Plasma polymer coatings for modulation of drug release from bioceramics

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Introduction. Cold plasmas are a source of highly excited species allowing modification of materials in the first nanometres of the surface without altering their bulk properties. One possible effect of plasmas is the production of polymer coatings. The potential of Calcium Phosphate (CaP) as local drug delivery systems for bone tissues has raised great interest in the last years [1]. However, in CaPs, drug release is mainly driven by diffusion, which is strongly affected by the porosity of the matrix and the drug-material interaction so tuning their drug release beyond their intrinsic properties is a very challenging task. It is the aim of this talk to investigate and discuss plasma polymerization processes with views on modulating drug release from biomimetic CaPs and bioceramics.

Experimental. Low-temperature biomimetic hydroxyapatite (HA) and β-tricalcium phosphate (β -TCP) flat discs were synthesised, as well as their 3D macroporous counterparts, obtained by foaming. Different monomers have been investigated to produce biocompatible plasma polymer coatings in a low pressure radiofrequency reactor. Different antibiotics and statin drugs have been incorporated to the materials. Physic-chemical characterisation of the materials and of the coatings was performed, as well as drug delivery and microbiological and biological evaluation.

Results and Discussion. Nano-rough topographies with different characteristics are obtained depending on the plasma process employed, on the microstructure and specific surface area of the CaPş, leading to varying coating thicknesses, and affecting the wettability of the materials. These polymers have been shown to block, delay and/or control drug release depending on the plasma treatment conditions, while conserving the properties of the drug (ie. Antibacterial effects). The plasma coatings produced on the surface of the bioceramics positive effects in the biological properties of CaPs (adhesion, proliferation and morphological changes) with osteoblastic cells (Figure 1).

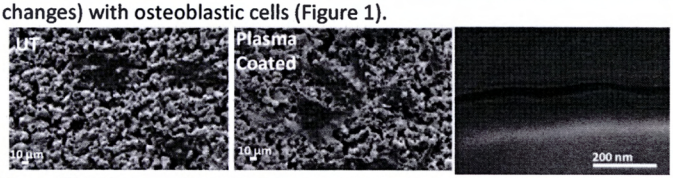

Figure. 1 SEM images of SaOS-2 adhered on β-TCP uncoated (left) and QP10 (center) at 72h and FIB cross-section of the material showing the thickness of the layer (right).

Conclusions. The results obtained in this work open new opportunities for the control of drug release from ceramic biomaterials.

References.

[1] M.P. Ginebra, C. Canal, M. Espanol, et al. *Adv. Drug Deliv. Rev.* 2012; 64 (12): 1090.

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