socie mat sociedad española de materiales

VNiVERSiDAD D SALAMANCA
CAMPUS DE EXCELENCIA INTERNACIONAL

Sal 800 AÑOS 1218 - 2018

XV Congreso Nacional de MATERIALES

I Iberian Meeting on MATERIALS SCIENCE

www.cnmat2018.com

July, 4 - 6

2018

Salamanca

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177 Silver nanoparticles on bioceramic coatings for biomedical devices: fabrication and in vitro study

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Silver nanoparticles on bioceramic coatings for biomedical devices: fabrication and *in vitro* study

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Abstract (400 words):

Bioceramic coatings are an excellent strategy to improve the biocompatibilty of metal implants and great advances have been achieved in this field during the last decades. Moreover, adding additional biological properties, such as bactericidal effects, increases the interest in the applicability of these materials. Silver, on the other hand, is known to exhibit inhibitory and bactericidal effects and to show a broad spectrum of antimicrobial activities. Silver can be introduced in many different ways into a biomedical implant, being one them as nanoparticles (NPs). The use of silver in the shape of nanoparticles on top of bioceramic coatings, seem to be a promising approach, since in addition to addressing the antibacterial property, it also allows us to explore possible applications in the field of biosensors, based on the phenomenon known as plasmon resonance (PR).

Preparing a complex coating made of a NPs array, uniformly distributed on top of a continuous bioceramic coating is a challenging issue that usually requires very different fabrication processes. Pulsed laser deposition (PLD) is an interesting alternative technique because the achievable production of high material fluxes of material with high kinetic energy can be used to fabricate both, nanoparticles and continuous coatings.

The aim of this study was therefor to combine in a unique device the biocompatible properties of calcium phosphate coatings with the silver nanoparticles features, using a single PLD process. The influence of the number of laser shots used for the silver NPs growth has been explored and related to the physicochemical properties of the final device. Moreover, the dose-effect relation to define their biocompatible properties has been studied. Metallic disks were successively covered with a bioceramic hydroxyapatite film and silver nanoparticles using a pulsed ArF excimer laser (20 ns, 193 nm). The coatings were analyzed using SEM, AFM, XPS and UV-Visible spectroscopy. The results show a good PR with an indication of coalescence for the samples obtained with more than 200 laser shots. Moreover, the results also prove that the silver content and sample roughness can be controlled with the number of pulses used for the deposition of silver. The biocompatible properties were evaluated with healthy pre-osteoblasts MC3T3-E1 at short and long periods of incubation.

Acknowledgements

This research was partially financed by the Xunta de Galicia: REDES (ED431D2017/13) - GRC (ED431C2017/51) and the European Commission: UE-INTERREG (0302_CVMAR_I_1_P) -(0245_IBEROS_1_E). Technical support by CACTI (University of Vigo) is also gratefully acknowledged.