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TRIBOMECHANICAL RESPONSE OF BARE AND HYDROGENATED AMORPHOUS CARBON COATED METALLIC BIOMATERIALS

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Abstract: Wear and corrosion have been identified as two of the main forms of metallic implant failure mechanisms [1-3]. The objective of this work was to improve the protective and tribomechanical characteristics of metallic surfaces used for medical implants. Towards this end, hydrogenated amorphous carbon (a-C:H) nanofilms have been deposited on Stainless Steel (SS), Titanium (Ti) and Niobium (Nb) metal plates using Plasma Enhanced Chemical Vapor Deposition (PE-CVD). The nanomechanical and nanotribological characteristics of the bare and a-C:H coated metallic surfaces have been quantified through nanoindentation and nanoscratch testing, respectively. The density and thickness of the a-C:H films have been probed using X-ray reflectivity (XRR) whereas the morphological characteristics of the metallic surfaces before and after a-C:H deposition have been studied using atomic force microscopy (AFM). Furthermore, the residual imprints through nanoscratch testing have been investigated using scanning electron microscopy (SEM). In summary, it is observed that the a-C:H films improve the tribomechanical properties of the metallic surfaces by reducing their friction coefficient and improving their resistance to plastic deformation and wear.

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