MME SEE CONGRESS 2023

5th Metallurgical & Materials Engineering Congress of South-East Europe
Trebinje, Bosnia and Herzegovina
7-10th June 2023

BOOK OF ABSTRACTS

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Poster presentations

ADVANCEMENT OF BIOCOMPATIBILITY AND MECHANICAL SURFACE CHARACTERISTICS OF THE Ti-13Nb-13Zr ALLOY USING ELECTROCHEMICAL ANODIZATION

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The coarse-grained (CG) and ultrafine-grained (UFG) Ti-13Nb-13Zr alloy (TNZ) were used as tested materials in this study. UFG alloy was obtained using a high-pressure torsion process (HPT) at room temperature, with 5 rotations, and with 4.1 GPa pressure. After that, the surface was modified using electrochemical anodization in the 1M H_3PO_4 + NaF electrolyte, for 60 and 90 minutes.

Scanning electron microscopy (SEM) was used to characterize the morphology of the modified surface after electrochemical anodization. In order to determine whether the electrochemical anodization leads to obtaining the surface modulus of elasticity values close to the values characteristic of the human bones, a nanoindentation test was done. The nanoindentation test was performed on the device called nanoindenter *G200, Agilent Technologies*, where a diamond tip of the Berkovich type shaped as a three-sided pyramid was used as an indenter. Control of the nanoindentation test was done by nanoindentation depth, where for non-anodized materials a depth of 2000 nm was used, while for anodized materials a minimum value of 10% of the thickness of the formed nanostructured oxide layer was used. Biocompatibility of the tested titanium alloy was estimated by the tetrazolium salt colorimetric test (MTT test) using mouse fibroblasts (L-929) and human lung fibroblasts (MRC-5). The cell adhesion on the alloy surface was analyzed using SEM.

Electrochemical anodization has led to the formation of the nanostructured oxide layer on the titanium alloy surface. The obtained results show the existence of the influence of anodizing time on the nanostructured oxide layer morphology. Characterization of the titanium alloy surface using nanoindentation showed a decrease in the values of modulus of elasticity for an alloy with a nanostructured oxide layer, which is close to the values of bone tissue in the human body. The results of the MTT test showed that the titanium alloys before and after electrochemical anodization were not cytotoxic. After electrochemical anodization, a uniform nanostructured surface, with nanotubes, was formed which led to better cell viability and adhesion of L-929 and MRC-5 cells in contact with the test alloys than of cells in contact with the control material.

Keywords: High-pressure torsion, Ultrafine-grained Ti-13Nb-13Zr alloy, Electrochemical anodization, Biocompatibility, Surface modulus of elasticity

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