



Politechnika Śląska

Wydział Inżynierii Biomedycznej

ROZPRAWA DOKTORSKA

„Kształtowanie właściwości użytkowych warstwy  
powierzchniowej protez szkieletowych wykonanych  
technologią przyrostową”

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Zabrze 2023

Zabrze, dnia 10-05-2023 r.

**Summary of the doctoral dissertation  
"Shaping the functional properties of the surface layer of skeletal dentures  
made by additive technology".**

The dissertation presents the characteristics of the usefulness of the ZnO + ZrO<sub>2</sub> coating applied to the CoCr alloy dedicated to the frame of the partial denture.

The development of modern materials allows us to look differently at prosthetic restorations that have been used in dentistry for decades. One of them is the partial skeletal denture. It provides the opportunity to restore the proper functioning of the stomatognathic system in the case of missing teeth. This type of solution belongs to the group of removable prosthetic restorations. The construction of such a prosthesis includes a metal frame with retention clasps, acrylic gum imitation and artificial tooth crowns. It is one of the best solutions offered to patients who cannot use implantation, it is also a more financially advantageous alternative. The development of 3D printing technology has made it possible to precisely match the skeleton to the anatomy of the mucous membranes by making it using additive technology as an additional advantage of skeletal prostheses. Although skeletons made with this method are characterized by a better fit to the anatomical features of the patient, the method of surface preparation is still a challenge, if only because of their complicated shape, which is an ideal environment for colonization by bacteria and fungi. This results in the occurrence of stomatopathies and secondary caries in patients equipped with this type of prosthetic solution.

The dissertation proposes a solution to the above issue by modifying the surface of the partial denture frame made with 3D printing technology from the CoCr alloy, thanks to the low-temperature ALD method enabling the application of a ZnO + ZrO<sub>2</sub> coating with bacteriostatic properties. Verification of the adopted thesis required the implementation of a series of tests that would allow for full characterization of coating properties in simulated conditions of use, reflecting contact with the oral cavity environment. At the initial stage, microstructural and chemical composition tests of the substrate and the coating were performed. Then, tests of electrochemical

and physical properties were carried out. In the final stage, biological tests were carried out, in which the development of colonies of Streptococcus mutant bacteria on a modified medium was observed.

The implementation of the proposed research program made it possible to select the most advantageous variant of modifying the surface of the CoCr alloy with a ZnO + ZrO<sub>2</sub> coating dedicated to the frame of the removable denture, showing bacteriostatic properties and limiting the penetration of metal ions into the oral cavity environment.