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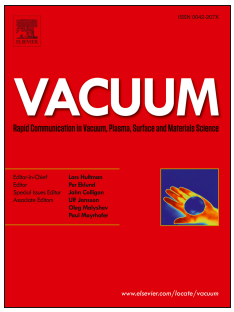

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Performance enhancement by plasma nitriding at low gas pressure for 304 austenitic stainless steel

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Abstract Plasma nitriding was conducted at low gas pressure and low temperature of 400 ℃ for 304 austenitic stainless steel. The combined performance of the treated specimens was evaluated by scanning electronic microscopy (SEM), X-ray diffractometer (XRD), microhardness tester, ball-on-disc tribometer and electrochemical polarization. The results showed that an expanded austenite (γ_N), also called S phase layer was formed after plasma nitriding at low gas pressure and low temperature of 400 ℃, and the nitriding efficiency was significantly improved at lower gas pressure; maximum expanded austenite layer of 51.7 μm and effective hardening layer of 72 μm were obtained at low gas pressure of 100 Pa. Surface hardness and wear resistance were enhanced dramatically by plasma nitriding at 100 Pa, and the weight loss after wear test decreased from 0.102 g to the minimum of 0.013 g. Meanwhile, the corrosion resistance was improved after plasma nitriding at 100 Pa, the minimum corrosion current of 0.009 $\mu A \cdot cm^{-2}$ and the maximum corrosion potential of -361.9mV are obtained.

Keywords plasma nitriding; 304 austenitic stainless steel; gas pressure; wear resistance

1 Introduction

304 austenitic stainless steel is widely used in many industrial fields due to its excellent corrosion resistance due to the presence of an inherent and self-healing passive film, mainly composed of chromium oxide [1-4]. However, its poor mechanical properties, such as low surface hardness and wear resistance restrict its applications [5]. Surface modification is essential to overcome these shortcomings and enlarge its real application. Among the existed surface-modification techniques, nitriding is an effective technique to improve the surface hardness and wear resistance [6-8].

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