DLC THIN FILMS GROWN ON 304 STAINLESS STEEL USING THE ACTIVE SCREEN PLASMA TECNIQUE WITH DC PE-CVD

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1. Introduction

Surface engineering today is constantly conducting research on materials to significantly improve some of their physical properties such as adhesion, hardness and roughness among others. These features make special steels used in the automotive, metallurgical and oil pipelines attractive for each of the applications and increase the replacement time due abrasion or fracture. Reducing energy and the consumed fuel with a decreasing in abrasion and increasing in hardness with lubricants incorporated as part of the coatings and maximum bond are current issues of research that transforms simple systems in highly complex surfaces. Therefore the customization of the processes requires better understanding of the mechanisms used in growing thin films for surface modification and Taylorization.

Diamond-Like carbon (DLC) coatings have attracted the attention due to their low friction, high degree of hardness, and high wear resistance [1]. The amorphous hydrogenated carbon (a-C:H) coating are attractive for your tribological properties. Plasma technologies have long been studied for surface engineering and extensively studied and discussed by many authors, now the active screen plasma process is and advanced technology applied in plasma surface engineering, provide advantages more uniform material properties process and allows to obtain films with conditions of low temperature and low power consumption, achieving minimize production costs and to attain better quality films adhesion and finishing [1-4].

The new ASP technology has been gradually engaged by the industrial sector due to theirs advantages [8-9]. In a standard plasma reactor, the plasma surrounding the samples is used to heat them directly. Therefore, it is impossible to ensure that the temperature is the same on the outside of the load and the center where it they tend to be higher [10-11]. In plasma equipment, active screen the active window is designed to surround all of the equipment and all parts are heated by radiation from plasma. Fig.1 shows a schematic connection for the ASP system permit films growth.

The DLC coatings are characterized by extremely low friction, high wear resistance and high hardness. In engineering, low friction signify a lower loss of energy, high reliability and better wear resistance [5]. 304 stainless steel is used extensively in industry in applications with elevated corrosion and high wear rates due extremely severe conditions.

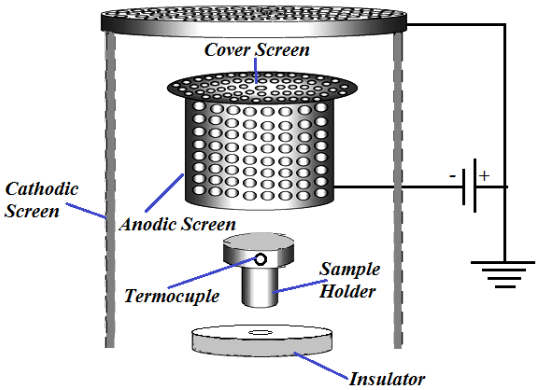

Fig. 1. *Schematic representation of active screen system*

2. Experimental

DLC films were deposited over steel substrates by a modified Plasma Enhanced Chemical Vapor Deposition system in order to obtain denser and more reactive plasma. The samples were polished by using a sequence of different grain sizes to a mirror-like finish surface, and cleaned ultrasonically in an acetone bath for 10 min. The substrate was mounted on the screen cathodes in the plasma chamber. The cathode was powered by two different pulsed DC power supply, with variable pulse voltage from -100 V a -10 kV, at frequency in a range of 2-20 kHz and duty-cycle of 50%. The vacuum base pressure of the chamber was 0.0013 Pa. The substrates were also cleaned by an argon discharge with 5 sccm gas flow at the lowest working pressure in each system, 5,3 Pa e 0,66 Pa for the Active Screen Partial System, and the Active Screen System, respectively, and discharge voltage of -600 V for 30 min prior to deposition. In order to enhance the adhesion between coating

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