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Influence of albumin on the tribological behavior of Ag-Ti (C, N) thin films for orthopedic implants

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The materials used in medical devices are subjected to high stresses and high regular endeavour. This very demanding situation associated whit aggressive body fluids induces premature failure of the implants whichever material they are made, metallic, polymeric or ceramic. The fatigue wear process causes the generation of wear debris which, by acute host-tissue reactions tend to aggravate and speed up the failure of the biomaterial. However, these problems could be resolved with the development of new multifunctional-coatings.
For this purpose Ag-TiCN, films were deposited by reactive magnetron sputtering, with contents of Ag ranging from 0 to 9 at.% and Ti from 34 to 22 at.% while keeping C, N and O content almost constant.
Extended physical, chemical and structural characterization such as the study of composition, phase composition, film surface topography and morphology, were achieved resorting to surface analysis techniques, such as, Electron Probe Microanalysis, X-ray diffraction, Atomic Force Microscopy, scanning electron microscopy. The tribological tests were performed in unidirectional and alternative conditions, being the antagonist polymer beads, PTFE and Al2O3 as ceramic. For this purpose Hanks' balanced solution (HBSS) and albumin solution in HBSS were used as lubrication fluids, in order to mimic the body conditions. Albumin was used because it is known to have a key role in the tribological properties of the synovial fluids TiCN coatings with Ag content above 5at. % presented a wear rate of PTFE lower than those for the clinically pair PTFE/Stainless Steel. In this case there was no wear of coated surfaces. When the pair Ag-TiCN/Al203 was tested, the wear rate was 5x10-8 mm3/Nm for 4 and 8 at. %Ag. All the wear mechanisms were analysed by SEM.
The wear rate results emphasize the albumin protector character, being more evident in the more hydrophobic surfaces. In contrast, albumin leads to a higher friction coefficient.

Keywords
Multifunctional-coatings
Ag antimicrobial coating
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