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TRIBOLOGICAL STUDY OF A-C:H COATINGS DEPOSITED ON Ti6Al4V ALLOY BY MODIFIED PULSED DC-PECVD USING AN ADDITIONAL CATHODE FOR SPACE APPLICATIONS

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Diamond-like carbon (DLC) is a metastable form of amorphous carbon that contain a significant fraction of sp3 bonds. DLC has many beneficial properties such as high hardness and elastic modulus, chemical inertness, high wear resistance and low friction coefficient. These excellent properties allow a wide use of DLC as protective coatings in different sectors as biomedical, mechanical and space. Additionally, the DLC has been studied as a promising solid lubricant since liquid lubricants are ineffective and undesirable for many space applications. Solid lubricants are required to perform well both in the severe space environment (i.e. high vacuum, cryogenic temperatures, high temperatures or debris) and on Earth, where spacecraft are assembled and tested. Some moving mechanical assemblies and tribological components of the spacecraft use solid lubricants for a correct and reliable operation, ensuring the satellite lifetime. This work presents a tribological study of a hydrogenated a-C:H coating deposited by pulsed DC-PECVD with an additional cathode, in very low pressure (below 0.1 Pa), using acetylene as precursor gas. An amorphous silicon interlayer was deposited in order to guarantee good adhesion between the coating and the substrate. Raman spectroscopy, scanning electron microscopy (SEM), Rockwell C indentation test, and scratch test were used to characterize the DLC films structure, morphology, and adhesion, respectively. The outcomes of the tribological study were the friction coefficient value and wear rate of the DLC films, in both the atmosphere and the vacuum environments, using different loads and sliding speeds. Results show that DLC can act as a good space solid lubricant due to its low friction coefficient value, good adhesion, and high structural quality.