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Effects on Corrosion Rate of Mg and MgN Thin Films Prepared by PVD Method

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1. Introduction

The films, particularly those deposited from plasma-assisted vacuum coating process, are usually quite different from the respective bulk material as to their structure and properties. For this reason, the use of plasma-assisted process, e.g. physical vapour deposition such as RF magnetron sputtering method, has spread into various types of industrial applications.

The properties of the deposited film depend on the deposition condition and these, in turn depend critically on the crystal orientation and morphology of the films. Therefore, it is important to clarify that the formation mechanism for the morphology and orientation of the film affected by deposition parameters, e.g. the gas pressure, bias voltage and environmental gas such as Ar and N_2 etc..

In this work, Mg and MgN thin films are prepared by RF magnetron sputtering method in order to investigate the influence of Ar and N_2 gas pressure on the corrosion rate of the films.

2. Experiment

Mg and MgN thin films were prepared on SPCC(cold-rolled steel) substrates by RF magnetron sputtering method, which bias voltage was 0V. The influence of gas pressure on the crystal orientation and morphology of the films was determined by using X-ray diffraction and field emssion scanning electron micrography(FE-SEM), respectively. And the effect of crystal orientation and morpholgy of the magnesium thin films on corrosion behavior was estimated by electrochemical impedance spectroscopy method. Besides, hardness of these films were measured knoop hardness tester, respectively.

3. Result

In general, all the deposited MgN films showed good corrosion resistance and hardness properties to compare with Mg films. and grain size of MgN films was smaller than Mg one. Meanwhile, Mg and MgN film morphology changed from a columnar structure to a granular one with the increase of gas pressure. The influences of gas pressures can be explained by applying the effects of adsorption, occulusion and ion sputter of gas. And also, the properties of all the films can be improved greatly by controlling the crystal orientaton and morphology with effective use of the plasma sputtering technique.