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Influx of Different Growth Geometries on Titanium Thin Film for Medical Applications

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Abstract

The present study focuses on the differences in behaviour and corrosion properties between three titanium thin films produced with different growth geometries. Two of the thin films were prepared with the same angle of deposition (60°), but different growth geometries (inclined and zig-zag), while the third (the reference sample) was prepared by the conventional geometry (normal incidence, 0°). Multiple analysis was conducted on these samples to reach a better understand the influence of the growth geometry on the corrosion response of the films. Characterization support analysis carried by scanning electron Microscopy (SEM) was used to investigate parameters such as thickness and morphological features, while atomic force microscopy (AFM) was used for surface roughness characterization. X-ray diffraction (XRD) was used to characterize the crystallinity state of the thin films. Regarding corrosion tests in simulated physiological fluid, a mix of alternating and continuous current techniques was used. The obtained results showed that varying the deposition geometry, a significant change on the material corrosion resistance is observed. The results show that there is an improvement in corrosion resistance in both the zigzag and inclined prepared samples, when compared to the conventional geometry grown sample. The sample prepared in the zigzag geometry reveals the highest corrosion resistance in simulated body fluid. These findings reinforce the conclusion that complex surface architectures enable the design of surfaces with distinct properties, specifically optimized for targeted medical applications, where surface features play a decisive role.

Keywords: Thin films, corrosion, Glancing angle deposition, Titanium, Inclination