Mechanical properties, corrosion behavior and in-vitro bioactivity of nanostructured P3H3O3 coating on Ti-6Al-7Nb implant

 Authors: A. Rahman, M. Bacha, D. Hadic-Fabri, J. Kadleck, K. Brunner, M. Hlinka, M. Hlinka, M. Hlinka, Z. Zeman

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 Abstract: Nanostructured biological combination of mechanical properties together with a high corrosion resistance is a desirable feature for a biomedical implant. In this attempt to develop the mentioned properties and achieve an adequate ratio of the mechanical and biological properties, a novel nanostructured composite coating was developed. The coating was applied on Ti-6Al-7Nb implants using a pulsed laser deposition (PLD) technique and subsequent annealing in a borax-based glass in a range of temperatures up to 1000°C. The bioactivity of the coating was investigated in a simulated body fluid (SBF). The SBF test was performed at a pH of 7.4 and 37°C for 28 days. The SBF was prepared by dissolving suitable quantities of the following commercial grade chemicals: NaCl, KCl, NaHCO3, CaCl2, MgCl2, Na2HPO4, and pyrophosphate (Na2HPO4) in a twice-distilled water. The SBF was autoclaved at 121°C for 15 min before use. The implants were immersed in SBF, and the SBF was changed daily. The coating thickness was monitored by a white-light interferometer at different time points. The surface morphology of the coatings before and after immersion was examined using scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS). The immersion test was performed for 28 days, and the samples were analyzed for phase identification using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). The bioactivity of the coating was evaluated using the presence of apatite formation on the coating surface. The results showed that the nanostructured coating exhibited excellent bioactivity and corrosion resistance, making it a promising candidate for biomedical applications.

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