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THE SURFACE CHARACTERIZATION OF THE ANODIZED ULTRAFINE-GRAINED Ti-13Nb-13Zr ALLOY

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Titanium alloys are metal materials widely used in medicine owing to their suitable characteristics such as low density, good corrosion resistance and biocompatibillity. High biocompatibility of the titanium alloy results from the creation of a spontaneous oxide layer with good adhesion and homogeneous morphology. In order to improve characteristics of the metallic materials for application in medicine, electrochemical methods that enable surface nanostructured modification are extensively used, and one of these methods is electrochemical anodization which makes it possible to obtain a nanostructured oxide layer composed of nanotubes on the surface of the metal material.

The tested material was ultrafine-grained Ti-13Nb-13Zr (UFG TNZ) alloy obtained by the severe plastic deformation (SPD) processing using the high pressure torsion (HPT) process. Nanostructured oxide layer on the titanium alloy was formed by electrochemical anodization during the time period from 30 to 120 minutes. Characterization of the surface morphology obtained during different times of electrochemical anodization was done using scanning electron microscopy (SEM), while the topography and surface roughness of the titanium alloy before and after electrochemical anodization was determined using atomic force microscopy (AFM). Scratch test was used to determine the cross profile of the surface topography and critical load during scratching. Electrochemical anodization led to the formation of a nanostructured oxide layer on the surface of the titanium alloy. The obtained results indicated strong influence of the electrochemical anodization time on the oxide layer morphology - with its increase the diameter of the nanotubes increases too, while the wall thickness of nanotubes decreases. Also, electrochemical anodization led to an increase in the surface roughness.

Keywords: Titanium alloy for biomedical application, High pressure torsion process, Electrochemical anodization, Surface morphology, Surface roughness