

## THE ANALYSIS OF THE MECHANICAL PROPERTIES OF F75 Co-Cr ALLOY FOR USE IN SELECTIVE LASER MELTING (SLM) MANUFACTURING OF REMOVABLE PARTIAL DENTURES (RPD)

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The presented work discusses the applicability of the selective laser melting technique (SLM) in manufacture of removable partial denture (RPD) frameworks with the emphasis on material properties. The paper presents initial results of a conducted test of the mechanical properties of the F75 Co-Cr dental alloy used with selective laser melting.

*Key words:* mechanical properties, selective laser melting, removable partial dentures, Co-Cr alloy

**Analiza mehaničkih svojstava F75 Co-Cr legure za primjenu kod selektivnog laserskog topljenja (SLT) izrade djelomičnih zubnih proteza.** Dana istraživanja se odnose na primjenljivost tehnike selektivnog laserskog topljenja (SLT) u proizvodnji djelomičnih zubnih proteza, pri čemu je posebna pažnja usmjerena na svojstva materijala. Rad prikazuje inicijalne rezultate sprovedenog testiranja mehaničkih svojstva F75 Co-Cr dentalne legure za primjenu kod selektivnog laserskog topljenja.

*Ključne riječi:* mehaničke karakteristike, selektivno lasersko topljenje, djelomične zubne proteze, Co-Cr legura

### INTRODUCTION

During the last several years, numerous novel technologies which allow the design and manufacture of precision, custom-made, optimal dental restorations have been introduced in the field of dental prosthetics. Recent, efforts have concentrated on the development of modelling and manufacture of dental restorations by introducing contemporary computer-aided (CA) techniques and state-of-the-art materials in order to improve weaknesses of the traditional manual approaches in design and manufacture which are prone to numerous subjective errors [1-4].

Removable partial dentures (RPD) represent a special type of dentures, designed for functional or aesthetic reasons for partially edentulous dental patients who cannot have a fixed partial denture i.e., a bridge. Traditionally, RPD frameworks are manufactured through so-called lost-wax technique that is, though in use for decades, prone to human induced errors [5].

In the modern approaches, modelling of dental restoration is based on the application computer-aided de-

sign (CAD) systems and reverse engineering (RE). RE, a modelling technique widely used in different engineering fields [6], has been increasingly applied to the field of dental prosthetics during the last several years, mainly because of the rapid development of dental 3D digitization systems and corresponding modelling software [2,7]. Realizing the benefits of RE, recently there have been several research projects aimed at further developing this technique in the design of RPDs [8,9].

In the field of computer aided manufacture (CAM) of dental restorations, rapid manufacture (RM) technologies have been increasingly applied in recent years as presented by Eysers and Dotchev [10]. Moreover, Bibb et al. [11] have showed the results of RM application in the manufacture of surgical guides for dental surgery. Selective laser melting (SLM) is a RM technique based on layer-wise material addition that allows the generation of complex 3D parts by selectively melting successive layers of metal powder on top of each other. This technology is very suitable for dental applications, due to the complex geometry of the produced parts, as shown by Vandenbroucke and Kruth [12] for the case of personalized frameworks that support artificial teeth. However, application of SLM in RPD framework fabrication is still in the investigation phase. Though case studies on RPD framework fabrication by SLM presented by Williams et al. [13] showed promising results, there is still a lot of work that needs to be accomplished before studies are finalised.

The applied material, i.e., the alloy, is one of the most important issues in dental prosthetics [4,12,14,15].

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