

**POLITECHNIKA ŚLĄSKA**  
**WYDZIAŁ MECHANICZNY TECHNOLOGICZNY**



**PRACA DOKTORSKA**

**Badania struktury i własności fizykochemicznych Ti i stopu  
Ti6Al4V ELI stosowanych na implanty w protetyce stomatologicznej**

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# Examination of structure and physicochemical properties of Ti and Ti6Al4V ELI alloy used for implants in dental prosthetics

## Abstract

The work presents the results of numerical simulations and research on issues of shaping the functional properties of prefabricated endodontic posts, the applied metallic biomaterials and conditions of their surface treatment. In preliminary considerations for selected geometric form of prefabricated endodontic posts numerical analysis was performed with the use of the finite element method. On this basis, the state of displacements and stresses in the post and core - tooth configuration and forces at the border of the post - layer of dental cement connection were analyzed. The analysis was the basis for selection of mechanical properties of the material used to manufacture the conventional endodontic posts.

Two metallic biomaterials: CP Grade 4 Ti and Ti-6Al-4V ELI were selected. At first, several studies of initial material and technology of the surface modification were conducted. The surface modification was realized by means of a jet machining, and an electrochemical method. Then the usefulness of the selected methods of surface modification was verified in electrochemical, mechanical and surface topography studies. On the basis of the electrochemical research the corrosion resistance of the selected metallic biomaterials in the initial state and with the modified surface was estimated (resistance to pitting and crevice corrosion, electrochemical impedance spectroscopy). However, in the context of mechanical testing, dental cement adhesion to the modified surface of the metallic biomaterial was examined. The topography of the surface-modified metal biomaterials with the use of the optical profilograph was also analyzed.

The conducted research shows the link between the structure quality and physicochemical properties of biomaterials surface with the terms of conducting surface treatment of fixed dentures used in dental prosthetics.