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Author: Eun-Young Yun, Woo-Jae Lee, Qi Min Wang, Se-Hun Kwon

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Electrical and Corrosion Properties of Titanium Aluminum Nitride Thin Films Prepared by Plasma-Enhanced Atomic Layer Deposition

Eun-Young Yun [1], Woo-Jae Lee [1], Qi Min Wang [2,*], Se-Hun Kwon [1,**]

[1] *School of Materials Science and Engineering, Pusan National University, 30 Jangjeon-Dong Geumjeong-Gu, Busan 609-735, Republic of Korea*

[2] *School of Electromechanical Engineering, Guangdong University of Technology, Guangzhou 510006, China*

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* Corresponding author. Prof.; Tel.: + 86 13802729261.

E-mail address: qmwang@gdut.edu.cn (Q.M. Wang).

** Corresponding author. Prof.; Tel.: +82 0515103775.

E-mail address: sehun@pusan.ac.kr (S.H. Kwon).

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Titanium-aluminum-nitride (TiAlN) films were grown by plasma-enhanced atomic layer deposition (PEALD) on 316L stainless steel at a deposition temperature of 200 °C. A supercycle, consisting of one AlN and ten TiN subcycles, was used to prepare TiAlN films with a chemical composition of $Ti_{0.25}Al_{0.25}N_{0.50}$. The addition of AlN to TiN resulted in an increased electrical resistivity of TiAlN films of 2800 μΩ cm, compared with 475 μΩ cm of TiN films, mainly due to the high electrical resistivity of AlN and the amorphous structure of TiAlN. However, potentiostatic polarization measurements showed that amorphous TiAlN films exhibited excellent corrosion resistance with a corrosion current density of 0.12 μA/cm^2, about three times higher than that of TiN films, and about 12.5 times higher than that of 316L stainless steel.

Key words: Titanium-aluminum nitride; Plasma-enhanced atomic layer deposition; Corrosion protection; Ternary transition metal nitrides

1. Introduction

Protecting metals against corrosion is of great technical significance[1,2]. One of the most common methods to achieve this is the deposition of a corrosion-protective film on metal

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