Influence of the deposition parameters on the properties of a-C:H coatings deposited on AISI 316 using a modified pulsed-DC PECVD technique with an active screen as an additional cathode

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Diamond-Like Carbon (DLC) coatings are widely used due to their attractive mechanical, chemical, tribological, and biological properties [1]. Some mechanical properties, such as modulus of elasticity and hardness could be modified by controlling the deposition parameters [2]. This modified pulsed-DC Plasma Enhanced Chemical Vapor Deposition (PECVD) technique has stood out in this field for making it possible to grow films at low pressures in a near collision-less regime leading to achieve improved mechanical and tribological properties [3]. In this work, DLC coatings were deposited on AISI 316 stainless steel via modified pulsed-DC PECVD technique with an additional cathode. The mechanical, tribological, microstructural properties and the adhesion of the film were studied as a function of the variation of the deposition parameters. The results showed that harder films were obtained, with lower wear rates and with low coefficient of friction for lower deposition pressures, reaching a maximum hardness up to 28 GPa. Also, films with better structural quality and better adhesion to the substrate were obtained for lower bias-voltages. Therefore, the tribological and mechanical properties and film''s microstructural quality were strongly dependent on the internal pressure, applied bias-voltage, and the power supply duty cycle. In addition, the use of the modified pulsed-DC PECVD with an active screen allowed the obtainment of films with excellent properties, making it possible to expand their applicability for mechanical and tribological applications.

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References:

[1] J. Robertson, Compr. Hard Mater. 3, 101–139 (2014)

[2] G.Capote, et al. Surf. Coat. Technol. 308, 70–79 (2016)

[3] P.C.S da Silva, et al. Mater. Research 19 (4), 882–888 (2016)