Study of the hard coating on surface of aluminum

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ABSTRACT

The anodizing process forms an oxide film on the surface of aluminum. The anodizing conditions, such as voltage, current density of anodization, temperature of the bath, types and of anodic acid, anodization time, and concentration of electrolyte, have a great influence on the hardness, corrosion and abrasion resistant properties of aluminum. The main purpose of this work was to obtain a harder alumina membrane. Conventional hard coat process was performed in a low temperature and high current density. In this paper, hard coat process was carried out at higher temperatures about 20°C. By using an anodizing additive in the process and high current density, this process could produce the best results of microhardness and thickness are 400 Hv and 25 μm, respectively.

INTRODUCTION

Aluminium is the most widely used non-ferrous metal. It is a soft, lightweight, malleable, durable, nontoxic, nonmagnetic, and nonsparking metal. Aluminum is also good thermal and electrical conductor, and good corrosion resistance, but surface modification is an important issue in increasing the usage of aluminum. This includes chrome free surface treatments, anodization processes, and modification of aluminium surfaces for novel properties such as self-clean, anti-bacterial, and non-wetting. However, there are several challenges ahead in many of these areas.

The main purpose of this paper is to obtain a harder alumina membrane. Conventional hard coat is produced in a very cold sulfuric acid bath and using high current density. In this paper, hard coat process was carried out at temperatures about 20°C. By using an anodizing additive in the process, and by using high current density, this process will produce the best results of microhardness and thickness are 400 Hv and 25 μm, respectively.

EXPERIMENTAL

The fabrication procedure of the polishing alumina membrane was as follows. First, the aluminum foils were degreased in acetone followed by ultrasonic cleaning and rinsed with de-ionic water. Then the samples were dipped in 0.1N sodium hydroxide for 2 min. and rinsed with de-ionic water again. Subsequently, the samples were electrochemically polished in a 1:4 solution of perchloric acid and ethanol to achieve a mirror and shiny surface.

For the preparation of harder anodic film on aluminum, first, immersing the aluminum specimens in ammonium molybdate solution and then anodizing. Anodization was carried out under a constant voltage of 30, 40, 50, 60 V, the bath temperature was controlled at 10 to 25 °C, and in 15% to 25 wt.% sulfuric acid solution, that acted as an