

Codeposition of W Oxide with Zn-Ni Alloy Electrodeposited from Sulfate Bath

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1. Introduction

Zn coating by electrodeposition from an aqueous solution has good corrosion resistance, uniform film thickness, and enable to plate at low temperature. Therefore, Zn coating has been utilized in the production of steel sheets. In order to improve the corrosion resistance by Zn coating, Zn alloys electrodeposited with Al, Ni, Co and Mo have been researched and developed¹⁾.

Especially, the electrodeposited Zn-Ni alloy is used as automotive body panels to bring the excellent corrosion resistance.

On the other hand, W can not electrodeposit as a metal from a sole aqueous solution, but codeposit as a alloy with iron-group metals (Fe, Ni, Co). Codeposition of W improves corrosion resistance because of formation of passive films on the surface and change from crystal to amorphous films. In addition, tungstate has been researched as a chemical conversion coating material for an alternative chromate coating²⁾.

For the purpose of improving the corrosion resistance of Zn-Ni alloy electrodepositon, we tried codeposition of W with Zn-Ni alloy electrodeposited from sulfate bath. In this paper, we will report about the behavior of Zn-Ni-W electrodeposition and the analysis results of the deposit.

2. Experimental

$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (0.43 mol/L), $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ (0.10 mol/L), and $\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$ (0.02 mol/L) were used as the reagent for the preparation of an aqueous electrolytic solution. $(\text{NH}_4)_3\text{C}_6\text{H}_5\text{O}_7$ (0.11 mol/L) was used as the complexing agent. The pH of the electrolyte solution was adjusted to 4.00 with NaOH or H_2SO_4 . Low carbon steel sheets with an exposed surface area of 1cm^2 were used as the cathode. Ti mesh deposited with Pt was used as the anode. The electrodeposition was performed at 40°C with quiescent bath under galvanostatic conditions (current density : $0.1\text{-}100\text{ A/dm}^2$, amount of charge : 600 C/dm^2). The content of the deposit was measured by inductively coupled plasma atomic emission spectrometer (ICP). Mapping analysis of cross section of the deposit was performed using electron probe micro analyzer (EPMA). The surface of the deposit was analyzed by X-ray photoelectron spectroscopy (XPS).