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Analysis of Cu-Tio2- Al_2O_3 Solution on Cutting Tool with Nano Coating

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Abstract

This paper presents based on Nano-coating. In the present work we employed Electrodeposition process to develop a composite coating with Cu matrix and Ceramic oxide particles TiO2 (particle size ~202 nm), Al2O3 (particle size ~287 nm) as reinforcements. The coatings were developed with 10 g/l, 30 g/l and 0 g/l (unreinforced) concentrations in bath, at four different current densities (5, 8, 11, 14 A/dm2) with using copper sulfate bath in order to study the effect of Current density and particle concentration in bath, on structure and properties of the coatings developed

Keywords: : Electrodeposition, Electrocodeposition, TiO2, Al2O3, copper, texture

1. Introduction

Copper (Cu) is environment friendly and abundantly available material that possesses a unique combination of low electrical resistivity (16.78x10 –9 Ωm) and high thermal conductivity (394Wm-1K-1), excellent malleability/workability, attractive colour, reasonably good corrosion resistance at ambient temperature [1] and recyclability, apart from these it is cheaper than the other conducting metals.

In the present work parallel plate electrodeposition process employed to improve the surface mechanical properties of copper without adversely effecting it's electrical and thermal conductivities, by developing a layer of nanocomposite coating consisting of copper matrix and ultrafine ceramic oxide particles (TiO2, Al2O3) on surface of copper. And to determine the optimized current density and particle concentration in the bath with the coating results achieved.

3.Electrodeposition

Electrodeposition is also called electroplating", a short version of electrolytic deposition. Electrodeposition is to nano dimensions. Electrolyte in the electroplating process is used as precursor for the material to be developed and the material on which the material is to be deposited is termed as a cathode. If coating is the objective of the processing, then the substrate material itself is used as a cathode.a versatile technique in making coatings, bulk products in micro

4.Electrocodeposition

It is the process of particle incorporation during the electrolytic deposition of metal, which involves both the processes, elctrodeposition of metal from electrolyte solution and electrophoretic deposition of the small sized particles from the suspension. This process produces composite films consisting of a metallic matrix containing a dispersion of small particles. The particles of pure metals, ceramics, and organic materials, for example oxide or carbide particles, such as Al2O3, SiC, TiO2, WC, SiO2 or diamond, a solid lubricant

5.Nanocoating

Nanocoating is the field of nanotechnology. Nanotechnology is impacting the field of consumer goods, several products that incorporate nanomaterials are already in a variety of items. Nanotechnology is being applied to paints to obtained the coatings having self healing capabilities and corrosion protection under insulation. Since these coatings are hydrophobic and repels water from the metal pipe and can also protect metal from salt water attack.

Nanoparticle based systems can provide better adhesion and transparency. The TiO_2 coating captures and breaks down organic and inorganic air pollutants by a photocatalytic process, which leads to putting roads to good environmental use.

6.Related Work

Catalina *et al*. prepared Cu- TiO2 nano composite coating on a copper substrate using electro codeposition technique from copper sulfate bath. They studied the influence of the concentration of TiO2 nano particles as dispersed phase in copper matrix coatings obtained at different current densities, and also studied the influence of TiO2 on structure and properties of coatings. They have taken concentrations of nano-TiO2 particles (17 nm) as 5, 10 and 50 g/l in electroplating bath. The surface morphology and composition of layers were studied by optical and scanning electron microscopy (SEM) and EDX analysis [48].

Ramalingam *et al*. prepared Cu- TiO2 nano composite coating on copper substrate using electro codeposition technique from copper sulfate bath. Aim of their work was how to assess the effect of nano sized TiO2 content on the wear and corrosion resistance of the deposited coatings.

Andreas Bund *et al.* prepared Cu- Al2O3 thin films by using three different types of baths such as an acidic copper sulfate, a neutral pyrophosphate, and an alkaline sorbitol based bath, with covering a wide *pH* range were used.

I. Zamblau, *et al.* prepared Composite coatings of copper incorporating Al2O3 nanoparticles by using electrodeposition on carbon steel and characterized. By using electrochemical methods such as open circuit potential (ocp) measurements, polarization curves and electrochemical impedance spectroscopy, the corrosion behavior of the Al2O3-copper nanocomposite coatings was examined .

7. Proposed Work

The aim of the present work is to improve the surface mechanical properties of Cu by electro code position of Cu with dispersed second phase ultra fine particles like TiO2, Al2O3 individually the objectives of the work as summarized below: To determine the particle size and Zeta potential (for isoelectric point) of the ceramic oxide powders (TiO2, Al2O3) procured from Inframat Advanced Materials, Forming ton, USA by using Malvern Zetasizer nano series Nano-ZS model instrument According to these fitness values Genetic algorithm decides the optimum route. The optimum route is one which is having minimum distance as well as the congestion cost. A path having larger distance but less congestion cost may be selected depending upon the objective function.

Electro code position of Cu with dispersed second phase ultra fine particles TiO_2, Al_2O_3 individually such that to develop Cu-TiO_2 and Cu-Al_2O_3 nano composite coatings uniformly on the surface of the Copper substrate.

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