Seminários de Física

Centro de Física da Universidade do Minho

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Development Of Bioactive Surfaces For Bone Ingrowth On Dental Implants

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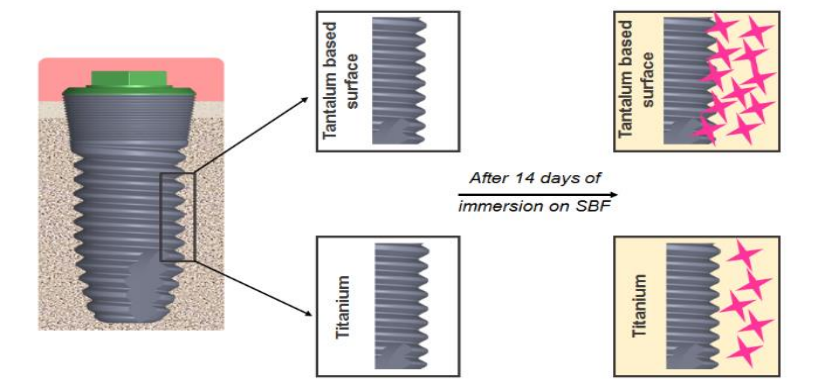

Resumo: Dental implants are usually fabricated in titanium (Ti) based materials due to its biocompatibility and good corrosion resistance. However, the low ability to form a strong chemical bond with living tissue, known as bioactivity, is one of the drawbacks of Ti dental implants. Tantalum (Ta) and Ta oxide coatings have been proven to be bioactive materials due to their high wettability and high surface free energy. Therefore, they were recently proposed to enhance the osseointegration and the performance of medical devices, such as dental implants. Hence, the development of highly bioactive surfaces, with enhanced osseointegration and corrosion resistance, can then be achieved through the deposition of Ta-based coatings by magnetron sputtering.

In this work Ta1-xOx coatings were deposited by DC magnetron sputtering in an Ar+O2 atmosphere, onto SS316L substrates, to study the importance of the oxygen in the bioactivity performance.

Structural results show that a small increase of oxygen content leads to a change of Ta from the stable bcc phase (α-Ta) to a mixture of nanocrystalline phases. For large amounts of oxygen, oxide phases could be achieved. The combination of the structural and mechanical experimental results with ab-initio DFT calculations shows that the increasing addition of oxygen to the Ta phase leads to a decrease of the density and improvement of the elastic properties of the crystal structures. Additionally, a more corrosion protective behavior of the coatings is observed as the oxygen amount increases in the films. Nevertheless, independently of the film composition, a higher pitting inhibition in the coated stainless steel is achieved, allowing, globally, to match the performance of the market reference, the CP Ti Gr2 material. Bioactivity evaluation of Ta1-xOx samples show better ability to change and adsorb ions of SBF, comparatively to the commercial control CP Ti Gr2, which proves that the bioactivity kinetics of Ta1-xOx surfaces is faster than that of Ti surface favoring a faster osseointegration.