EFFECT OF ADDITIVES ON THE DIFFUSION COEFFICIENT OF NICKEL ELECTRODEPOSITION

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Introduction

The diffusion of nickel plays a critical role in the transfer of ions from the anode and to the cathode during nickel deposition. The presence of additives also influences the rate of deposition [1]. While the additive Saccharin increases the deposition and dissolution current, the additive coumarin inhibits deposition and dissolution by decreasing diffusion co-efficient. The present study aims at calculating the diffusion coefficient, which helps to understand the role of various additives in nickel electro deposition[2].

Experimental Details

All the electrolytes $NiSO_4.6H_2O$, $NiCl_2.6H_2O$, boric acid, coumarin and saccharin were prepared using analytical reagent grade. Solutions were prepared in double distilled water. Platinum electrodes were used as working and counter electrodes. A Saturated calomel electrode was used as the reference electrode. Experiments were carried out at room temperature under thermostatic conditions. Current Potential curves were obtained from Bioanalytical System using cyclic Voltammetric technique.

Results and Discussion

The effect of saccharin on nickel deposition and dissolution is depicted in Fig.1. With respect to Saccharin concentration (0.05g/l to 0.1g/l), the deposition and dissolution peak current increases. This increase could be due to electron withdrawing group present in the aromatic ring of Saccharin molecule, which favors oxidation of metal [3]. When the concentration is increased to 0.15g/l, the peak current decreases. (Which is also reflected from the diffusion coefficient values, indicated in the Table (I). the inflection point occurs in between 0.1g/l to 0.15g/l of saccharin.

Effect of coumarin

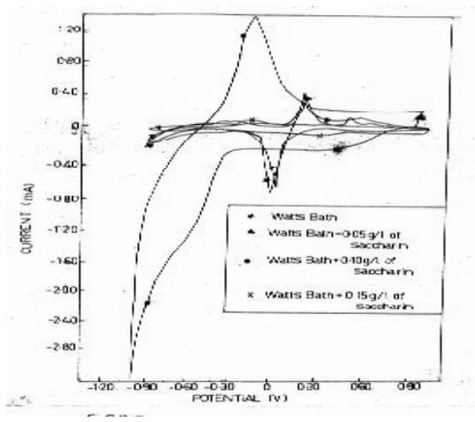
The anodic charge decreases with the addition of coumarin, which is evident from the diffusion coefficient values given in Table (I). This is because coumarin gets preferentially adsorbed on to the Ni electrode surface by the opening of >C = C< and the formation of C-Ni bonds [3]. Coumarin gets adsorbed on the electrode surface and hence increasing the concentration of coumarin inhibits Ni deposition.

Thus addition of coumarin decreases diffusion coefficient, while saccharin increases the same. Further results are discussed in the paper.

Fig. 1. Effect of Saccharin on the electro deposition and dissolution of Nickel from Watts Bath

Bath Composition	Watts Bath	Watts Bath + 0.05g Saccharin	Watts Bath + 0.1g Saccharin	Watts Bath + 0.15g Saccharin	Watts Bath + 0.05g Coumarin
Cathodic Diffusion Co-efficient cm^2/s	1.39 x 10^{-5}	1.904 x 10^{-5}	1.95 x 10^{-5}	2.487 x 10^{-6}	1.877 x 10^{-6}
Anodic Diffusion Co-efficient cm^2/s	1.874 x 10^{-6}	3.385 x 10^{-6}	2.76 x 10^{-5}	3.17 x 10^{-7}	2.99 x 10^{-7}

Table I. Diffusion Co-efficient values for Nickel Deposition and dissolution from Watts Bath with additives



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