

NASTAVNO-NAUČNOM VEĆU  
TEHNOLOŠKO-METALURŠKOG FAKULTETA  
UNIVERZITETA U BEOGRADU

Na sednici Nastavno-naučnog veća Tehnološko-metalurškog fakulteta u Beogradu održanoj 21. septembra 2017. imenovani smo za članove Komisije za podnošenje izveštaja o ispunjenosti uslova za sticanje naučno-istraživačkog zvanja VIŠI NAUČNI SARADNIK kandidata dr Ane Janković, dipl. inž. tehnologije.

O navedenom kandidatu Komisija podnosi sledeći

## IZVEŠTAJ

### 1.1 BIOGRAFSKI PODACI

Ana D. Janković je rođena 24.12.1972. godine, u Jagodini, Republika Srbija. Završila je VIII beogradsku gimnaziju u Beogradu. Diplomirala je 2000. godine Tehnološko-metalurškom fakultetu Univerziteta u Beogradu na odseku za Biohemijsko inženjerstvo i biotehnologiju. Srednja ocena tokom studija je 8,08.

Po diplomiranju, od septembra 2000. godine, godinu dana je bila zaposlena na Tehnološko-metalurškom fakultetu kao asistent-pripravnik na Katedri za opštu i neorgansku hemiju.

Godine 2001. dobija punu stipendiju za doktorske studije na „Wayne State University“, Detroit, Mičigen, SAD. Doktorsku disertaciju pod nazivom “Isothermal Titration Calorimetry Studies of Protein-mediated Interactions and Preliminary Structural Studies of Tandem PDZ1-2 Domain of PSD-95 Protein” odbranila je decembra 2009. godine na „Department of Chemistry, Wayne State University“, Detroit, MI, SAD, pod rukovodstvom mentora Dr Mark Spaller-a. Komisija Univerziteta u Beogradu za priznavanje stranih visokoškolskih isprava donela je rešenje 19.04.2012. kojim se diploma priznaje kao diploma akademskih studija (doktor nauka-hemijske nauke).

Tokom studija radila je kao Graduate Research Assistant od novembra 2001. godine do novembra 2007. godine, a kao Graduate Teaching Assistant od septembra 2001. godine do maja 2005. godine, na „Department of Chemistry, Wayne State University“, Detroit, MI, SAD. U periodu od februara 2008. do juna 2009. radila je kao Research Assistant na „Department of Biochemistry and Molecular Biology, School of Medicine, Wayne State University“, Detroit, MI, SAD. U toku studija dva puta je nagrađivana Wayne State University Excellence in Teaching Award, 2004. i 2005. godine.

Ana Janković bila je zaposlena od 9.01.2012. na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu na projektu REGPOT-FP7 “Reinforcing of Nanotechnology and Functional Materials Centre” (No: 245916) u trajanju od 01.01.2010 do 31.12.2012. Projekat je realizovan u okviru Centra za nanotehnologije i funkcionalne materijale pri Tehnološko-metalurškom fakultetu Univerziteta u Beogradu. U okviru ovog projekta boravila je na NILPRP-The Laser-Surface-Plasma Interactions Laboratory, National Institute for Laser, Plasma, and Radiation Physics u Bukureštu, Rumunija, u periodu od 17.04.2012. do 31.05.2012, zatim od 1.10.2012 do 14.10.2012 i od 29.10.2012 do 15.11.2012. Od 01.03.2013. zaposlena je u Inovacionom centru TMF-a i angažovana sa 12 istraživačkih meseci na projektu Ministarstva prosvete, nauke i tehnološkog razvoja pod nazivom „Sinteza, razvoj tehnologija dobijanja i primena nanostrukturnih multifunkcionalnih materijala definisanih svojstava“, sa evidencionim brojem III45019. Dr Ana Janković izabrana je u zvanje naučni saradnik 12.06.2013.

Dr Ana Janković do sada ima objavljena dva rada u međunarodnim časopisima izuzetnih vrednosti, devet radova u vrhunskim međunarodnim časopisima, dva rada u istaknutim međunarodnim časopisima, dva rada u međunarodnim časopisima i jedan rad u međunarodnom časopisu van SCI liste, petnaest naučnih saopštenja u zbornicima međunarodnih skupova i četiri naučna saopštenja u zborniku nacionalnog skupa (spisak referenci je u prilogu). Do sada ima dva objavljena i dva prijavljena patenta na nacionalnom nivou.

Pohađala je međunarodni Workshop, CCP4 school: From data processing to structure refinement and beyond, na APS, Argonne Laboratory, Chicago, USA u periodu 23/05/2008 - 28/05/2008.

Govori tečno engleski jezik. Član je Srpskog hemijskog društva.

## 1.2 NAUČNO-ISTRAŽIVAČKI RAD

Naučno-istraživački rad dr Ane Janković u toku boravka u SAD na izradi doktorske disertacije bio je fokusiran na proteinsku biohemiju, specifično na slabe međuproteinske interakcije. Istraživanja su se fokusirala na postsinaptičke proteine za koje je interakcija protein-mali molekul ili protein-peptid karakterisana mikrokaloimetrijskom metodom. Ispitivana je termodinamika interakcija tandem PDZ domena proteina PSD-95 sa peptidno-baziranim ligandima, kao i kristalizaciju sa preliminarnim X-ray kristalografskim istraživanjima istog dual proteinskog domena. Strukturne studije su se oslanjale primarno na metodu proteinske kristalografije X-zracima, karakterizaciju afiniteta jona gvožđa ka frataksin proteinu pomoću titracione kalorimetrije, kao i strukturno određivanje metalo-proteina na nivou atoma koristeći X-ray apsorpcionu spektroskopiju i iz ove problematike je objavljen jedan rad u vrhunskom međunarodnom časopisu (M21) i odbranjena doktorska disertacija.

Drugi deo istraživanja, po povratku na Univerzitet u Beogradu, odnosi se na dobijanje i karakterisanje elektroforetskih biokompozitnih prevlaka na metalima, primarno elektroforetskih prevlaka hidroksiapatita dopiranih srebrom, kao i biokompozitnih Ag/hidroksiapatit/lignin prevlaka na titanu i ispitivanje uticaja koncentracije lignina na morfologiju, strukturu i termičko ponašanje Ag/hidroksiapatit/lignin prevlaka. U okviru ovog dela projekta posebno je značajna naučna saradnja sa Département des sciences du bois et de la forêt, Université Laval, Québec, Canada. Ispitivana su antimikrobna svojstva i citotoksičnost biokompozitnih Ag/hidroksiapatit/lignin prevlaka i utvrđeno je da optimalna koncentracija lignina od 1 mas. % nije citotoksična za ispitane periferne ćelije krvi. Do sada su iz ove problematike objavljena tri rada u vrhunskim međunarodnim časopisima (3M21) i rad u časopisu međunarodnog značaja (1M23), pet radova saopšteno je na skupovima međunarodnog značaja štampana u izvodu (5M34), kao i jedan rad saopšten na skupu nacionalnog značaja štampan u izvodu (1M64).

U okviru međunarodnog REGPOT-FP7 projekta "Reinforcing of Nanotechnology and Functional Materials Centre" (No: 245916) ostvarena su tri studijska boravka tokom 2012. godine na NILPRP-The Laser-Surface-Plasma Interactions Laboratory, National Institute for Laser, Plasma and Radiation Physics u Bukureštu, Rumunija. Istraživanja na sistemu biokompozita Ag/hidroksiapatit/lignin podrazumevaju nanošenje tankih filmova na pločice titana tehnikama Pulsed Laser Deposition (PLD) i Matrix Assisted Pulsed Laser Evaporation (MAPLE). Istraživanja su bila fokusirana na antimikrobno dejstvo prevlaka dobijenih laser depozicijom na titanu. Testirani su sojevi *Staphylococcus aureus*, *Pseudomonas aeruginosa* i *Candida famata*. Utvrđeno je da su biokompozitne hidroksiapatit/lignin prevlake dopirane srebrom pokazale baktericidni efekat, naročito prema *C. famata*. Iz ove oblasti istraživanja objavljen je jedan rad u vrhunskom međunarodnom časopisu (1M21), jedan rad u istaknutom međunarodnom časopisu (1M22), kao i četiri saopštenja sa međunarodnih skupova štampanih u izvodu (4M34).

U toku 2013. godine započeta je saradnja sa laboratorijom Prof. Kyong Yop Rhee, Department of Mechanical Engineering, Kyung Hee University, Seul, Južna Koreja. Fokus ovih istraživanja je upotreba grafena, naročito u svrhu dobijanja i karakterisanja elektroforetskih prevlaka hidroksiapatita dopiranih srebrom, kao i biokompozitnih Ag/hidroksiapatit/grafen prevlaka na titanu. Uticaj grafena kao materijala budućnosti, veoma je značajan na morfologiju, strukturu i termičko ponašanje Ag/hidroksiapatit/grafen prevlaka i detaljno je karakterisan sledećim metodama SEM, FE-SEM, TGA, Raman spektroskopija, FTIR, XPS i XRD. Citotoksičnost biokompozitnih Ag/hidroksiapatit/grafen prevlaka ispitivana je pri koncentraciji grafena od 1 mas. % u konačnoj masi prevlake za ispitane periferne ćelije krvi. Ispitivana je i antimikrobna aktivnost dobijenih prevlaka na bakterijskim sojevima *Staphylococcus aureus* i *Escherichia coli* metodom preživljavanja u rastvoru i agar difuzionim testom. Rezultati su veoma ohrabrujući jer su prevlake dopirane srebrom pokazale odlična baktericidna

svojstva već u prva 3h nakon inkubacije, što potvrđuje sposobnost sprečavanja nastanka biofilma, ključnu osobinu za sve antibakterijske implantate. Zona inhibicije je naročito izražena oko uzoraka Ag/hidroksiapatit/grafen u slučaju *S.aureus*. Iz ove oblasti istraživanja objavljena su dva rada u vrhunskom međunarodnom časopisu (2M21), jedan rad u istaknutom međunarodnom časopisu (1M22), kao i šest saopštenja sa međunarodnih skupova štampanih u izvodu (6M34). Tokom 2015. istraživanja su proširena i u smeru uključivanja polimera i formiranje novih kompozita. Izbor je bio prirodni polimer hitozan, te je postupak dobijanja i potpuna karakterizacija na ovaj način dobijenog hidroksiapatit/hitozan/grafen kompozita objavljen kao nacionalni patent (1M94), a potom i u vrhunskom međunarodnom časopisu (1M21). Najnovija istraživanja fokusirana su na implementaciju izabranog antibiotika-gentamicina i njegovo uključivanje u kompozitnu prevlaku. Optimizacija i postupak dobijanja su veoma novi i kao takvi prijavljeni su kao patenti na nacionalnom nivou (2M87).

Istraživanja su nastavljena i u oblasti elektrohemijske sinteze hidrogelova na bazi nanokompozita polivinil-alkohola sa nanočesticama srebra, optimizacija uslova elektrohemijske sinteze nanočestica srebra u hidrogelovima polivinil-alkohola (PVA), sa i bez grafena (Ag/PVA/Gr i Ag/PVA), određivanje morfologije i elektrohemijskih karakteristika dobijenih hidrogelova i ispitivanje kinetike otpuštanja srebra, citotoksičnosti i antibakterijskih svojstava nanokompozitnih hidrogelova za potencijalnu primenu u medicini kao implantati mekih tkiva. Dobijeni hidrogelovi su netoksični i sa izraženim antibakterijskim svojstvima. Specifičnosti inkorporisanja grafena u svrhu poboljšanja pre svega mehaničkih svojstava, u postupku su zaštite kao novi proizvod i objavljen je patent na nacionalnom nivou (1M94). Ova istraživanja rezultirala su objavljivanjem dva rada u međunarodnim časopisima izuzetnih vrednosti (2M21a) i jednog rada u vrhunskom međunarodnom časopisu (1M21), kao i jednog rad u međunarodnom časopisu (1M23).

Tokom svog istraživačkog rada aktivno je učestvovala u realizaciji 2 doktorske disertacije; kandidata Mohamed Mohamed Abudabbus za izradu doktorske disertacije pod nazivom "Electrochemical synthesis and characterization of poly(vinyl alcohol) nanocomposites with silver nanoparticles" i kandidata Radeta Surudžića za izradu doktorske disertacije pod nazivom "Elektrohemijska sinteza i karakterizacija nanokompozita polivinil-alkohola, grafena i nanočestica srebra" kao član Komisije za ocenu podobnosti teme i kandidata na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu.

## 2. SPISAK NAUČNIH RADOVA KANDIDATA

### 2.1. RADOVI OBJAVLJENI U NAUČNIM ČASOPISIMA MEĐUNARODNOG ZNAČAJA – M20

#### 2.1.1. Rad u međunarodnom časopisu izuzetnih vrednosti - M21a (2x10=20)

##### Posle izbora u prethodno zvanje:

- 2.1.1.1. M.M. Abudabbus, I. Jevremović, **A. Janković**, A. Perić-Grujić, I. Matić, M. Vukašinović-Sekulić, D. Hui, K.Y. Rhee, V. Mišković-Stanković, Biological activity of electrochemically synthesized silver doped polyvinyl alcohol/graphene composite hydrogel discs for biomedical applications, *Compos Part B-Eng* **104** (2016) 26-34. (Materials Science, Composites, 2/25, IF (2016) = 4,727), ISSN 1359-8368. Publisher: Elsevier

<http://www.sciencedirect.com/science/article/pii/S1359836816302943>

- 2.1.1.2. Rade Surudžić, **Ana Janković**, Natasa Bibić, Maja Vukašinović-Sekulić, Aleksandra Perić-Grujić, Vesna Mišković-Stanković, Soo Jin Park, Kyong Yop Rhee, "Physico-chemical and mechanical properties and antibacterial activity of silver/poly(vinyl alcohol)/graphene nanocomposites obtained by electrochemical method", *Compos Part B-Eng* **85** (2016) 102–112. (Materials Science, Composites, 2/25, IF (2016) = 4,727), ISSN 1359-8368. Publisher: Elsevier

<http://www.sciencedirect.com.proxy.kobson.nb.rs:2048/science/article/pii/S1359836815005648>

## 2.1.2. Rad u vrhunskom međunarodnom časopisu – M21 (9x8=72)

### Posle izbora u prethodno zvanje:

2.1.2.1 M. Došić, S. Eraković, A. Janković, M. Vukašinović-Sekulić, I. Z. Matić, J. Stojanović, K. Y. Rhee, V. Mišković-Stanković, S. J. Park, „In vitro investigation of electrophoretically deposited bioactive hydroxyapatite/chitosan coatings reinforced by graphene“, *J Ind Eng Chem* **47** (2017) 336-347. (Chemistry, Multidisciplinary, 32/166, IF (2016) = 4.421), ISSN 1226-086X. Publisher: Elsevier

<http://dx.doi.org/10.1016/j.jiec.2016.12.004>

2.1.2.2 Rade Surudžić, **Ana Janković**, Miodrag Mitrić, Ivana Matić, Zorica D. Juranić, Ljiljana Živković, Vesna Mišković-Stanković, Kyong Yop Rhee, Soo Jin Park, David Hui, “The effect of graphene loading on mechanical, thermal, and biological properties of poly(vinyl alcohol)/graphene nanocomposites”, *J Ind Eng Chem* **34** (2016) 250-257. (Chemistry, Multidisciplinary, 32/166, IF (2016) = 4.421), ISSN 1226-086X. Publisher: Elsevier

<http://dx.doi.org/10.1016/j.jiec.2015.11.016>

2.1.2.3 **Ana Janković**, Sanja Eraković, Maja Vukašinović-Sekulić, Miodrag Mitrić, Vesna Mišković-Stanković, Kyong Yop Rhee, “ Graphene-based antibacterial composite coatings electrodeposited on titanium for biomedical applications”, *Prog Org Coat* **83** (2015) 1–10. (Materials Science, Coatings & Films, 3/18, IF (2015) = 2,632), ISSN 0300-9440. Publisher: Elsevier

<http://www.sciencedirect.com/science/article/pii/S0300944015000284>

2.1.2.4 **Ana Janković**, Sanja Eraković, Miodrag Mitrić, Ivana Z. Matić, Zorica D. Juranić, Gary C.P. Tsui, Chak-yin Tang, Vesna Mišković-Stanković, Kyong Yop Rhee, Soo Jin Park, “Bioactive hydroxyapatite /graphene composite coating and its corrosion stability in simulated body fluid”, *J Alloy Compd* **624** (2015) 148-157. (Materials Science, Multidisciplinary, 58/271, IF (2015) = 3,014), ISSN 0925-8388. Publisher: Elsevier

<http://www.sciencedirect.com/science/article/pii/S0925838814027261>

2.1.2.5 S. Eraković, **A. Janković**, C. Ristoscu, L. Duta, N. Serban, A. Visan, I.N. Mihailescu, G.E. Stan, M. Socol, O. Iordache, I. Dumitrescu, C.R. Luculescu, Dj. Janačković, V. Mišković-Stanković, “Antifungal activity of Ag:hydroxyapatite thin films synthesized by pulsed laser deposition on Ti and Ti modified by TiO<sub>2</sub> nanotubes substrates”, *Appl Surf Sci* **293** (2014) 37–45. (Materials Science, Coatings & Films, 2/17, IF (2014) = 2,711), ISSN 0169-4332. Publisher: Elsevier

<http://www.sciencedirect.com/science/article/pii/S016943321302299X>

2.1.2.6 Sanja Erakovic, **Ana Jankovic**, Gary C. P. Tsui, Chak-Yin Tang, Vesna Miskovic-Stankovic and Tatjana Stevanovic, “Novel Bioactive Antimicrobial Lignin Containing Coatings on Titanium Obtained by Electrophoretic Deposition”, *Int J Mol Sci* **15**(7) (2014) 12294-12322. (Chemistry, Multidisciplinary, 46/157, IF (2014) = 2,862), ISSN 1422-0067. Publisher: MDPI

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4139845/>

- 2.1.2.7 Sanja Eraković, **Ana Janković**, Ivana Z. Matić, Zorica D. Juranić, Maja Vukašinović-Sekulić, Tatjana Stevanović and Vesna Mišković-Stanković, "Investigation of Silver Impact on Hydroxyapatite/Lignin Coatings Electrodeposited on Titanium", *Mater Chem Phys* **142** (2013) 521-530. (Materials Science, Multidisciplinary, 48/232, IF (2011) = 2,385), ISSN 0254-0584. Publisher: Elsevier

<http://www.sciencedirect.com/science/article/pii/S0254058413005816>

### **Pre izbora u prethodno zvanje:**

- 2.1.2.8 Sanja Eraković, **Ana Janković**, Djordje Veljović, Eriks Palcevskis, Miodrag Mitrić, Tatjana Stevanović, Djordje Janačković, Vesna Mišković-Stanković, "Corrosion Stability and Bioactivity in Simulated Body Fluid of Silver/Hydroxyapatite and Silver/Hydroxyapatite/Lignin Coatings on Titanium Obtained by Electrophoretic Deposition", *J Phys Chem B* **117** (2013) 1633-1643. (Chemistry, Physical, 32/134, IF (2011) = 3,696), ISSN 1520-6106. Publisher: ACS Publications

<http://pubs.acs.org/doi/abs/10.1021/jp305252a>

- 2.1.2.9 Cook, J.D.; Bencze, K.Z; **Jankovic, A.D.**; Crater, A.K.; Busch, C.N.; Bradley, P.B.; Stemmler, A.J.; Spaller, M.R.; Stemmler, T.L. "Monomeric Yeast Frataxin is an Iron Binding Protein", *Biochemistry-US* **45** (2006) 7767-7777. (Biochemistry & Molecular Biology, 72/261, IF (2005) = 3.848), ISSN 0006-2960. Publisher: ACS Publications

<http://pubs.acs.org/doi/abs/10.1021/bi060424r>

### **2.1.3. Rad u istaknutom međunarodnom časopisu – M22 (2x5=10)**

#### **Posle izbora u prethodno zvanje:**

- 2.1.3.1 **A. Janković**, S. Eraković, C. Ristoscu, N. Mihailescu (Serban), L. Duta, A. Visan, G.E. Stan, A.C. Popa, M.A. Husanu, C.R. Luculescu, V.V. Srdić, Dj. Janačković, V. Mišković-Stanković, C. Bleotu, M.C. Chifiriuc, I.N. Mihailescu, , "Structural and biological evaluation of lignin addition to simple and silver doped hydroxyapatite thin films synthesized by matrix-assisted pulsed laser evaporation", *J Mater Sci-Mater M* **26**:17 (2015) 1-14. (Engineering, Biomedical, 21/72, IF (2014) = 2,587), ISSN 0957-4530. Publisher: Springer

<http://link.springer.com/article/10.1007/s10856-014-5333-y>

- 2.1.3.2 Vesna Mišković-Stanković, Sanja Eraković, **Ana Janković**, Maja Vukašinović-Sekulić, Miodrag Mitrić, Young Chan Jung, Soo Jin Park and Kyong Yop Rhee "Electrochemical synthesis of nanosized hydroxyapatite/ graphene composite powder" *Carbon Lett* **16** (2015) 233-240. (Materials Science, Multidisciplinary, 124/260, IF (2014) = 1,625), ISSN 1976-4251. Publisher: Korean Carbon Society

[http://carbonlett.org/PublishedPaper/topic\\_abstract.asp?idx=515](http://carbonlett.org/PublishedPaper/topic_abstract.asp?idx=515)

### **2.1.4. Rad u međunarodnom časopisu – M23 (2x3=6)**

#### **Posle izbora u prethodno zvanje:**

- 2.1.4.1 Rade Surudzić, **Ana Janković**, Maja Vukašinović-Sekulić, Aleksandra Perić-Grujić, Kyong Yop Rhee, Vesna Mišković-Stanković, "Optimization of the electrochemical synthesis of silver nanoparticles in poly(vinyl alcohol) colloid solutions", *Bulg Chem Commun* **49** (2017) 186–193. (Chemistry, Multidisciplinary, 163/166, IF (2016) = 0,238), ISSN 0324-1130.

[http://www.bcc.bas.bg/BCC\\_Volumes/Volume\\_49\\_Special\\_C\\_2017/BCC21\\_49-C-2017\\_M-Stankovic\\_p186.pdf](http://www.bcc.bas.bg/BCC_Volumes/Volume_49_Special_C_2017/BCC21_49-C-2017_M-Stankovic_p186.pdf)

**Pre izbora u prethodno zvanje:**

- 2.1.3.2 **Ana Janković**, Sanja Eraković, Antonija Dindune, Djordje Veljović, Tatjana Stevanović, Djordje Janačković, Vesna Mišković-Stanković, “The electrochemical impedance spectroscopy of silver doped hydroxyapatite coating in SBF solution used as corrosive agent“, *J Serb Chem Soc* **77** (2012) 1609-1623. (Chemistry, Multidisciplinary, 102/152, IF (2011) = 0,879), ISSN 0352-5139.

<http://www.shd.org.rs/JSCS/>

**2.1.5. Radovi u međunarodnom časopisu van SCI liste**

**Posle izbora u prethodno zvanje:**

- 2.1.5.1 Vesna Mišković-Stanković, **Ana Janković**, Sanja Eraković, Kyong Yop Rhee “Graphene Based Biomedical Composite Coatings Produced by Electrophoretic Deposition on Titanium” *Eurasian Chemico-Technological Journal* **17** (2015) 3-15. ISSN 1562-3920. Publisher: Institute of Combustion Problems

<http://ect-journal.kz/index.php/ect01/article/view/189>

**2.2. ZBORNICI MEĐUNARODNIH NAUČNIH SKUPOVA – M30**

**2.2.1. Saopštenje sa međunarodnog skupa štampano u izvodu – M34 (15x0.5=7.5)**

**Posle izbora u prethodno zvanje:**

- 2.2.1.1 Sanja Eraković, **Ana Janković**, Gary C.P. Tsui, Chack-Yin Tang, Maja Vukašinović-Sekulić, Ivana Z. Matić, Vesna Mišković-Stanković, Tatjana Stevanovic, „Use of electrophoretic deposition in the processing of novel bioactive hydroxyapatite/lignin coatings“, 6th ISE Satellite Student Regional Symposium on Electrochemistry (ISE-SRSSE), 8. Juli 2016, Zagreb, Croatia, Book of abstract, p. 32-33.
- 2.2.1.2 Sanja Erakovic, **Ana Jankovic**, Maja Vukasinovic-Sekulic, Kyong Yop Rhee and Vesna Miskovic-Stankovic, „Biomedical Composite Silver/Hydroxyapatite/Graphene Coatings“, 5th Regional Symposium on Electrochemistry South-East Europe (RSE-SEE5), 7-11 June 2015, Pravets, Bulgaria, Book of Abstracts, BEH-P-01, p. 35.
- 2.2.1.3 Vesna Miskovic-Stankovic, **Ana Jankovic**, Sanja Erakovic and Kyong Yop Rhee, „Electrochemical Hybrid Hydroxyapatite/Graphene Coatings on Titanium“, 2015 International Conference on Hybrid Materials (ICHM 2015), 15-17 May 2015, Jeonju, South Korea, Abstracts, ICHM201515-04, p. 34.
- 2.2.1.4 Sanja Eraković, **Ana Janković**, Miodrag Mitrić, Ivana Matić, Zorica Juranić, Gary C.P. Tsui, Chak-yin Tang, Vesna Mišković-Stanković, Kyong Yop Rhee, Soo Jin Park, “Electrophoretic Hybrid Hydroxyapatite/Graphene Coatings on Titanium”, Thirteenth Young Researchers’ Conference: Materials Science and Engineering, 10-12 December 2014, Belgrade, Serbia, Book of Abstracts, II/5, p.6.
- 2.2.1.5 Vesna Mišković-Stanković, **Ana Janković**, Sanja Eraković, Kyong Yop Rhee, “Novel biocomposite hydroxyapatite/graphene coatings on titanium substrate assembled by electrophoretic deposition”, XXXIII-rd ROMANIAN CHEMISTRY CONFERENCE, L’atelier „Nouveaux matériaux pour la reconnaissance electrochimique des minéraux et des espèces biologiques” « NOMARES», 1-3 October 2014, Caciulata, Valcea, Romania, Book of Abstracts,(CD-ROM),O-3, p. 21.

- 2.2.1.6 V. Mišković-Stanković, **A. Janković**, S. Eraković, K. Y. Rhee, “ Graphene based biomedical composite coatings produced by electrophoretic deposition on titanium”, VIII International Symposium Physics and Chemistry of Carbon Materials/Nanoengineering, Almaty, The Republic of Kazakhstan, 17-19 September 2014, Book of Abstracts, Proceedings, p. 21-23.
- 2.2.1.7 Vesna Mišković-Stanković, **A. Janković**, Vivek Dhand, Kyong Yop Rhee, “ Electrochemical Biocomposite Graphene/Hydroxyapatite Coatings on Titanium Aimed for Medical Applications”, Carbon 2014; World Conference on Carbon, Carbon Materials for Ubiquitous and Sustainable Life, June 29 - July 4 2014, Jeju, Korea, Carbon 2014, Oral Abstracts, ILT3-06.
- 2.2.1.8 Sanja Eraković, **Ana Janković**, Carmen Ristoscu, Liviu Duta, Natalia Serban, Anita Visan, George E. Stan, Catalin Luculescu, Djordje Janacković, Ion N. Mihailescu, Vesna Mišković-Stanković, “Laser assembling of thin bioceramic and biocomposite films on titanium utilizing Pulsed laser deposition (PLC) and Matrix-assisted pulsed laser evaporation (MAPLE) techniques“, Twelfth Young Researchers’ Conference-Materials Science and Engineering, 11-13 December 2013, Belgrade, Serbia, Book of Abstracts, XII/1, p. 41.
- 2.2.1.9 S. Eraković, **A. Janković**, C. Ristoscu, L. Duta, N. Serban, A. Visan, I.N. Mihailescu, G.E. Stan, M. Socol, O. Iordache, I. Dimitrescu, C.R. Luculescu, Dj. Janačković, V. Mišković-Stanković, “Silver/hydroxyapatite coating on pure and anodized titanium obtained by pulsed laser deposition“, YUCOMAT 2013, 2-6 September 2013, Herceg Novi, Montenegro, Book of abstracts, P.S.E.12, p. 140.
- 2.2.1.10 **A. Jankovic**, N. Serban, L. Duta, S. Erakovic, C. Ristoscu, G.E. Stan, A. Visan, C. Luculescu, M.C. Chifiriuc, V. Miskovic-Stankovic, I.N. Mihailescu, “Pure and doped hydroxyapatite thin films synthesized by advanced laser techniques for metal implant coatings“, E-MRS 2013 Spring Meeting, 27-31 May 2013, Strasbourg, France, Book of abstracts, p. V10.
- 2.2.1.11 S. Erakovic, **A. Jankovic**, C. Ristoscu, L. Duta, N. Serban, A. Visan, G. Stan, M. Socol, C.R. Luculescu, I.N. Mihailescu, V. Miskovic-Stankovic, “PLD deposited thin films on titanium modified by TiO<sub>2</sub> nanotubes“, Fourth Regional Symposium on Electrochemistry South East Europe (RSE-SEE), 26-30 May 2013, Ljubljana, Slovenia, Book of abstracts, p. 129.

### **Pre izbora u prethodno zvanje:**

- 2.2.1.12 Sanja Eraković, Rade Surudžić, Djordje Veljović, **Ana Janković**, Tatjana Stevanović, Vesna Mišković-Stanković, “Electrochemical studies of composite hydroxyapatite/lignin coatings doped with silver”, Satellite Student Regional Symposium on Electrochemistry-3<sup>rd</sup> Regional Symposium on Electrochemistry of South-East Europe (SSRSE-RSE-SEE 3), 13-17 May 2012, Bucharest, Romania, Book of Abstracts, SS – O – 05, p. 129.
- 2.2.1.13 **A. Janković**, S. Eraković, R. Surudžić, Dj. Veljović, M. Vukašinović-Sekulić, I. Matić, Z. Juranić, Dj. Janačković, T. Stevanović, V. Mišković-Stanković, “*The Investigation of Silver Impact on Hydroxyapatite Coatings*”, First International Conference on Processing, characterisation and application of nanostructured materials and nanotechnology (NanoBelgrade), 26-28 September 2012, Belgrade, Serbia, Book of Abstracts, OP18, p. 68.
- 2.2.1.14 Sanja Eraković, **Ana Janković**, Ivana Z. Matić, Zorica D. Juranić, Maja Vukašinović-Sekulić, Tatjana Stevanović, Vesna Mišković-Stanković, “Investigation of silver bioactivity of electrodeposited silver/hydroxyapatite/lignin coatings in simulated body fluid”, First International Conference of Young Chemists of Serbia, 19-20 October 2012, Belgrade, Serbia, Book of Abstracts, (CD Rom), BH-PP2, p. 4.
- 2.2.1.15 Sanja Eraković, **Ana Janković**, Ivana Matić, Zorica Juranić, Maja Vukašinović-Sekulić, Tatjana Stevanović, Vesna Mišković-Stanković, “The Bioactivity Investigation of

Electrodeposited Silver/Hydroxyapatite/Lignin Coatings in Simulated Body Fluid“, The Eleventh Young Researchers’ Conference: Materials Science and Engineering, 3-5 December 2012, Belgrade, Serbia, Book of Abstracts, TM 3, p. 45.

## **2.3. ZBORNICI SKUPOVA NACIONALNOG ZNAČAJA – M60**

### **2.3.1. Saopštenje sa skupa nacionalnog značaja štampano u izvodu – M64 (4x0.2=0.8)**

#### **Posle izbora u prethodno zvanje:**

- 2.3.1.1 Katarina Nešović, **Ana Janković**, Maja Vukašinić-Sekulić, Vesna Kojić, Vesna Mišković-Stanković, “Poly(vinyl alcohol)/chitosan/graphene hydrogels with silver nanoparticles for applications in biomedicine“, 54th Meeting of the Serbian Chemical Society, Faculty of Technology and Metallurgy, Belgrade, Serbia, 29-30 September 2017, Book of Abstracts, EH 08, p. 25.
- 2.3.1.2 Milena Stevanović, Marija Došić, **Ana Janković**, Maja Vukašinić-Sekulić, Vesna Mišković-Stanković, “Biocompatible coating hydroxyapatite/chitosan/gentamicin obtained by electrophoretic deposition on titanium from aqueous suspension“, 54th Meeting of the Serbian Chemical Society, Faculty of Technology and Metallurgy, Belgrade, Serbia, 29-30 September 2017, Book of Abstracts, EH 09, p. 26.
- 2.3.1.3 Sanja Eraković, **Ana Janković**, Miodrag Mitrić, Ivana Z. Matić, Maja Vukašinić-Sekulić, Kyong Yop Rhee, Soo Jin Park, Vesna Mišković-Stanković, „Koroziona stabilnost kompozitnih prevlaka na bazi grafena u simuliranoj telesnoj tečnosti“, 53. Savetovanje Srpskog hemijskog društva, Kragujevac, Srbija, 10-11 Juni 2016, Kratki izvodi radova radova (CD Rom), EHP04, str. 40.

#### **Pre izbora u prethodno zvanje:**

- 2.3.1.4 Sanja Eraković, Marija Došić, Rade Surudžić, **Ana Janković**, Tatjana Stevanović, Vesna Mišković-Stanković, „SEM i XRD analiza prevlaka hidroksiaptita i kompozitnih hidroksiapatit/lignin prevlaka na titanu u simuliranoj telesnoj tečnosti“, 50. Savetovanje Srpskog hemijskog društva, 14-15 Juni 2012, Beograd, Knjiga apstrakata (CD Rom), EHP4, str. 28.

## **2.4. MAGISTARSKE I DOKTORSKE TEZE – M70**

### **2.4.1. Odbranjena doktorska disertacija – M71 (M71=6)**

- 2.4.1 **Ana D Jankovic**, “Isothermal Titration Calorimetry Studies of Protein-mediated Interactions and Preliminary Structural Studies of Tandem PDZ1-2 Domain of PSD-95 Protein” Wayne State University 2009, Detroit, MI, SAD.

## **2.5. TEHNIČKA REŠENJA – M80**

### **2.5.1. Prijavljen patent na nacionalnom nivou – M87 (2x0.5=1)**

#### **Posle izbora u prethodno zvanje:**

- 2.5.1.1 Mišković-Stanković V., Djošić M., **Janković A.**, „Dobijanje biokompatibilnih kompozitnih prevlaka hidroksiapatit/hitozan sa gentamicinom na titanu iz vodene suspenzije“, patentna prijava br P-2017/0732, Zavod za intelektualnu svojinu Republike Srbije, od 19.07.2017.
- 2.5.1.2 Mišković-Stanković V., Djošić M., **Janković A.**, „Dobijanje biokompatibilnih kompozitnih prevlaka hidroksiapatit/hitozan/grafen sa gentamicinom na titanu iz vodene



suspenzije“, patentna prijava br P-2017/0731, Zavod za intelektualnu svojinu Republike Srbije, od 19.07.2017.

## **2.6. PATENTI – M90**

### **2.6.1. Objavljen patent na nacionalnom nivou – M94 (2x7=14)**

#### **Posle izbora u prethodno zvanje:**

2.6.1.1 Mišković-Stanković V., Eraković S., Djošić M., **Janković A.**, „Dobijanje biokompatibilnih kompozitnih prevlaka hidroksiapatit/hitozan/grafen na titanu“, objava patentne prijave broj P-2015/0785, u „Glasniku intelektualne svojine“ Republike Srbije, broj 5/2017 od 31.05.2017.

2.6.1.2 Mišković-Stanković V., Jevremović I., **Janković A.**, „Dobijanje kompozitnih diskova hidrogelova polivinil alkohol/grafen sa inkorporisanim nanočesticama srebra“, objava patentne prijave broj P-2015/0784, u „Glasniku intelektualne svojine“ Republike Srbije, broj 5/2017 od 31.05.2017.

## **2.7 IZVEDENA DELA, NAGRADE, STUDIJE, IZLOŽBE, ŽIRIRANJA I KUSTOSKI RAD OD MEĐUNARODNOG ZNAČAJA – M100**

### **2.7. 1. Nagrada na izložbi – M104 (3x2=6)**

#### **Posle izbora u prethodno zvanje:**

2.7.1.1 Mišković-Stanković V., Jevremović I., **Janković A.**, “Production of composite polyvinyl alcohol/graphene hydrogels discs with incorporated silver nanoparticles“, XIII INTERNATIONAL SALON OF INVENTIONS AND NEW TECHNOLOGIES “New Time“, September 28-30, 2017, Sevastopol, Russian Federation. (Diploma awarded Gold medal) <https://www.ifia.com/ifia-members/collaborating-members/new-time/>

2.7.1.2 Milena Stevanović, Marija Došić, **Ana Janković**, Maja Vukašinović-Sekulić, Vesna Mišković-Stanković, “Biocompatible coating hydroxyapatite/chitosan/gentamicin obtained by electrophoretic deposition on titanium from aqueous suspension“, 54th Meeting of the Serbian Chemical Society, Faculty of Technology and Metallurgy, Belgrade, Serbia, 29-30 September 2017, Najbolja posterska saopštenja - IUPAC Poster Prize. <http://www.shd.org.rs/54SHD/>

2.7.1.3 Mišković-Stanković V., Jevremović I., **Janković A.**, Pronalazak „Dobijanje kompozitnih diskova hidrogelova polivinil alkohol/grafen sa inkorporisanim nanočesticama srebra“, 34. Međunarodna izložba pronalazaka, novih tehnologija i industrijskog dizajna „Pronalazaštvo-Beograd 2016“, Savez pronalazača Beograda, Katalog 34. međunarodne izložbe pronalazaka, novih tehnologija i industrijskog dizajna „Pronalazaštvo – Beograd 2016“, str. 93-95, Beograd, 26-30. 09. 2016., ISBN 978-86-910813-5-7 (Zlatna medalja sa likom Nikole Tesle u oblasti novih tehnologija).

## **2.8. RAD U OKVIRU AKADEMSKE DRUŠTVENE ZAJEDNICE**

### **Organizacija naučnih skupova**

2.8.1 Član Organizacionog odbora First International Conference on Processing, characterisation and application of nanostructured materials and nanotechnology (NanoBelgrade 2012), Belgrade, Serbia, 2012.

## 2.9. NAUČNA SARADNJA I SARADNJA SA PRIVREDOM

### Učešće u projektima finansiranim od strane nadležnog Ministarstva

- 2.9.1 Projekat III45019 Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije pod nazivom: „Sinteza, razvoj tehnologija dobijanja i primena nanostrukturnih multifunkcionalnih materijala definisanih svojstava“, 2011-2017.

### Učešće u međunarodnim naučnim projektima

- 2.9.2 REGPOT-FP7 “Reinforcing of Nanotechnology and Functional Materials Centre” (No: 245916) u okviru Nanotechnology and Functional Materials Centre na Tehnološko-metalurškom fakultetu, Univerziteta u Beogradu, 2010 – 2012.

[http://cordis.europa.eu/result/rcn/56353\\_en.html](http://cordis.europa.eu/result/rcn/56353_en.html)

- 2.9.3 *TD COST Action TD1305: Improved Protection of Medical Devices Against Infection* (iPROMEDAI), European Cooperation in Science and Technology – COST, 2014-2018.

<http://www.ipromedai.net/>

## 3. ANALIZA PUBLIKOVANIH RADOVA

Dr Ana Janković do sada ima objavljena dva rada u međunarodnim časopisima izuzetnih vrednosti (**2M21a**), devet radova u vrhunskim međunarodnim časopisima (**9M21**), dva rada u istaknutim međunarodnim časopisima (**2M22**), dva rada u međunarodnim časopisima (**2M23**) i jedan rad u međunarodnom časopisu van SCI liste, petnaest naučnih saopštenja u zbornicima međunarodnih skupova (**15M34**) i četiri naučna saopštenja u zborniku nacionalnog skupa (**4M64**) (spisak referenci je u prilogu). Do sada ima dva objavljena (**2M94**) i dva prijavljena (**2M87**) patenta na nacionalnom nivou.

Radovi i saopštenja koje je do sada publikovala Ana Janković mogu da se podele u nekoliko grupa, na osnovu tema istraživanja i rezultata koji su u njima prikazani.

U okviru izrade doktorske teze na Wayne State University naučno-istraživački rad kandidata obuhvatio je studije termodinamike interakcija tandem PDZ domena proteina PSD-95 sa peptidno-baziranim ligandima, kao i kristalizaciju sa preliminarnim X-ray kristalografskim istraživanjima istog dual proteinskog domena, karakterizaciju afiniteta jona gvožđa ka frataksin proteinu pomoću titracione kalorimetrije, kao i strukturno određivanje metalo-proteina na nivou atoma koristeći X-ray Absorpcionu Spektroskopiju. Iz ove problematike je objavljen štampani rad (**1M21**) **2.1.2.9** i odbranjena doktorska disertacija **2.4.1**.

Drugi deo istraživanja se odnosi na dobijanje i karakterisanje elektroforetskih prevlaka hidroksiapatita dopiranih srebrom, kao i biokompozitnih Ag/hidroksiapatit/lignin prevlaka na titanu i ispitivanje uticaja koncentracije lignina na morfologiju, strukturu i termičko ponašanje Ag/hidroksiapatit/lignin prevlaka. Ispitivana su antimikrobna svojstva i citotoksičnost biokompozitnih Ag/hidroksiapatit/lignin prevlaka i utvrđeno je da optimalna koncentracija lignina od 1 mas. % nije citotoksična za ispitane periferne ćelije krvi. Takođe, krajnji cilj istraživanja je ispitivanje korozione stabilnosti biokompozitnih hidroksiapatit/lignin prevlaka, sa i bez srebra, pre i nakon termičkog tretmana, u simuliranoj telesnoj tečnosti na temperaturi od 37 °C. Sinterovane prevlake su se pokazale da imaju izuzetnu korozionu stabilnost u poređenju sa nesinterovanim prevlakama. Iz ove problematike objavljena su tri rada u vrhunskim međunarodnim časopisima (**3M21**) **2.1.2.6**, **2.1.2.7**, **2.1.2.8** objavljen rad u međunarodnom časopisu (**1M23**) **2.1.4.2**, a na međunarodnim naučnim skupovima saopšteni radovi (**5M34**) **2.2.1.12**, **2.2.1.13**, **2.2.1.14**, **2.2.1.15**, **2.2.1.1** i na nacionalnom naučnom skupu saopšten rad (**1M64**) **2.3.1.4**.

U okviru studijskih boravaka tokom 2012. godine na NILPRP-The Laser-Surface-Plasma Interactions Laboratory, National Institute for Laser, Plasma and Radiation Physics u Bukureštu,

Rumunija primenjena je tehnika laserski asistirane depozicije i formiranja taknih prevlaka ovom naprednom metodom. Istraživanja na sistemu biokompozita Ag/hidroksiapatit/lignin podrazumevaju nanošenje tankih filmova na pločice titana tehnikama Pulsed Laser Deposition (PLD) i Matrix Assisted Pulsed Laser Evaporation (MAPLE). Potpuna je fizičko-hemijska karakterizacija je urađena na NILPRP, Rumunija. Istraživanja su bila fokusirana na antimikrobno dejstvo prevlaka dobijenih laser depozicijom na titanu. Testirani su sojevi *Staphylococcus aureus*, *Pseudomonas aeruginosa* i *Candida famata*. Utvrđeno je da su biokompozitne hidroksiapatit/lignin prevlake dopirane srebrom pokazale baktericidni efekat, naročito prema *C. famata*. Iz ove oblasti istraživanja objavljen je jedan rad u vrhunskom međunarodnom časopisu **(1M21) 2.1.2.5**, jedan rad u istaknutom međunarodnom časopisu **(1M22) 2.1.3.1**, kao i četiri saopštenja sa međunarodnih skupova štampanih u izvodu **(4M34) 2.2.1.8, 2.2.1.9, 2.2.1.10 i 2.2.1.11**.

Treća grupa radova odraz je istraživanja čiji je fokus upotreba grafena, naročito u svrhu dobijanja i karakterisanja elektroforetskih prevlaka hidroksiapatita dopiranih srebrom, kao i biokompozitnih Ag/hidroksiapatit/grafen prevlaka na titanu. Sve prevlake taložene su iz etanolskih suspenzija. Grafen je od 2004. godine predstavljen kao materijal budućnosti, te je potencijalno veoma je značajan njegov uticaj na morfologiju, strukturu i termičko ponašanje Ag/hidroksiapatit/grafen prevlaka i detaljno je karakterisan sledećim metodama SEM, FE-SEM, TGA, Raman spektroskopija, FTIR, XPS i XRD. Dokazano je formiranje novog sloja apatita, što ukazuje na biološki rast karbonatnog HAP-a tokom samo 7 dana potapanja u SBF. Ova bioaktivnost Ag/HAP/Gr kompozitne prevlake detaljno je karakterisana EIS, kao i rezultatima XRD i FE-SEM. Citotoksičnost biokompozitnih Ag/hidroksiapatit/grafen prevlaka ispitivana je pri koncentraciji grafena od 1 mas. % u konačnoj masi prevlake za ispitane periferne ćelije krvi. Ispitivana je i antimikrobna aktivnost dobijenih prevlaka na bakterijskim sojevima *Staphylococcus aureus* i *Escherichia coli* metodom preživljavanja u rastvoru i agar difuzionim testom. Rezultati su veoma ohrabrujući jer su prevlake dopirane srebrom pokazale odlična baktericidna svojstva već u prva 3h nakon inkubacije, što potvrđuje sposobnost sprečavanja nastanka biofilma, ključnu osobinu za sve antibakterijske implantate. Zona inhibicije je naročito izražena oko uzoraka Ag/hidroksiapatit/grafen u slučaju *S.aureus*. Iz ove oblasti istraživanja objavljena su dva rada u vrhunskom međunarodnom časopisu **(2M21) 2.1.2.3 i 2.1.2.4**, jedan rad u istaknutom međunarodnom časopisu **(1M22) 2.1.3.2**, kao i šest saopštenja sa međunarodnih skupova štampanih u izvodu **(6M34) 2.2.1.2, 2.2.1.3, 2.2.1.4, 2.2.1.5, 2.2.1.6, 2.2.1.7**, kao i saopštenja sa nacionalnog skupa štampano u izvodu **(1M64) 2.3.1.3**.

Istraživanja bioaktivnih prevlaka na titanu su proširena i u smeru uključivanja polimera i formiranja novih kompozita. Izbor je bio prirodni polimer hitozan. Elektroforetska depozicija je uspešno primenjena za formiranje netoksičnih bioaktivnih kompozitnih prevlaka na bazi HAP, hitozana i grafena na Ti supstratima, a njihove interakcije su karakterisane analizama XRD, FT-IR, TG/DTG, FE-SEM i XPS. Promene veličine kristalita za HAP/CS i HAP/CS/Gr prevlake u odnosu na čist HAP, otkrivaju hemijske interakcije između HAP-a, hitozana i grafena, gde grafen deluje kao nanofiler u polimernoj matrici hitozana. Prevlaka HAP/CS/Gr pokazuje najveću otpornost na koroziju i najmanji stepen korozije u SBF-u, zbog biomimetičkog karbonatnog sloja HAP-a na njenoj površini. Obe kompozitne prevlake HAP/CS i HAP/CS/Gr su klasifikovane kao necitotoksične kada su testirane na zdravim PBMC ćelijama, a antibakterijska aktivnost protiv *S. aureus* i *E. coli* nije mogla biti potvrđena. Postupak dobijanja i potpuna karakterizacija na ovaj način dobijenog hidroksiapatit/hitozan/grafen kompozita objavljen kao nacionalni patent **(1M94) 2.6.1.1**, a potom i u vrhunskom međunarodnom časopisu **(1M21) 2.1.2.1**. Najnovija istraživanja fokusirana su na implementaciju izabranog antibiotika-gentamicina i njegovo uključivanje u kompozitnu prevlaku. Optimizacija i postupak dobijanja su veoma novi i kao takvi prijavljeni su kao patenti na nacionalnom nivou **(2M87) 2.5.1.1 i 2.5.1.2**. Nakon prijave, ova istraživanja su saopštena na nacionalnom skupu štampano u izvodu **(1M64) 2.3.1.2**, gde su privukla pažnju i osvojila nagradu IUPAC nagradu za postersku prezentaciju **(1M104) 2.7.1.2**.

Rad na problematici inkorporacije grafena u različite biomaterijale nastavljen je i na projektu elektrohemijske sinteze hidrogelova na bazi nanokompozita polivinil-alkohola sa nanočesticama srebra, optimizacija uslova elektrohemijske sinteze nanočestica srebra u hidrogelovima polivinil-alkohola (PVA), sa i bez grafena (Ag/PVA/Gr i Ag/PVA), određivanje morfologije i elektrohemijskih karakteristika dobijenih hidrogelova i ispitivanje kinetike otpuštanja srebra, citotoksičnosti i antibakterijskih svojstava nanokompozitnih hidrogelova za potencijalnu primenu u medicini kao implantati mekih tkiva. Dobijeni hidrogelovi su netoksični i sa izraženim antibakterijskim svojstvima. PVA/Gr nanokompozit je pokazao bolje mehaničke osobine (čvrstoća povećana za 56,0 % i Young-ov modul za 20,7%) i veću termičku stabilnost nego čist PVA. Hidrogel PVA/Gr je klasifikovan kao necitotoksičan u odnosu na zdrave mononuklearne ćelije periferne krvi (PBMC) prema MTT testu i pokazao snažnu antibakterijsku aktivnost protiv *S. aureus*. Ag/PVA/Gr nanokompoziti pokazali su veću termičku stabilnost i bolje mehaničke osobine nego Ag/PVA nanokompoziti. Sporo otpuštanje srebra, kao i visok sadržaj ostatka srebra (76%) nakon 28 dana u simuliranoj telesnoj tečnosti potvrdili su da hidrogelovi Ag/PVA/Gr i Ag/PVA mogu sačuvati sterilnost tokom vremena. Ova karakteristika, zajedno sa njihovom snažnom antibakterijskom aktivnošću, ukazuje na to da su Ag/PVA / Gr i Ag/PVA hidrogelovi odlični kandidati za implantate mekog tkiva i obloge rane. Oba hidrogela, Ag/PVA i Ag/PVA/Gr značajno su smanjili preživljavanje bakterijskih ćelija nakon samo *S. aureus* i *E. coli* 1 h inkubacije u poređenju sa početnim brojem ćelija u suspenziji. Ag/PVA je smanjio broj kolonija *S. aureus* za logaritamske jedinice i za 2 logaritamske jedinice broj kolonija *E. coli*, dok je inkubacija sa Ag/PVA/Gr dovela do potpunog smanjenja *S. aureus* i smanjenja od 5 logaritamskih jedinica *E. coli* kolonije. Ag/PVA je posle 24 h potpuno redukovao sve *S. aureus* kolonije i sve kolonije *E. coli* nakon 3 h. Nasuprot tome, Ag/PVA /Gr je potpuno redukovao broj *S. aureus* TL i *E. coli* kolonija nakon 3 h i 24 h, redom. Veća antibakterijska aktivnost Ag/PVA/Gr od Ag/PVA mogla bi biti posledica manjih dimenzija čestica AgNP ugrađenih u hidrogelnu mrežu. Specifičnosti inkorporisanja grafena u svrhu poboljšanja pre svega mehaničkih svojstava, u postupku su zaštite kao novi proizvod i objavljen je patent na nacionalnom nivou (**1M94**) **2.6.1.2**. Ova istraživanja rezultirala su objavljivanjem dva rada u međunarodnim časopisima izuzetnih vrednosti (**2M21a**) **2.1.1.1** i **2.1.1.2** i jednog rada u vrhunskom međunarodnom časopisu (**1M21**) **2.1.2.2**, jednog rada u međunarodnom časopisu (**1M23**) **2.1.4.1**, kao i saopštenja sa nacionalnog skupa štampano u izvodu (**1M64**) **2.3.1.1**. Važno je istaći i da su prezentovana istraživanja osvojila i dve međunarodne nagrade (**2M104**) i to Zlatna medalja sa likom Nikole Tesle u oblasti novih tehnologija-**2.7.1.3** i Zlatnu medalju na izložbi “New Time“, Sevastopol, Rusija **2.7.1.1**.

### 3.1. LISTA PET NAJZNAČAJNIJIH NAUČNIH REZULTATA Dr Ane Janković

#### Rad u međunarodnom časopisu izuzetnih vrednosti - M21a

- 3.1.1 M.M. Abudabbus, I. Jevremović, **A. Janković**, A. Perić-Grujić, I. Matić, M. Vukašinić-Sekulić, D. Hui, K.Y. Rhee, V. Mišković-Stanković, Biological activity of electrochemically synthesized silver doped polyvinyl alcohol/graphene composite hydrogel discs for biomedical applications, *Compos Part B-Eng* **104** (2016) 26-34. (Materials Science, Composites, 2/25, IF (2016) = 4,727), ISSN 1359-8368. Publisher: Elsevier. *Citiran 6 puta (BEZ AUTOCITATA)*.

<http://www.sciencedirect.com/science/article/pii/S1359836816302943>

- 3.1.2 Rade Surudžić, **Ana Janković**, Natasa Bibić, Maja Vukašinić-Sekulić, Aleksandra Perić-Grujić, Vesna Mišković-Stanković, Soo Jin Park, Kyong Yop Rhee, “Physico-chemical and mechanical properties and antibacterial activity of silver/poly(vinyl alcohol)/graphene nanocomposites obtained by electrochemical method”, *Compos Part B-Eng* **85** (2016) 102–112. (Materials Science, Composites, 2/25, IF (2016) = 4,727), ISSN 1359-8368. Publisher: Elsevier. *Citiran 10 puta (BEZ AUTOCITATA)*.

<http://www.sciencedirect.com.proxy.kobson.nb.rs:2048/science/article/pii/S1359836815005648>

#### Rad u vrhunskom međunarodnom časopisu – M21

- 3.1.3 **Ana Janković**, Sanja Eraković, Maja Vukašinić-Sekulić, Miodrag Mitrić, Vesna Mišković-Stanković, Kyong Yop Rhee, “ Graphene-based antibacterial composite coatings electrodeposited on titanium for biomedical applications”, *Prog Org Coat* **83** (2015) 1–10. (Materials Science, Coatings & Films, 3/18, IF (2015) = 2,632), ISSN 0300-9440. Publisher: Elsevier. *Citiran 25 puta (BEZ AUTOCITATA)*.

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- 3.1.4 **Ana Janković**, Sanja Eraković, Miodrag Mitrić, Ivana Z. Matić, Zorica D. Juranić, Gary C.P. Tsui, Chak-yin Tang, Vesna Mišković-Stanković, Kyong Yop Rhee, Soo Jin Park, “Bioactive hydroxyapatite /graphene composite coating and its corrosion stability in simulated body fluid”, *J Alloy Comp* **624** (2015) 148-157. (Materials Science, Multidisciplinary, 58/271, IF (2015) = 3,014), ISSN 0925-8388. Publisher: Elsevier. *Citiran 30 puta (BEZ AUTOCITATA)*

<http://www.sciencedirect.com/science/article/pii/S0925838814027261>

#### Objavljen patent na nacionalnom nivou – M94

- 3.1.5 Mišković-Stanković V., Eraković S., Djošić M., **Janković A.**, „Dobijanje biokompatibilnih kompozitnih prevlaka hidroksiapatit/hitozan/grafen na titanu“, objava patentne prijave broj P-2015/0785, u „Glasniku intelektualne svojine“ Republike Srbije, broj 5/2017 od 31.05.2017.

#### 4. CITIRANOST RADOVA

Ukupna citiranost kandidata iznosi 281, odnosno **252 bez autocitata** (oktobar 2017), izvor: Scopus. Prema istoj indeksnoj bazi **Hiršov indeks je 8**. Citirani su sledeći radovi:

*Došić, M., Eraković, S., Janković, A., Vukašinić-Sekulić, M., Matić, I.Z., Stojanović, J., Rhee, K.Y., Mišković-Stanković, V., Park, S.-J. In vitro investigation of electrophoretically deposited bioactive hydroxyapatite/chitosan coatings reinforced by graphene (2017) Journal of Industrial and Engineering Chemistry, 47, pp. 336-347. Citiran 1 put (BEZ AUTOCITATA).*

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## 5. ELEMENTI ZA KVALITATIVNU OCENU NAUČNOG DOPRINOSA KANDIDATA I MINIMALNI KVANTITATIVNI USLOVI ZA IZBOR

### 5.1. Pokazatelji uspeha u naučnom radu

Pokazatelji uspeha u naučnom radu koji kvalifikuju kandidata dr Anu Janković u predloženom naučnom zvanju su:

- Koautor je dva rada u međunarodnim časopisima izuzetnih vrednosti (**2M21a**), devet radova u vrhunskim međunarodnim časopisima (**9M21**), dva rada u istaknutim međunarodnim časopisima (**2M22**), dva rada u međunarodnim časopisima (**2M23**) i jednog rada u međunarodnom časopisu van SCI liste, petnaest naučnih saopštenja u zbornicima međunarodnih skupova (**15M34**) i četiri naučna saopštenja u zborniku nacionalnog skupa (**4M64**) (spisak referenci je u prilogu). Do sada ima dva objavljena (**2M94**) i dva prijavljena (**2M87**) patenta na nacionalnom nivou.
- Bila je član organizacionog odbora First International Conference on Processing, characterisation and application of nanostructured materials and nanotechnology (NanoBelgrade 2012), Belgrade, Serbia, 2012.
- Učestvovala je u istraživanjima u okviru međunarodnog *TD COST Action TD1305: Improved Protection of Medical Devices Against Infection (iPROMEDAI)*, European Cooperation in Science and Technology – COST, 2014-2018. u okviru koga je prisustvovala sastanku u Valletti, Malta 18.04-22.04.2017. godine.
- Učestvovala je u istraživanjima u okviru međunarodnog REGPOT-FP7 projekta “Reinforcing of Nanotechnology and Functional Materials Centre” (No: 245916) u okviru koga je imala tri studijska boravka tokom 2012. godine na NILPRP-The Laser-Surface-Plasma Interactions

Laboratory, National Institute for Laser, Plasma, and Radiation Physics u Bukureštu, Rumunija.

- Aktivno učestvuje na nacionalnom projektu III45019 Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije pod nazivom: „Sinteza, razvoj tehnologija dobijanja i primena nanostrukturnih multifunkcionalnih materijala definisanih svojstava“, 2011-2017.
- Doktorska disertacija je urađena na „Wayne State University“, Mičigen, SAD u okviru koje je više puta boravila na „Brookhaven National Laboratory“, Upton, NY, SAD i na „SLAC National Accelerator Laboratory, Stanford University“, CA, SAD.

## 5.2. Razvoj uslova za naučni rad, obrazovanje i formiranje naučnih kadrova

Tokom svog dosadašnjeg naučno-istraživačkog rada dr Ana Janković je učestvovala u izradi eksperimentalnog dela, osmišljavanju toka i tumačenju rezultata doktorskih disertacija 2 kandidata, o čemu svedoče Odluke Nastavno-naučnih veća fakulteta o članstvu u Komisijama za ocenu podobnosti teme i kandidata ili pisanim zahvalnicama i zajedničkim publikovanim radovima sa kandidatima, proisteklih iz disertacija.

- Odlukom Nastavno-naučnog veća Tehnološko-metalurškog fakulteta Univerziteta u Beogradu br. 35/501 od 24.11.2016. god., dr Ana Janković je imenovana za člana Komisije za ocenu podobnosti teme i kandidata Mohamed Mohamed Abudabbus za izradu doktorske disertacije pod nazivom “Electrochemical synthesis and characterization of poly(vinyl alcohol)nanocomposites with silver nanoparticles”. Iz doktorske disertacije sa kandidatom je publikovan 1 rad kategorije M21a. (skenirani dokument u Prilogu A)
- Odlukom Nastavno-naučnog veća Tehnološko-metalurškog fakulteta Univerziteta u Beogradu br. 35/110 od 20.04.2017. god., dr Ana Janković je imenovana za člana Komisije za ocenu podobnosti teme i kandidata Radeta Surudžića za izradu doktorske disertacije pod nazivom “Elektrohemijska sinteza i karakterizacija nanokompozita polivinil-alkohola, grafena i nanočestica srebra”. Iz doktorske disertacije sa kandidatom je publikovan 1 rad kategorije M21a, 1 rad kategorije M21 i rad kategorije M23. (skenirani dokument u Prilogu A)

Osim navedenih, učešće dr Ane Janković u izradi doktorske disertacije “Elektroforetsko taloženje i karakterizacija hidroksiapatit/lignin i srebro/hidroksiapatit/lignin prevlaka na titanu” dr Sanje Eraković, završnog master rada “Elektrohemijsko dobijanje i karakterizacija hidrogelova na bazi polivinil alkohola sa hitozanom, grafenom i nanočesticama srebra” master inž. Katarine Nešović, diplomskog rada “Elektroforetsko taloženje kompozitnih prevlaka hidroksiapatit/grafen i srebro/hidroksiapatit/grafen na titanu” dipl. inž. Jelene Marković i završnog rada “Elektroforetsko taloženje biokompozitnih keramičkih prevlaka hidroksiapatita i hitozana sa srebrom i gentamicinom na titanu za primene u medicini” dipl. inž. Ive Ilić, se može videti iz priloženih zahvalnica (skenirani dokumenti u Prilogu A). Iz doktorske disertacije dr Sanje Eraković sa kandidatom su publikovana 3 rada kategorije M21 i 1 rad kategorije M23.

Dr Ana Janković bila je član Komisije za izbor u naučno zvanje sledećih kandidata.

- Odlukom Nastavno-naučnog veća Tehnološko-metalurškog fakulteta Univerziteta u Beogradu br. 35/354 od 18.09.2015. god., dr Ana Janković je imenovana za člana Komisije za podnošenje izveštaja – referata o ispunjenosti uslova za izbor u istraživačko zvanje – NAUČNI SARADNIK za dr. Ivanu Jevremović, istraživača saradnika. (skenirani dokument u Prilogu A)
- Odlukom Nastavno-naučnog veća Tehnološko-metalurškog fakulteta Univerziteta u Beogradu br. 35/449 od 26.12.2013. god., dr Ana Janković je imenovana za člana Komisije za podnošenje izveštaja – referata o ispunjenosti uslova za izbor u istraživačko zvanje – NAUČNI SARADNIK za dr. Sanju Eraković, istraživača saradnika. (skenirani dokument u Prilogu A)

Tokom realizacije naučnih projekata kandidatkinja je aktivno učestvovala u realizaciji naučne saradnje Tehnološko-metalurškog fakulteta sa drugim institucijama u zemlji i inostranstvu.

- Posebno je značajna naučna saradnja sa Département des sciences du bois et de la forêt, Université Laval, Québec, Canada u okviru koje su objavljena tri rada ranga M21 (3M21), objavljen rad u međunarodnom časopisu (1M23), kao i saradnja sa NILPRP-The Laser-Surface-Plasma Interactions Laboratory, National Institute for Laser, Plasma, and Radiation Physics u Bukureštu, Rumunija, u okviru koje su ostvarena tri studijska boravka. Kao rezultat iz ove oblasti istraživanja objavljen je jedan rad u vrhunskom međunarodnom časopisu (1M21) i jedan rad u istaknutom međunarodnom časopisu (1M22). Od 2013. godine započeta je saradnja sa laboratorijom Prof. Kyong Yop Rhee, Department of Mechanical Engineering, Kyung Hee University, Seul, Južna Koreja. Ova saradnja je veoma plodna i rezultirala je velikim brojem publikovanih radova i to dva rada u međunarodnim časopisima izuzetnih vrednosti (2M21a) i četiri rada u vrhunskom međunarodnom časopisu (4M21), kao i po jednog rada u istaknutom međunarodnom časopisu (1M22) i međunarodnom časopisu (1M23). Od posebnog je značaja uticaj i iskustvo koje je dr Ana Janković prenela na mlađe saradnike u realizaciji, prezentovanju i publikovanju naučnih rezultata.

### 5.3. Kvalitet naučnih rezultata

#### 5.3.1. Uticajnost, pozitivna citiranost, ugled i uticajnost publikacija u kojima su kandidatovi radovi objavljeni

- U svom dosadašnjem naučno-istraživačkom radu dr Ana Janković je nakon poslednjeg izbora u zvanje objavila 2 rada u međunarodnim časopisima izuzetnih vrednosti (**2M21a**), 7 radova u vrhunskim međunarodnim časopisima (**7M21**), dva rada u istaknutim međunarodnim časopisima (**2M22**), 1 rad u međunarodnim časopisima (**1M23**) i jedan rad u međunarodnom časopisu van SCI liste. Ukupna citiranost kandidata iznosi 281, odnosno **252 bez autocitata** (oktobar 2017.), izvor: Scopus . Prema istoj indeksnoj bazi **Hiršov indeks je 8**. Pozitivna citiranost radova kandidata ukazuje na aktuelnost, uticajnost i ugled objavljenih radova.
- Rad dr Ane Janković objavljen u vrhunskom međunarodnom časopisu **Biochemistry-US** citiran je 83 puta, uglavnom u vrhunskim međunarodnim časopisima, uključujući i citat u časopisu **Science** (Multidisciplinary Sciences (2/56), IF(2011)=31.201, ISSN 1095-9203), **Nat Struct Mol Biol** (*Biochemistry & Molecular Biology* (8/290), *Biophysics* (2/74), *Cell Biology* (12/181), IF(2011)=12.712, ISSN 1545-9985) i **Structure** (*Biophysics* (8/74), *Cell Biology* (35/181), *Biochemistry & Molecular Biology* (38/290), IF(2011)= 6.347, ISSN 1359-0278). Dr Ana Janković objavila je 2 rada u **Compos Part B-Eng** (Materials Science, Composites, 2/25, IF (2016) = 4,727), 2 rada u **J Ind Eng Chem** (Chemistry, Multidisciplinary, 32/166, IF (2016) = 4.421), 1 rad u **J Alloy Comp.**(Materials Science, Multidisciplinary, 58/271, IF (2015) = 3,014), 1 rad u **Prog Org Coat** (Materials Science, Coatings & Films, 3/18, IF (2015) = 2,632), 1 rad u **Appl Surf Sci** (Materials Science, Coatings & Films, 2/17, IF (2014) = 2,711), 1 rad u **Int J Mol Sci** (Chemistry, Multidisciplinary, 46/157, IF (2014) = 2,862), 1 rad u **Mater Chem Phys** (Materials Science, Multidisciplinary, 48/232, IF (2011) = 2,385), 1 rad u **J Phys Chem B** (Chemistry, Physical, 32/134, IF (2011) = 3,696), 1 rad u **J Mater Sci-Mater M** (Engineering, Biomedical, 21/72, IF (2014) = 2,587), 1 rad u **Carbon Lett** (Materials Science, Multidisciplinary, 124/260, IF (2014) = 1,625), 1 rad u **Bulg Chem Commun** (Chemistry, Multidisciplinary, 163/166, IF (2016) = 0,238), 1 rad u **J Serb Chem Soc** (Chemistry, Multidisciplinary, 102/152, IF (2011) = 0,879), kao i 1 rad u **Eurasian Chemico-Technological Journal** (van SCI liste).

#### 5.3.2. Efektivan broj radova i broj radova normiran na osnovu broja koautora, ukupan broj kandidatovih radova, udeo samostalnih i koautorskih radova u njemu, kandidatov doprinos u koautorskim radovima

- Dr Ana Janković je u dosadašnjem naučnoistraživačkom radu publikovala 34 bibliografske

jedinice i to: 15 naučnih radova u uticajnim međunarodnim časopisima i 15 saopštenja na međunarodnom nivou, kao i 4 saopštenja na nacionalnom nivou. Prosečan broj autora po radu za ukupno navedenu bibliografiju iznosi 8,2. Dr Ana Janković je bila prvi autor na 2 rada u vrhunskom međunarodnom časopisu, 1 radu u istaknutom međunarodnom časopisu, 1 radu u međunarodnom časopisu i 2 saopštenja na međunarodnim skupovima.

### ***5.3.3. Stepen samostalnosti u naučnoistraživačkom radu i uloga u realizaciji radova u naučnim centrima u zemlji i inostranstvu***

Dr Ana Janković je tokom dosadašnjeg naučno-istraživačkog rada pokazala visok stepen samostalnosti u idejama, kreiranju i realizaciji eksperimenata, obradi rezultata i pisanju naučnih radova, koji se u najvećem broju odnose na fizičko-hemijska i biološka ispitivanja svojstava materijala. Rezultate svojih istraživanja je sistematski analizirala, objasnila i publikovala u uticajnim međunarodnim časopisima.

**Sumarni prikaz dosadašnje naučno-istraživačke aktivnosti**

Kategorija rada	Koeficijent Kategorije	Broj radova u kategoriji		Zbir	
		ukupno	posle izbora	ukupno	posle izbora
Radovi u međunarodnom časopisu izuzetnih vrednosti (M21a)	7,14 - 8,33*	2	2	15,47	15,47
Radovi u vrhunskim međunarodnim časopisima (M21)	3,64 - 8*	9	7	55,42	43,04
Radovi u istaknutom međunarodnom časopisu značaja (M22)	1.79 - 4.17*	2	2	5.96	5,96
Radovi u međunarodnom časopisu (M23)	3	2	1	6	3
Radovi saopšteni na skupovima međunarodnog značaja štampani u izvodu (M34)	0.21 – 0.5*	15	11	6,09	4,28
Radovi saopšteni na skupovima nacionalnog značaja štampani u izvodu (M64)	0,17– 0.2*	4	3	0,77	0,57
Odbranjena doktorska disertacija (M71)	6	1	0	6	0
Tehničko rešenje-prijavljen patent na nacionalnom nivou (M87)	0,5	2	2	1	1
Patenti-objavljen patent na nacionalnom nivou (94)	7	2	2	14	14
Nagrada na izložbi (104)	2	3	3	6	6
<b>Ukupan koeficijent</b>				<b>116,71</b>	<b>93,32</b>

\* Usled normiranja naučnih radova po broju koautora po formuli  $K/(1+0,2(n-7))$ , koeficijenti (K) za radove u kategoriji M21a (koeficijent kategorije je 10) Ane Janković su redom: 8,33; 7,14; dajući zbir od 15,47.

Koeficijenti (K) za radove u kategoriji M21 (koeficijent kategorije je 8) Ane Janković su redom: 5,71; 5; 8; 5; 3,33; 8; 8; 6,67; 5,71 dajući zbir od 55,42.

Koeficijenti (K) za radove u kategoriji M22 (koeficijent kategorije je 5) Ane Janković su redom: 1,79; 4,17; dajući zbir od 5,96.

Koeficijenti (K) za radove u kategoriji M23 (koeficijent kategorije je 3) Ane Janković su redom: 3; 3; dajući zbir od 6.

\* Usled normiranja naučnih radova po broju koautora po formuli  $K/(1+0,2(n-7))$ , koeficijenti (K) za radove u kategoriji M34 (koeficijent kategorije je 0,5) Ane Janković su redom: 0,42; 0,5; 0,5; 0,31; 0,5; 0,5; 0,5; 0,28; 0,21; 0,28; 0,28; 0,5; 0,5; 0,31; 0,5 dajući zbir od 6,09.

\* Usled normiranja naučnih radova po broju koautora po formuli  $K/(1+0,2(n-7))$ , koeficijenti (K) za radove u kategoriji M64 (koeficijent kategorije je 0,2) Ane Janković su redom: 0,2; 0,2; 0,17; 0,2; dajući zbir od 0,77.

Uslov za izbor u zvanje viši naučni saradnik za tehničko-tehnološke i biotehničke nauke, koje propisuje *Pravilnik o postupku, načinu vrednovanja, i kvantitativnom iskazivanju naučnoistraživačkih rezultata istraživača*, je da kandidat ima ukupno najmanje 50 poena koji treba da pripadaju sledećim kategorijama:

Diferencijalni uslov - od prvog izbora u prethodno zvanje do izbora u zvanje	Potrebno je da kandidat ima najmanje 50 poena, koji treba da pripadaju sledećim kategorijama:	Neophodno	Ostvareno
<b>Viši naučni saradnik</b>	Ukupno	<b>50</b>	<b>93,32</b>
Obavezni (1)	M10+M20+M31+M32+M33+M41+M42+M51+M80+M90+M100	<b>40</b>	<b>88,47</b>
Obavezni (2)*	M21+M22+M23+M81-83+M90-96+M101-103+M108	<b>22</b>	<b>81,47</b>
	M21+M22+M23	<b>11</b>	<b>67,47</b>
	M81-83+M90-96+M101-103+M108	<b>7</b>	<b>14</b>

**\*Napomena:** Za izbor u naučno zvanje viši naučni saradnik, u grupaciji "Obavezni (2)", kandidat mora da ostvari najmanje 11 poena u kategorijama M21+M22+M23 i najmanje sedam poena u kategorijama M81-83+M90-96+M101-103+M108.

Kandidatkinja ispunjava kvantitativne uslove za izbor u zvanje Viši naučni saradnik za tehničko-tehnološke i biotehničke nauke, koji su propisani navedenim Pravilnikom.

## ZAKLJUČAK

Na osnovu detaljne analize dosadašnjeg naučno-istraživačkog rada i ostvarenih rezultata, dr Ana Janković, dipl. inž. tehnologije, je pokazala izrazitu sklonost i sposobnost za bavljenje naučno-istraživačkim radom i ispunjava sve uslove neophodne za sticanje zvanja VIŠI NAUČNI SARADNIK. Stoga, sa zadovoljstvom predlažemo Nastavno-naučnom veću Tehnološko-metalurškog fakulteta u Beogradu da ovaj izveštaj prihvati i isti prosledi odgovarajućoj komisiji Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije na konačno usvajanje.

U Beogradu, 19. oktobar 2017.

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