Mechanical evaluation of titanium-niobium thin films deposited on 316L stainless steel

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Resumo:
Metallic materials have been used in medical applications for more than 50 years. Titanium and its alloys received extensive attention in dental and orthopedic applications. The widespread and successful application of titanium and titanium alloys in biomedical devices (implants) is clearly due to the combination of its high corrosion resistance and appropriate mechanical performance, which in turn makes it biocompatible. Compared to other metallic materials, titanium is more suitable for orthopedics implants due to its high specific strength and low elastic modulus. Because the Young’s modulus is smaller, less stress shielding can be expected leading to healthier and faster bone regeneration. With the objective of evaluating the effect of the deposition of thin films on the steel substrate, it was analyzed the mechanical and structural properties of the material after deposition. Structural and surface analyses were performed by means of X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). Thin films were produced at four different compositions: Ti-15Nb, Ti-20Nb, Ti-30Nb, and Ti-40Nb (at%). Structural characterization by XRD indicated the predominance of beta-phase in the thin films. The surface composition determined by XPS analysis showed oxidized Ti and Nb; no traces of the substrate elements were detected, suggesting a good coating uniformity. The elastic modulus measurements showed that all samples had values lower than that of stainless steel. With this method could be evaluated elasticity modulus, not only the thin film but the substrate (AISI 316L) with the deposited films.