HRVATSKO MIKROSKOPIJSKO DRUŠTVO

POZIV NA 250. SASTANAK

Hrvatskog mikroskopijskog društva, koji će se održati u prostorijama **Instituta „Ruđer Bošković“, Bijenička cesta 54,** predavaonica **I. krila**, u

utorak, 28. siječnja 2020. u 16:30 sati
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uz sljedeći

D n e v n i r e d:

1. Izlaganja stipendista HMD-a na skupovima u 2019:

Andreja Gajović (IRB): Stabilised zirconia/calcium phosphate composites for bone implants

Suzana Šegota (IRB): Enhanced protection of biological membranes during lipid peroxidation using flavonoid loaded mesoporous silica nanoparticles

Vilko Mandić (FKIT): The role of amino acids (G, A, N) in the wet chemistry synthesis and thermal development of gamma alumina with specific morphology

2. Razno

Tajnica:
Jelena Macan

Predsjednica:
Andreja Gajović

Stabilised zirconia/calcium phosphate composites for bone implants

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Stabilized zirconia ceramic with good mechanical properties, is widely applied for orthopedic and dental restoration. Zirconia is a biocompatible but bio-inert ceramic material, meaning it poorly or not at all interacts with the surrounding tissue and cannot connect with hard tissues. Stabilizing compounds such as yttria, magnesia, ceria, and alumina are commonly used to stabilize the metastable tetragonal phase in a zirconia, thus enabling transformation toughening. On the other hand, calcium phosphate (CaP) based biomaterials are often used as coatings for bio-inert metal and polymer implant materials.

With the aim to prepare bioactive materials for bone implants, we investigated growth and stability of CaP coating on porous ZrO_2 obtained by sol-gel process. In order to test their suitability as a material for possible bone implants mechanical properties of these composite bioactive ceramics was tested by ball to ball compression test, indentation hardness test and by scratch test. The aim of this work was to prepare porous stabilized zirconia ceramics and to study potential of use CaP as its bioactive coating. Capability of porous zirconia ceramic to induce formation of calcium phosphate in metastable solution was studied. Biomimetic process of applying calcium phosphate (CaP) on the surface of porous ZrO2 ceramics was used. This procedure is based on the deposition of calcium phosphate from solution under conditions close to those in the body that is at physiological temperature, pressure and pH.

Yttria-stabilised zirconia with 10 wt% yttria was prepared by sol-gel process. Obtained powder was uniaxially pressed and sintered in air for 8 h at 1000, 1200 and 1400 °C with the aim to form ceramics of different porosity. The ability of ZrO_2 ceramics to induce calcium phosphate growth was tested by immersing the plates into the metastable calcifying solution. The structure and morphology of zirconia ceramics and CaP growth were studied by scanning electron microscopy, Raman spectroscopy and X-ray diffraction. In order to test their suitability as a material for possible bone implants, mechanical properties (strength, hardness and density) of the ceramic with and without coating were measured.

We observed that prepared zirconia ceramics were able to initiate formation of calcium phosphates from metastable solution. The growth of CaP coatings and its morphology will be discussed taking into account ceramics porosity. It was shown that obtained CaP was calcium deficient hydroxyapatite (CaDHA), but the cowering of the

zirconia ceramic surface by CaP, were dependent on the procedure of washing ceramic surface before immersion of ceramics in calcifying solution. It was shown that CaP coating did not influence mechanical properties. The mechanical characteristics of porous zirconia will be discussed and compared with known properties of the bones.

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Enhanced protection of biological membranes during lipid peroxidation using flavonoid loaded mesoporous silica nanoparticles

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Flavonoids, polyphenols with anti-oxidative activity have high potential as novel therapeutics for neurodegenerative disease, but their applicability is rendered by their poor water solubility and chemical instability under physiological conditions. In this study, this is overcome by delivering flavonoids to model cell membranes (unsaturated DOPC) using prepared and characterized biodegradable mesoporous silica nanoparticles, MSNs. Quercetin, myricetin and myricitrin have been investigated in order to determine the relationship between flavonoid structure and protective activity towards oxidative stress i.e. lipid peroxidation induced by addition of hydrogen peroxide and/or Cu2+ ions. Among investigated flavonoids, quercetin showed the most enhanced and prolonged protective anti-oxidative activity. The nanomechanical (Young modulus) measurement of the MSNs treated DOPC membranes during lipid peroxidation confirmed attenuated membrane damage. By applying combination of experimental techniques (AFM, force spectroscopy, ELS, DLS), this work generated detailed knowledge about the effects of flavonoid loaded MSNs on the elasticity of model membranes, especially under oxidative stress conditions. Results from this study will pave the way towards the development of innovative and improved markers for oxidative stress-associated neurological disorders. In addition, the obtained could be extended to designing effective delivery systems of other high potential bioactive molecules with an aim to improve human health in general.

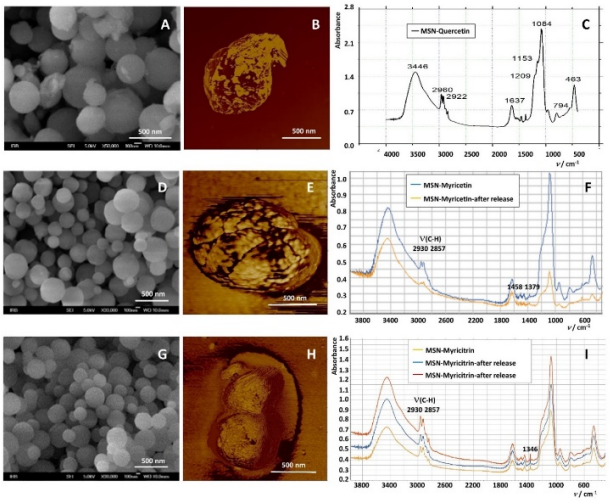

Figure 1 (A, B, C) Flavonoid loaded MSNs: with quercetin, (D, E, F) myricetin, (G, H I) myricitrin, (A, D, G) FF-SEM of flavonoid loaded MSNs, (B, E, H) AFM phase images, (C, F, I), FTIR spectra of flavonoid loaded MSNs

References

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POTVRDA O SLANJU

Dear author

We are pleased to inform you that your Abstract has been successfully submitted. The registration to the Conference is open now. We look forward to welcoming you.

The Local Organizing Committee of Sol-Gel 2019

SAŽETAK

#Porous materials (aerogels, xerogels, cryogels, template-based) and hierarchical structured materials

The role of amino acids (G, A, N) in the wet chemistry synthesis and thermal development of gamma alumina with specific morphology

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Summary:

Alumina (Al_2O_3) is critically important material in variety of applications such as catalysis, due to chemical stability and mechanical durability over the wide temperature range. Furthermore, gamma alumina powders having defect cubic spinel structure with nanocrystalline character can be prepared using only moderate thermal treatment to facilitate catalyst support application. Reaching out to advanced morphological features is becoming increasingly important, as the limits of the nano-seized powders have been reached.

Here we bring about wet chemistry synthesis using aluminium nitrate nonahydrate (ANN) precursor combined with different amino acid fuel. The amino acids; glycine (G), alanine (A) and asparagine (N) have been specifically selected in order to show the role of gradual increase of their: 1) molar weight, 2) enthalpy of combustion, 3) amine groups content and 4) ratio to ANN, on the derived morphologies. Namely, the conditions leading to development of different morphologies from gels to powders were found to be heavily under the influence of fuel/oxygen ratio, i.e. on the smouldering vs flaming mechanism of the combustion. Thereof, the thermal evolution of the alumina precursors was monitored in details.

Higher content of nitrates (predominately from amino rich amino acids) strongly promoted auto-combustion behaviour. As-derived alumina precursors have been thermally treated at various temperatures (quenched and soaked), to monitor gamma and alpha alumina crystallisation, with respect to the development of morphology.

It was shown that this combustion synthesis allows facile tailoring nanocrystalline gamma alumina with different morphological features. Different textures types have been observed, such as porous wormhole, porous particulate and porous flakes. Detailed structural (XRD, FTIR), microstructural (SEM, EDS, BET N_2 A/D, PSD) and thermal (DTA, TGA) characterisations confirm the nanocrystalline character, thermomechanical stability and were not diminished for different porous morphologies in the course of this synthesis.

Keywords

Gamma alumina, Catalyst support, Wet synthesis, Intermediate Gels, Combustion, Tailoring morphology, Thermal evolution, Diffraction, Electron microscopy

Acknowledgement

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