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Study on heat treatment temperature of the corrosion performance

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ABSTRACT

In this work the effect of titanium particles on wear of electro less Ni–P–TiO2 composite coatings deposited on mild steel substrates at different annealing temperatures. Electro less process is an autocatalytic reduction method in which metallic ions are reduced in the solution. Micro composite coatings of Ni-P-TiO2 on mild steel are deposited by varying volume of TiO2 nano-powder by electro-less method from Ni-P plating bath containing Nickel chloride as a source of nickel ions, sodium hypophosphite as the reducing agent, ammonium hydroxide as a complexing agents and TiO2 micro powder. Electroless Ni-P-TiO2 coating have been widely used in the chemical process industries, mechanical industries, and electronic industries due to their excellent mechanical properties. In the present work, deposition of Ni-P alloy coating and Ni-P-TiO2 micro composited coatings were done on the mild steel and hardness properties were studied.

Keywords: Electro less, alloys, Mild steel.

1. INTRODUCTION

Wear is one of the main problems faced by the repair and maintenance department. Only 15% of the wear problems can be controlled if the materials are surface coated with other material. The impinged materials have transformation in both mechanical and physical properties such as wear-resistance, hardness, electrical properties, oxidation resistance and thermal insulating properties. The electro less coating chemistry has emerged as one of the leading growth area in surface engineering, metal finishing etc and is estimated to grow at a rate of beyond fifteen percent per annum, certainly no other chemistry is growing at this rate. Electro less coating has unique physiochemical and mechanical properties for which they are being used increasingly. Nickel-phosphorous can electroless deposited on the base metal. It had wide range of commercial applications because of their wear and corrosion resistance, adaptability for uniform coating on complex shapes etc. the quality of coating depends upon the micro structure and composition of the deposits. Electro less process for nickel coating produces deposits having micro crystalline nature over a wide range of composition. In this electro less coating process the metal ions are reduced to a metallic deposition by a reducing agent in solution. Deposition takes place only on a suitable catalytic surface. The deposition rate, properties of deposited components and the structural behavior of deposits mainly depends upon the plating bath constituents and conditions such as the type and concentration of the reducing agent and stabilizer used, PH and temperature of the bath etc. An electro less nickel plating bath may decompose spontaneously during the deposition process, bath decomposition is usually preceded by an increase in the volume of

hydrogen gas evolved. Certain chemical agents are added to the bath to delay or prevent the onset of the homogeneous reaction that triggers the subsequent random decomposition of the entire plating bath. It requires activation energy in order to trigger the catalytic reaction. This energy is supplied in the form of heat. The quantum of energy required by the system or added to it is one of the most important factors affecting deposition process. The modern era of production engineering demands the use of expensive corrosion resistance metals and alloys. But due to the less availability of high corrosion resistant metals and their high cost, practically it‘s not possible to use these metals in all appliances. This put forth the need for converting the easily available and less cost metals like mild steel to convert them into high corrosion resistant metals. The best way to prolong the metal life or improve its appearance is to coat the surface.

2. EXPERIMENTAL SETUP

In this work, mild steels discs of about 24 mm diameter and 3 mm thickness were prepared from 25mm rod stock to be used as substrates. It is cutted through the hawkshaw and machined in the Lathe. Then they are taken to the surface grinder for grinding the surface to be coated. After that they are fine polished to 2.5

Depth of cut = 0.02 mm; Feed = 0.01mm; Speed = 30m/s

Fig.1 Plating bath composition

Table 1

Constituent	Role	Quantity (g/l)
Nickel chloride	Source of nickel	30
Sodium hypophosphite	Reducing agent	50
Sodium citrate	Stabilizer	30
Ammonium chloride	Complex agent	60
Titanium dioxide	Coating material	0.05

The heater is switched ON. Heat transfer from heater to plating bath takes place by mode of convection heat transfer using commonly using automobile engine oil as medium. This is done for uniform heating of electro-less plating bath. The oil bath was heated to a temperature of 850c and it was monitored and controlled by the PID controller. The pH value of the bath is maintained at a constant value between 9 and 10 by adding ammonia solution. When the salt bath temperature reached 800c, the specimen is gently placed into the bath, after that the titanium dioxide is added to the bath and are stirred well and keep it for 1 hr. The pH value and temperature are monitored periodically. After one hour, heater is switched OFF and the piece is taken out and cleaned with distilled water. The desired coating is obtained over the surface.

3. RESULTS AND DISCUSSION

The electro less Ni-p deposits with Titanium oxide were heat treated, the variation in weight is represented in the table

Table 2

Piece	Weight before coating(gm)	Weight After Coating(gm)	Weight gained (gm)	Heat Treatment Temperature(°C)
1	10.46	10.52	0.06	-
2	9.59	9.7475	0.1575	300
3	10.07	10.1724	0.1024	350
4	10.41	10.5037	0.0937	400
5	10.40	10.4873	0.0873	450
6	10.24	10.3482	0.1082	500
7	10.29	10.397	0.107	550

Corrosion test carried out under ACM corrosion analyser ACM Instruments designs and manufacturers a number of models ideal for lab based work. The range itself meets the needs of a wide variety of customers through its low current, high current, high speed sweep and multiple channel options. We even have a specialized instrument for welds. For ease of use, the ACM software is divided into three. The 'sequencer' allows tests to be set up, 'core running' handles data collection and 'analysis' processes collected data. All our standard instruments are supplied with our standard software for no extra cost, plus there are options to help design and purchase customised software for your specific applications.

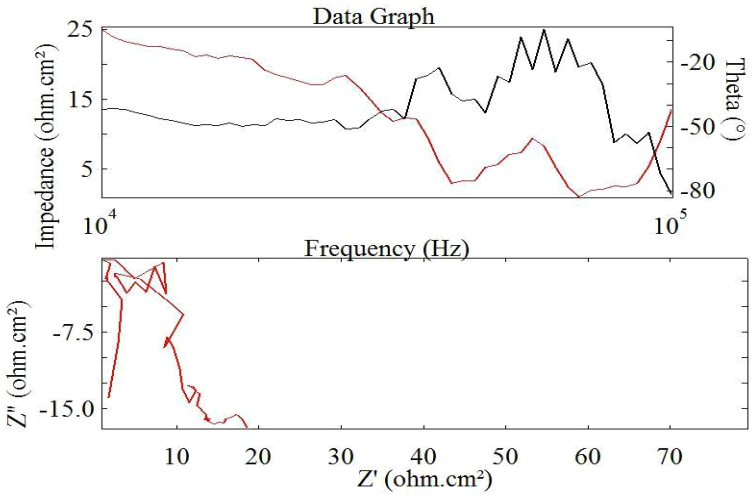

Fig.2 Piece 1, Temperature 300 °/C

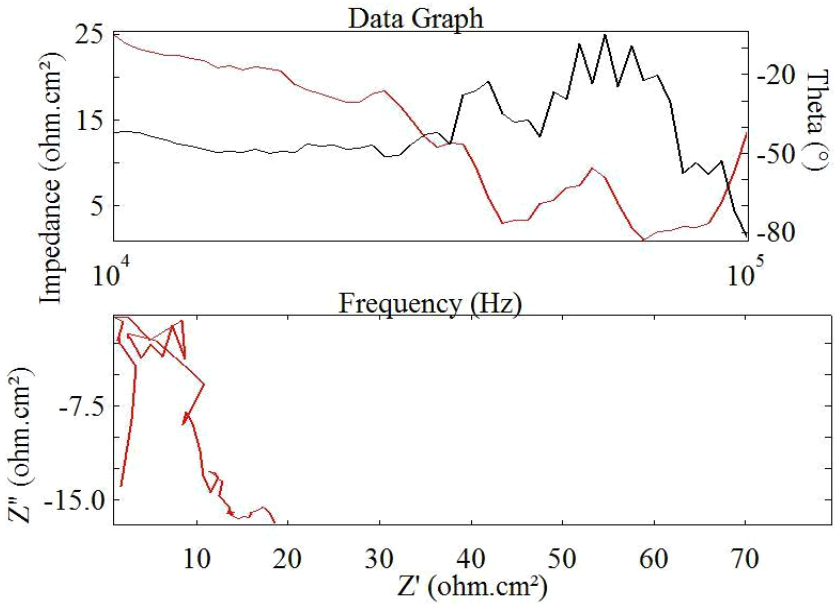

Fig.3

4. CONCLUSION

A compromise/ balance between deposition rate and decomposition of the bath could be noticed by previous research when the quantity of the stabilizer in the bath should be 25 g/l to 45 g/l, bath temp 82^0c. Increasing of micro hardness is due to the formation of various phases of phosphates. Grain Coarsening was occurred more in micro wave heat treatment than in conventional heat treatment techniques. The higher focus of surface heat treatment could improve the micro stress and strain. This could improve the micro hardness. Micro wave heat treatment technique was gives better result than the conventional heat treatment technique.

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