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CHARACTERIZATION AND TRIBOLOGIC STUDY IN HIGH VACUUM OF HYDROGENATED DLC FILMS DEPOSITED USING PULSED DC PECVD SYSTEM FOR SPACE APPLICATIONS

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Abstract

This paper focuses on Diamond-Like Carbon (DLC) films for space applications. Specifically, it reports the structure, morphology, adhesion, and the high-vacuum tribological performance of several DLC films with different hydrogen content. DLC films have been studied as a promising solid lubricant since liquid lubricants are ineffective and undesirable for many space applications. The films were deposited by pulsed Direct Current Plasma Enhanced Chemical Vapor Deposition (DC PECVD) technique with an additional cathode. An amorphous silicon interlayer was deposited in order to guarantee the adhesion between DLC coating and substrate. For the films characterization, Raman spectroscopy, Scanning Electron Microscopy (SEM), Rockwell C indentation test, and Ion Beam analysis (IBA) were performed. Additionally, the friction coefficient was measured in high vacuum and atmospheric conditions. Results showed that the increase of the deposition voltage led to the decrease of hydrogen content of the films and the increase of DLC films hardness. Furthermore, films deposited at -200 V, -300 V, and -400 V showed a decrease in their friction coefficients under high vacuum conditions when compared to their friction coefficients at atmospheric ambient conditions. Moreover, DLC films produced with the highest