FIRST INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY OF NANOSTRUCTURES

ELMINA 2018

ПРВА МЕЂУНАРОДНА КОНФЕРЕНЦИЈА О ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ НАНОСТРУКТУРА

САНУ

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

FIRST INTERNATIONAL CONFERENCE
ELMINA 2018
Program and Book of Abstracts

Publisher:	Serbian Academy of Sciences and Arts Knez Mihailova 35, 11000 Belgrade, Serbia Phone: +381 11 2027200 https://www.sanu.ac.rs/en/
Editor:	Velimir R. Radmilović and Vuk V. Radmilović
Technical Editor:	Vuk V. Radmilović
Cover page:	Vuk V. Radmilović
Printed in:	Serbian Academy of Sciences and Arts Knez Mihailova 35, 11000 Belgrade, Serbia Phone: +381 11 2027128 stamparija@sanu.ac.rs
Circulation:	50 copies

ISBN 978-86-7025-785-6

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 prospective, 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.

ORGANIZERS

SERBIAN ACADEMY OF SCIENCES AND ARTS

Knez Mihailova 35, 11000 Belgrade, Serbia

Phone: +381 11 2027200 / https://www.sanu.ac.rs/

FACULTY OF TECHNOLOGY AND METALLURGY, UNIVERSITY OF BELGRADE

Karnegijeva 4, 11000 Belgrade, Serbia

Phone: +381 11 3370425 / https://www.tmf.bg.ac.rs/

ELMINA 2018

CONFERENCE CHAIR

Velimir R. Radmilović

CONFERENCE MANAGER

Vuk V. Radmilović

INTERNATIONAL ADVISORY BOARD

Chair: Robert Sinclair (USA)

Members: Sara Bals (Belgium), Gianluigi Botton (Canada), Vladimir Bumbaširević (Serbia), Fu-Rong Chen (Taiwan), Vladica Cvetković (Serbia), Rafal Dunin-Borkowski (Germany), Rolf Erni (Switzerland), Hamish Fraser (USA), Ferdinand Hofer (Austria), Randi Holmestad (Norway), Đorđe Janaćković (Serbia), Wayne D. Kaplan (Israel), Vesna Lačković (Serbia), Joachim Mayer (Germany), Paul Midgley (UK), Eva Olsson (Sweden), Stephen Pennycook (Singapore), Dejan Popović (Serbia), Tamara Radetić (Serbia), Quentin Ramasse (UK), Frances Ross (USA), Etienne Snoeck (France), Erdmann Spiecker (Germany), Leposava Šiđanin (Serbia), Maria Varela del Arco (Spain), Johan Verbeeck (Belgium).

PROGRAM COMMITTEE

Chair: Velimir R. Radmilović (Serbia)

Members: Nataša Bibić (Serbia), Vladimir Bumbaširević (Serbia), Zoran Đurić (Serbia), Jasmina Grbović Novaković (Serbia), Aleksandra Korać (Serbia), Zoran Popović (Serbia).

ORGANIZING COMMITTEE

Chair: Petar Uskoković

Vice-chair: Zlatko Rakočević

Members: Anđelika Bjelajac, Vladan Ćosović, Ivana Cvijović-Alagić, Željko Kamberović, Smilja Marković, Nataša Nestorović, Irena Nikolić, Mirjana Novaković, Vladimir Pavlović, Vuk Radmilović, Dragan Rajnović, Milica Ševkušić, Đorđe Veljović.

TECHNICAL COMMITTEE

Chair: Đorđe Veljović

Members: Anđelika Bjelajac, Jovana Dimitrijević, Ivana Drvenica, Špiro Đurđević, Tamara Matić, Daniel Mijailović, Katarina Nešović, Vladimir Pavkov, Jelena Petrović, Anđela Radisavljević, Mia Radonjić, Željko Radovanović, Ivana Radović, Milena Stevanović.

Polyacrilic Acid and Chitosan Assisted Solvothermal Synthesis of Up-converting $NaYF_4$: Yb,Er Particles

Marina Vuković[1], Ivana Dinić[1], Lidija Mančić[2], Marko Nikolić[3], Mihailo Rabasović[3] and Olivera Milošević[2]

[1] *Innovation Center of the Faculty of Chemistry, University of Belgrade, Serbia*
[2] *Institute of Technical Sciences of SASA, Belgrade, Serbia*
[3] *Photonic Center, Institute of Physics Belgrade, University of Belgrade, Belgrade, Serbia*

There is a growing interest for development of a facile and reproducible approach for the synthesis of biocompatible lanthanide doped up-converting nanoparticles (UCNPs) for deep tissue imaging and targeted drug delivery [1]. Synthesis of such particles is usually performed through the decomposition of organometallic compounds, followed either with a ligands exchange or with a biocompatible layer coating [2,3]. In this work, biocompatible $NaYF_4$:Yb,Er (17 mol% Yb; 3 mol% Er) nanoparticles were synthesized by one-pot hydrothermal processing with an assistance of chitosan (Ch) or *polyacrylic acid* (PAA). Obtained powders were analyzed by X-ray powder diffraction (XRPD, Bruker D8 Discovery), field emission scanning electron microscopy (FE-SEM, *Zeiss*, DSM 960), transmission electron microscopy (TEM, JEOL JEM 2010), Fourier transform infrared (FTIR, Thermo Scientific Nicolet 6700) and photoluminescence (PL, Spex Fluorolog with C31034 cooled photomultiplier) spectroscopy.

The results showed that although both powders crystallize in the same crystal arrangement (cubic, *Fm-3m*), particles size, shape and optical properties are dependent on the polymer used. Powder which synthesis was performed in the presence of Ch is composed from spherical, monodispersed particles which size is of about 120 nm, Fig.1a. TEM observation revealed coexistence of much smaller crystallites on the surface of these particles, Fig. 1b. On the other hand, PAA functionalized UCNPs were consisted of very thin foils (~6 nm) sized around 10 μm in both in-plane directions, Fig.1c. Degree of the UCNPs functionalization was investigated using FTIR analysis. The obtained results confirm the presence of corresponding

PAA or Ch functional groups on the UCNPs surface, indicating that these could be used in biomedical field. The up-conversion luminescent spectra of the synthesized particles demonstrated both, green emissions in the range of 520–550 nm (assigned to the $^2H_{11/2} \rightarrow {}^4I_{15/2}$ and $^4S_{3/2} \rightarrow {}^4I_{15/2}$ electronic transitions) and red emission (assigned to $^4F_{9/2} \rightarrow {}^4I_{15/2}$ electronic transitions) of Er^{3+} ion, Fig.2. Since more intense emission was observed for $NaYF_4$:Yb,Er monodispersed spherical particles obtained through Ch assisted synthesis than those obtained in the presence of PAA, former are additionally tested to check their citotoxicity and internalization capacity in human gingival fibroblasts (HGF) cells. MTT assay shows that viability of HGF cells was highly preserved after 24 h exposure to Ch functionalized UCNPs, being above 90% over the whole investigated concentration range (10–50 μg/mL). The homemade nonlinear laser scanning microscope used in this study comprises Ti:Sapphire laser (Coherent, Mira 900-F) capable to operate in femto-second (FS) pulse mode and continuous wave (CW) mode. FS mode at 730 nm was used for visualization of the unlabeled cells while CW radiation at 980 nm was used for the excitation of Ch functionalized UCNPs in cells. The results presented in Fig.3 confirm that observed fluorescence spots are related to the non-specific uptake of UCPNs through cell membrane, indicating that these could be used as new cell labeling agents in the future [4].

References:

[1] A Sedlmeier and H Gorris, Chem. Soc. Rev. **44** (2015), 1526.
[2] X Chen, D Peng, Q Ju and F Wang, Chem. Soc. Rev. **44** (2015), 1318.
[3] Z Gu *et al*, Adv. Mater. **25** (2013), 3758.
[4] This work was financially supported by the Ministry of Education, Science and Technological Development of Serbia project OI 172035.

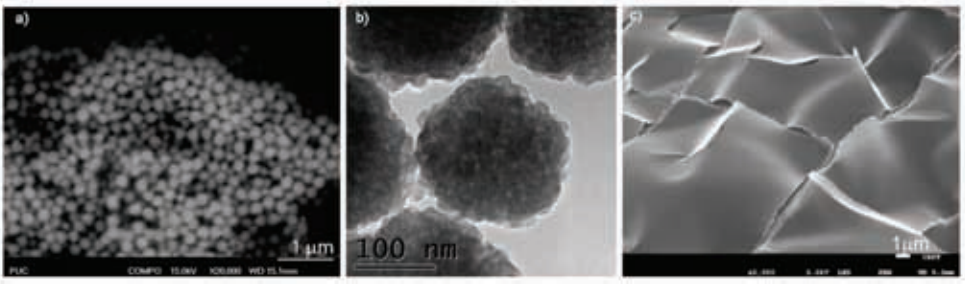

Figure 1. a) SEM and b) TEM images of Ch functionalized $NaYF_4$:Yb,Er particles; c) SEM image of PAA functionalized $NaYF_4$:Yb,Er particles.

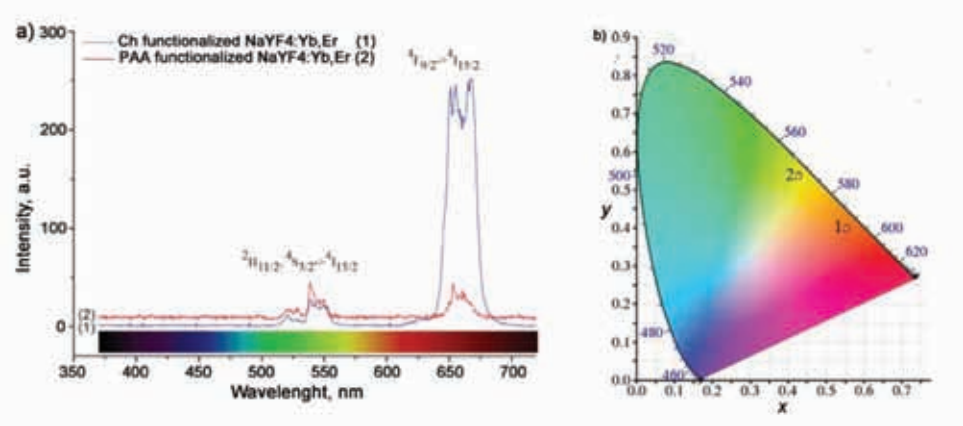

Figure 2. a) Emission spectra and b) corresponding CIE diagram of Ch- and PAA- functionalized $NaYF_4$:Yb,Er particles.

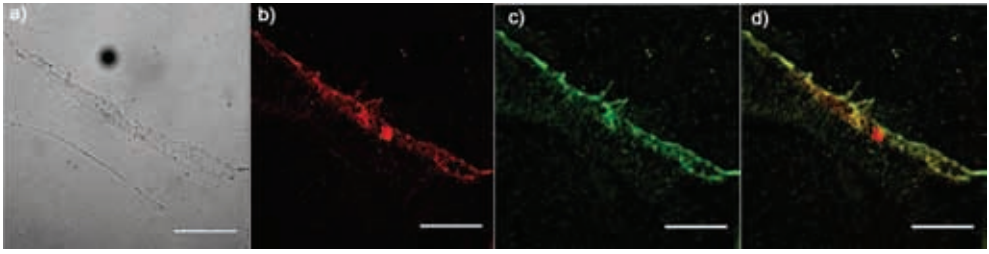

Figure 3. Laser scanning images of HGF following 24 h incubation with 10 µg/ml of Ch functionalized $NaYF_4$:Yb,Er: a) bright field image of cells; b) cells auto-fluorescence; c) up-conversion emission of the Ch- functionalized $NaYF_4$:Yb,Er particles and d) their positioning in cells revealed through co-localization of the b and c. The scale bars correspond to 50 µm.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

66.017/.018(048)
544.2(048)
621.385.833.2(048)

INTERNATIONAL Conference on Electron Microscopy of Nanostructures ELMINA (1 ; 2018 ; Beograd)
Program ; & Book of Abstracts / First International Conference on Electron Microscopy of Nanostructures ELMINA 2018, August 27-29, 2018, Belgrade, Serbia = Прва међународна конференција о електронској микроскопији наноструктура ELMINA 2018, 27-29 август 2018. Београд, Србија ; [organized by Serbian Academy of Sciences and Arts and Faculty of Technology and Metallurgy, University of Belgrade ; editor Velimir R. Radmilović and Vuk V. Radmilović]. - Belgrade : SASA, 2018 (Belgrade : SASA). - XXIX, 289 str. : ilustr. ; 24 cm

Na nasl. str.: European Microscopy Society and Federation of European Materials Societies. - Tiraž 50. - Bibliografija uz svaki apstrakt. - Registar.

ISBN 978-86-7025-785-6
a) Наука о материјалима - Апстракти b) Нанотехнологија - Апстракти
c) Електронска микроскопија - Апстракти
COBISS.SR-ID 266767116