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Influence of surface features on the adhesion of Staphyloccocus epidermidis to Ag-TiCN thin films

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S*taphylococcus epidermidis* have emerged as one of the major nosocomial pathogens associated with infections of implanted medical devices. The initial adhesion of these organisms to biomaterials' surface is thought to be an important stage in their colonization. The main objective of this work is to develop surfaces that are able to prevent microbial colonization. Thus, the present work explores the potentialities of silver-containing carbonitride-based (Ag-TiCN) thin films. The Ag-TiCN coatings were deposited onto stainless steel 316L, by DC reactive magnetron sputtering using two targets, Ti and Ti+Ag, in an Ar + C_2H_2 + N_2 atmosphere. Silver pellets were placed in the area of erosion of Ti target in order to obtain a silver content up to 20 at. %.
Compositional analysis was achieved by Electron Probe Microanalysis (EPMA). The structural results obtained by X-ray diffraction (XRD) show that the coatings crystallize in a B1-NaCl crystal structure typical of $TiC_{0.3}N_{0.7}$. The increase of Ag atomic content promoted the formation of Ag crystalline phases. According to the results obtained with Atomic Force Microscopy (AFM) the increase of Ag content promotes a decrease on the roughness of the films from 47 nm for the sample without Ag to 7 nm with 20 at. % as Ag content.
Bacterial adhesion and biofilm formation on coatings were assessed by Crystal Violet staining, which quantifies total amount of biomass and by enumeration of colony forming units (CFUs) in order to assess the number of viable cells. The results showed that the surface with the lower roughness leads to greater bacterial adhesion and biofilm formation, highlighting that surface morphology rules materials colonization. Additionally, Scanning Electron Microscopy (SEM) was also used to observe the bacteria adhesion and biofilm formation confirming the above results.

Keywords
Sputtering
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