

**HIGH SPEED ELECTROPLATING OF NICKEL OVER
STAINLESS STEEL**

AHMAD ABDOLAH

UNIVERSITI TEKNOLOGI MALAYSIA

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AHMAD ABDOLAH

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To my beloved parents and wife thanks for all your affectionate caring and supporting, and above all your sacrifices and prayers accorded to me until the successful completion of this project.

“ My Success Is Yours Too”

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ABSTRACT

Electrodeposition of nickel has been investigated intensely during the past decades in relation to its particular mechanical properties and numerous applications in industry. Electroplating of nickel coatings is frequently used for corrosion protection of stainless steel, also nickel electroplating plate is one of the protective-decorative electrodeposited metallic coating for stainless steel. Usually the electroplating process of nickel over stainless steel is done by common methods needed to some pretreatments such as preparation of surface, activating of the surface, striking a thin layer of nickel on the surface. In these methods there are some problems including: Poor level of Adhesion. Peeling off, Sometimes even after following all the proper pre-plating treatment the adhesion is also poor. Another problem is that a strike deposits usually very thin and examination of the strike layer may not show any signs of pitting and roughness. Because of these problems the nickel layer can not stick to stainless steel properly and it can peel off from the surface. In this study high speed electroplating will be applied to solve the problems and without any preparation the nickel will deposited on stainless steel

ABSTRAK

Penyelidikan mengenai pemendapan nikel telah lama dilakukan dan ia berhubung kait dengan sifat-sifat mekanikal dan banyak kegunaannya di dalam industri. Penyaduran nikel sering digunakan untuk melindungi keluli tahan karat dan melindungi bahan hiasan yang diperbuat daripada keluli tahan karat dari berkarat. Lazimnya, proses penyaduran nikel pada keluli tahan karat dilakukan dengan kaedah biasa dimana beberapa pra-rawatan perlu dilakukan seperti penyediaan awal permukaan keluli tahan karat, pengaktifan permukaan keluli tahan karat dan penghasilan lapisan nikel di permukaan keluli tahan karat. Bagaimanapun, melalui kaedah ini terdapat beberapa masalah yang dihadapi seperti tahap perlekatan yang rendah, mudah tertanggal dan walaupun selepas melakukan semua rawatan pra-saduran, lekatan yang dihasilkan juga tidak memuaskan. Selain daripada itu, saduran yang dihasilkan juga sangat nipis dan ujian yang dilakukan tidak dapat menunjukkan sebarang tanda bopeng dan kesat. Disebabkan oleh masalah ini, lapisan nikel tidak dapat melekat di permukaan keluli tahan karat dengan baik dan mudah tertanggal. Dalam kajian ini, *high speed electroplating* akan digunakan untuk menyelesaikan masalah yang dihadapi tanpa melakukan sebarang penyediaan untuk menyadur nikel pada keluli tahan karat.

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CHAPTER 1

INTRODUCTION

1.1. Background of the Project

It is common practice to nickel plate many different types of industrial parts which are made of stainless steel in order to give the parts a bright, shiny surface. By way of example, automotive vehicle body moldings, door handles, and other functional or decorative parts are nickel-plated for appearance purposes. In commercial practice, nickel plating stainless steel parts typically is accomplished by initially buffing the stainless steel to achieve a high luster and then electroplating with chromium to retain the high luster and to make the finished surface more durable[1].

In the past, stainless steel parts have been electroplated with nickel before the chromium electrolytic plating step. But, the adhesion between the nickel plating and the stainless steel part has been erratic. It has been understood that proper adhesion and good red rust resistance could not be consistently achieved when electroplating nickel over stainless steel. Particularly, conventional pre-plating surface treatment followed by conventional plating has not been effective in producing sufficient chemical bond between the stainless steel surface and the nickel coating [1]. This has been especially true in the case of bright annealed stainless steel. Thus, there has been a need for a process to strongly adhere nickel plating to a stainless steel parts. This study relates to an improvement in the nickel-plating process by using high speed electroplating method

which causes the plating to better adhere to the stainless steel while, simultaneously, not destroying the red rust resistance of the stainless steel surface[1,3].

1.2. Problem Statement

Common electroplating methods of nickel over stainless steel have some problems. The adhesion between the nickel plating and stainless steel part has been erratic. Also the preparation of the surface for electroplating is difficult, for example wood's nickel strikes are very sensitive to metallic impurities or the strike deposit is usually very thin and examination of strike layer may not show any signs of pitting and roughness. Sometimes even after following all the proper pre-plating treatment the adhesion is also poor. Further, the red rust resistance of the nickel plated part has been erratic because this oxide layer is not electrical conductive and so it should be removed from the surface and it's removing is a hard work. These problems lead to use better methods for nickel electroplating over stainless steel such as high speed electroplating.

1.3. Objectives

Study on:

- Common methods for nickel electroplating over stainless steel.
- Problems with common methods.
- High speed electroplating of nickel over stainless steel.
- Characteristics of nickel deposited on stainless steel.

1.4. Scope of Project

The scope of this research is:

- Using equipments for high speed electroplating of nickel over stainless steel.

- Using SEM / EDX to study the microstructure of plating interface.
- Using nano hardness equipments to study the nature of adhesion between nickel and stainless steel.

1.5. Thesis Outline

This thesis consists of six main chapters that are covering introduction, literature review, research methodology, experimental working, results and discussion and conclusion. First three chapters are covering proposal for the research and next chapters are focusing on proposed method and validating it.