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17. MEĐUNARODNO SAVJETOVANJE LJEVAČA
VISOKOTEHNOLOŠKA RJEŠENJA U LJEVARSTVU I INŽENJERSTVO UTEMELJENO NA ZNANJU

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
HI-TECH CASTING SOLUTION AND KNOWLEDGE BASED ENGINEERING

Opatija, 16.-18. svibnja 2018. / Opatija, May 16th-18th, 2018

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17. MEĐUNARODNO SAVJETOVANJE LJEVAČA: Visokotehnološka rješenja u ljevarstvu i inženjerstvo utemeljeno na znanju, Studentska sekcija

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PREDGOVOR

Metalurgija je specifično polje koje se bavi dizajnom, razvojem i karakterizacijom materijala od onih svakodnevnih koji nas okružuju u našim domovima, radnim mjestima, ali i materijala s posebnim zahtjevima za specifične namjene poput onih za automobilsku ili svemirsku industriju. Pritom treba poznavati i proizvodne procese. Kroz ove prethodne spoznaje provlači se oporaba i zbrinjavanje metalnih materijala i otpada iz proizvodnje kojim se bavi Industrijska ekologija. Industrijske djelatnosti, koje se utvrđuju kao strateške djelatnosti u Republici Hrvatskoj su Lijevanje metala i Proizvodnja gotovih metalnih proizvoda, prepoznate kao „pokretači gospodarskog rasta" jer se od njih očekuje da ostvaruju veće stope rasta i zapošljavanja. Korelacijom inženjerstva materijala utemeljenog na znanju i visoko tehnoloških rješenja odvija se transfer znanja interakcijom tvrtki i visokoškolskih institucija. Osim navedenog, a uvažavajući vještine i znanja stečene u praksi Fakultet prepoznaje i organizira radionice, predavanja i prezentacije radi transfera znanja i iskustva stručnjaka iz industrije usmjerenih prema nastavnicima radi podizanja kompetencija, ali i studentima radi stjecanja specifičnih znanja i vještina.

Visokoškolsko obrazovanje na Metalurškom fakultetu koncipirano programom i ishodima učenja zasniva se, između ostalog i na poticanju znanstvenoistraživačkog rada studenata s primijenjenim temama, kako bi ambiciozni i kreativni mladi ljudi postali samostalni rješavatelji problema, razvijajući i podupirući njihovu znatiželju, analitičnost, komunikativnost: kako bi postali diplomci kakve želi tržište rada!

Predsjednica Organizacijskog odbora

Z. Z. Brodarac

Izv.prof.dr.sc. Zdenka Zovko Brodarac

PREFACE

Metallurgy, as a specific field of technical sciences, deals with the design, development and characterization of everyday materials in our homes, workplaces, as well as materials with special requirements for specific applications such as those for the automotive or space industry. Knowledge about manufacturing processes should also be acquired. The recovery and disposal of metal materials and waste from the production is underlined as a prerequisite knowledge. Industrial activities, which are defined as strategic activities in the Republic of Croatia are Metal Casting and Production of Final Metal Products, recognized as "economic growth drivers" because they are expected to realize higher rates of growth and employment. Correlation of material knowledge based engineering and technology improvement known as Hi-Tech solutions, represent a knowledge transfer between industry and Higher Education Institutions'. With respect to the skills and knowledge gained in practice, the Faculty recognizes and organizes workshops, lectures and presentations directed to the scientists in order to enhance their competences, but also to the students to acquire specific knowledge and skills.

Higher education at the Faculty of Metallurgy, conceived through the program and the learning outcomes, is based, inter alia, on promoting students scientific and research work on applied topics, enabling ambitious and creative young people to become independent problem solvers, developing and supporting their curiosity, analytics and communication: Graduates like the labour market needs!

President of Organizing Board

Assoc.Prof. Zdenka Zovko Brodarac, PhD

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SADRŽAJ / CONTENTS

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
Opatija, May 16th-18th, 2018
Students' section

MIKROSTRUKTURNA ANALIZA TROJNIH Ag-Bi-Ga LEGURA ŽARENIH NA 300 °C

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U ovom radu izvršena je mikrostrukturna analiza trojnih legura Ag-Bi-Ga. Ovaj ternarni sistem je eksperimentalno istraživan samo jednom do sada. S druge strane, dobro je poznato da je zbog odlične toplinske i električne provodljivosti srebro jedinstveno za različite specijalne primjene. Legure srebra s bizmutom i galijem se široko koriste za lemljenje, zavarivanje i za proizvodnju opreme ili komponenata u elektronskoj i kemijskoj industriji. Pet uzoraka odabranih sastava pripremljeno je taljenjem čistih metala u indukcionoj peći pod zaštitnom atmosferom argona. Pripremljeni uzorci su zatvoreni, pod vakuumom, u ampule od kvarcnog stakla, žareni na 300 °C tokom 48 h, a zatim kaljeni u ledenoj vodi da bi se održala visoko temperaturna struktura za mikroskopsku analizu. Mikrostruktura uzoraka ispitana je metodom SEM-EDX. EDX analizom određen je ukupan sastav i ispitanih uzoraka i sastav sadašnjih faza u mikrostrukturi legura. Dobiveni eksperimentalni rezultati su uspoređeni s rezultatima termodinamičkog predviđanja faznog dijagrama ternarnog sistema Ag-Bi-Ga sistema baziranog na CALPHAD metodi. Za izračunavanje korišteni su optimizirani termodinamički parametri iz literature.

Ključne riječi: *legure Ag-Bi-Ga, SEM-EDX, mikrostruktura*

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
Opatija, May 16th-18th, 2018
Students' section

MICROSTRUCTURAL ANALYSIS OF THE TERNARY Ag-Bi-Ga ALLOYS ANNEALED AT 300 °C

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In this paper, microstructural analysis of the ternary Ag-Bi-Ga alloys was carried out. This ternary system has been experimentally investigated only once until now. On the other hand, it is well known that due to its excellent heat and electrical conductivity silver is basically unique for various special applications. Silver based alloys with bismuth and gallium are widely used for soldering, welding and for manufacturing of equipment or components in electronics and chemical industries. Five samples of the selected compositions were prepared by melting pure metals in an induction furnace under the protective argon atmosphere. The prepared samples were sealed, under vacuum, into quartz glass ampoules, annealed at 300 °C for 48 h and then quenched in ice water to maintain the high temperature structure for microscopic analysis. The microstructure of the quenched samples was examined using the SEM-EDX method. Using EDX analysis the total composition of the tested samples and the composition of the present phases in the microstructure of the alloys were determined. The obtained experimental results were compared with the results of thermodynamic calculation of phase diagram of the ternary Ag-Bi-Ga system based on the CALPHAD method. Optimized thermodynamic parameters from literature were used for the calculation.

Keywords: *Ag-Bi-Ga alloys, SEM-EDX, microstructure*

PROCJENA KVALITETE ODLJEVKA PRIMJENOM NUMERIČKE SIMULACIJE[1]

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Suvremena proizvodnja odljevaka nezamisliva je bez implementacije novih strategija i koncepcija. Jedan od osnovnih ciljeva ovih postupaka je visoka iskoristivost materijala uz što manji broj primijenjenih operacija u procesu oblikovanja. Koncepcije su usmjerene na računalno podržano projektiranje procesa razvoja proizvoda i konstrukcijske pripreme proizvodnje te inženjerstvo i razradu procesa lijevanja i skrućivanja uz predviđanje grešaka. Računalne simulacije lijevanja izvode se radi matematičkog, fizikalnog i kemijskog predviđanja pojava tijekom lijevanja, uzimajući u obzir parametre materijala, kalupa i primijenjene tehnologije lijevanja.
U okviru ovog rada provedena je numerička simulacija lijevanja i skrućivanja odljevaka od AlSi7Mg legure, koja je rezultirala predviđanjem procesa lijevanja i skrućivanja te pojave poroznosti. Rezultati su uspoređeni s onima realno lijevanih uzoraka u ASTM-B108 kokilu. Usporedba je omogućila kvalitativnu procjenu realnih uzoraka s naglaskom na razvoj mikrostrukture koja se odražava na postignuta mehanička svojstava. Metalografska ispitivanja potvrdila su pojavu poroznosti. Dobiveni rezultati su visoke točnosti, koji vizualno kvalitativno i kvantitativno prikazuju tijek lijevanja i proces skrućivanja te omogućavaju predviđanje kvalitete odljevka.

Ključne riječi: *numerička simulacija, AlSi7Mg legura, poroznost, mehanička svojstva, mikrostruktura*

[1] Rad je prezentiran na 21. Tehnologijadi 2017. godine

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
Opatija, May 16th-18th, 2018
Students' section

EVALUATION OF THE CASTING QUALITY USING NUMERICAL SIMULATION[1]

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Recent casting production is impossible without the implementation of new strategies and concepts. The main objectives of these procedures are highly material utilization, with minimal number of forming operations. Those concepts follow product development by CAD and development of pouring and solidification process, and errors prediction by CAE. Computer simulations of casting were performed in order to determine mathematical, physical and chemical phenomena during casting process, with respect to material, mold and applied casting technology parameters.
In this paper numerical simulation of pouring and solidification of AlSi7Mg alloy was performed, which resulted in prediction of casting process as well as porosity occurrence. Results have been compared with those obtained by real samples cast in ASTM-B108 mold. Comparison enables qualitative evaluation of real samples with the emphasis on microstructure development related to its direct influence on achieved mechanical properties. Metallographic investigation confirmed assumption porosity occurrence. Obtained results with high accuracy can qualitatively and quantitatively describe the casting process and enable evaluation of casting quality.

Keywords: *numerical simulation, AlSi7Mg alloy, porosity, mechanical properties, microstructure*

[1] Paper was presented at 21st Tehnologijada, 2017

TVRDOĆE VIŠESLOJNIH GRADIJENTNIH PREVLAKA

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U radu su istražena mehanička svojstva prevlaka na supstratu tvrdog metala. Ispitni uzorak, tvrdi metal na bazi wolfram karbid – kobalta, oznake WC 10 Co, proizveden je metalurgijom praha, Sinter HIP postupkom. PACVD postupak je korišten za dobivanje višeslojne prevlake koja se sastojala od, titan karbonitrida TiCN i titan nitrida TiN, ukupne debljine 2 µm. Ispitivanja prevlake provedena su primjenom instrumentirane metode utiskivanja sukladno HRN EN ISO 14577-1:2015. Različita opterećenja korištena su u cilju dobivanja različitih dubina indentacije u prevlaku. Na temelju istraživanja i provedenih mjerenja, doneseni su zaključci o utjecaju dubine indentacije na dobivene rezultate tvrdoće.

Ključne riječi: *nanostrukturirani tvrdi metal, instrumentirana metoda utiskivanja, titan karbonitrid TiCN, titan nitrid TiN*

HARDNESS OF MULTILAYER COATINGS

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In this paper mechanical properties of PACVD coating on a hard metal substrate were investigated. The tested sample, hard metal based on Tungsten Carbide – Cobalt, designation WC 10 Co, was made by powder metallurgy process – Sinter HIP. Sample was coated by PACVD method, with a multilayer coating consisting of titanium carbonitride TiCN and titanium nitride TiN, with a total thickness of 2 µm. Testing of the samples was performed using instrumented indentation method. Different loads were used in order to achive various indentation depths in the coated layers. Based on conducted measurements, conclusions on influence of indentation depth on hardness results were made.

Keywords: *nanostructured hard metal, instrumented indentation method, titanium carbonitride TiCN, titanium nitride TiN*

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
Opatija, May 16th-18th, 2018
Students' section

FAZNE TRANSFORMACIJE U Cu-Al-Mn-Ag LEGURAMA S PRISJETLJIVOŠĆU OBLIKA[1]

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Cu-Al-Mn legure s prisjetljivošću oblika postale su vrlo atraktivne za komercijalnu primjenu u bioinženjerstvu, dentalnoj industriji te u proizvodnji senzora i aktuatora, i sve više zamjenjuju uporabu vrlo skupe Ni-Ti legure, s obzirom na njihovu nisku cijenu koštanja, veliku superelastičnost te izrazitu duktilnost. Efekt prisljetljivosti oblika u istraživanim legurama posljedica je bezdifuzijske martenzitne transformacije, koja podrazumijeva promjenu kristalne strukture materijala. Dodavanjem mangana osnovnoj binarnoj Cu-Al leguri, proširuje se područje β-faze, ključnoj fazi za postizanje martenzitne strukture, β`-faze, čime se povećava duktilnost materijala te sposobnost njenog hladnog deformiranja. Daljnjim dodavanjem mikrolegirajućih elemenata ternarnoj Cu-Al-Mn leguri, može se utjecati na smanjenje veličine zrna, čvrstoću materijala, pomak faznih transformacija te efekt prisjetljivosti oblika.
Stoga je u ovom radu istražen utjecaj srebra na mikrostrukturu i temperature faznih transformacija Cu-Al-Mn legura. Cu-Al-Mn-Ag legure pripremljene su taljenjem u elektrolučnoj peći te lijevane u cilindrični kalup, dimenzija 8 mm*1,2 cm. Termodinamički proračun i mehanizam skrućivanja Cu-Al-Mn legura proveden je programom Thermo-Calc, korištenjem termodinamičkih podataka prema Miettinenu. Simultanom tehnikom toplinske analize, diferencijalnom pretražnom kalorimetrijom/termogravimetrijom (STA DSC/TG) određene su temperature transformacija Cu-Al-Mn-Ag legura, dinamičkim mjerenjima kroz 2 ciklusa zagrijavanje/hlađenje, u atmosferi argona. Mikrostrukturna ispitivanja provedena su optičkom mikroskopijom (OM) te skenirajućom elektronskom mikroskopijom (SEM), dok je energijsko disperzijskom spektrometrijom (EDS) određen kemijski sastav istraživanih sustava. Rezultati mikrostrukture korelirani su s promjenom sastava Cu-Al-Mn-Ag legure i udjelom srebra te pomakom temperatura transformacija.

Ključne riječi: *legure s prisjetljivošću oblika, Cu-Al-Mn-Ag, fazne transformacije, martenzit, DSC analiza*

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17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
Opatija, May 16th-18th, 2018
Students' section

PHASE TRANSFORMATIONS IN Cu-Al-Mn-Ag SHAPE MEMORY ALLOY[1]

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Cu-Al-Mn shape memory alloys became very attractive for commercial use in the bioengineering, dental industry and in the high-demand industry for sensors or actuators, and they are frequently used instead of very expensive Ni-Ti alloy, due to their low cost, superelasticity and high ductility. Shape memory effect is a consequence of the diffusionless martensitic transformation, which implies a change of crystal structure. Addition of manganese to binary Cu-Al alloy, broadens β-phase region, parent phase for formation of martensitic structure, β`-phase, what increase ductility and cold workability of material. Further addition of alloying elements influences to decreasing of grain size, changes of phase transformation temperatures, mechanical properties and shape memory effect.
In this paper, the effect of silver addition on the microstructure and transformation temperatures of Cu-Al-Mn alloys was investigated. Cu-Al-Mn-Ag alloys were prepared by melting in the electric-arc furnace and casted in the moulds dimensions 8 mm*1.2 cm. Thermodynamic calculation and solidification mechanism was performed by software Thermo-Calc 5, with thermodynamic data according to Miettinen. Transformation temperatures of Cu-Al-Mn-Ag alloys were carried out by simultaneous thermal analysis differential scanning calorimetry/thermogravimetry (STA DSC/TG) through two dynamic cycles in the argon atmosphere. Microstructural investigations were performed by optical microscopy (OM) and scanning electron microscopy (SEM), while chemical content of specimens was determined by energy-dispersive spectrometry (EDS). Microstructural results were correlated with silver content in Cu-Al-Mn-Ag alloy as well as transformation temperatures.

Keywords: *shape memory alloys, Cu-Al-Mn-Ag, phase transformations, martensite, DSC analysis*

Acknowledgment:
This work has been fully supported by Croatian Science Foundation under the project IP-2014-09-3405.

[1] Paper was presented at 22nd Tehnologijada, 2018

MIKROSTRUKTURNA I TERMIČKA KARAKTERIZACIJA LEGURA Cu SA Sn, Zn, Pb, Al i Ag

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Bakar ima široku primenu u elektrotehnici za izradu provodnika zbog izvanredne električne i toplotne provodljivosti, u mašinskoj industriji, građevinarstvu, arhitekturi zbog velike plastičnosti i sposobnosti obrazovanja velikog broja tehničkih legura s dobrim mehaničkim i tehnološkim svojstvima. Najvažniji legirajući elementi u legurama bakra su Zn, Sn, Al, Be, Ni, Mn, Si, Ag i Au. U ovom radu su prikazani rezultati mikrostrukturne i termičke karkterizacije livenih legura Cu sa Zn (mesinga), Cu sa Sn (kalajne bronze) i uz dodatak Pb (olovne bronze) i Al (aluminijumske bronze), kao i Rg bronze i legure Cu sa Ag. Istraživanja koja su izvršena u okviru ovog rada bila su usmerena na određivanje termijskih karakteristika legura korišćenjem metode diferencijalno skenirajuća kalorimetrije (DSC), utvrđivanje strukturnih karakteristika primenom optičke mikroskopije (LOM) i skenirajuće elektronske mikroskopije s energetskom difrakcijom X-zraka (SEM – EDS), kao i merenja toplotne difuzivnosti i određivanje toplotne provodljivosti i specifične toplote primenom metode svetlosnog pulsa (Discovery Xenon Flash, DXF-500).

Ključne riječi: *legure Cu, DSC, SEM-EDX, mikrostruktura, toplotna provodljivosti*

17th INTERNATIONAL FOUNDRYMEN CONFERENCE
Hi-tech casting solution and knowledge based engineering
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Students' section

MICROSTRUCTURAL AND THERMAL ANALYSIS OF Cu ALLOYS WITH Sn, Zn, Pb, Al AND Ag

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The copper is widely used for application in electronics industry for making conductors due to exceptional electrical and thermal conductivity, in the mechanical engineering, construction and architecture due to high plasticity and the ability to form a large number of alloys with good mechanical and technological properties. The most important alloying elements in copper alloys are Zn, Sn, Al, Be, Ni, Mn, Si, Ag, and Au. This paper presents the results of the microstructural and thermal analysis of as-cast Cu alloys with Zn (Brass), Cu with Sn (Tin Bronze) and with the addition of Pb (Lead Bronze) and Al (Aluminum Bronze), as well as Rg bronze and Cu alloys with Ag. The investigations were focused on the determination of the thermal properties of the alloys using the DSC method, the determination of structural characteristics by using optical microscopy (LOM) and scanning electron microscopy with X-ray energy diffraction (SEM - EDS), as well as measurements of thermal diffusivity and determination of thermal conductivity and specific heat capacity using the flash method of light pulse (Discovery Xenon Flash, DXF-500).

Keywords: *Cu alloys, DSC, SEM-EDX, microstructure, thermal conductivity*

OPORABA CRVENOG MULJA

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U ovom preglednom radu razmatraju se sastav i svojstva crvenog mulja te problematika njegovog zbrinjavanja. U Bayer-ovom procesu izluživanja boksita za dobivanje aluminija, nastanak aluminatne otopine popraćen je nastankom boksitnog ostatka poznatijeg kao crveni mulj. Kemijski sastav crvenog mulja čini šest glavnih komponenata: silicij, aluminij, titan, željezo, kalcij i natrij. Zbog visoke lužnatosti crvenog mulja potrebno je provoditi neutralizaciju, optimalno na vrijednost pH 8, obradom mulja kiselinama, CO_2, morskom vodom, bioremedijacijom ili sinteriranjem. Crveni mulj pokazao se kao odličan katalizator zbog visokog udjela željeznih oksida, velike aktivne površine i niske cijene. Može se koristiti kao adsorbens, sredstvo za izmjenu iona, sredstvo za pročišćavanje otpadnih voda i plinova te u procesu katalitičkog krekiranja. U budućnosti postoji mogućnost potpune oporabe crvenog mulja, naročito za izradu konstrukcijskih materijala, ukoliko se poboljšaju postojeći ili osmisle novi načini tretiranja visokobazičnog mulja koji će biti ekonomski i ekološki prihvatljiviji.

Ključne riječi: *crveni mulj, oporaba, bazičnost, obrada, zbrinjavanje*

RED SLUDGE RECOVERY

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In this review the composition and properties of the red sludge and the problem of its disposal are considered. In Bayer process of bauxite leaching for obtaining aluminum, the formation of aluminate solution is accompanied by the formation of bauxite residue known as red sludge. The chemical composition of the red sludge consists of six major components: silicon, aluminum, titanium, iron, calcium and sodium. Due to the high alkalinity of the red sludge, neutralization should be carried out, optimally at pH 8 with sludge acid treatment, CO_2, seawater, bioremediation or sintering. The red sludge proved to be an excellent catalyst due to the high content of iron oxides, large active surfaces and low price. It can be used as an adsorbent, an ion exchange agent, waste water and gas purifier, and in the catalytic cracking process. In the future, there is a possibility of full recovery of the red sludge, especially for the production of structural materials, if existing methods are improved or completely new ways of highly alkaline sludge treatment that are more economically and environmentally friendly are developed.

Keywords: *red sludge, recovery, alkalinity, treatment, disposal*

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Students' section

ELEKTROISPREDANJE NOSAČA ZA UZGOJ STANICA TKIVA OKA NA 3D PRINTANIM KOLEKTORIMA[1]

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Tkivno inženjerstvo pruža velike mogućnosti u razvoju umjetnih organa, osobito bioloških regenerativnih materijala, kao što su hrskavica, kosti i koža. Dizajniranje odgovarajućih biorazgradljivih i biokompatibilnih materijala te praćenje biokemijskih i fizikalnih svojstava, kao i rasta ljudskih stanica omogućuje generiranje nadomjestaka koji mogu obnoviti ili znatno poboljšati funkciju oštećenih tkiva.
U ovom radu, istražen je utjecaj različite topografije elektroispredenih polimernih nosača polikaprolaktona (PCL) na uspješnost zasijavanja i rasta stanica. Kolektori za elektroispredanje pripremljeni su 3D printanjem te su postupkom elektroispredanja iz polimerne otopine PCL/CEFUROXIM® (CFU) dobiveni nosači različite strukture i poroznosti. Otopina polikaprolaktona pripremljena je uz 15 i 20 % mas. antibiotika CFU, koji se koristi za lokalno liječenje vanjskih infekcija oka. Morfologija vlakana pripremljenih nosača prije i nakon zasađivanja stanica praćena je skenirajućom elektronskom mikroskopijom (SEM), dok je kapsulacija antibiotika u polimerni nosač ispitana infracrvenom spektroskopijom s Fourierovom transformacijom (ATR-FTIR). Temperature kristalizacije (T_k) i taljenja (T_t) nosača PCL/CFU te stupanj kristalnosti (χ_c) određeni su diferencijalnom pretražnom kalorimetrijom (DSC), a toplinska stabilnost materijala praćena je tehnikom termogravimetrije (TG). Dobiveni rezultati mikrostrukture nosača korelirani su s rezultatima dobivenih temperatura transformacija te koncentracijom antibiotika, kao i rasprostranjenošću i rastom stanica na nosaču.

Ključne riječi: *tkivno inženjerstvo, elektroispredanje, polikaprolakton, Cefuroxim®, mikrostruktura*

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Students' section

ELECTROSPUNNING OF FIBROUS CARRIER FOR TISSUE ENGINEERING ON 3D PRINTED COLLECTORS[1]

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Tissue engineering provides great opportunities in the development of artificial organs, especially biological regenerative materials, such as cartilage, bone and skin. Designing the appropriate biodegradable and biocompatible materials and investigation of their biochemical and physical properties as well as cell growth factors, makes it possible to generate substitutes that can restore or substantially improve the function of damaged tissues.
In this paper, the effect of different topographies of electrospun Polycaprolactone fibrous carrier on the incorporation and cell growth was investigated. Polymer carriers with different structure and porosity, have been prepared by electrospinning of PCL/CEFUROXIM® (CFU) solution at the 3D printed collectors. Polymer solution was prepared with different concentrations of antibiotic CFU, 15 and 20 %wt., which is used for local eye infection treatment. Fibrous morphology was followed by scanning electron microscopy (SEM), while the incorporation of cells in the polymer carrier was identified by Fourier transformation infrared spectroscopy (ATR-FTIR). Melting (T_m) and crystallization (T_c) temperatures of PCL/CFU as well as degree of crystallinity were determined by differential scanning calorimetry (DSC), while thermal stability of material was obtained by thermogravimetry (TG). Results of PCL/CFU carrier microstructure were correlated with transformation temperatures and antibiotic concentrations as well as cell growth.

Keywords: *tissue engineering, electrospinning, polycaprolactone, Cefuroxim®, microstructure*

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Students' section

THERMAL AND CHEMICAL STABILITY OF SOL-GEL COATINGS WITH ZIRCON FILLER

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Coatings with added sol-gel component can improve the rheological properties of the coating and thus also the application and adhesion of the coating on the surface of sand molds or cores. Coating on mould or core creates a high thermal integrity barrier between the metal and the mould in the reduction of the thermal shock experienced by the sand system. The fundamental requirements for refractory coatings are minimum porosity, high refractoriness and reduction of the physicochemical reaction at the metal-coating interface (lubrication, solution, penetration).
Coatings in the metallurgical industry are becoming increasingly important as they contribute to the improvement of metallurgical products. A refractory coating on the mould or core should have the following characteristics: high refractory properties, good adhesion to the substrate, good permeability to minimize air entrapment, no tendency to blistering, cracking or scaling on drying, provides adequate protection against the penetration of melt into forms, quick drying and good suspension and remixing properties. In the field of coatings, industry wants to make the most optimal coating which would satisfy the above-mentioned needs. Therefore, the desire to add a sol-gel component to the coating is increasing.
According to the literature data, the sol-gel additive significantly improve the surface of the castings in some application processes. The coating technology itself plays an important role in the ratio of the added sol-gel component to the other components. Because of this affects the viscosity of the coating and with its growth properties such as lubrication and, consequently, the surface of the casting are improved.
The application of sol-gel coating process in foundry coating production is a novel area. Purpose of this research is to investigate the effect of using sol-gel component as additive to water-based coating with zircon filler. Three different sol-gel components were investigated, whereas the adhesion surface and layer on the mould and the surface of the castings was analyzed. The results show much better surface quality of castings obtained by adding the sol-gel component to the coatings.

Keywords: *coatings, sol-gel component, foundry, mould, castings*