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&

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XII WRTCS

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P.S.I.E.1.

Laser-induced chemical and mophological changes of the titanium alloy surface under different irradiation parameters

Slađana Laketić[1], Marko Rakin[2], Miloš Momčilović[1], Jovan Ciganović[1], Đorđe Veljović[2], Ivana Cvijović-Alagić[1]
[1]*Institute of Nuclear Sciences „Vinča“, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia*
[2]*Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia*

Titanium alloys are finding increasing use as biomaterials due to their low elastic modulus and high damage tolerance. However, the somewhat inadequate alloy surface performance can impede their biomedical application. Surface modification methods have been therefore developed to improve the alloys' surface bioactivity and osseointegration. Laser treatment allows the alloy surface to be modified, providing it with new functionalized surface chemistry and morphology, without compromising the rest of the material properties. Thus, the aim of the study was to examine the laser-induced alterations generated on the Ti-45Nb alloy surface by an ultrashort pulsed laser. The obtained results reveal that laser beam interaction with the target material led to the formation of significant alterations in surface morphology. Surface craters, microcracks, and surface features in the form of periodic and rippled structures and solidified droplets can be observed in the irradiated area. Also, it was found that the higher damage degree along with the material depth and the higher surface roughness were achieved during the irradiation in the argon atmosphere due to the formation of the more pronounced morphological changes on the alloy surface that are induced by higher laser ablation. Furthermore, obtained results showed that alloy surface modification in air, argon, and nitrogen atmosphere additionally caused changes in the surface chemical composition. Namely, after irradiation, the presence of oxygen was observed in the central irradiated area indicating the formation of bioactive Ti-oxide surface film with content that varies with the irradiation parameters variation. Therefore, laser beam irradiation can be singled out as the surface modification method for efficient inducement of the specific surface characteristics that can provide titanium alloys with enhanced osseointegration properties.