

FIRST INTERNATIONAL
CONFERENCE ON ELECTRON
MICROSCOPY
OF NANOSTRUCTURES

ELMINA 2018

ПРВА МЕЂУНАРОДНА
КОНФЕРЕНЦИЈА О
ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ
НАНОСТРУКТУРА



August 27-29, 2018, Belgrade, Serbia
27-29. август 2018. Београд, Србија

FIRST INTERNATIONAL CONFERENCE

ELMINA  2018

PROGRAM



BOOK OF ABSTRACTS

Rectorate of the University of Belgrade, Belgrade, Serbia
August 27-29, 2018
<http://elmina.tmf.bg.ac.rs>

Organized by:
Serbian Academy of Sciences and Arts and Faculty of Technology and Metallurgy,
University of Belgrade

Endorsed by:
European Microscopy Society and Federation of European Materials Societies

At the beginning we wish you all welcome to Belgrade and ELMINA2018 International Conference organized by the Serbian Academy of Sciences and Arts and the Faculty of Technology and Metallurgy, University of Belgrade. We are delighted to have such a distinguished lineup of plenary speakers who have agreed to accept an invitation from the Serbian Academy of Sciences and Arts to come to the first in a series of electron microscopy conferences: Electron Microscopy of Nanostructures, ELMINA2018. We will consider making it an annual event in Belgrade, due to this year's overwhelming response of invited speakers and young researchers. The scope of ELMINA2018 will be focused on electron microscopy, which provides structural, chemical and electronic information at atomic scale, applied to nanoscience and nanotechnology (physics, chemistry, materials science, earth and life sciences), as well as advances in experimental and theoretical approaches, essential for interpretation of experimental data and research guidance. It will highlight recent progress in instrumentation, imaging and data analysis, large data set handling, as well as time and environment dependent processes. The scientific program contains the following topics:

- Instrumentation and New Methods
- Diffraction and Crystallography
- HRTEM and Electron Holography
- Analytical Microscopy (EDS and EELS)
- Nanoscience and Nanotechnology
- Life Sciences

To put this Conference in proper perspective, we would like to remind you that everything related to nanoscience and nanotechnology started 30 to 40 years ago as a long term objective, and even then it was obvious that transmission electron microscopy (TEM) must play an important role, as it was the only method capable of analyzing objects at the nanometer scale. The reason was very simple - at that time, an electron microscope was the only instrument capable of detecting the location of atoms, making it today possible to control synthesis of objects at the nanoscale with atomic precision. Electron microscopy is also one of the most important drivers of development and innovation in the fields of nanoscience and nanotechnology relevant for many areas of research such as biology, medicine, physics, chemistry, etc. We are very proud that a large number of contributions came from young researchers and students which was one of the most important objectives of ELMINA2018, and which indicates the importance of electron microscopy in various research fields. We are happy to present this book, comprising of the Conference program and abstracts, which will be presented at ELMINA2018 International Conference. We wish you all a wonderful and enjoyable stay in Belgrade.

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GENERAL INFORMATION

DATE AND VENUE: The conference will be held August 27-29, 2018 at the Rectorate of the University of Belgrade, Studentski Trg 1, 11000 Belgrade, Serbia with the beginning at 8:30 AM on August 27th, 2018, in the Solemn Hall.

REGISTRATION: At the registration desk, located on the ground floor hall of the conference venue. Registration desk working hours are: Sunday, August 26th, from 16:00 to 18:00, Monday, August 27th, from 08:00 to 18:30, Tuesday, August 28th, from 08:00 to 13:00, Wednesday, August 29th, from 08:00 to 11:00. Registered participants will receive a nametag and a conference bag.

INSTRUCTIONS FOR AUTHORS: The conference will feature plenary sessions and poster sessions as well as vendor presentations during lunch breaks. Presentations during plenary sessions will last 30 minutes each, including discussion. Standard and hands-free microphones will be on site. No A-V equipment will be provided for any poster presentations. Poster presenters must remain at their poster on their assigned day during the required poster session. Each poster will be allocated a 130 cm high and 95 cm wide (130X95) display area.

CONFERENCE AWARDS: Poster presentations will be reviewed according to the following criteria: (a) relevance to a specific symposium, (b) scientific content, quality and innovative proposals, (c) clarity of the text, and (d) compliance with the format. During the conference, the best three (3) posters, selected by a poster award committee, will receive awards.



Bioactive Hydroxyapatite/Chitosan/Gentamicin Composite Coating Electrodeposited on Titanium

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Titanium (Ti) is the most widely used implant material due to its high corrosion resistance, and good mechanical properties. The biocompatibility and bioactivity of titanium can be significantly improved by the modification of its surface through the deposition of bioceramic coating on Ti [1]. Materials of choice were hydroxyapatite (HAP), chitosan (CS) and gentamicin because of their good properties. HAP is well known for its outstanding biocompatibility, chemical composition similar to natural bone and its ability to promote osseointegration. Improvement of mechanical and antimicrobial properties of the coating was achieved by addition of CS, biocompatible, natural polymer [2]. In order to improve antibacterial properties, and to avoid the occurrence of various inflammatory processes during implantation, a broad spectrum antibiotic gentamicin was added [3]. The combination of good mechanical properties of Ti, the bioactivity of HAP and good adhesion properties of CS enables the production of bone tissue implants with improved biological functions.

Cathodic electrophoretic deposition process (EPD) was employed for assembling composite HAP/CS and HAP/CS/Gent coating on Ti substrate (Figure 1.). EPD was carried out at the constant voltage on pure Ti plates from an aqueous suspension. The aim was to produce homogenous bioactive coatings with improved mechanical properties and remarkable antibacterial effects. Obtained coatings were characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray photoelectron

spectroscopy (XPS) and field emission scanning electron microscopy (FE-SEM). Antibacterial properties of coatings were tested against two bacteria strains – *Staphylococcus aureus* and *Escherichia coli*, by agar diffusion test. Evaluation of relative cytotoxicity of obtained coatings was performed using MTT test. The ability of coatings to promote osseointegration was tested using ALP assay.

Obtained results confirmed the successful deposition of HAP/CS and HAP/CS/Gent coatings on Ti using EPD technique. Hydrogen bonding of functional groups of CS and HAP was confirmed by FT-IR analysis which also revealed several bands characteristic for CS. Due to low gentamicin content in HAP/CS/Gent coating, no characteristic bands corresponding to gentamicin were detected. The presence of gentamicin in HAP/CS/Gent was revealed by XPS analysis through the deconvolution of C1s peak that indicated binding of gentamicin to the matrix. Addition of the polymer significantly improved morphology, and bioactivity of thus formed composite. Morphology examination of HAP/CS and HAP/CS/Gent is represented in Figure 2. FE-SEM micrographs confirmed bioactivity of HAP/CS and HAP/CS/Gent after immersion in SBF. The rapid formation of apatite in a relatively short time (after only 7 days) showed coatings ability to promote bonding between natural bone and implants. MTT assay for HAP/CS and HAP/CS/Gent indicated low cytotoxicity against MRC-5 and L929 cell lines. Both composite coatings exhibited strong antibacterial activity against *S.aureus* and *E. coli*, indicating the high potential for biomedical applications. This effect was slightly more pronounced for the samples tested against *S. aureus*, for both HAP/CS and HAP/CS/Gent coatings.

Excellent osteogenic properties, through the promotion of osteoblast differentiation were confirmed by ALP assay. Results were much more pronounced for HAP/CS/Gent coating. Therefore, HAP/CS and HAP/CS/Gent coatings can be considered as an excellent promising candidate for biomedical hard tissue implants [4].

References:

- [1] MS Đošić *et al*, J.Ind.Eng.Chem **47** (2017), 336.
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- [4] The authors acknowledge funding from the Ministry of Education, Science and Technological Development, Republic of Serbia (Grant No. III 45019).

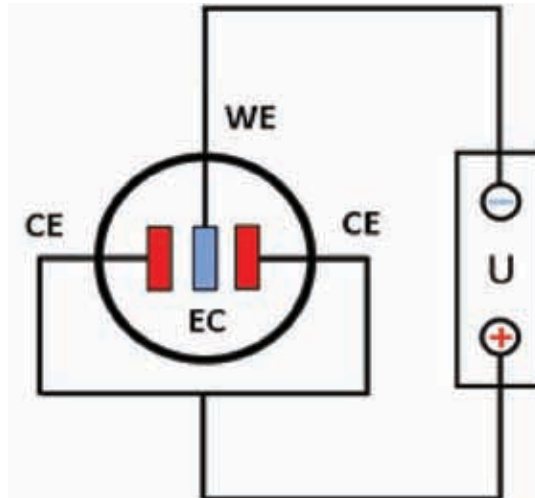


Figure 1. Scheme of electrochemical cell (EC): WE-working electrode, CE-counter electrode.

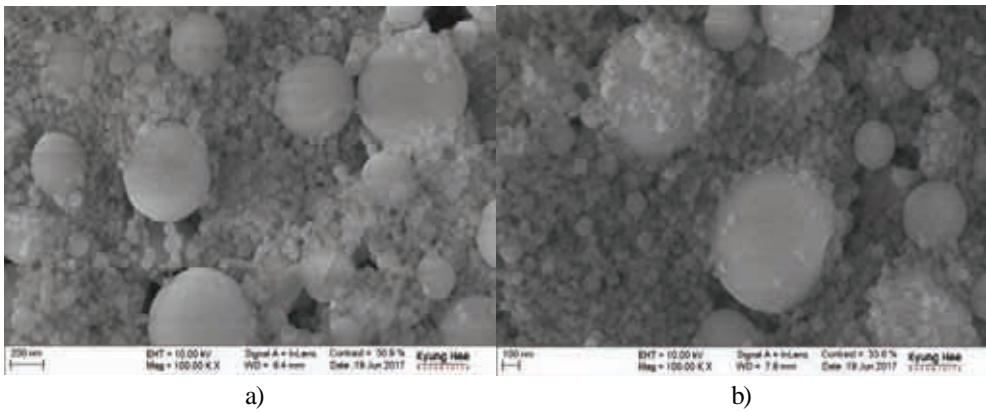


Figure 2. FE-SEM micrographs of composite coatings: a) HAP/CS and b) HAP/CS/Gent.

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