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## COMPARATIVE STUDY OF CORROSION INHIBITOR EFFICIENCY ON NICKEL-COBALT ALLOY THIN FILM FOR MARINE ENVIRONMENT

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### ABSTRACT

Ni-Co alloy thin films have been grown on steel substrate from a sulphate bath. A Comparative study on corrosion rates of alloy have been done in NaCl corrosive medium in presence and absence of Pyridine used as inhibitor in deposition bath and inhibitor efficiency was calculated. The pyridine was found suitable for the better corrosion resistance i.e. alloys synthesized in presence of pyridine showed more corrosion resistance.

**Key words:** Corrosion, corrosion resistance, alloy, inhibitor.

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### I. INTRODUCTION

Nickel and cobalt both are iron group metals with good anti-corrosion<sup>[1]</sup> ability. Ni-Co alloys are achieving great interest of researcher community due to its better applications. Now a day it is widely used in marine industry<sup>[2]</sup> due to its durable properties. Many researchers synthesized Ni-Co alloys<sup>[3-5]</sup> from different synthesis techniques and studied its structural<sup>[6]</sup>, morphological and mechanical properties. The codeposition of nickel and cobalt with higher concentration of cobalt is anomalous in nature. Inhibitors<sup>[7]</sup> are the substances which suppress the effect of corrosion on the alloy thin films. Pyridine is an organic substance having one nitrogen atom in ring structure. Very less amount of these inhibitors are sufficient to inhibit corrosion action either by altering cathodic or anodic activity or by adsorption on surface of the alloy.

The motive of present work is to compare and report the anticorrosion ability of electrochemically synthesized Ni-Co alloy thin films in presence and absence of pyridine used as organic inhibitor.

### II. MATERIAL AND METHOD

Ni-Co alloy thin films were synthesized by electrodeposition from citrate bath containing sulphates of Nickel and cobalt along with boric acid as buffer. The films were deposited on steel substrate using a conventional three electrode cell having standard calomel electrode as reference electrode. A static current density of 2mA/cm<sup>2</sup> was applied for 20 minutes for codeposition of Ni-Co alloy thin film. The corrosion behavior was tested electrochemically by tafel polarization method in 0.1M and 0.01M NaCl medium for alloys in presence and absence of inhibitor.

### III. RESULTS AND DISCUSSION

The Ni-Co alloy thin films deposited on steel substrate in presence and absence of pyridine at 2mA/cm<sup>2</sup> current densities with the 1:1 Ni/Co ratio in deposition bath. The corrosion behavior was tested by polarization method in NaCl solution at two different concentrations i.e. 0.1M and 0.01M because the main constituent of seawater is about 3.5% sodium ions and Chloride ions. The corrosion rates were calculated by tafel polarization curves shown in fig. 1(a-b).

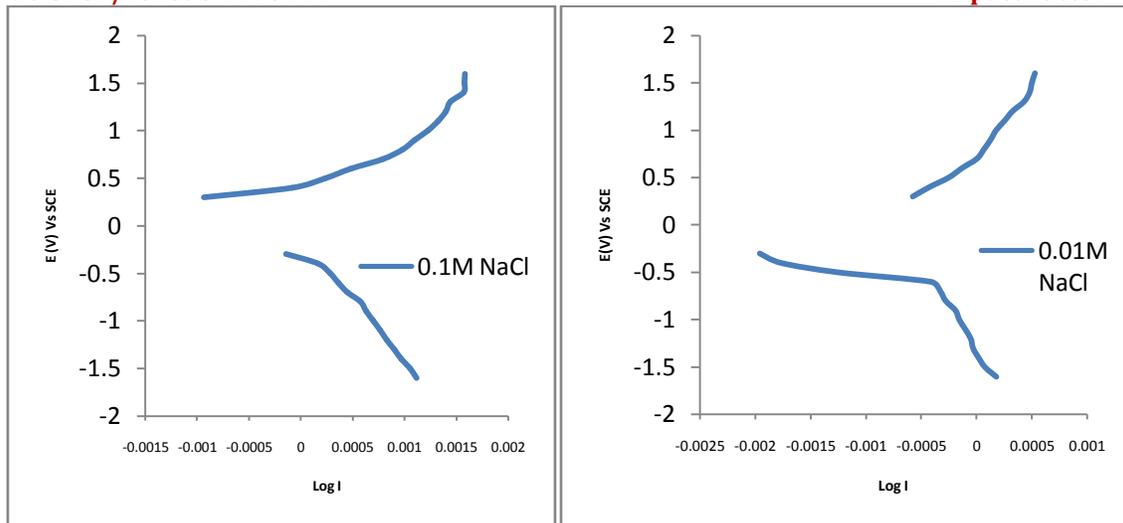


Fig1(a) Fig1(b)  
Fig 1(a-b). Tafel polarization curve for nickel Cobalt alloy thin films

The corrosion data and inhibitor efficiency is given in table 1. It was found that the corrosion rate for the films having inhibitor is much lower than the films synthesized without inhibitor. The inhibitor efficiency is higher in 0.01M NaCl medium.

Table1: Corrosion data of Ni-Co Alloy thin films

Corrosion medium	Conc. Of Ni <sup>2+</sup> :Co <sup>2+</sup> ion in deposition bath	Conc. Of pyridine (M)	Corrosion Rate (mpy)	Inhibitor Efficiency (%)
0.1M NaCl	1:1	-	57.24838	16.61
	1:1	0.0005	47.73711	
0.01M NaCl	1:1	-	33.79778	43.78
	1:1	0.0005	18.99996	

The comparative graph of corrosion rates in all four mediums mentioned in table 1 is shown in fig.2

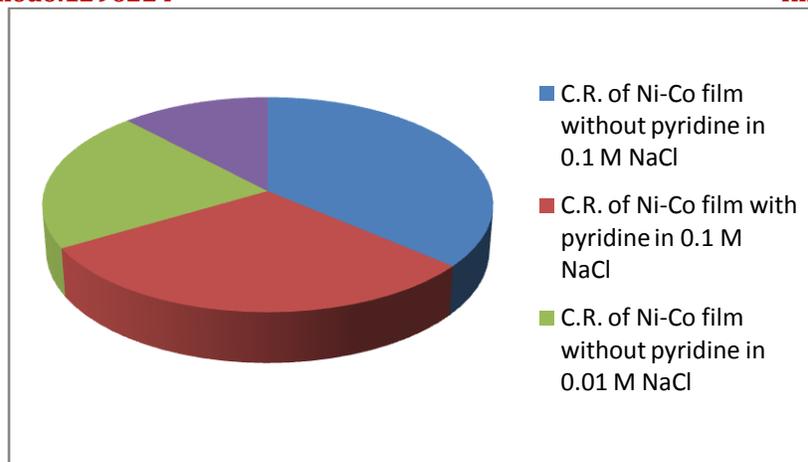


Fig.2 Comparative corrosion rates for Ni-Co alloy thin films

#### IV. CONCLUSION

The Ni-Co alloy synthesized electrochemically shows good corrosion resistance both in presence and absence of pyridine. The corrosion rate of NiCo films synthesized in presence of pyridine is much lower than the films synthesized in absence of Pyridine. The inhibitor efficiency in 0.01M NaCl corrosive medium is in good agreement with literature. Thus the pyridine is suitable inhibitor for NiCo alloy in marine environment.

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