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EVALUATION OF THE MECHANICAL BEHAVIOUR OF A DLC FILM ON PLASMA NITRIDED AISI 420 WITH DIFFERENT SURFACE FINISHING

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Diamond-like-carbon films (DLC) are hard coatings with a very low friction coefficient and chemically inert, and plasma nitriding is a well established method to harden stainless steels and act as a pre-treatment to increase adhesion and improve tribological behavior of the DLC coating. In this work, the mechanical behavior or a DLC film deposited over martensitic stainless steel is studied.
The AISI 420 steel was heat treated, but two different surface finishing were accomplished previous to the nitriding process: paper grounding until grit 1000 and polishing with 0.5 µm diamond powder. Another group of samples was coated without nitriding. The nitriding process was carried out in a DC pulsed discharge, at low temperature and the DLC film was deposited by CVD, with a bipolar DC pulsed discharge. Hardness was measured on the surface and the nitrided layer and film were observed with optical microscope and SEM. The mechanical behavior was analyzed in both linear and rotational reciprocating sliding wear tests. Adhesion was tested with the methods of Rockwell C Indentation and Scratch Test.
The coating was 3 µm thick and the nitrided layers were different, depending on the previous surface finishing. In the polished samples the layer thickness was about 11 µm and only 8 µm in the grounded ones; surface hardness was similar, 1150 HV. With the DLC coating, hardness reached 1400 HV. Regarding the mechanical behavior, the nitrided layers in both samples yielded a better wear resistance of the duplex system, and the volume loss was much smaller than in the only nitrided samples. In the case of film adhesion, the results tend to point that the rougher surface was the best, for the resistance of the duplex coating.

Keywords
DLC
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