Influence of the applied bias voltage in a-C:H film deposited on Ti6Al4V by using a modified pulsed DC-PECVD system

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Diamond-like carbon (DLC) is a metastable form of amorphous carbon that has excellent properties such as high hardness, elastic modulus and chemical inertness. Also DLC films have very good tribological behavior such as high wear resistance, and low friction coefficient. This thin film has a wide range of applications, as protective coatings in areas such as optical windows, biomedical coatings, mechanical and space devices[1]. In this work, DLC films was deposited using pulsed DC PECVD system with an additional cathode, acetylene was used as precursor gas. With this process it was possible to get work conditions at very low pressure, in a collisionless regimen. Different bias voltages were applied to analyze its influence on film properties and adhesion between film and substrate. DLC films were grown by using a variation from -1kV to -12kV. An amorphous Silicon interlayer was deposited to ensure a good adherence between DLC film and Ti6Al4V using Silane as precursor gas, at -4kV bias voltage. Characterization of DLC films were performed using Raman scattering spectroscopy to estimate the film''s atomic arrangements and its structural quality, scanning electron microscopy (SEM), Rockwell C indentation test, and scratch test were used to study the adhesion between the a-C:H and the substrate. Nanoindentation measurements allowed the determination of hardness and elastic modulus of the coatings Results exhibited how the variation of pulsed DC bias voltage affected DLC properties. Hardness values pointed out that an increase in the self-bias voltage results in a decrease of DLC films surface hardness.

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References:

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