SILVER ACTIVATION EFFECT IN THE ANTIBACTERIAL ACTIVITY IN MULTIFUNCTIONAL COATINGS

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With the increase of life expectancy, hip joint prosthesis is being widely used worldwide, with concerns about the quality of life of patients and costs involved in the chirurgical procedures. S*taphylococcus epidermidis* have emerged as one of the major nosocomial pathogens associated with microbial infections, one of the major causes of the failure of medical devices, that can happen at the time of the chirurgical procedure or subsequently.

In order to minimize this drawback, the introduction of multifunctional coatings in the biomaterial could be a step to improve their physical, mechanical, tribological and biological properties and consequently avoid the revision surgeries by microbial infection. Plasma Vapor Deposition (PVD) is a powerful technique disseminated today, used in order to make thin films in many substrates.

The main goal of this work was to produce multifunctional Ag-ZrCN for antimicrobial coatings for hip prostheses. Metallic silver (content up to 11 at. %) in ZrCN matrix, was deposited onto stainless steel 316L, by DC reactive magnetron sputtering. In spite silver historic performance in medicine due his potent antibacterial effect, Ag-ZrCN does not show antibacterial effect, since silver is present on its metallic form. Indeed antibacterial activity depends of the released Ag+ from metallic silver. Therefore, the proposed challenge of this work is to enhance the silver ionization, in order to achieve their release to the biological environment and promote its action on microorganisms, preventing its development.

Silver antibacterial activity of these coatings was achieved by an activation procedure, by immersion of the samples in a 5% (w/v) NaClO solution for 5 minutes. After the activation, there are significant changes in the Ag 3d XPS spectra. The peak related to Ag-clusters simply disappears and a new peak shifted to lower energies arises, which can be attributed to silver oxides. In fact, the formation of oxidized nano silver based material can inhibit bacterial growth since its bioavailability allows improve biocidal Ag+ formation and mobility, providing a constant concentration of Ag+ ions in aqueous environments. Samples were tested using the halo method, using *S. epidermidis*. In close contact with medium humidity, Ag^{+} spontaneously diffuses over the surrounding aqueous medium (bacteria suspension and agar) killing or inhibiting bacteria growth and a Zone of Inhibition was disclosed.

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