Tribology Properties and Microstructure of Sulfurized, Nitrided, and Nitrocarburized Layers Deposited in a Hollow Cathode Discharge

CATEGORY OR KEYWORDS

Layer; Tribology properties; Sulfurized; Hollow cathode discharge

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INTRODUCTION

Plasma nitriding is a commonly used method to increase the surface hardness and wear-resistance. The ionization rate of hollow cathode is approximately ten times higher than that of abnormal glow discharge. It has been shown that low temperature nitrocarburized is advantageous over low temperature nitrided and carburized for austenitic stainless steel due to increased S-phase layer thickness, improved load bearing capacity and reduced treatment temperature [1]. The conditions under sulfuration process was conducted resulted in emergence of FeS as the dominant phase of the created layer. The close-packed hexagonal crystalline structure of FeS phase allows it to act as a solid lubricant [2]. The hard nitrocarburized layer can give a strong support to the soft sulfide layer, the duration time of the sulfide layer must be prolonged [3]. So, the nitrocarburized layer (PCN) and sulphonitrocarburized layer (PSNC) was investigated in this paper.

The surface structure of different layers was observed by SEM, AFM and 3D White Light Scanner. The surface of sulfurized layer (PS) is porous relatively, that may be good for oil lubrication, the pores can be used to contain oil. The grain size and micro roughness of PSNC layer is much smaller than the sulfurized layer (Fig.1.).

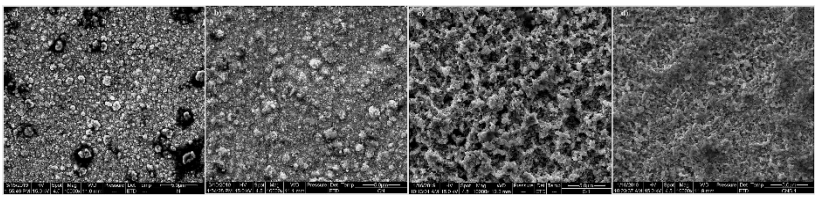

Fig. 1. The SEM result of PN (a), PCN (b), PS (c), PSNC (d)

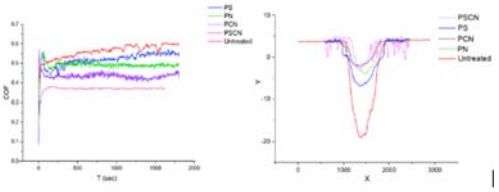

Fig. 2. The friction coefficient and wear loss of dry sliding test

The Dry sliding wear and oil sliding test of different diffusion layers were carried out on ball-on-disc tester. The wear scars were investigated by SEM and 3D White Light Scanner. It is obvious that the PSNC had the lowest friction coefficient and wear loss (Fig.2.). EDS, XPS, XRD, hardness and cross section structure were also investigated to detect the valence states of boundary and the phase structure to illustrate the reason for various tribology properties.

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