ELSEVIER

Surface and Coatings Technology 136 (2001) 207–210

SURFACE & COATINGS TECHNOLOGY

www.elsevier.nl/locate/surfcoat

Corrosion resistance of TiN coatings produced by various dry processes

Ryuhei Morita[a,*], Kingo Azuma[a], Shozo Inoue[a], Ryuichi Miyano[b], Hirofumi Takikawa[b], Akira Kobayashi[c], Etsuo Fujiwara[a], Hitoshi Uchida[a], Mitsuyasu Yatsuzuka[a]

[a] *Himeji Institute of Technology, 2167 Shosha, Himeji, Hyogo 671-2201, Japan*
[b] *Toyohashi University of Technology, 1-1 Hibarigaoka, Tempaku-cho, Toyohashi, Aichi 441-8580, Japan*
[c] *Osaka University, 11-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan*

Abstract

The corrosion resistance of a TiN surface prepared by plasma-based ion implantation (PBII) was compared with that of TiN coating films prepared by sputtering deposition, plasma spraying, and shielded vacuum arc deposition. The corrosion test with the potentiodynamic polarization curve shows that the PBII sample had the best corrosion resistance. The SEM observation indicates that there was no pinhole on the TiN surface prepared by PBII. However, a lot of pinholes were observed in the TiN coating films prepared by the other dry coating processes. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Plasma-based ion implantation (PBII); Titanium nitride (TiN); Corrosion resistance; Surface modification; Plasma dry process

1. Introduction

Titanium nitride (TiN) has intrinsically excellent corrosion resistance [1,2]. The corrosion resistance of TiN coating films, however, is strongly dependent on micro-defects, such as pinholes in the coating films, because these micro-defects become the starting point of corrosion. In general, a lot of pinholes appear in the TiN coating films prepared by plasma dry processes such as ion plating or sputtering deposition. On the other hand, it is expected that ion implantation will not result in micro-pinholes in the target surface, producing a TiN layer of superior corrosion resistance.

In this paper, the corrosion resistance of TiN surface prepared by plasma-based ion implantation (PBII) was compared with that of TiN coating films produced by sputtering deposition, plasma spraying, and shielded vacuum arc deposition.

2. Experimental

The TiN coating films were prepared by PBII [3], sputtering deposition [4], plasma spraying [5], and shielded vacuum arc deposition [6,7]. The preparation conditions of each TiN coating method are shown in Table 1. In the PBII technique, a negative high-voltage pulse with a voltage of 10 kV, pulse duration of 10 μs, and repetition rate of 100 Hz was applied to a substrate immersed in the nitrogen plasma with a plasma density

* Corresponding author. Tel.: +81-792-67-4862; fax: +81-792-67-4862.
E-mail address: yatuzuka@elct.eng.himeji-tech.ac.jp (R. Morita).

0257-8972/01/$ - see front matter
PII: S0257-8972(00)01057-4