wiart***(64). This mechanism is studied by means of the analysis of the polarization characteristic and of the cathodic impedance. The result can be accounted for by a mechanism implying two successive transfer reactions in which $(NiOH)_{ads}$ acts as intermediate compound and not as catalysts.

The hydrogen discharge during nickel deposition was investigated by many authors(65,66), ***M. Fleischmann et al.***(66) showed that a mixture of two nickel phases is usually deposited. These two phases have been identified as hydrogen rich β-nickel and the solid solution α-nickel. However, ***E. Chassaing et al.***(65) reported their observation by means of impedance measurements and study the kinetics of nickel electrocrystallization in strongly acidified chloride electrolytes

The microstructure of nickel plated by pulse electrolysis was studied by ***C. Kollia et al.***(67). It was found that nickel growth from an organic free Watts bath working under d.c. plating conditions is governed by several interfacial inhibitors such as H_2/H_{ads}. Or

$Ni(OH)_2$ .These inhibitors determine most of the structural or microscopic properties of the nickel plates.

Electroplating of nickel onto steel substrates from citrate baths has been investigated under different conditions of bath composition, current density, pH and temperature. A detailed study has been made of the influence of these variables on the potentiodynamic cathodic polarization curves, cathodic current efficiency and throwing power, as well as the throwing index of these baths. The optimum conditions of producing sound and satisfactory nickel deposits are: