Međunarodna konferencija EUREKA GOLD-GER
E!17091
Knjiga sažetaka

International Conference EUREKA GOLD-GER
E!17091
Abstract Book

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Hotel M

Eureka project:
Development of a new Au-Ge alloy
E!17091

Abstract:

The project GOLD-GER is aimed at designing a new gold-germanium (Au-Ge) alloy, with properties for use in Dentistry as an alloy for porcelain dental restorations, for use in jewellery as a white Au alloy and in industry for a joining alloy for brazing.
The new Au dental alloy with Ge is, thus, intended to have comparable mechanical characteristics and biocompatibility and corrosion resistance to other noble metals, while also providing an economic advantage, as the content of high-priced metals such as Pd is reduced.
The second aim is to explore the possibility for replacement with Ge in white gold alloys. In jewellery most white-Au producers use Ni as the key element for final colouring, while some use Pd.
As an addition of Ge in the Au alloy increases its metal flow, there is also an opportunity to use such alloys in brazing, where metal flow is an important function. As Ge, as well as Au, have a high oxidation resistance, the newly designed alloy may be used in brazing without the addition of flux, adding another beneficial feature for brazing. The alloy is expected to have a high electrical and thermal conductivity, as well as corrosion resistance due to the content of Au.

Start Date
01/10/2021

End Date
01/10/2024

Coordinator:
Zlatarna Celje d.o.o., Slovenia
Assoc. Prof. Dr. Rebeka Rudolf

Partners:
School of Dental Medicine, University of Belgrade, Serbia
Prof. Dr. Vojkan Lazić

Tehnodent d.o.o. Novi Sad, Serbia
Director: Dejan Šakota

Editors: Assoc. Prof. Dr. Rebeka Rudolf, Prof. Dr. Vojkan Lazić

Program:

Introductory speech

Prof. Dr. Vojkan Lazić at 12:00 p.m

Lectures

1. Prof. Dr. Rebeka Rudolf at 12:15 p.m

Development of a new dental alloy based on gold and germanium

2. Prof. Dr. Branimir Grgur at 12:30 p.m

Determination of corrosion properties of a new AuCuZnGe alloy

3. Doc. Dr. Milena Radunović at 12:45 p.m

Antimicrobial properties of a new nanogold resin for dentures and epithesis

4. Assist. Minja Miličić Lazić dr. stom spec at 13:00 p.m

Biocompatibility Study of a Cu-Al-Ni Rod Obtained by Continuous Casting

5. Prof. Dr. Karlo Raić at 13:15 p.m

Dental Gold Alloys and Gold Nanoparticles for Biomedical Applications

5. Director Dejan Šakota at 13:30 p.m

Presentation of Tehnodent d.o.o. and the state of dental technology in Serbia

Abstracts:

Rebeka Rudolf, Peter Majerič

Development of a new dental alloy based on gold and germanium

In the lecture we will present the idea and development of a new gold-germanium (Au-Ge) alloy, which takes place within the international project Eureka GOLD-GER E! 17091. The requirements and properties to be met by the new Au-Ge alloy are as follows: (i) for use in dentistry, the requirements are similar to those intended for porcelain dental constructions, (ii) for use in jewellery production, the requirements are related to achieving white alloys and (iii) for properties related to industrial use as solders for the most demanding applications.

The development of a new Au-Ge dental alloy is aimed at achieving appropriate chemical composition, comparable mechanical properties, corrosion resistance and biocompatibility with existing Au precious dental alloys. A special component in the development work is the economic requirement to exclude precious metals from the chemical composition, such as e.g. Pd and others.

The second goal is to explore the possibility of replacing germanium in Au white alloys, which are used exclusively for various products in the jewellery sector (necklaces, earrings, rings, etc.). In jewellery, most manufacturers use to achieve white colour Au alloys as a key element Ni, and some manufacturers even expensive Pd. Both elements are allergenic and therefore in the final stage it is necessary in most cases to improve the corrosion resistance of jewellery by applying different galvanic layers of nanometre thickness such as Rh or Pt.

Research has shown that the addition of Ge in an Au alloy increases the fluidity of the Au alloy, so there is the possibility of using such Au alloys in soldering, where the fluidity of the alloy is an important function for application. Because Ge and Au have high resistance to oxidation, the newly designed Au-Ge alloy will be able to be used in soldering without adding flux, which is a useful feature in soldering. The new Au-Ge alloy is expected to have high electrical and thermal conductivity as well as corrosion resistance.

Key words: Au-Ge alloy, development, characterization, application.

Rebeka Rudolf, Peter Majerič, Vojkan Lazić, Branimir Grgur

Determination of corrosion properties of a new AuCuZnGe alloy

In this lecture, we present the idea and development of a new gold-copper-zinc-germanium (AuCuZnGe) alloy, which is related to the method of production and research of its key properties, so that the new Au alloy could be used for jewelry production and in dental technology. Melting and casting technologies were used to cast the AuCuZnGe alloy while rolling was used to prepare the cylinders and cutting to make square plates with a = 10 mm and thickness of 1 mm. Such plates were provided for corrosion testing.

Observation of the plate's microstructure was performed with Scanning Electron Microscopy (SEM) equipped by Energy-Dispersive X-ray spectrometry (EDS) and X-ray diffraction (XRD). Corrosion testing involved performing the following measurements: Polarization, the open circuit potentials, and linear polarization resistance. Based on the SEM, EDS, XRD, and results of corrosion testing it can be concluded that the new AuCuZnGe alloy possesses high corrosion stability and can be classified as a high noble alloy.

Key words: gold alloy, germanium, production, characterization, corrosion properties.

Milena Radunović, Vera Ivanović, Sanja Petrović, Danica Popović, Igor Djordjević, Miloš Lazarević, Rebeka Rudolf, Peter Majerič, Vojkan Lazić

Antimicrobial properties of a new nanogold resin for dentures and epithesis

Poly(methyl methacrylate) (PMMA) is the material mostly used to produce dentures and epithesis. It does not show antimicrobial properties and it presents a favorable ground for the growth of microorganisms and for biofilm formation. The aim of this study was to examine the antimicrobial properties of a novel material- PMMA enriched with gold nanoparticles (AuNPs) – PMMA/AuNPs.

The AuNPS were synthetized from HAuCl 4 with the Ultrasonic Spray Pyrolysis method with lyophilization. PMMA/AuNPs samples were compared to PMMA samples. Monomicrobial biofilm formation (Streptococcus mitis, Candida albicans, Staphylococcus aureus and Escherichia coli) was measured by Colony Forming Units (CFU) and MTT test and visualized by SEM. AuNPs release was measured indirectly by measuring the CFU in the medium around sample. CFU and MTT values for biofilms of each tested species were higher on PMMA than on PMMA/AuNPs. SEM analysis show that all tested species tend to form bigger conglomerates on PMMA, while on PMMA/AuNPs microorganisms are dispersed individually or form pairs or small chains on the surface The CFU measured in medium around the test and control materials did not show statistically significant difference for any tested species implying that AuNPs are not released from PMMA/AuNPs.

Key words: PMMA, gold nanoparticles (AuNPs), Biofilm, Antibiofilm effect.

Marko Lazić, Minja Miličić Lazić, Milica Jakšić Karišik, Miloš Lazarević, Andraž Jug, Ivan Anžel and Jelena Milašin

Biocompatibility Study of a Cu-Al-Ni Rod Obtained by Continuous Casting

Cu-Al-Ni shape memory alloys (SMAs) are widely known for their better properties in comparison to other SMAs (lower production costs, increased ductility, enhanced machinability, reduced liquidus temperature, and decreased hysteresis), but there is still controversy in terms of
the biological properties of these materials. The aim of this study was to evaluate biofunctional performances of Cu-Al-Ni alloy produced by continuous casting. The micro-chemical analysis was investigated by SEM/EDX. Immersion tests performed for seven days were used to estimate the quantity of Cu, Al, and Ni ions released in neutral pH and slightly acidic artificial saliva. To assess the biocompatibility of the Cu-Al-Ni alloy samples, MTT assay on fibroblasts and dental pulp cells was performed in indirect and direct contact with samples after 1,3, and 7 days.The study revealed that continuous casting enables the primary fabrication of Cu-Al-Ni rods with a shape memory effect. Samples immersed in artificial saliva with 6.5 pH value showed no significant amounts of released ions, despite the high concentration of copper in the alloy. However, in the acidic environment, the suppression of Cu was 0.14 μg/cm2, Al 1.9 μg/cm2, and Ni 0.73 μg/cm2, and as expected, it was confirmed that Cu-Al-Ni alloy is not corrosion resistant in an acidic environment. In conclusion, this study showed that biocompatibility concerns are related only to materials with a high Cu content in acidic environments. Oppositely, small doses of Cu ions promote cell proliferation, which might be useful in further attempts to enrich different biomedical materials with copper.

Key words: Cu-Al-Ni rod, microstructure, biocompatibility, Cu ions, cell proliferation, characterization.

Rebeka Rudolf, Vojkan Lazić, Peter Majerič, Andrej Ivanič, Gregor Kravanja, Karlo T. Raić

Dental Gold Alloys and Gold Nanoparticles for Biomedical Applications

Gold has always been around us. Tempting, fascinating and financially desirable. In time, that wonderful ***Au****rum* crept into our everyday life, our bodies, as well as neoteric technologies. Through its mysterious paths, gold has conquered medicine through a handful of areas. Modern achievements in the application of gold and gold dental alloys are indicated in this occasional monograph, in which the present authors have participated for many years through their intensive scientific and professional work.

Thus, after introductory information on gold, a detailed analysis of Dental Gold Alloys (DGAs) is given in the second chapter. The third chapter points out the importance of Gold Nano Powders (GNPs), which are increasingly present in all areas of science and applied technology, with a special emphasis on biomedical applications.
The authors tried to bring this area closer to future readers in an acceptable way, and encourage them to further inventive reflections on the impact of gold on our future.

Keywords: dental gold alloys, gold nanoparticles, biomedical applications, biocompatibility and corrosion.

Dejan Šakota

Presentation of Tehnodent d.o.o. and the state of dental technology in Serbia

Tehnodent d.o.o. (TD) is a SME established in 2000. in Serbia. After many years of experience in servicing and production of spare parts, as well as repairs of used dental appliances, expanded the range of service offer on the Serbian market. Beside the equipment manufacturers, has established cooperation with manufacturers of dental materials. Since 2016, has opened a new business segment in the field of prophylaxis. TD is present with its offices in two regions of Serbia: Vojvodina (Novi Sad) andCentral Serbia (Belgrade). Fulfilling Company's Quality Policy, the Management of Tehnodent implemented a QMS (Quality Management System) - ISO 9001 : 2008 standard. The System is in line with the Company's organizational structure, services, procedures and operations. Part of the business strategy of TD is to invest more in the research, development and co- production of the dental materials. The ultimate goal of TD's participation in the project is the testing of Au-Ge new alloys on laboratory level and preparation of dentures with Au-Ge prototype for biocompatibility and corrosion testings.

Contribution of the TD is expected from: participation in defining projects tasks in accordance with standards, through testing of intermediate results of biocompatibility/corrosion of Au-Ge alloy prototype, to the end user (dental laboratories and dental offices). Long-term successful cooperation in the national framework between TD and UB, through this project will expand to the development and progress of the scientific research segment of cooperation in the international framework. Management of project, including the active role of TD in comunication, participations in partners meeting, as well as dissimination of the projects results in R&D. TD plans to hold seminars and workshops for students especially for dentists and dental technicians.

Keywords : Au-Ge alloy prototype, marketing, dental laboratories and dental offices