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14TH ECerS CONFERENCE FOR YOUNG SCIENTISTS IN CERAMICS

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FOR YOUNG SCIENTISTS IN CERAMICS

BOOK OF ABSTRACTS

October 20-23, 2021
Faculty of Technology Novi Sad
Novi Sad, Serbia

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and
BOOK OF ABSTRACTS

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SURFACE DAMAGE CAUSED BY LASER IRRADIATION OF THE Ti45Nb ALLOY PROCESSED BY HIGH-PRESSURE TORSION

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In recent years, implant materials engineering was focused on the modification of implant surface properties to improve their biocompatibility and osseointegration and in that way broaden implant functionality and durability during the biomedical application. The objective of this work was to investigate the possibility of successful laser surface modification of the Ti-45Nb alloy before and after high-pressure torsion processing by examining surface morphology and damage features resulting from the laser irradiation. Ultrashort pulses were used to produce different surface effects. Interaction of the laser beam with the alloy surfaces resulted in the target material heating, melting and melting propagation, solidification, and generation of the plasma in front of the target. Furthermore, it was found that the applied irradiation parameters led to the target surface modifications in the form of the hydrodynamic effects, such as periodic wave-like structures, ripples, and solidified droplets. The change in the surrounding atmosphere composition also had a decisive influence on the modified alloy surface characteristics. The higher damage spot depth and surface roughness were achieved during the irradiation in argon atmosphere than in air and nitrogen atmosphere due to the higher ablation. The chemical composition of the irradiated surfaces differs depending on the chosen irradiation atmosphere. Obtained results showed that in the central irradiation region nitrogen was absent after the irradiation in all investigated atmospheres, while oxygen concentration was recorded as the highest during the irradiation in air. Also, it should be pointed out that the irradiation in argon atmosphere resulted in the formation of more pronounced morphological changes on the alloy surfaces. In general, the obtained results imply that the employed irradiation parameters can be used for the inducement of the specific surface damage which can be useful for the enhancement of the bioactivity and biocompatible properties of the Ti-based alloys for biomedical applications.