ACADEMY OF SCIENCES AND ARTS
OF THE REPUBLIC OF SRPSKA


ALMA MATER
EUROPAEA


United Nations
Educational, Scientific and
Cultural Organization

State Commission of
Bosnia and Herzegovina
for UNESCO

XII МЕЂУНАРОДНИ НАУЧНИ СКУП

**САВРЕМЕНИ МАТЕРИЈАЛИ 2019**

# ПРОГРАМ РАДА
# И
# КЊИГА АПСТРАКАТА

XII INTERNATIONAL SCIENTIFIC CONFERENCE

**CONTEMPORARY MATERIALS 2019**

# PROGRAMME
# AND
# THE BOOK OF ABSTRACTS

Бања Лука, 1 – 3. септембар 2019. године
Banja Luka, September 1st to 3rd, 2019

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ОРГАНИЗАТОР НАУЧНОГ СКУПА

*Академија наука и умјетности Републике Српске*

СУОРГАНИЗАТОР

*Alma Mater Europaea*

ПОКРОВИТЕЉ НАУЧНОГ СКУПА

*Министарство за научнотехнолошки развој, високо образовање и информационо друштво*

ОДРЖАВАЊЕ СКУПА СУ ПОМОГЛИ

*Електропривреда Републике Српске*
*Универзитетски Клинички центар Републике Српске*
*Комора доктора медицине РС*
УНЕСКО
ЕХЕ д.о.о. Бања Лука

ОРГАНИЗАЦИОНИ ОДБОР

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Академик Васкрсија Јањић, потпредсједник
Академик Рајко Кузмановић
Мр Срђан Рајчевић
Академик Бранко Шкундрић
Академик Нђо Ђурић
Проф. др Есад Јакуповић, дописни члан АНУРС-а
Проф. др Лудвик Топлак
Проф. др Зоран Рајилић
Проф. др Владо Ђајић
Проф. др Саша Вујновић

ORGANIZER OF THE CONFERENCE

*Academy of Sciences and Arts of the Republic of Srpska*

COORGANIZER

*Alma Mater Europaea*

UNDER THE PATRONAGE OF

*Ministry for Scientific and Technological Development, Higher Education and Information Society*

THE SCIENTIFIC CONFERENCE HAS BEEN SUPPORTED BY

*Power Utility of the Republic of Srpska*
*University Clinical Center of Republic of Srpska*
*The Republic of Srpska Medical Association*
UNESCO
EHE, LLC Banja Luka

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Academician Vaskrsija Janjić, vice-president
Academician Rajko Kuzmanović
Srđan Rajčević, MSc
Academician Branko Škundrić
Academician Neđo Đurić
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Prof. Ludvik Toplak, Ph.D.
Prof. Zoran Rajilić, Ph.D.
Prof. Vlado Đajić, Ph.D.
Prof. Saša Vujnović, Ph.D.

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Проф. др Јукио Косуги (Јапан)
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Проф. др Перо Дугић (Бања Лука)
Проф. др Дубравка Марковић (Србија)

*Научни скуп одржаће се у Великој сали АНУРС-а у Бањој Луци*

SCIENTIFIC COMMITTEE

Academician Dragoljub Mirjanić, ASARS
Academician Branko Škundrić, ASARS
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Prof. Miomir Pavlović, Ph.D. (East Sarajevo)
Prof. Pero Dugić, Ph.D. (Banja Luka)
Prof. Dubravka Marković, Ph.D. (Serbia)

*The scientific conference will take place in the Big Hall of the ASARS in Banja Luka*

*НЕДЕЉА, 1. СЕПТЕМБАР 2019. ГОДИНЕ*

- Долазак и смјештај пленарних предавача у хотелу „Босна” у Бањој Луци
- Долазак и смјештај учесника научног скупа који живе изван Бање Луке у хотелима по избору

*ПОНЕДЕЉАК, 2. СЕПТЕМБАР 2019. ГОДИНЕ*

08.30 Регистрација учесника научног скупа (АНУРС)
09.00 Отварање конференције
09.20 Пленарна предавања
Промоција монографије „ЕЛЕКТРОЕНЕРГЕТИКА У СРБИЈИ И РЕПУБЛИЦИ СРПСКОЈ”
14.00 Постер презентације
15.00 Дискусија
Затварање конференције
Ручак у хотелу „Босна”
Одлазак учесника научног скупа

*УТОРАК, 3. СЕПТЕМБАР 2019. ГОДИНЕ*

10.00 - 13.30

ОКРУГЛИ СТО "УТИЦАЈ РАДОНА И ТОРОНА НА ЗДРАВЉЕ СТАНОВНИШТВА"

УНЕСКО партиципацијски програм 2018-2019

*SUNDAY, SEPTEMBER 1, 2019*

- Arrival of the plenary speakers and accommodation in the hotel „Bosna" in Banja Luka
- Arrival of the participants and accommodation in the hotels optionally

*MONDAY, SEPTEMBER 2, 2019*

| | |
|---|---|
| 08.30 | Registration of the participants in the ASARS |
| 09.00 | Opening of the Conference |
| 09.20 | Plenary session |
| | Promotion of monography „ELECTRIC POWER INDUSTRY IN SERBIA AND THE REPUBLIC OF SRPSKA" |
| 14.00 | Poster presentations |
| 15.00 | DISCUSSION |
| | Closing ceremony |
| | Lunch at the hotel „Bosna" |
| | Departure of the participants |

*TUESDAY, SEPTEMBER 3, 2019*

10.00 - 13.30

THE ROUND TABLE "THE INFLUENCE OF RADON AND TORON TO THE HEALTH OF POPULATION"

UNESCO PARTICIPATION PROGRAMME 2018-2019

*ПОНЕДЕЉАК, 2. СЕПТЕМБАР 2019. ГОДИНЕ*

*MONDAY, SEPTEMBER 2, 2019*

## СВЕЧАНО ОТВАРАЊЕ СКУПА
## OPENING CEREMONY
## (09.00 – 09.20)

- Скуп ће отворити и учеснике поздравити академик Рајко Кузмановић, предсједник АНУРС-а

  Academician Rajko Kuzmanović, president of ASARS will give an opening speech

- Поздравни говор министра за научнотехнолошки развој, високо образовање и информационо друштво, Мр Срђана Рајчевића

  Welcome side speechs – Minister for Scientific and Technological Development, Higher Education and Information Society

  Srđan Rajčević, MSc

  Поздравно обраћање гостију
  Welcome speeches of the guests

РАДНИ ДИО СКУПА
WORKING SESSION
(09.20 – 15.10)

***ПЛЕНАРНА ПРЕДАВАЊА***
***PLENARY SESSION***
(09.20 – 13.40)

| | |
|---|---|
| 9.20 – 9.40 | Slavko Mentus<br>*Batteries as a tool against climate changes* |
| 9.40 – 10.00 | Jean-Marie Dubois<br>*Amorphous Al-Ce-Cu-Fe alloys: Glass formation and properties* |
| 10.00 - 10.20 | Stane Pejovnik, Genorio Boštjan<br>*Li-B alloys and borophene materials – current status* |
| 10.20 – 10.40 | Spomenka Kobe<br>*New processing re-based magnetic materials* |
| 10.40 – 11.00 | Francesco Bochicchio<br>*Italian experience on research and other activities on protection from radon exposure, in the European context* |
| 11.00 – 11.20 | Пауза (Coffee break) |
| 11.20 – 11.40 | Nenad Filipović<br>*In Silico clinical trials to design and safely test new drugs and medical devices in virtual patients - SILICOFCM and InSilc projects* |

11.40 – 12.00 Plamen Tsankov
*Technical and Economic Development of the Photovoltaic Electricity in Bulgaria*

12.00 – 12.20 Ljubomir Majdandžić
*Contemporary materials and equipment for zero energybuildings*

12.20 - 12.40 Vojislav V. Mitić
*The submicro particles and organism's nature in the light of Brownian's motion*

12.40 – 13.00 Duško Dudić
*The concept of dielectric neural prosthesis*

13.00 – 13.20 Jovan Vojinović
*Contemporary medicaments and materials for treatment of caries in early childhood*

13.20– 13.40 Predrag Dašić
*Bibliometric and statistical analysis of categories in the field of "materials science" within SCI-E*

13.40–14.00 Svetlana Stević
*Nanotechnology in the function of sustainable water use*

# ПОСТЕР ПРЕЗЕНТАЦИЈЕ
# POSTER SESSION

*ПОНЕДЕЉАК, 2. СЕПТЕМБАР 2019. ГОДИНЕ*
*MONDAY, SEPTEMBER 2, 2019*
(14.00 – 15.00)

1. Suzana Apostolov, Đenđi Vaštag, Borko Matijević, Gorana Mrđan, Jelena Nakomčić
   *Study of the biological activity descriptors of the barbituric acid derivatives*

2. Gorana Mrđan, Sanja Vlaisavljević, Đenđi Vaštag, Suzana Apostolov, Borko Matijević
   *Study of the antioxidant potential of selected monothiocarbohydrazone derivatives*

3. Savka Janković, Aleksandra Šmitran, Sanja Pržulj, Dragana Gajić, Mladena Malinović, Dijana Jelić
   *Antimicrobial and photocatalytical performances of doped and undoped nanoparticles of zinc oxide*

4. Dijana Jelić, Aleksandra Šmitran, Sanja Pržulj, Savka Janković, Dragana Gajić, Mladena Malinović
   *Study of ferrum oxide nanoparticles dopped with copper: antimicrobial and photocatalytical approach*

5. Rada Petrović, Branko Škundrić, Jelena Penavin-Škundrić, Darko Bodroža, Zora Levi, Slavica Sladojević
   *Adsorption of diethyl ether from the gas phase on mordenite*

6. Danijela Vuković, Slavica Maletić, Blanka Škipina, Adriaan Stephanus Luyt, Dragoljub Mirjanić i Duško Dudić
*Dielectric, photodielectric and optical properties of pmma/Alq3 composites*

7. Amela Greksa, Mladenka Novaković, Maja Đogo, Ivana Mihajlović, Mirjana Sekulić, Jasna Grabić
*Assessment of heavy metals (Cu, Pb, Zn and Ni) in the stormwater runoff from the main streets of the city of Novi Sad*

8. Ljiljana Suručić, Dijana Mihajlović, Bojana Marković, Zvjezdana Sandić, Aljoša Stanković, Aleksandra Nastasović
*Metal ions speciation by magnetic polymer/bentonite nanocomposite*

9. Zvjezdana Sandić, Bojana Marković, Dijana Mihajlović, Ines Miljanović, Ivan Stefanović, Jasna Džunuzović, Aleksandra Nastasović
*Novel amino-functionalized magnetic polymer/bentonite composite for chromium removal from aqueous solutions*

10. Aco Janićijević, Nemanja Stojanović, Srđan Divac, Aleksandra Kalezić-Glišović, Aleksa Maričić
*Activation time dependent magnetization of the Fe/BaTiO3 system with varying Constituent mass ratios*

11. Milesa Srećković, Aco Janićijević, Milovan Janićijević, Sanja Jevtić, Zoran Latinović, Katarina Zarubica, Aleksandar Bugarinović
*Application and modeling of laser invasive, modulation and diagnostical techniques in biomedicine*

12. Ana Simović, Svetislav Savović, Alexandar Djordjevich, Branko Drljača, Aco Janićijević
*Bandwidth of plastic-clad silica optical fibers with w-shaped refractive index profile*

13. Siniša Vučenović, Jovan Šetrajčić, Dušan Ilić
*Superconductivity of lanthanum hydride up to 250 K*

14. Sandra Veljković, Vojislav V. Mitić
*Synthetized diamonds thermal and electro conductivity bridging by fractal nature analysis*

15. Svjetlana Sredić, Ljiljana Tankosić, Pavle Tančić, Zoran Nedić
*Flocculation studies of natural quartz sample using anionic polyacrilamide*

16. Ana Vesković, Jelena Kostić, Dušan Mladenović, Đura Nakarada
*Application of EPR spectroscopy for in vitro studies of PLGA particles degradation*

17. Matilda Lazić, Danijela Jašin
*Influence of synthesis conditions on textural properties of AlFe pillared clays*

18. Dane Marčeta, Vladimir Petković, Gordana Lakić Globočki
*Production of wood energy by chipping*

19. Mirjana Dragoljić, Branka Rodić-Grabovac, Ljubica Vasiljević, Vesna Matić, Ljiljana Simurdić
*Identification of basic cannabinoids using gas chromatography technique with mass detector – method validation*

20. Mirjana Dragoljić, Branka Rodić-Grabovac, Ljubica Vasiljević, Vesna Matić, Ljiljana Simurdić
*Identification of basic cannabinoids using gas chromatography technique with mass detector – method validation*

21. Ivana Radonjić, Tomislav Pavlović, Dragoljub Mirjanić, Darko Divnić
*The influence of solar modules soiling on their energy efficiency*

22. Zoran Ivić
*Effects of spatial dispersion on self-induced transparency in two-level media*

23. Branko Pejović, Duško Kostić, Mitar Perušić, Zoran Obrenović, Vladimir Damjanović
*Graphic interpretation of exergy problem of ideal gas in characteristic thermodynamics diagrams*

24. Ivan Živić, Dušanka Marčetić, Sunčica Elezović-Hadžić
*Monte Carlo simulations of a polymer chain model on euclidean lattices*

25. Zoran Rajilić, Nikola Stupar, Tatjana Vujičić, Sreten Lekić
*Emergence of ordered motion of the oscillator driven by fluctuating force*

26. Dušan Ješić, Pavel Kovač, Borislav Savković, Dražen Sarjanović D. Golubović
*Comparatively testing of tribological characteristics of nodular cast iron austempered by classic and isothermal procedure*

27. Darko Divnić, Dragoljub Mirjanić, Tomislav Pavlović, Ivana Radonjić, Ljubiša Preradović
*Analysis of software application in solar energy*

28. Nikola Cekić
*Glass facades in contemporary urbarchitecture*

29. Dragoljub Mirjanić, Tomislav Pavlović, Esad Jakupović, Darko Divnić
*Methods of solar energy materials characterization*

30. Tomislav Pavlović, Dragoljub Mirjanić, Ivana Radonjić, Darko Divnić
*Comparative investigation of fixed and tracking PV solar power plants energy efficiency*

31. Hana Stefanović, Slobodan Obradović, Nikola Davidović
*Some applications of new technologies in receive satellite antenna positioning parameters evaluation*

32. Slobodan Obradović, Borivoje Milošević, Đurđe Milanović
*Algorithm for realization of energy efficient plan-parallel UV reactor with a large number of individual sources of radiation*

33. Slobodan Obradović, Nikola Davidović, Borivoje Milošević, Borislav Đorđević
*The influence of setting parameters on RAID 0 magnetic disk array performance*

34. Dražan Jaroš, Goran Kolarević, Dragoljub Mirjanić
*Application of radiation protection in the design of radiotherapy department*

35. Goran Kolarević, Dražan Jaroš, Dragoljub Mirjanić
Radiation protection in the design of orthovoltage radiotherapy facility

36. Suad Obradović, Krsto Mijanović
*The production of 1,5-dinitroxy-3-nitrosine pentane double reaction*

37. Radoslav Grujić, Danica Savanović
*Thermal analysis of food products using differential scanning calorimetry (DSC)*

38. Igor Grujić, Branko Latinović, Brane Novaković
*3D printing technologies: a novel possibilities of application in industrial production*

39. Brane Novaković, Igor Grujić
*Application google solutions for evaluation efficiency and cost of application quality and food safety management system*

40. Gordana Broćeta, Marina Latinović, Žarko Lazić
*Modeling abrasion resistance of self-compacting concrete*

41. Marina Nikolić Topalović, Milenko Stanković
*Evaluation of floor coverings from the ecological and economic aspect in the design stage*

42. Petar Mali, Milan Pantić, Milica Pavkov-Hrvojević, Slobodan Radošević
*Stripe phase of J1-J2 Heisenberg antiferromagnet on BCC lattice: GF method VS Z2XO(3) nonlinear sigma-model*

43. Rade Biočanin, Slađana Mirjanić, Dražen Sarjanović, Mubina Čolaković
*Modern materials for decontamination treatment and remediation of land in conditions of high-spoticated contamination*

44. Sonja Ketin, Marko Andrejić, Mitar Lutovac, Rade Biočanin
*Future of technology of polymerization production (polypropylene)*

45. Vojkan Zorić
*Resonance as new method in determining the age of paints*

46. Milorad V. Tomić, Mihael Bučko, Marija G. Riđošić, Jelena B. Bajat
*The effect of 4-hydroxy-benzaldehyde on Zn and Zn-Mn electrodeposition from ethaline*

47. Marijana Kosanić, Tatjana Stanojković
*Biomedical potential of selected mushroom species*

48. Tatjana Botić, Mirko Petković, Pero Dugić, Aleksandra Šinik
*Adsorbens regeneration from the tube oil rerafination process*

49. Neđo Đurić, Perica Đuran, Svetlana Stević, Dijana Đurić, Milan Perišić, Marko Đurić
*Corrosion of concrete and armature due to the process of carbonatization and sulfate corrosion*

50. Dragan Despotović, Tanja Milešević, Strahinja Rogić
*The use of bentonite on „Srbačko-Nožička ravan" floodplain*

51. Dijana Đeorđić, Dragoljub Mirjanić, Svetlana Pelemiš
*Hydrogen implanted into metals-properties and application*

52. Stojan Srbinoski
*Benefits of new over older types of materials in the construction of sewer pipes*

53. Stojan Srbinoski
*Results and experience from the new test working of the station for the purification the fecal waste water in Volkovo*

54. Mehmet Cetin
*Post-modern view of design and planning materials a with landscape design*

55. Dušan Ilić, Jovan Šetrajčić, Siniša Vučenović
*Nanostructures as a mediums for the targeted drug delivery*

56. Gordana Kuprešak, Tatjana Šljokavica, Jovan Vojinović
*Fluoride varnishes as a solution for poor health of milk teeth in Sipovo municipality*

57. Jovan Vojinović, Tatjana Šljokavica, Gordana Kuprešak
*Use of composite materials for fixed restoration of lost tooth in a teenager*

58. Ljubiša Petrov, Lidija Matija
*Atomic force microscopy as a tool for testing biomedical samples and elimination probe artifacts*

59. Valentina Matović, Jasna Trbojević-Stanković, Lidija Matija, Dušan Šarac, Aleksandra Vasić-Milovanović, Andrija Petrović, Nikola Stojiljković
*Using NIR spectrum of spent hemodialysis fluid to predict serum iron level*

60. Valentina Matović, Jasna Trbojević-Stanković, Lidija Matija, Dušan Šarac, Aleksandra Vasić-Milovanović, Andrija Petrović, Nikola Stojiljković
*Predicting CRP level using nir spectrum of spent hemodialysis fluid*

61. Željka Kojić, Olivera Dolić, Nataša Trtić, Nataša Knežević, Andrija Bošnjak
*Efficacy of platelet -rich finrin (PRF) in donor sote healing after removel of free gingival graft (FGG)*

62. Nataša Knežević, Željka Kojić, Olivera Dolić, Marija Obradović, Slava Sukara, Aleksandra Đeri
*The efficiency of hydrogen peroxide in bleaching vital teeth*

63. Tanja Jošić Tegeltija, Nataša Knežević, Ranka Knežević, Sanja Ilić
*The effect of differrent materials for definitive opturation of root canal on postoperative pain, quality of endodontic filling and discoloration of teeth*

64. Tijana Adamović, Nataša Trtić, Verica Pavlić, Valentina Veselinović, Ognjenka Janković, Renata Tamburić
*Efficacy of local use of probiotics as an adjunct to non-surgical periodontal therapy*

65. Ognjenka Janković, Smiljana Paraš, Radmila Arbutina, Irena Kuzmanović Radman, Tijana Adamović, Valentina Veselinović, Vladan Mirjanić
*Evaluation of gingival microleakage in class II composite restorations: an in vitro study*

66. Ognjenka Janković, Radmila Arbutina, Vladan Mirjanić
*Cytotoxic effect of newly synthesized nanomaterials for potential dental application*

67. Valentina Veselinović, Nataša Trtić, Tijana Adamović, Olivera Dolić, Radmila Arbutina, Nataša Knežević, Slava Sukara
*Influence of chemical plaque control agents on the color stability of hybrid nanoceramics*

68. Vesna Ljubojević
*Digital imaging analysis of the extraembryonic structures*

69. Đorđe Mirjanić, Vladan Mirjanić, Jovan Vojinović
*Analysis of protective effects ofxylitol ontooth enamel*

70. Radmila Arbutina, Nataša Trtić, Ognjenka Janković, Vladan Mirjanić, Valentina Veselinović
*The hardest substance in human body and its wear off tooth enamel*

71. Branislava Jeftić, Lidija Matija, Djuro Koruga
*New approach to detection of abnormal cervical cells*

72. Nemanja Vuković, Đorđe Antonijević , Vladimir Biočanin, Dragan Ilić, Milica Gajić, Vukoman Jokanović
*Difference in contact angle values among calcium silicate and calcium aluminate dental cements*

73. Svetlana Pelemiš, Srđan Vuković
*Biomaterials in dentistry*

74. Barbara Stanimirović, Tatjana Mamić, Sonja Đurić
*Clinical significance of capillaroscopy in rheumatic diseases*

75. Barbara Stanimirović, Dragi Stanimirović, Sonja Đurić, Tatjana Mamić
*Diagnostic value of triple-phase bone scintigraphy in diagnosis of osteomyelitis at children*

76. Srđan Vuković, Jelena Vulinović, Svetlana Pelemiš
*Radon in the water*

77. Goran Grahovac, Milomir Trivun, Bojan Guzina, Goran Pašić
*The impact of creatine monohydrate on body weight of swimmers*

78. Mirjana Đermanović, Ljubica Bojanić
*Analysis of the contents of calcium, magnesium and total hardness in purified water and water for injection*

79. Veljko Đukić, Ognjen Đukić
*The health significance of aluminum in drinking water*

80. Biljana Bespaljko
*Economic utilization of surface and groundwater as natural resources in industry*

*TUESDAY, SEPTEMBER 3, 2019*
10.00 - 13.30, Small Hall 1st floor

*УТОРАК, 3. СЕПТЕМБАР 2019. ГОДИНЕ*
10.00 - 13.30, мала сала I. спрат

## ORAL PRESENTATIONS
*THE ROUND TABLE "THE INFLUENCE OF RADON AND TORON TO THE HEALTH OF POPULATION"*

## УСМЕНЕ ПРЕЗЕНТАЦИЈЕ
*ОКРУГЛИ СТО "УТИЦАЈ РАДОНА И ТОРОНА НА ЗДРАВЉЕ СТАНОВНИШТВА"*

1. Gennaro Venoso
   *The Importance of Radon Research*

2. Perko Vukotić, Ranko Zekić, Tomislav Anđelić, Nikola Svrkota, Aleksandar Dlabac
   *Radon survey in the buildings of pre-university education in Montenegro*

3. Predrag Kolarž, Zdenka Stojanovska, Zoran Ćurguz, Zora Žunić
   *Diurnal and spatial variations of radon and its influence on ionization of the nearground atmospheric layer*

4. Zdenka Stojanovska, Zoran Ćurguz, Predrag Kolarž, Zora S. Zunić
   *The indoor radon and thoron concentrations in schools of Skopje (Republic of North Macedonia) and Banja Luka (Republic of Srpska) cities measured by raduet detectors*

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7. Zoran Ćurguz, Zdenka Stojanovska, Rosaline Mishra, Balvindar K. Sapra, Ilja V.Yarmoshenko, Predrag Kolarž, Aco Janičijević, Zora S. Žunić
   *Long-term measurements of equilibrium equivalent radon and thoron progeny concentrations in Republic of Srpska dwellings*

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# *A B S T R A C T S*

# *PLENARY PRESENTATIONS*

## BATTERIES AS A TOOL AGAINST CLIMATE CHANGES

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**Abstract**: In order to prevent rising danger by climate chenges, in recent decades agreement on the United Nations lewel was established, to reduce gradually the consumption of fossil fules until its total termination. This agreement (Paris conferences) till 2018 was signed by mayority of countries along the Globe. One of the requirements was the transition to electrically powered automobiles, which in developed countries started roughly in 2010. The competition between fuel cells and batteries as driving tools was then actual, but in key moment batteries mainfested themselves to be technologically superior. Already in 2018 ne number of electric cars produced in leading developed countries is expressed in millions.

The aim of this contribution is a short presentation on the principle of energy conversion in batteies, from which the troubles in their development may be derived, then, the comparison in which measure are the batteries competitive to the fossil fuels in energetic sense, and, what is the forecast that in near future the competitive power of batteries, by development of advanced types, may be additionally improved.

**Key words**: Advanced batteries, climate changes, competitiveness of batteries, electric cars, how battery works.

## AMORPHOUS Al-Ce-Cu-Fe ALLOYS: GLASS FORMATION, PROPERTIES AND STRUCTURAL COMPLEXITY

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**Abstract**: The Al-Cu-Fe system is well known for it contains a quasicrystal, the ultimate degree of lattice complexity in an ordered solid. Susbtitution of Ce for Al atoms cancels formation of the quasicrystal, but favours amorphisation upon rapid solidification from the liquid state. Accordingly, we have studied the solubility range of Ce in this alloy when replacing Al atoms, as well as we have varied the Cu/Fe ratio at constant Al, Ce concentration. We found evidence that the lo-

cal order in the glass is predominantly icosahedral, which matches the evidence of a very low glass transition temperature in the vicinity of the eutectic concentration known in the binary Al-Ce system. This interesting result can be exploited to prepare bulk specimens by spark plasma sintering, a technique that we used to produce centime-wide specimens. The magnetic properties were studied in a wide composition range and will be reported in the talk. Replacement of Ce by Gd was studied as well, although it leads to a narrower glass formation range and, with no surprise, the rise of ferromagnetic properties. The overall picture of the atomic structure at short and medium range is better understood within the concept of push-pull alloys, which will be briefly evoked.

**Key words**: Complex intermetallics, metallic glasses, formation and stability, glass transition, bulk amorphous, magnetism.

## LI-B ALLOYS AND BOROPHENE MATERIALS – CURRENT STATUS

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**Abstract**: The lithium-boron system has been extensively studied due to the practical importance of Li-B alloys as anode materials for the production of lithium batteries. (1,2) However, many questions remained unexplained. Some ambiguities also remained regarding the existence of a $LiB_3$ compound and the dissolution of boron in lithium melt. Preparation of Li-B alloys is very challenging, because it is carried out at relatively high temperatures, where molten Li is highly reactive. An argon-filled dry-box, containing less than 0.1 ppm of oxygen and water, was used in synthesis protocol. Li-metal and crystalline boron were heated in electric furnace in a pure iron crucible. The processes for the preparation and characterization of Li-B alloys are described in detail in previously published publications (3,4). It is interesting that in the present time most of researchers avoid the classic metallurgical preparation of Li-B alloys. There are some documented procedures using metallurgical approaches, which significantly differs from ours (5), due to a highly demanding experimental work.

In the present work we report on the development of materials that originate from Li-B system and could lead to the preparation and application of 2-D boron materials – i.e. borophenes – graphene analogs. Borophenes are promising new class of materials, due to their exceptional physical and mechanical properties, which offer a wide range of applications, especially for energy conversion and storage devices. It is hard to say that borophenes have been synthesized as pure 2-

D material. We believe that Li-B alloys, which we began to develop in the early 1990s can be used for this purpose (1,2).

Using extensive research work and quantum chemical calculations (*ab initio* MO) we explained the mechanisms of formation of Li-B alloys and so-called "dissolution" of the boron in the melt of metalic lithium (6,7 and 8). We found that the $LiB_3$ composition is not actually an alloy, but rather interstitial solid Li solution, which is incorporated into $B_{12}$ interstices in the β-rombohedral boron. We also found that Li incorporation increases the unit cell of the boron which then causes local disorder and micro stress in its crystal lattice. Using X-ray powder diffraction, we have shown that due to this stress, the surface of the crystalline boron peels off, which leads to the formation of layered boron material.

We prepared Li-B alloy, by metallurgical process and with $H_2O$/HCl(aq.) solution remained lithium was etched away. This material was then purified and exfoliated in water suspensions, filtered and dried in vacuum oven at elevated temperature. Detailed synthesis procedure will be published elsewhere. The resulting material was then morphologically characterized by scanning electron microscopy (SEM) and transmission electron microscopy (TEM), chemically with energy-dispersive X-ray spectroscopy (EDS), and Electron energy loss spectroscopy (EELS). The material was further characterized by powder XRD, evolved gas analysis (EGA), Brunauer-Emmett-Teller analysis (BET) and electrochemical methods.

Within the material we found layered, amorphous, material which is stable at relatively high temperature and could be borophene. We tested this material as an anode in Li-ion batteries, as a supercapacitor and as an additive to spectrally selective coatings for concentrated solar power plants (CSPs). All results confirmed unusual behavior of material.

**Keywords**: Li-B alloy, Borophene, Li ion batteries, Electrochemistry.

## NEW PROCESSING RE-BASED MAGNETIC MATERIALS

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**Abstract**: Rare-Earth Transition Metals permanent magnets are vital components in the rapidly-developing renewable energy sector, where the motors require strong magnets with the ability to operate at temperatures well over 100°C. To achieve high coercivity, remanence and consequently high energy product at elevated temperatures the addition of heavy rare earth (HRE) to the basic Nd-Fe-B composition is needed. On the list of Critical Raw Materials published by the EC in 2014, HRE is on the very top of it. To drastically reduce the use of HRE we focused on developing a

new method, which should enable us to achieve the properties needed for high-temperature application with the lowest amount of scarce elements.

By our new inventive technique further transferred to a pilot production, we could minimize the amount of HRE used, down to 0.2 at %, the improvement of coercivity was 30 % with minimal loss in remanence. The total saving of the HRE is 16-times less need for the same performance, which is a significant contribution to the world economy and clean environment.

In studying the mechanism for such an improvement in coercivity without significantly decreasing the remanence, a detailed microstructure investigation was performed by using high-resolution transmission electron microscopy.

Besides the use of these new developed high energy magnets for electric and hybrid cars and the wind turbine generators the important application is also as the source of the magnetic field in the development of the new magnetic cooling devices.

**Key words**: processing, rare-earth magnets, magnetic materials.

## ITALIAN EXPERIENCE ON RESEARCH AND OTHER ACTIVITIES ON PROTECTION FROM RADON EXPOSURE, IN THE EUROPEAN CONTEXT

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**Abstract**: Many research and other activities on indoor radon exposure and related health effects have been carried out in Italy since ’80s. After a first period it became more and more clear that an effective protection of population and workers from health risk due to exposure to radon and its decay products in dwellings and workplaces requires many different actions and involves many different institutions, both national and regional/local ones. This is particularly true for countries with a federal organization, such as Italy. Therefore, a National Radon Action Plan – promoted by the Ministry of Health and coordinated by the Italian National Institute of Health – was set-up in 2002 to coordinate such actions. Several activities have been carried out in the framework of this plan and information and data regarding such activities have been collected in the National Radon Archive. Recently, the Directive 2013/59/Euratom introduced several new requirements on protection from radon exposure in workplaces and in dwellings. In this presentation, a summary description of research and other activities on radon protection in Italy will be reported. These includes: i) several national and regional surveys, involving more than 50 000 indoor environments (dwellings, schools and workplaces); ii) estimates of lung cancer rates attributable to radon exposure for each of the 21 Italian regions; iii) remedial actions to

reduce indoor radon concentration; iv) training activities on radon issues. Moreover, the main perspectives for protection from radon exposure in Italy are presented, with particular attention to the requirements of the Directive 2013/59/Euratom, including the development of a new national radon action plan.

**Key words**: Italian experience, radon protection, indoor radon concentration, health risk, national and regional survey.

## *IN SILICO* CLINICAL TRIALS TO DESIGN AND SAFELY TEST NEW DRUGS AND MEDICAL DEVICES IN VIRTUAL PATIENTS – SILICOFCM AND INSILC PROJECTS

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**Abstract**: Computer simulations are used to design and safely test new products in virtual patients. In silico clinical trial represents a new paradigm for development of new drug and medical device.

Familial cardiomyopathies (FCM) are most commonly diagnosed, or progress of the disease is monitored, through in vivo imaging, with either echocardiography or, increasingly, cardiac magnetic resonance imaging (MRI). The treatment of symptoms of FCM by established therapies could only in part improve the outcome, but novel therapies need to be developed to affect the disease process and time course more fundamentally. In SILICOFCM project we are doing in silico multiscale modeling of FCMs that would take into consideration comprehensive list of patient specific features (genetic, biological, pharmacologic, clinical, imaging and patient specific cellular aspects) capable of optimizing and testing medical treatment strategy with the purpose of maximizing positive therapeutic outcome, avoiding adverse effects, avoiding drug interactions, preventing sudden cardiac death, shortening time between the drug treatment commencement and the desired result.

SILICOFCM platform is a cloud based ICT platform that combines detailed heart reconstructed and computable geometries with state-of-the-art multiphysics solvers (MUSICO, BIOINFORMATICS, DATA ANALYTICS, ALYA and PAK) to directly simulate the heart function and performance of complex biomedical products.

In InSilc project we are developed in silico mechanical stent testing within ISO 25539 standards. The following standard tests are simulated: Dimensional verification, Profile/diameter test, Simulated use – Pushability, Torquability, Trackability, Recoil, Crush resistance Flex/kink, Force to deploy, Longitudinal tensile strength, Crush resistance with parallel plates, Local Compression, Radial Force,

Foreshortening, Dog Boning, Three-point bending, Stent-free Surface Area. Risk of fatigue failure is calculated using multiaxial criteria specific for polymers (PL-LA) or metals (magnesium).

We believe that with SILICOFCM and InSilc projects we will connect basic experimental research with clinical study and bioinformatics, data mining and image processing tools using very advanced computer models drug, stent and patient database and regulative in order to reduce animal and clinical studies.

**Key words**: Computer simulation, virtual patients, in silico clinical trials, cardiomyopathy, stent deployment.

## TECHNICAL AND ECONOMIC DEVELOPMENT OF THE PHOTOVOLTAIC ELECTRICITY IN BULGARIA

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**Abstract**: The report presents technical and economic data on the development of photovoltaic electricity in Bulgaria in recent years. The mix of different types of conventional and renewable energy sources in the country's electricity system is shown. The changes in the installed photovoltaic capacities and the price of electricity from them for the studied period are shown in tabular and graphical form. The number of photovoltaic power plants and their distribution by groups of individual powers are shown. Brief technical and economic data for some of the largest photovoltaic power plants in Bulgaria are provided. The analysis of the data shows the short period of rapid development of the construction of high-capacity photovoltaic power plants after the introduction of high feed-in tariff for the purchase of photovoltaic electricity, as well as the influence of the installed photovoltaic capacities on the market change of the feed-in tariff in time. There is a sharp decrease in the cost of the feed-in tariff with an increase in the volume of installed photovoltaic capacity and even its removal for larger-capacity photovoltaic power plants. Examples are given of the economic profitability of a grid-connected and autonomous photovoltaic systems in Bulgaria. The analysis and conclusions of the report may be helpful in determining government policies and market conditions to promote the development of renewable energy sources.

**Key words**: Photovoltaic electricity; Feed-in tariff; Economic profitability; Bulgaria; Electricity market.

# CONTEMPORARY MATERIALS AND EQUIPMENT FOR ZERO ENERGYBUILDINGS

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**Abstract**: Energy efficiency in buildings is recognized today as an areathat has the greatest potential to reduce total energy consumption and thus reduce the emissions of pollutants into the environment.Measures to achieve energy efficiency in buildings include a whole range of different possibilities for saving heat, cooling and electricity.In order to achieve almost zero energy (nZEB) construction, there is a need for a synergy between technical systems in obtaining all useful forms of energy, but with the use of renewable energy sources in buildings. From design to construction maximum attention must be paid to thermal insulation of the building envelope (windows and external doors), efficient system of space heating and domestic hot water using solar systems, photovoltaic system for electricity generation, etc. All materials and equipment should comply with the principles of cleaner production and products using recycled materials. The Life Cycle Assessment-(LCA) proved to be a suitable method for the comparison of such products and the products made exclusively from new natural resources.

**Key words**: energy efficiency; renewable energy sources; Nearly Zero-Energy Buildings (nZEB); contemporary materials and equipment; Life Cycle Assessment (LCA).

# THE SUBMICRO PARTICLES AND ORGANISM'S NATURE IN THE LIGHT OF BROWNIAN'S MOTION

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**Abstract**: The main idea of our research in the area of microparticles and microorganisams motion in the nature is analyzed by Brownian's Motion fractal nature. It is very important to make some inlights on particles motion especially

between the grains and pores of ceramics materials. We tried to establish the control over the relation order-disorder on particles motion and their collision effects by Brownian's Motion phenomena in the frame of the matter of fractal nature. Also, we made some experiments and got interesting results based on microorganisam motion by the influence of different outside energetic effects. The idea of biomimetic correlation between these two particles and microorganisams Worlds is very original and leads towards biunivocal understanding of this different phenomena's. We would like to establish some controlling effects for electro ceramic particles motion by some effects of microorganisams motion in the nature. These important ideas open the new frontiers with very specific reflections for future research.

**Key words**: microparticeles; microorganisams; Brownian's motion; fractals.

## THE CONCEPT OF DIELECTRIC NEURAL PROSTHESIS

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**Abstract**: Neural prostheses are implants that allow communication between external hardware and nervous system, they consist of a well-designed electronic circuit and electrodes that are in contact with the nervous tissue. A commonly accepted method of communication between the neural prosthesis and an external device is wireless communication through a radio frequency link, wherein the electrical supply of the prosthesis is achieved by induction in a coil which is part of the prosthesis. The electrical power of the order of a magnitude of 50 mW or more is required for the supply of such designed neural prostheses. The release of heat from the neural prosthesis causes warming of the surrounding tissue, which is a significant problem. In the case of neural prostheses of small dimensions, which is a common requirement, the rise in temperature in the surrounding tissue can reach up to several degrees Celsius. This paper presents a new concept of communication with an electronic implant based on the analysis of the AC current that flows through the part of the body in which the implant is located. The working part of the implant are LC circuits which are able to change the frequency characteristic of the AC current flowing through the implant and the body in the presence of nerve signals. Also, this same concept could enable nerve stimulation. The total electrical power required for the operation of the proposed neural prosthesis is about 10 μW, which is more than three orders of magnitude less than the electrical power required for the operation of a wireless inductively coupled neural prosthesis. The application of this new "dielectric" concept of the work of neural prostheses would eliminate the problem of heating the tissue around the prosthesis.

**Key words**: neural prostheses; neural engineering; bioengineering.

# CONTEMPORARY MEDICAMENTS AND MATERIALS FOR TREATMENT OF CARIES IN EARLY CHILDHOOD

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**Abstract**: Not even the youngest are deprived of the risk ofmodern nutrition rich in free sugars and from poor oral hygiene. Consequences are significant deterioration in oral health, because35% of two-year olds inBanja Luka, and66,4% of three-year oldsin Serbia already have affected milk teeth. This is significantly higher than in developed countries, since promotional programs and screenings in pregnancy and in the first years have not beenset as a binding priority. The highest number of present carious lesions is untreated, followed by number of com-pli-cations that threatenchild's nutrition, growth and development, as well as permanent teeth. Recent studies support the direct correlation of dental diseases in childhood with the development of chronic diseases in adults.

Classic invasive approach in preparation andobturation of carious lesionsis difficult in little patients since by the third year of lifeit is hard to establish satisfactory cooperation, without the general anesthesia, which again brings with it a number of other health and financial issues. The last decades have brought a series of dramatic changes in technologyand approach to the treatment of early cariesin milk teeth. The goal is to detect the risks and neutralize them as early as possible. The onset of initial demineralization (white spots) is a sign of high risk. There are number ofhighly effective techniques for its remineralisation. Fluorides are central medicament, but regular oral hygiene and toothpaste, even with 1000 ppm fluoridesis no longer a sufficient measure. Systematic studies give preference to fluoride varnish. The nanoparticles of apatite andxylitol enhance the remineralisation efficiency. Covering ofnon-cavitated lesionwith a glass-ionomerliner or with bond may prevent its cracking during the hardening process.

When working with children younger than three years, the biggest challenge is to maintaina dry working field and short working time. ART method of preparation has proven its effectiveness, with use of new generation of glass-ionomer cements for filling small cavities,both on smooth, and on occlusal surfaces. Larger rebuilding ofanterior teeth is possible even without the ideal dry working fieldwith „strip crown“ technique, with help of glass-ionomer bonding and composites. Special progressin recent years was accomplished with the introduction of silver diamine fluoride (SDF) products, which impregnate and remineralize, enabling the fi-

xation ofthe soften dentin tissueand preservation of teeth even without the overlaying with final filling.

**Key words**: early childhood caries, silver diaminfluorid, ART, caries, decideous teeth.

## BIBLIOMETRIC AND STATISTICAL ANALYSIS OF CATEGORIES IN THE FIELD OF "MATERIALS SCIENCE" WITHIN SCI-E

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**Abstract**: SCI-E is one of the major citation databases (CDBs) in the world in the natural and applied scientific disciplines. For the year 2018, under the SCI-E, 9156 scientific journals are indexed, which are classified into 178 categories. Scientific journals in the field of "Materials Science" are classified in SCI-E into 10 (ten) categories.

The paper presents the status and analysis of scientific journals indexed within the SCI-E citation database (CDB) for 10 (ten) listed categories in the field of "Materials Science" for the period 1981-2018, as well as bibliometric and statistical analysis of those categories. The top-ranked category from all ten in "Materials Science", by number of journals, was the "Materials Science, Multidisciplinary" category with 293 scientific journals and a cumulative growth index (CGI) of 263.96% for the period 1997-2018. The largest increase in the number of scientific journals for the period 1981-2018 for all ten of the above categories in the field of "Materials Science" had the category "Nanoscience & Nanotechnology" with a cumulative growth index (CGI) of 348.15% for the period 2005-2018. The highest number of published articles (A) and total citations (TC) for 2018 had the category "Materials Science, Multidisciplinary", with 114027 published articles (A) and 4389013 total citations (TC). The highest bibliometric indicators for 2018 had the category "Nanoscience & Nanotechnology" with MedIF=2.843, AggIF=6.795 and AggII=1.500.

**Key words**: Bibliometric analysis, statistical analysis, "Materials Science", Science Citation Index Expanded (SCI-E).

# NANOTECHNOLOGY IN THE FUNCTION OF SUSTAINABLE WATER USE

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**Abstract**: Nanotechnology, as contemporary field of research in forming of materials and devices on the level of molecule and atoms, is founding broad utilization in different scientific and engineering domains. The influence of nanotechnology on development of contemporary human society has got a significant potential in domains as economy, environment protection, health and improvement of the quality of life. The need for fresh water as a necessary resource for living world, as well as the economic activity on the level of humanity is growing in the conditions of increasing population, increasing economic activities and increasing pollution. In that sense the conventional methods for water treatment may become not effective enough for providing sustainable utilization of water resources in future. Nanotechnology as contemporary scientific and engineering field is considered as efficient and potentially, the only solution for sustainable utilization of fresh water in the future. The efforts in nanotechnology utilization for sustainability of fresh water resources mean comprehensive approach and clarity in goals definition as well as the ways for their realization. The basic expectations of nanotechnology in the sense of fresh water resources utilization are directed to enhancement of fresh water availability, increase of efficiency of fresh water delivery and enabling next generation systems for fresh water quality monitoring. The increase of fresh water availability by nanotechnology means development of filtering systems and development of membrane systems, inverse osmosis for water desalinization and catalysts for water treatment. Efficiency of fresh water delivery based on nanotechnology means reducing energy necessary for its transportation, developing system of pipes and components which are easier, stronger and longer lasting as well as to provide cheap materials which improve energy efficiency for heating and cooling. All these processes for nanotechnology development aiming to provide sustainable fresh water resources utilization require significant efforts on scientific and engineering level in order to be utilized in everyday life. This paper aims to research the state of the art of nanotechnology development in the domain of sustainable utilization of fresh water resources.

**Key words**: Nanotechnology, fresh water resources, sustainability.

# POSTER PRESENTATIONS

## STUDY OF THE BIOLOGICAL ACTIVITY DESCRIPTORS OF THE BARBITURIC ACID DERIVATIVES

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**Abstract**: Barbituric acid derivatives have been pharmacologically significant compounds for decades. The central nervous system effects are conditioned by the presence of the pyrimidine-trione ring and the nature of the substituent in position 5. Lipophilicity as one of the key molecular descriptors of biological activity for selected barbituric acid derivatives was determined experimentally, using reversed-phase thin layer chromatography (RP TLC18 $F_{254s}$), in two solvent systems. The influence of the substituent's nature and the effects of applied organic modifiers on the chromatographic behavior of the tested derivatives were examined. Applying the appropriate software packages for the studied derivatives the values of the partition coefficient (log*P*) as a standard measure of lipophilicity and effective concentration ($EC_{50}$) as a measure of acute toxicity for different test organisms were calculated. Dependence between the chromatographic parameters as assumed measures of lipophilicity and the software-derived biological activity parameters of the studied barbituric acid derivatives were studied by linear regression analysis.

**Keywords**: barbituric acid derivatives, lipophilicity, toxicity.

## STUDY OF THE ANTIOXIDANT POTENTIAL OF SELECTED MONOTHIOCARBOHYDRAZONE DERIVATIVES

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**Abstract**: As well as carbohydozone, their thio analogues, thiocarbohydozones, have a variety of biological activity and wide range of application. Previous reports indicated that they have shown anti-cancer, antitumor, anti-bacterial, antioxidant and many other known biological properties. In this work, the antioxidant potential of selected monosubstituted derivatives of thiocarbohydrazones was investigated in order to obtain information on their potential biological activity. These studies were based on the results of three different assays: DPPH, ABTS and FRAP. The obtained results are very important and they will serve for further investigation of biological activities, such as cytotoxicity and as well as potential application of monothiocarbohydrazones.

**Key words**: *monothiocarbohydrazones, antioxidant, biological activity, DPPH, ABTS, FRAP.*

## ANTIMICROBIAL AND PHOTOCATALYTICAL PERFORMANCES OF DOPED AND UNDOPED NANOPARTICLES OF ZINC OXIDE

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**Abstract**: To be used for biomedical purposes, the nanoparticle (NP) must meet the following criteria: low-risk toxicological profile, long-term physical stability and high adsorption capacity power. Precise and detailed control of the surface of the NP, or knowledge of surface chemistry, is very important when the NP is connected with biology. Thanks to the better ratio between the volume and the surface in the NP in relation to the larger particles, as well as the better magnetic properties, the nanoparticle application for biomedical purposes has become multifunctional. The chemical composition of the nanoparticle, its structure, size, and coating of the nanoparticle depend primarily on the synthesis method. The method of synthesis of the nanoparticle itself controls the physicochemical and biochemical properties of the NP, and thus its application. The green chemistry method is currently very effective because it is an ecologically acceptable method that uses biological molecules from plant species (phytosynthesis) in the form of extracts for the purposes of reduction processes. Most plant species contain flavonoids, phenols, alcohols, and proteins that can produce metal nanoparticles from metal salts by reduction process. Here, Cu dopped zink oxide nanoparticles (ZnO NP) were synthesized by using black and green tea, vitamine C and trisodium citrate as a reduction agents. Antimicrobial and photocatalytical properties were

tested. The antimicrobial sensitivity of the dopped synthesized ZnO NP on the isolates *Acinetobacter baumannii* and *methicillin resistant Staphylococcus aureus* (MRSA) was performed by the diffusion method on the Muller-Hinton substrate. ZnO NP with all four reduction agents showed antimicrobial activity toward MRSA with inhibition zone 10 mm, while only dopped ZnO NP synthesized with green and black tea showed antimicrobial sensitivity for *Acinetobacter baumannii* with average value of inhibition zone around 8 mm. Photocatalytical activity was more pronaunced in case of undoped ZnO nanoparticles.

**Key words**: zink oxide, nanoparticles, antimicrobial sensitivity, photocatalysis.

## STUDY OF FERRUM OXIDE NANOPARTICLES DOPPED WITH COPPER: ANTIMICROBIAL AND PHOTOCATALYTICAL APPROACH

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**Abstract**: Last decade is designated as the postantibiotic era due to increasing number of resistant and multiresistant strains of microorganism which show resistance to one or more antibiotics. Antimicrobial resistance becomes a global health problem. This phenomenon of antimicrobial resistance will undoubtedly affect the efficiency and use of antibiotics in the future. Science and technological development are committed to researching and developing new antibiotics that will satisfy the missing criteria and address the problem of antimicrobial resistance. One of the possible solutions lies in nanotechnologies. Nanoparticles have been isolated as one of the most promising substances on which microorganisms rarely or even develop mechanisms of resistance. The nanoparticles may be in conjunction with already existing antibiotics structures and contribute to the improvement of physicochemical properties in order to successfully overcome the mechanism of antimicrobial resistance or nanoparticles may themselves be an antitumour agent such as colloidal silver, zinc, ferrum, copper, titanium or vanadium. By designing nanoparticles with proper physicochemical and biochemical characteristic we determine their application. The aim of this research is to synthesized ferrum oxide nanoparticles dopped with copper ions in order to test their antimicrobial acitivity and to evaluate their use as potential antimicrobial agent. Extracts of green and black tea were used as reduction agent for the Fe oxide nanoparticles dopped with Cu. The antimicrobial sensitivity of the synthesized nanoparticles on the isolates

*Acinetobacter baumannii* and *methicillin resistant Staphylococcus aureus* (MRSA) was performed by the diffusion method on the Muller-Hinton substrate. Synthesized ferrum oxide nanoparticles showed sensitivity toward *Acinetobacter baumannii* with inhibition zone around 12mm. Photocatalytical activity was also evaluated by UV/VIS spectrophotometry. Samples dopped with copper showed better photocatalytical perfomances.

**Key words**: nanoparticles, antimicrobial resistance, ferrum oxide, photocatalytical.

## ADSORPTION OF DIETHYL ETHER FROM THE GAS PHASE ON MORDENITE

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**Abstract**: In this paper was studied adsorption of diethyl ether from the gas phase on two zeolites, mordenite (NaM) and H-form mordenite (HM), under 5000 Pa pressure and 300 K temperature. Adsorption study was experimentally examined by volumetric method.

Adsorption of diethyl ether on NaM and HM in this pressure range fit to adsorption isotherm Type III, which describes weak interactions between adsorbate and adsorbent. Classic interpretation of adsorption isotherm Type III is weak adsorbate-adsorbent interaction and low adsorption at relative lower pressure, but when the molecules of adsorbate are adsorbed, those interactions help through adsorption of other molecules of adsorbate. Adsorpiton increases with increasing the relative pressure.

It was found that, under the experimental conditions in this study, HM has higher adsorption capacity than NaM. Those differences in adsorption capacity are the consequences of different specific areas and sthrenght of active sites of these two zeolites. Experimental data for both adsorbents are fitted due to Freundlich isotherm model.

**Key words**: adsorption, diethyl ether, mordenite, adsorption isotherms.

## DIELECTRIC, PHOTODIELECTRIC AND OPTICAL PROPERTIES OF PMMA/Alq3 COMPOSITES

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**Abstract**: Polymer composite films of tris-(8-hydroxy-quinoline) aluminum (Alq3) and polymethyl methacrylate (PMMA) at three different concentrations were investigated. Dielectric properties of samples were measured in broad frequency range and results showed decrease in admintance by adding Alq3 in PMMA. Changes in dielectric spectra by irradiation of samples with LED lamps different weavelengths were recorded. UV-Vis and FTIR spectroscopy were done on pure PMMA and the doped PMMA. The shift and change in the intensity of the FTIR bands in the doped PMMA samples have been found. The main result of this study showed that the doping of the PMMA polymer with different concentrations of the Alq3 leads to unique photodielectric properties. PMMA/Alq3 film, which have unique optical properties, are found to be promising candidate for the applications of solar cells, energy storage and optoelectronics.

**Key words**: Dielectric properties, Optical properties, Photodielectric properties, PMMA, Alq3, polymer composites.

## ASSESSMENT OF HEAVY METALS (Cu, Pb, Zn and Ni) IN THE STORMWATER RUNOFF FROM THE MAIN STREETS OF THE CITY OF NOVI SAD

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In order to examinate the presence of heavy metals in urban stormwater runoff, six main streets of Novi Sad city with high traffic intensity were chosen for the analysis. In recent years, after heavy rains these locations are also being flooded and the wastewater of the city of Novi Sad (combined sewage, industrial, municipal and stormwater) is directly discharged without any chemical or mechanical treatment into the Danube River. Samples of stormwater runoff were collected around the storm drains along the selected streets in april 2017. year after a rain event that lasted 2 hours. Stormwater samples were tested for zinc (Zn), copper (Cu) lead (Pb) and nickel (Ni). Concentrations of zinc were above limit of quantification (LOQ) (mean value 0.58 mg/L) for all six sampling locations in the city of Novi Sad, while for other metals, concentrations were under LOQ. The highest measured concentration of zinc was 1.21 mg/L. All detected values of zinc concentration were under the maximum allowable value for wastewater discharge to watercourse (2 mg/L).

**Key words**: stormwater runoff, heavy metals, urban streets, Novi Sad.

## METAL IONS SPECIATION BY MAGNETIC POLYMER/BENTONITE NANOCOMPOSITE

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**Abstract**: Speciation of Cu(II), Cd(II) and Ni(II) ions from aqueous solutions by means of the magnetic amino-functionalized polymer/bentonite composite based on methacrylates was investigated. The influence of contact time and initial concentration was monitored and the obtained data were analyzed by kinetic models, as well as the Langmuir and Freundlich adsorption isotherms. The composite was shown to be very efficient in the sorption of investigated ions, which can effectively be removed from aqueous solutions by applying the external magnetic field.

**Key words**: magnetic sorbent; metal ions speciation; kinetics; isotherms.

## NOVEL AMINO-FUNCTIONALIZED MAGNETIC POLYMER/BENTONITE COMPOSITE FOR CHROMIUM REMOVAL FROM AQUEOUS SOLUTIONS

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**Abstract**: In this study, macroporous magnetic poly(glycidyl methacrylate-co-ethylene glycol dimethacrylate)/bentonite composite functionalized with hexamethylene diamine (SGE/MB-HD) was tested as potential Cr(VI) sorbent from aqueous solutions. The sorption kinetics and adsorption isotherms were studied according to the data obtained in static experiments with different initial Cr(VI) concentration at room temperature and pH = 2.0. The Cr(VI) sorption obeys the pseudo-second-order model with definite influence of pore diffusion. Desorption experiments show that chromium anion sorption was reversible and the SGE/MB-HD was easily regenerated with 0.1 mol/dm3 NaOH.

**Key words**: macroporous composite, magnetite, bentonite, Cr(VI).

## ACTIVATION TIME DEPENDENT MAGNETIZATION OF THE Fe/BaTiO3 SYSTEM WITH VARYING CONSTITUENT MASS RATIOS

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**Abstract**: Powdery mixtures of Fe and BaTiO3 with mass ratios of 10% Fe, 20% Fe, 30% Fe, 50% Fe, 60% Fe and 70% Fe were activated in a planetary ball mill for times ranging form 30 min to 300 min. Activated powders were pressed, then sintered at 1200 oC for two hours.

Depending on the activation time, the system changes its chemical composition. It has been experimentally observed that the magnetization of sintered samples rises with the increase of iron in the initial powders.

For each sample, two measurements of the magnetization dependency on the activation time were made: the first measurement at room temperature and the second measurement after the heating to Curie temperature and subsequent cooling in the applied magnetic field of 50 kA/m. The most pronounced ferroelectric change after cooling was observed at 120 °C for the sintered sample of 70 mass% Fe and 30 mass% BaTiO3 activated for 120 min, with the magnetization value of 18,10 Am2/kg - a 51% net increase compared to the one obtained at room temperature before the heating.

Further increase of the activation time of initial powders leads to a decrease of magnetization of all sintered samples.

**Key words**: multiferroics, mechanochemical activation, sintering, mass magnetization.

## APPLICATION AND MODELING OF LASER INVASIVE, MODULATION AND DIAGNOSTICAL TECHNIQUES IN BIOMEDICINE

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**Abstract**: In this paper, three parallel fields are considered that deal with the interaction of laser systems and materials equivalent to chosen structures of tissues in medicine and photobiology (in micro and macro plane). Results of experiments, analytical approach, numerical supports and simulations of chosen interactions and also the monitoring of biological systems characteristics' are taken into account.

**Key words**: Laser diagnostics techniques in biomedicine; structures of tissues; photobiology; simulations interactions.

## BANDWIDTH OF PLASTIC-CLAD SILICA OPTICAL FIBERS WITH W-SHAPED REFRACTIVE INDEX PROFILE

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**Abstract**: A multimode plastic-clad silica optical fiber with W-shaped refractive index profile is proposed. The bandwidth is determined for such W type plastic-clad silica optical fiber for different structural parameters of the fiber. We have shown that bandwidth of W type plastic-clad silica optical fiber is significantly (up to 15 times at fiber length of 2 km) higher than the bandwidth of the singly clad step index plastic-clad silica optical fiber.

**Key words**: Plastic-clad silica fiberm bandwidthm power flow equationm.

## SUPERCONDUCTIVITY OF LANTHANUM HYDRIDE UP TO 250 K

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**Abstract**: The basic problem that follows transition of substance to the superconducting state is that transition is made on low temperatures (up to -100 oC in cupperoxide ceramics) and it is necessary to have special cooling equipment. The newest temperature record is 250 K in lanthanum hydride but this material is have to been pressurized with very high pressure (around 170 GPa) to make superconducting state possible. In our research we studied behavior of charged particle system in phonon field when modeled samples are low dimensional crystalline films. In extreme conditions, for example within high pressures, energy gaps for electrons and phonons are wide and they provide high temperature of activation (even more over 150 K). In this case electron-phonon interaction could explain high critical temperature in lanthanum hydride.

**Key words**: superprovodnost; lantan-hidrid; visoki pritisak; ultratanki filmovi; elektron-fonon interakcija.

## SYNTHETIZED DIAMONDS THERMAL AND ELECTRO CONDUCTIVITY BRIDGING BY FRACTAL NATURE ANALYSIS

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**Abstract**: Possibilities for application of synthesized diamonds are enormous. Diamonds can be used for medical-surgery, in professional industry and what is very important in microelectronic industry for components and devices. Due to their unique combination of properties, synthesized diamonds can be applied in many areas, but also, it requires constant research and improvement of their properties. Such research can be very helpful for understanding the fundamentals in this area. Also, intensive research of surface structure can contribute to the better insight of polycrystalline diamonds properties. By the experimental procedure, it is observed that structure and grain size has very important role and influence on thermal and electrical conductivity. These conductivities affect the possibility of application so, explaining of microstructure is of high importance. In further investigation, observation that when thermal conductivity increase, electrical conductivity decreases and opposite, is very important. In that sense, the main goal of these and future researches is to establish correlation between these two phenomena and explanation based on fractal nature.

**Key words**: synthesized diamonds, microelectronic, thermal conductivity, electrical conductivity, fractals.

## FLOCCULATION STUDIES OF NATURAL QUARTZ SAMPLE USING ANIONIC POLYACRILAMIDE

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**Abstract**: The waste sludge generated during processing of iron ore in the Omarska mine (Republika Srpska, BiH) is fine-grained (<15μm), containing relatively high concentrations of iron, and quartz as its major impurity. In present paper

there were studied the flocculation behaviour of the primary natural raw "quartz" sample from Omarska mine. This sample is composed of major quartz which dominate over minor contents of clay minerals and feldspars, and contain 92.9% of SiO2. Particle size distribution analysis confirm that it is present as fine and ultrafine particles. The zeta potential of quartz depend on pH value. Settling experiments were performed by using three different dispersants (Na-hexamethaphosphate, Na-pyrophosphate and Na-silicate), and anionic polyacrylamide as flocculants. The best results were achieved with Na-hexametaphosphate (1000 g/t) and anionic polyacrylamide A 100. The effect of flocculant on the settling rate depends on solid concentration. Settling rates increase significantly with the increase of the liquid component in both of the cases (natural settling and hindered settling by addition of flocculant).

**Key words**: Quartz, iron ore, sludge, flocculation, settling rates.

## APPLICATION OF EPR SPECTROSCOPY FOR IN VITRO STUDIES OF PLGA PARTICLES DEGRADATION

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**Abstract**: Poly(lactic-co-glycolic) acid (PLGA) is a biocompatible copolymer approved by FDA for human use. It is one of the most commonly used biodegradable polymers in medicine and pharmaceutics. Various methods have been developed for the synthesis of different types of PLGA-based particles. The morphological and physicochemical properties of the polymeric particles, which determine their degradation process, are of the essential importance for the specific application. In this study, PLGA microspheres were synthesized using two procedures based on oil in water emulsion-solvent evaporation method. The morphology and size of the particles were determined by optical microscopy. The in vitro degradation process of PLGA microparticles was monitored by UV/vis spectrophotometry. This technique has been proposed for polymer particles degradation monitoring. However, the obtained results were not consistent and repeatable. Therefore, PLGA particles were modified with two aminoxyl radicals, 3-carbamoyl-, and 3-carboxy-proxyl (3CP and 3CxP), which are widely used in EPR spectroscopy and imaging for the study of biosystems. The in vitro release of 3CP or 3CxP from the polymer matrix was monitored and quantified by EPR spectroscopy during dialysis. Based on the obtained results, it can be concluded that EPR spectroscopy is an appropriate technique for PLGA biodegradation studies.

**Key words**: biodegradation; PLGA; EPR; spin probes.

# INFLUENCE OF SYNTHESIS CONDITIONS ON TEXTURAL PROPERTIES OF AlFe PILLARED CLAYS

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**Abstract**: AlFe pillared clays are obtained by intercalation of montmorillonite with mixed solution of two (Al3+ i Fe2+/3+) polyoxications. Representatives of solid, modern ecomaterials and heterogeneous catalysts. They are applied in the commercial catalytic technologies of the oil and petrochemical industry, but also in the field of environmental protection, for example, for photocatalytic treatment of wastewater contaminated with phenol. We investigated the effect of pillaring conditions: Al / Fe ratio and the pH of the solution for pillaring (OH / Me ratio) as well as the conditions of drying and calcination in the textural properties of the prepared samples AlFe pillared clays. It has been assumed that the application of the montmorillonite copillaring process and the conditions for its performance, significantly influence the improvement of the textural properties of the AlFe pillared clays compared to montmorillonite. Obtained results of the texture series of samples prepared at different Al / Fe rations and pH for pillaring; which are air-dried (105°C, 4h) and calcined (300°C, 2h) show that there has been a significant improvement in the tested texture properties of all prepared samples compared to the montmorillonite texture. The resulting differences in the textural properties of the samples prepared with the test parameters of the synthesis were explained by the influence of the different content of the iron ions and the pH of the solution to create a different size of the pillar space in the structure of the samples, which in consequence, causes differences in the size of the formed pores and other textural beings.

**Key words**: AlFe pilarne gline, ekokatalizatori, uslovi pilarenja, tekstura.

# PRODUCTION OF WOOD ENERGY BY CHIPPING

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**Abstract**: Increasing demand for using renewable energy resources is strongly emphasized during the last decades. On the international level, it is recognized through a series of conventions, conclusions and recommendations. Forests are energy source through conversion of wood biomass into solid, fluent and gaseous

fuels for industrial and domestic use. Wood chip is a form of biomass, size of 5-50 mm, which is obtained by chipping of lower quality logs, trees, brushwood and wood residues. Some investigation showed that choosing the right chipper is crucial in a projection of chipping system. In this study, it was compared chipping at the landing site with the Jenz HEM 700 and Pezzolato PTH 1300/1500 chippers. The subject of chipping was beech long fuelwood and stacked fuelwood. The investigation was done with the time and work-study method. Cost calculation was performed according to FAO methodology, slightly modified for local conditions. Also, in simulations, Jenz HEM 561 DQ was included in order to cover a wider range of chippers by the capacity, but data for this chipper were undertaken from other research. Unit costs of chipping were calculated on the basis of raw material input and chipper output. Unit costs were expressed for factory projected chippers productivity also, in order to compare obtained unit costs with costs when chippers are working below full capacity. Results of the productivity and cost calculation of chippers showed that bigger chippers had lower unit costs, but because of inability to achieve full capacity at the forest landing site and because of their dimensions which hinder the manipulation, it can be recommended using of chippers of smaller capacity like Jenz HEM 561 DQ or even smaller.

**Key words**: wood energy, chipping, productivity, cost.

## IDENTIFICATION OF BASIC CANNABINOIDS USING GAS CHROMATOGRAPHY TECHNIQUE WITH MASS DETECTOR – METHOD VALIDATION

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**Abstract**: The basic task of each analytical laboratory is effective achieving accurate and credible test results. Therefore, it is necessary to conduct a validation process of the analytical method, which proves that method meets the intended purpose and whose application will yield reliable test results. In this paper, the validation method of identification of basic cannabinoids in the Cannabis sativa L. plant samples, using gas chromatographic technique with mass detector is described. The validation process included performance of the method for qualitative analysis of basic cannabinoids, performing tests of basic analytical parameters, as well as criteria and evaluation results. By questioning defined performance indica-

tors, it has been shown that method is suitable for qualitative analysis of basic cannabinoids and can be applied in forensic laboratories.

**Key words**: validation, cannabinoids, gas chromatography, mass detector.

## THE INFLUENCE OF SOLAR MODULES SOILING ON THEIR ENERGY EFFICIENCY

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**Abstract**: This paper deals with the influence of solar modules soiling on their energy efficiency. Soiling is the term used to describe the deposition of dust on solar modules. Dust, most often contains organic minerals and particles which result from the burning of fossil fuels, etc. In theoretical and experimental studies of the influence of dust on the solar modules efficiency in the world, in the Solar Energy Laboratory at the Faculty of Sciences and Mathematics in Nis, and in the Solar Energy Laboratory at the Academy of Sciences and Arts of the Republic of Srpska, it was concluded that all types of dust negatively affect the energy efficiency of solar modules, with ash, limestone (calcium carbonate), red soil and sand (silicon dioxide) having the greatest impact.

**Key words**: solar modules, soiling, dust, energy efficiency.

## EFFECTS OF SPATIAL DISPERSION ON SELF-INDUCED TRANSPARENCY IN TWO-LEVEL MEDIA

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**Abstract**: We study the effects of a dispersion of carrier wave on properties of a self-induced transparency solitons in two level media. We found that, in the absorbing (amplifying) media, soliton velocity gradually decreases (increases) as a function of its duration time. The degree of slowing down (accelerating) is determined by the ratio of the atomic transition frequency over the incoming pulse frequency. For example, an immediate pulse stopping is predicted for absorbing me-

dia when this ratio exceeds unity. For values less than one, velocity still decreases as a function of duration time, but now towards some finite value and can never be stopped. In the case of amplifying media super-luminal motion is predicted as well as in the case of resonance. However, in contrast to resonant case, there appear the lowest value of frequency ratio below which pulse velocity tends to sub-luminal region. This contradicts to fact that only super-luminal pulses should exist in amplifying media. For the intermediate values of frequency ratio velocity exhibits expecting behavior: increases with duration time until it reach critical value when the sudden drop is observed.

Our study reveals some new features of SIT phenomenon and opens novel ways how it may be exploited in the control of a propagation of electromagnetic radiation in two--level media. It may be achieved by varying frequency ratio. Convenient way of practical realization is the design of devices based on quantum metamaterials due to tunability of their parameters.

**Key words**: Spatial dispersion,s oliton velocity, Self-induced transparency, uantum metamaterials.

## GRAPHIC INTERPRETATION OF EXERGY PROBLEM OF IDEAL GAS IN CHARACTERISTIC THERMODYNAMICS DIAGRAMS

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**Abstract**: In paper it is analyzed in details and given graphically solution of this complex problem, based on relation for exergy ie maximal technical work in open thermodynamics systems. Based on this analysis for more complete view and better looking at the process, general model for graphical interpretation of exergy in p-v, h-s, and T-s diagrams is obtained, which is at the same time the most important both for theory and for practice. Model covers four characteristic cases depending on ratio of initial and final parameters of pressure and temperature.

Representation in work p-v diagram is derived from definition itself of technical work, while representation in T-s diagram is obtained from definition of exergy. In both cases, equivalent areas are defined. Representation of exergy in h-s diagram is obtained over the appropriate lines, using slope of tangent on characteristic isobara.

The goal of the paper is systematization of characteristic cases of exergy of open systems in general thermodynamics diagrams in one example based on which other similar cases will be solving. Considering that this problem is not solved and analyzed in details in literature.

Proposed general graphic models can be effectively used for solving and analysis of many practical and theoretical problems in exergy area.

**Key words**: Maximal technical work, open systems, thermodynamics analysis, graphical methods, graphical representation.

## MONTE CARLO SIMULATIONS OF A POLYMER CHAIN MODEL ON EUCLIDEAN LATTICES

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**Abstract**: We studied the critical properties of flexible polymers, modelled by self-avoiding random walks, in good solvents and homogeneous environments. By applying the PERM Monte Carlo simulation method, we generated the polymer chains on the square and the simple cubic lattice of the maximal length of $N$=2000 steps. We enumerated approximately the number of different polymer chain configurations of length $N$, and analysed its asymptotic behaviour (for large $N$), determined by the connectivity constant μ and the entropic critical exponent γ. Also, we studied the behaviour of the set of effective critical exponents $\nu_N$, governing the end-to-end distance of a polymer chain of length $N$. We have established that in two dimensions $\nu_N$ monotonically increases with $N$, whereas in three dimensions it monotonically decreases when $N$ increases. Values of $\nu_N$, obtained for both spatial dimensions have been extrapolated in the range of very long chains. In the end, we discuss and compare our results to those obtained previously for polymers on Euclidean lattices.

**Key words**: polymers, Monte Carlo simulations, lattice models, critical exponents.

## EMERGENCE OF ORDERED MOTION OF THEOSCILLATOR DRIVEN BY FLUCTUATING FORCE

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**Abstract**: Computational experiments with double pendulum, Tacker's oscillator and steel beam, described by Duffing equations, are performed. We assume that a fluid drives the oscillator by fluctuating force. The considered complex motion as a combination of deterministic chaos and stochasticity. If amount of the fluctuating force is large enough (the number of fluid particles interacting with the oscillator is then large), oscillator motion becomes ordered.

**Key words**: double pendulum, chaos, stochasticity, emergence.

## COMPARATIVELY TESTING OF TRIBOLOGICAL CHARACTERISTICS OF NODULAR CAST IRON AUSTEMPERED BY CLASSIC AND ISOTHERMAL PROCEDURE

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**Abstract**: In this paper the heat treatment of ductile iron in tribological properties of contact pairs (pin and disk) was tested. Two types of nodular cast iron EN-GJS-500-7 and EN-GJS-700-2, austempered by isothermal and conventional procedure were tested. Friction and wear test was carried using the PIN and DISC Tribometer and PQ test. The methodology of classical and nodular cast iron isothermal austempering and a methodology in the examination are shown as well. By analyzing the results, it was concluded that the tribological characteristics depend on the structural characteristic of nodular cast iron which are determined by heat treatment. The tested sample, austempered by classic approach, gives the best indication in terms of friction, but it also showed the worst in terms of wear. In the same heat treatment regime EN-GJS-500-7 it is characterized by better tribological characteristics compared to EN-GJS-700-2. The obtained results can be used for proper selecting of type and regime of nodular cast iron heat treatment, with the

aim for improving exploitation characteristics of contact pairs. By converting the laminar form of graphite into the nodular form, the modifier is added, prior to the spillage of smaller amounts of magnesium or Cerium as well as other materials if the specific properties of the nodular livers are required.

In this way, the concentration of the voltage due to the inclusion of graphite in the ductile iron is considerably lower than the gray cast.

**Key words**: nodular cast iron, heat treatment, friction, wear.

## ANALYSIS OF SOFTWARE APPLICATION IN SOLAR ENERGY

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**Abstract**: A remarkable flourishing of solar energy applications is accompanied by the emergence of a large number of simulation software and tools that make it easier for engineers, planners, managers and other users to create and optimize the operation of solar systems. These software packages can be used to improve, optimize or develop new elements and concepts of the PV system, which in turn helps to develop faster and increase the volume and number of experiments so that these programs can utilized in research, education and science. In this way, software technologies have become fundamental support to solar systems whereby different software categories have been created from desktop user applications on various computing platforms all the way to always available geographic information systems (GIS) set up on fast web servers and cloud technologies, to applications for solar system design using mobile devices and tablets. Some of them are listed: RETScreen, PV F-Chart, SolarDesignTool, INSEL, TRNSYS, NREL Solar Advisor Model, ESP-r, PVSYST, SolarPro, PV DesignPro-G, PV*SOL Expert, PVS SOL, Polysun, APOS photovoltaic StatLab, PV Designer, SolarNexus, Valentin Software, PV Cost Simulation Tool, PV Potential Estimation Utility, SolmetricIPV, Solmetric Suneye, Blue Oak Energy and Solar Pro Magazines Solar Select, Seneca Software; Solar, Inc, Sombrero, Horizon, Panorama master, METEONORM, GOSOL, Shadows, Shadow Analyzer, SPYCE, ECOTECT, Tetti FV, Kerychip, PV Professional, Pvcad, Meteocontrol, etc.

This is further supported by a large number of datasets, not just climatic, but also other necessary for simulating or creating solar systems. Since all these data

have common weather-related determinants, depending on the frequency of the measurement, the amount of data is growing every day, and this information needs to be properly stored. Due to further manipulation of these data and all of the above mentioned, it is necessary to ensure that they are stored in database management systems. Some of the most famous are NASA Surface meteorology and solar energy database, RETScreen solar database, PVGIS solar database, HelioClim-1, Metenorm, European Solar Radiation Atlas, SoDa Service, Solar and Wind Energy Resource Assessment (SWERA). This paper aims to analyze the application of the available software packages for the design, simulation and analysis of the solar system data, including the analysis of the yield prediction based on climate conditions.

**Key words**: software, solar radiation, solar energy, PV systems, meteorological data, design and simulation of solar systems.

## GLASS FACADES IN CONTEMPORARY URBARCHITECTURE

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**Abstract**: The construction industry practice confirmed that glass, as a contemporary material, provides an extremely great potential for artistic and designing creations in space, for construction of façade surfaces of urbarchitectonic structures. Those are in particular new types of glass produced with nano-technological characteristics, cost-efficient and energy efficient, with high quality physical properties: optical, thermal, acoustic, porous, fire-resistant with high toughness and strength, with surface stable structure etc. Apart from orthogonal glazed elements, the most commonly present ones are triangular and polygonal forms which are suitable to construct transitions of various inclinations of façade sections. Glass façade surfaces, either vertical or slanting, curved or parametrically deformed, are relatively easily solved nowadays in engineering, by employing computer software. Examples of buildings from the recent past show a tendency of the inspired formation wavy, twisting or dome-like architectonic shapes protruding from the vertical axes, cliché rectangular volumes, an so promoted archisculptoral artifact structures which used the glazed façade surfaces to establish a high quality visual communication between the interior and exterior space. It is an important fact for the necessary comfort of residents in the interior and exterior space.

**Key words**: glass, façade, design, architecture, performance, artifact structure.

## METHODS OF SOLAR ENERGY MATERIALS CHARACTERIZATION

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**Abstract**: In this paper the characterization methods of materials used in solar energy are analyzed. When electrons enter the specimen they scatter within the specimen and gradually lose their energy, then they get absorbed in the specimen. The scattering range of the electrons inside the specimen is different depending on the electron energy, the atomic number of the elements making up the specimen, and the density of the constituent atoms. Scanning electron microscopy (SEM) operation is based on the bombardment of the sample by the electrons of a specific energy and a detection of the secondary electrons, which are thereby emitted from the sample. Testing methods of materials using electron microprobe (EMP) consists of the sample bombing by a beam of electrons and analyzing the emitted X-rays from the sample. Auger electron spectroscopy (AES) is based on the Auger processes in which, under the influence of an external electron beam, the emission of Auger electrons in the material occurs. To measure photoconversion materials emissivity, emissometers are used. The emissometer consists of probes, heat stabilizer and digital voltmeter. Practical work with ellipsometry is performed by illuminating the sample by elliptically polarized laser beam and detection of linear polarized light that is reflected from the sample.

**Key words**: secondary electrons, backscattered electrons, Auger electrons, scanning electron microscopy (SEM), electron microprobe (EMP), ellipsometer, emissometer.

## COMPARATIVE INVESTIGATION OF FIXED AND TRACKING PV SOLAR POWER PLANTS ENERGY EFFICIENCY

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**Abstract**: The paper provides basic information on fixed (stationary), one-tracking and dual-trackinig PV solar power plants. In this regard, a schematic overview of the PV solar power plant and basic information on its components (solar modules, inverters, monitoring system, etc.) are given. The following is a

description of the fixed, one-tracking and dual-tracking PV solar power plant and their energy efficiency. Finally, energy efficiency comparisons were made of fixed, one-tracking and dual-tracking PV solar power plants.

**Key words**: PV solar power plant; one-axis tracking PV solar power plant; dual-axis tracking PV solar power plant; solar energy.

## SOME APPLICATIONS OF NEW TECHNOLOGIES IN RECEIVE SATELLITE ANTENNA POSITIONING PARAMETERS EVALUATION

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**Abstract**: This paper presents some new technologies applications in the numerical calculation of the angles necessary for satellite antenna positioning. The influence of antenna dish size, carrier signal frequency and antenna efficiency on desired satellite link are also analyzed, while the program Satellite Antenna Alignment is used for numerical calculation of receive satellite antenna positioning angles, including the possibility to calculate the position for all visible satellites at once. Receive antenna performance characteristics, the Sun's azimuth and user location parameters (latitude and longitude) are used in this calculation. Information about satellites which can be physically visible from the location where the dish will be installed is also available in Satellite Antenna Alignment working environment, while the user enters the geographical coordinates of the location where the satellite dish will be installed, and the size of offset dish.

**Key words**: satellite communication, receive satellite antenna positioning, paraboloid reflector, offset antenna.

## ALGORITHM FOR REALIZATION OF ENERGY EFFICIENT PLAN-PARALLEL UV REACTOR WITH A LARGE NUMBER OF INDIVIDUAL SOURCES OF RADIATION

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**Abstract**: The advantage of using UV reactors for final disinfection-sterilization of air, wastewater or drinking water is that it does not change the organoleptic or physical-chemical characteristics of the fluid, nor is there a problem of overdosing, as with chemical treatments. In the case of a plan-parallel UV reactor, a channel type with a large number of individual sources of radiation above the fluid, it is possible to achieve quality disinfection / sterilization in a significantly larger volume of flow and / or transparency of wather. With these reactors, it is possible to achieve significant energy savings depending on the flow, i.e., increase the energy efficiency of the reactor with extending the working life and increasing the reliability of the UV reactor. The paper describes an algorithm for managing the system for the inclusion of individual sources of UV radiation (UV lamps), which achieves uniform load on all individual lamps depending on the flow of water.

**Key words**: UV reatror, plan-parallel UV reatror, disinfection, sterilization, radiation dose, flow, transparency, algorithm, uniform load.

# THE INFLUENCE OF SETTING PARAMETERS ON RAID 0 MAGNETIC DISK ARRAY PERFORMANCE

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**Abstract**: In spite of the appearance of semiconductor memory - Solid State Drive (SSD), magnetic disk drives - Hard Disk Drive (HDD) still play a dominant role as secondary computer memory primarily due to their large capacity, practically unlimited number of write and read cycles and price of stored data per MB. The capacity and speed of a magnetic disk drive are limited by the physical characteristics of materials and technological capabilities. Further increase in capacity and access speed is possible by combining multiple physical disks that behave as one logical device, the so-called Redundant Array oh Independent Disks (RAID). The simplest way to combine multiple independent disks into one is the RAID 0 (Striping) array. Expected advantages are: capacity increase is directly proportional to the number of disks (CN = N * C1) and the access time should be reversed in proportion to the number of TN = T1 / N disks, where N is the number of disks in a row. Unfortunately, measurements on RAID 0 indicate that theoretical values can only be achieved if, when designing the RAID 0 series, parameters are carefully selected which, in addition to the number of disks, significantly affect the performance (read and write rate. These are: the size of the disk block, the size of the

data and the width of the queue depth, or the number of parallel transmissions. The paper presents the results of measuring the speed of writing and reading for one disc and series of 2, 3, 4 and 6 disks, without parallel entries and with 4 parallel entries. The influence of the size of the data on the speed of reading and writing was spetialy analyzed.

**Key words**: Magnetic disk, write speed, reading speed, RAID 0, data block, bandwidth.

## APPLICATION OF RADIATION PROTECTION IN THE DESIGN OF RADIOTHERAPY DEPARTMENT

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**Abstract**: First designs of radiotherapy department was based on the empirical formulas. Advanced recommendation were introduced through National Council on Radiation Protection (NCRP) report No 49 related to the design and installation of structural shielding. Accelerating voltages of 10 MV was maximum that was covered in that report. After this report there were several recommendations resulting with the NCRP report No 151. This Report includes the necessary information for higher accelerating voltages as well as a discussion of the various factors to be considered in the selection of appropriate shielding materials and in the calculation and evaluation of barrier thicknesses. Equivalent European protocol is International Atomic Energy Agency (IAEA) Safety Reports Series No 47. Purpose of this paper is to check wheter the tickness of the bunker is enough to limit radiation exposures to members of the public and employees to an acceptable level in the Center for Radiotherapy. Calculation of the wall tickness was done following the NCRP 151 protocol. Results are showing that the wall thickness is adequate for accelerating voltages of 6MeV.

**Key words**: Radijaciona zaštita, bunker, radioterapija.

## RADIATION PROTECTION IN THE DESIGN OF ORTHOVOLTAGE RADIOTHERAPY FACILITY

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**Abstract**: Orthovoltage units are used in the treatment of shallow benign and malignant lesions. The high voltage in the X-ray tube is 100-300 kV (half value layer 0.5-4 mm of copper).

This type of units requires construction protection against ionizing radiation. The protection requirements should be based on the highest energies the appliances have. In this energy range, the effective scattering cross section for photon removal from the beam for photoelectric effect will be large in materials with high atomic numbers. Therefore, a thin layer of lead will be equivalent to a thick layer of concrete, of which barriers (walls) are usually made, which is the cheapest solution. The purpose of radiation protection is to limit the radiation exposure of the general population and employees (persons professionally exposed to ionizing radiation) to a legally acceptable level of 1 mSv/year, i.e. 20 mSv/year. The aim of the study is to calculate the values of primary barrier thicknesses (towards the control panel and exterior wall) for concrete and lead in the case of 250 kV devices, based on IAEA recommendations, as well as the thickness of the safety doors when the beam cannot be directed directly at them (secondary barrier). The calculation is based on the average workload. The thickness of the barrier to the control panel for concrete is 431.9 mm and 12.3 mm for lead. For the outer walls of the bunker, 333.9 mm of concrete or 9.5 mm of lead is appropriate. The security door requires a lead plate 6.28 mm thick. Ambient measurements (on the outer surfaces of all barriers) check the degree of protection achieved and detect any errors.

**Key words**: Orthovoltage, Protective barrier, Ionizing radiation.

## THE PRODUCTION OF 1,5-DINITROXY-3-NITROSINE PENTANE DOUBLE REACTION

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**Abstract**: DINA, 1,5-Dinitroxy-3-nitrosine pentane belongs to the class of active nitroplasticizers, which recently have been partially or completely replaced in the gunpowder mixtures with nitroglycerin. Previously, a method for laboratory synthesis of DINA was described, which involved the reaction of diethanolamine and nitric acid, and then dehydration of intermediate 1,5-dinitroxy-3-aza pentane nitrate. Following this procedure, several hundred kilograms of DINA were produced and incorporated into the gunpowder mixtures and showed good and expected results. Until today, DINA has been manufactured in the world in two ways. The first method is a one-stage process where, at one stage of the reaction, diethanolamine is nitrated and rewarded 1,5-dinitroxy-3-aza pentane nitrate is dehydrated into DINA. This is being achieved by simultaneous dosing of nitric acid with dietha-

nolamine and acetic anhydride. The second method is a two step process where, in the first phase,the reaction between diethanolamine and nitric acid generates a so-called 1,5-dinitroxy-3-aza pentane which is dehydrated in a particular reaction stage into DINA with the help of acetic anhydride and the presence of suitable catalysts. As already mentioned, we decided to take the procedure for the production of DINA based on a two-stage reaction, that is, the reaction of diethanolamine and nitric acid as the first phase and dehydration as the second phase of the reaction.

**Key words**: 1,5-dinitroxy-3-aza pentane nitrate, nitration, dehydration, diethanolamine.

## THERMAL ANALYSIS OF FOOD PRODUCTS USING DIFFERENTIAL SCANNING CALORIMETRY (DSC)

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**Abstract**: Intensity of changes during the freezing storage frozen foods, depends on several factors. Changes of foods during freezing and thawing can be rapid determined by scanning calorimetry (DSC). The aim of this study was to test the influence of scanning rate on the thermal properties of previously heat-treated food products (boiled apple), using the differential scanning calorimetry method. By increasing the scanning rate, a significant change ($p<0.05$) Tcon from -14,20 °C (rate 5 °C/min) to -15.57 °C (rate 15 °C/min) and Tcend (from -17.53 °C to -22.90 °C) were determined, and ΔTc increased from 3.33 °C to 7.33 °C. At the same time, the width of the melting temperature interval (ΔTm) increased from 7.80 °C to 12.87 °C. The glass transition temperature (Tgmid) ranged from -7.15 ° C (rate 5 °C/min) to -6.60 ° C (rate 15 °C/min). Based on the obtained results, it was found that the scanning rate during the DSC determination statistically significant ($p<0.05$) influenced the measured values of the thermal properties of the tested heat-treated apple samples.

**Key words**: DSC; food products; apple; frezing; thermal properties; DSC; food products; apple; frezing; thermal properties.

# 3D PRINTING TECHNOLOGIES: A NOVEL POSSIBILITIES OF APPLICATION IN INDUSTRIAL PRODUCTION

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**Abstract**: 3D printing is an additive technology, during which the three-dimensional objects are produced by successive application of the material layers. 3D printing is the most advanced form of 3D printing, during which living cells and tissues used as print media. 3D printing and 3D bio-printing are at the moment the most attractive technological innovations in various fields of industrial production. Their application has great technological and economic significance. 3D printing, and in particular 3D bio-printing, offers the ability to design new food products with improved nutritional value and better sensory properties. The benefits of applying new technology are seen in the expansion of product assortments, meeting the requirements of personalized food, simplifying the production process, shortening the supply chain. Currently, 3D printing is used in the production of food for the military, space food, food for the elderly and sweets.

The aim of this review is the analysis of published works related to the 3D printing technique, the impact on food design and technical issues that can be bottlenecks. This paper provides an overview of several techniques that can be used for this purpose: printing methods by extrusion of liquid materials, powders or hydrogels, inject or laser-based methods, printing methods, and others. Before applying 3D printing in industrial food production and cooking, it is necessary to conduct new research on the impact of 3D printing parameters on the quality and product structure.

**Key words**: 3D printing, 3D bio-printing, application in industry.

# APPLICATION GOOGLE SOLUTIONS FOR EVALUATION EFFICIENCY AND COST OF APPLICATION QUALITY AND FOOD SAFETY MANAGEMENT SYSTEM

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**Abstract**: This paper presents the results of research carried out in companies engaged in the production and distribution of bakery products, which relate to

the advantages, disadvantages and costs of implementing the system for quality and food safety management. In focused companies, a quality and food safety management system has been applied, which, after development, has been certified by independent certification bodies. The methodology for collecting data using the Google questionnaire that was created and through which the data from the surveyed companies was obtained.

The highest initial costs during the introduction of quality and food safety management systems relate to the elucidation of infrastructure deficiencies (66.6% of surveyed enterprises) and consulting services (33.3% of surveyed enterprises). A key advantage of establishing a company's quality management system is to improve document management and product quality improvement (4.55).

The applied quality management systems and food safety systems offer companies numerous advantages, savings in business and represent a model by which applications and other companies can improve their own performance. Determining system efficiency methodologically using google questionnaires is a very simple and useful tool that can be used for similar research with minimal knowledge of online programming techniques.

**Key words**: Google; QMS HACCP; Google; QMS; HACCP.

## MODELING ABRASION RESISTANCE OF SELF-COMPACTING CONCRETE

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**Abstract**: Considering that self-compacting concrete is a fairly new type of concrete composite, researching its durability properties is of the utmost importance. This paper presents the possibility of modeling resistance to abrasion of self-compacting concrete by selecting appropriate component materials. With own experimental research it has been shown that the dominant influence on the abrasion resistance has the applied aggregate type and then, to a lesser extent, the achieved compressive strength.

**Key words**: abrasion resistance; experimental research; concrete; component materials.

## EVALUATION OF FLOOR COVERINGS FROM THE ECOLOGICAL AND ECONOMIC ASPECT IN THE DESIGN STAGE

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**Abstract**: Measures to reduce the impact of the construction sector on the environment and human health need to be taken at the design stage of the facility and evaluate building materials and products from an ecological and economic aspect. For the research needs, a comparison of floor coverings at the design stage was made to assess their impact during the life cycle. The research uses the life cycle analysis (LCA), a methodology that is the basis for analyzing the impacts during the life cycle of the analyzed construction products. The research covers the life cycle stages from A1 to C4, according to the standard ISO EN 15978: 2011. The software package BEES, the National Institute of Standardization and Technology (NIST), the United States of America is used for the turn. Five types of floor coverings were analyzed, from the aspect of their impact on the environment and human health, but also from the economic point of view. The research has shown that in the design phase, using software packages can be managed with the quality of the environment, and the project design, and hence the quality of the facility. The research also points to the need for a national software package that can analyze construction products and materials Their application would improve the national construction industry and favored materials that are environmentally and economically acceptable in relation to materials with unfavorable effects on the environment and human health.

**Key words**: building materials, life cycle analysis, floor coverings, environmental impacts.

## STRIPE PHASE OF J1-J2 HEISENBERG ANTIFERROMAGNET ON BCC LATTICE: GF METHOD VS Z2XO(3) NONLINEAR SIGMA-MODEL

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**Abstract**: Starting from J1-J2 Heisenberg antiferromagnet on body centered cubic lattice we obtain low-temperature effective field theory in terms of Z2xO(3)

nonlinear sigma model. We analyze low energy sector of the nls-m and obtain four branches of type A Nambu-Goldstone bosons. Since excitations display instability at J2/ J1 > 2/3, we identify the critical ratio of exchange integrals to be J2/ J1 = 2/3. On the other hand, GF method predicts critical ratio J2/ J1 = 0.7142. By comparing predictions from Z2xO(3) NLs-M with RPA and QMC, we discuss its applicability on low temperature regime of corresponding Heisenberg model.

**Key words**: Heisenberg antiferromagnet, bcc lattice.

## MODERN MATERIALS FOR DEKONTAMINATION TREATMENT AND REMEDIATION OF LAND IN CONDITIONS OF HIGH-SPOTICATED CONTAMINATION

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**Abstract**: Remediation in the environment is a measure for remediation of existing pollution in order to reduce the concentration of pollutants to a level that does not pose a threat to the environment. Bioremediation is basically a process which represents the ability of microorganisms to decompose different dangerous contaminants, and it has an increasingly key role in detoxification of contaminated soil and groundwater. These processes are getting their place owing to capacity of enzyme metabolism of microorganisms to transform organic contaminants into pollutants and less dangerous compounds. But, we shouldn't forget that this method cannot always be applied. Among the available options for purification of contaminated soils, bioremediation is the best because it is less disturbing to environment and from the economic point of view-it costs less. Soil contamination occurs as a result of excessive discharge of hazardous substances and their "mixing" with substances that are naturally present in the soil. Disposal of waste to inadequately equipped landfills poses a potential threat to pollution of environment. Waste dumps can impair the quality of surrounding land, surface and underground water. Thus, the basic research questions are: what is worth keeping and preserving in an abandoned and underused industrial complex in the context of urban regeneration, what is meant by its identity and unique character of the site and how to formulate models of transformation of abandoned industrial complexes with the goal of preservation and enhancement its identity and achieving positive regeneration effects?

**Key words**: land, pollutants, contamination, hazardous waste, treatment, decontamination, bioengineering, remediation, eco-safety.

## FUTURE OF TECHNOLOGY OF POLYMERIZATION PRODUCTION (POLYPROPYLENE)

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**Abstract**: The paper presents the most important technology for the production of polypropylene (Spheripol, Novolen, Innovene, Unipool, Borstar), as well as the latest achievement in the field of propylene polymerization and Montell's process of circulating current. Considered the representation of different ways polymerization medium annual growth rate of installed capacities and production processes. The comparison of the most important commercial technology for obtaining polypropylene.

**Key words**: polypropylene, production, technology.

## RESONANCE AS NEW METHOD IN DETERMINING THE AGE OF PAINTS

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**Abstract**: In this work the mechanism of resonance is proposed as the way for determining of paint age, by application new method. This new method consists in accelerated growing old of paint on the basis of resonance. Measuring is concerned with humidity of paint and it is a general method since water molecules are present in every material. Besides, the water molecules are dipoles so that the resonance with them can be achieved and by the mechanical/electrical way. The molecules of water have random distribution. They oscillate in shallow potential wells so that they can be ejected from paint with low energy quanta. It is the reason

for decrease of paint humidity by evaporation process. The high energy quanta accelerate the process of ejecting water molecules from the paint. On the basis of this, it becomes obvious that the increase of energy of water molecules accelerates the growing old of paint. Since water molecule is mechanical oscillator it can be translated to resonant state by application of mechanical periodical field but also, since it is dipole, it can be translated into resonant state with periodical electrical field.

**Key words**: Mechanical/electrical Resonance, Accelerated growing, Age of Paints.

## THE EFFECT OF 4-HYDROXY-BENZALDEHYDE ON ZN AND Zn-Mn ELECTRODEPOSITION FROM ETHALINE

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**Abstract**: Zinc electrodeposition on steel from non-aqueous solutions has drawn a lot of attention recently, due to the many benefits that it offers. Literature data on bulk pH and diffusion coefficients of various species in reline and ethaline, were used to calculate the expected pH change in the diffusion layer at the cathode, during the electrodeposition process. As expected (due to the lower diffusivity), a much higher increase in pH occurs in deep eutectic solvents, as compared to aqueous solution, suggesting the beneficial effect of utilizing hydrogen evolution inhibitor during electroplating from reline and ethaline.

The influence of 4-hydroxy-benzaldehyde (HBA), as an additive in ethaline deep eutectic solution (DES, 1: 2 choline chloride: ethylene glycol), on the current efficiency and deposit appearance was analyzed. The electrodeposition process was assessed by cyclic voltammetry and it was shown that the onsets of the cathodic current, as well as bulk electrolysis, were shifted to more negative potentials in the presence of HBA, resulting in the increased current efficiency. When Zn2+ ions were introduced in ethaline a cathodic peak appeared below the potentials of electrolyte degradation and another one during the backward anodic sweep. The cathodic peak for Zn2+ reduction in ethaline+HBA+Zn2+ ionic liquid resembled the zinc reduction in aqueous solution. Upon addition of Mn2+ ions in the plating electrolyte, there was no peak related to Mn2+ reduction, which is in agreement with earlier results for Zn-Mn plating from reline DES.

**Key words**: deep eutectic solvents, electrodeposition, hydrogen evolution, Zn and Zn-Mn coatings.

## BIOMEDICAL POTENTIAL OF SELECTED MUSHROOM SPECIES

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**Abstract**: The aim of this study was to determine neuroprotective, antioxidant, antimicrobial and cytotoxic potential of acetone extracts of Coprinus comatus and Coprinopsis picacea mushrooms. The neuroprotetive activity was tested against acetylcholinesterase enzyme using the Ellman method. Antioxidant activity was evaluated by free radical scavenging ability, superoxide anion radical scavenging activity and reducing power. The total phenol content was examined using Folin-Ciocalteu reagent. The antimicrobial potential was determined by a microdilution method against 12 microorganisms. The cytotoxic activity was tested using MTT method on the Hela, A549 and LS174 cells. Our results indicate that C. comatus expressed a stronger neuroprotective effect (the percentage of inhibition of acetylcholinesterase was within the range 19.66-51.73%) than C. picacea. In antioxidant effect C. comatus had more potent free radical scavenging activity (IC50 = 276.69 μg/mL) and superoxide anion radical scavenging activity (IC50 = 39.40 μg/mL), while reducing power was relatively similar for both species. The total amount of phenols for C. comatus and C. picacea was 50.57 and 50.20 μg PE/mg of dry extracts, respectively. In antimicrobial activity, C. picacea showed a better effect with MIC values from 0.1 to 7.5 mg/mL. Finally, C. picacea expressed stronger cytotoxicity toward A549 and LS174 cells, while C. comatus was more active against Hela cell.

**Key words**: Acetone extract, bioactivity, mushrooms.

## ADSORBENT REGENERATION FROM THE TURBINE OIL RE-REFINING PROCESS

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**Abstract**: Used turbine oil belongs to category of hazardous waste. The oldest treatment procedure of used oil is known as acid-clay treatment. Treatment pattern of

viscous graduated used turbine oil ISO VG 32 is started by depositing suspended contaminants and additives with concentrated sulphuric acid. The resulting acid sludge is separated, and the rest of the oil is treated with adsorbent, neutralized with calcium hydroxide and filtrated. For decolouration is used commercial adsorbent obtained by acidic oxidation of bentonite. As a resulting product of re-refining is obtained purified acceptable quality base oil which can be used for formulation of new industrial oils and filtration cake as technological waste. Although it is neutral, this solid waste contains big percent of inorganic matter and bound hydrocarbons. By disposing of this dangerous and cumbersome waste, without any treatment, unwanted landfills are created which present risk for humans and environment, while environmentally friendly ways of disposing it are very expensive.

In this work it is examined the possibility of regeneration of adsorbent (clay) from oiled filtration cake. Samples of oiled filtration cake are annealed under controlled laboratory conditions on 450 °C and 550°C. Then the efficiency of reapplication in processes of re-refining clay samples annealed on 550 °C is compared with new commercial clay. Results showed that it is possible to get regenerated adsorbent which can be successfully reused in processes of re-refining and decolouration.

**Key words**: Used oil, clay, re-refining, acid–clay treatment.

## CORROSION OF CONCRETE AND ARMATURE DUE TO THE PROCESS OF CARBONATIZATION AND SULFATE CORROSION

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**Abstract**: Concrete corrosion is a process of its destruction due to the chemical activity of material of the surrounding area. Alkaline surrounding in the internal structure of the concrete protects the concrete and armature from the negative effect of corrosion, while external effects weaken this protection. With carbon dioxide from the atmosphere, the pH reduces, resulting in a surface appearance of corrosion. Several factors influence the speed of corrosion formation, some of which were considered in this paper during an examination of the quality of the construction of pumping stations along the Sava River.

Pumping stations were built in a different time interval, in the period from the fifties to the eighties of the twentieth century, and had a different preparation of

concrete. Concrete and armature samples from the least favorable position in the construction of pumping stations were analyzed. Laboratory tests included mechanical and chemical destruction, of which the paper presents the significance of the chemical process, ie the process of concrete carbonation and sulfate corrosion.

**Key words**: concrete, carbonation, sulfate corrosion.

## THE USE OF BENTONITE ON „SRBAČKO-NOŽIČKA RAVAN" FLOODPLAIN

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**Abstract**:Bentonite is an ore whose dominant constituents are the clay minerals of the smectite group, and within which montmorillonite is the most represented. Montmorillonite has a pronounced swelling ability and low hydraulic permeability. Due to its hydraulic characteristics, that is, its extremely low water permeability, bentonite is often used today as a new material in engineering waterproof barriers.

Frequent occurrences of instability of the slopes have been observed during the general condition assessment of the embankment in the „Gornja Sava" floodplain. These phenomena directly affect the stability and thus the functionality of the embankment.Following the critical damage of the „Sava" embankment in the village of Mlinarice, from March 2018, it is acceptable to consider ways of applying new materials (bentonite and geotextile with bentonite) in order to ensure the safety and functionality of the embankment.These materials are particularly applicable in emergency interventions on embankments during flood waves.

**Key words**: bentonite, geotextile with bentonite, embankments, water- protectiv facility, emergency interventions, functionality.

## HYDROGEN IMPLANTED INTO METALS-PROPERTIES AND APPLICATION

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**Abstract**: Studying electron screening effects is significant in understanding nuclear reactions involved in nucleosynthesis in the Universe. The experi-

mental focus is on bombarding hydrogen implanted into various materials with different beams. Electron screening differs in different host materials, which is very surprising. Better understanding of the metallic targets interesting for this research is possible using different spectroscopic methods. Futher, hydrogen deserves more attention becouse of his future role in the energy system.

**Key words**: hydrogen, implanted materials, nuclear astrophysics, nuclear reactions, energy system.

## BENEFITS OF NEW OVER OLDER TYPES OF MATERIALS IN THE CONSTRUCTION OF SEWER PIPES

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**Abstract**: The development of sewage systems inevitably leads to the need for finding new types of materials for the production of sewer pipes. The old types of materials that have been applied so far have been increasingly squeezed out by the new types of materials that are produced on the basis of plastic masses. New types of pipes are produced by P.V.C. polyethylene P.E., PP polypropylene and GRP polyester. These types of metrics are increasingly extruding old types of matnirials such as clay, concrete, reinforced concrete and asbestos cement.The development of the Skopje sewerage system provides a good opportunity to analyze the development of a system that is separating and which has recently been built by old types of pipes such as clay, concrete and reinforced concrete pipes. But in the latest practice almost exclusively use new types of pipes made of plastic masses.

**Key words**: Old types of materials; New types of materials; Plastic masses; Separation sewer system.

## RESULTS AND EXPERIENCE FROM THE NEW TEST WORKING OF THE STATION FOR THE PURIFICATION THE FECAL WASTE WATER IN VOLKOVO

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**Abstract**: During this trial period should be tested site parameters, which were designed and to perform the calibration of the necessary technical parameters that were related to the SCADA system for continuous tracking and managementin

the functioning of the cellsfor wastewater treatment. The main task of the probation of the wastewater treatment station Volkovois a creation of a lending mil in SBR bioaeration basin through which the process will be carried out on biological treatment. It is also necessary to create conditions for the natural cycle of replacement of the old mill with a new mill, which will be processed by the processing of the line for the sludge, via centrifugation the sludge, and its neutralization by means of liquid polyelectrolyte.Bearing into account that it is about a totally new building with one integrated processing line that contains in itself the mechanicaltreatment, biologically treatment and the treatment of the wastesludge, it is necessary to draw from the experiences of already existing station for the treatment of the waste water and to apply in the new treatment cells as finished solutions which can also contribute to the improvement of the work of the treatment station for the faecal waste water.Primary results refer to the time of the deposition of the sludge and the creation of its own active sludge in SBR bioaeration pools and the concentration of oxygen in the SBR bioaeration pools, through which can be obtained the basic mathematical dependence for thesuccess of the release in thetrial operation of treatment station Volkovo.

**Key words**: rial operation, SBR bioaeration pools, Concentration of oxygen, Mathematical dependence between parameters sludge.

## POST-MODERN VIEW OF DESIGN AND PLANNING MATERIALS A WITH LANDSCAPE DESIGN

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**Abstract**:In the history books, cities are ‘founded’, ‘taken by storm’ and ‘razed to the ground’. They are objects, which may be owned, conquered - or planned in two dimensions. Real places are perceived and seen as landscapes, dependent on physical and mental points of view, with foregrounds and backgrounds always switching positions. Some are ephemeral; others comparatively permanent. In these plural times, the day of the singular town plan has surelypassed away. Individuals, communities and social groups wish to plan their own worlds. A new age of planning is on the horizon. Different plans will be required for different purposes. We shall see more planning, but less control. The city of the future will be an infinite series of landscapes: psychological and physical, urban and rural, flowing apart and together. They will be mapped and planned for special purposes, with the results recorded in geographical information systems (GIS), which have the power to construct and retrieve innumerable plans, images and other records. Christopher Alexander was right: a city is not a tree. It is a landscape. And also for

trees, plants and infrastructure and skyscrapers, a major role in the design and planning of modern cities

**Key words**: Post-modern view, planning materials, landscape design.

## NANOSTRUCTURES AS A MEDIUMS FOR THE TARGETED DRUG DELIVERY

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**Abstract**: The paper points to the possibilities of efficient targeted drug delivery using nano-devices (ultrathin films and quantum dots), with special reference to the physical properties of above-mentioned materials. Particular attention has been given to the analysis of the phonon subsystem in these nanostructures, as it is expected that it can play a significant role in the transport and release of drugs, as well as in the biodegradation of carrier nanomaterials. Nano-devices used as carriers must also have properties that make them suitable for biomarkers so that they can be delivered to precisely defined sites in the body. This reduces the side effects of medicines and increases the effectiveness of their use.

**Key words**: targeted drug delivery, nanostructures, phonon subsystem.

## FLUORIDE VARNISHES AS A SOLUTION FOR POOR HEALTH OF PRIMARY TEETH IN SIPOVO MUNICIPALITY

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**Abstract**: Health of milk teeth is an important indicator of future oral health in community. The big mistake of past preventive programs was to aim all the activities towards the school children, which is rather late, as already acquired food and oral hygiene habits are difficult to change. Preschool dental care, although emphasized on paper, is practically not given much importance.

The paper presents an analysis of tooth condition of 6-year olds, examined before the enrollment into the first grade of primary school and compared with previous generations. Examination of 30 children has found caries prevalence of 86,6% (2017), 80% (2018) and 96,6%(2019). The average number of affected teeth was for each year 6,03 (2017), 5,93 (2018) and 8,36% (2019). There is no difference statistically in the recorded prevalence for the last three years, while the total number of affected teeth significantly increased in 2019. The obtained results are devastating and indicate the complete absence of organized prevention. In addition to the influence of affected milk teeth on the nutrition, development, speech and future health of permanent dentition, the latest research indicate significant risk for the development of chronic diseases (cardiovascular) in adults.

Sipovo Municipality is a small community with approx. 12.000 inhabitants. In the preschool age (0-4) 431 children were registered. 84 children are born annually (2016). With implementation of simple and achievable preventive program which would provide for: 1. examination of children, as provided for in Rulebook of Fund, in the first year of life, after dentition, 2. health education information for the parents and 3. protection of children under risk with fluoride varnish, we could significantly reduce the favorable caries prevalence.

**Key words**: early childhood caries, caries epicemiology, fluor varnishes, preventive program.

## USE OF COMPOSITE MATERIALS FOR FIXED RESTORATION OF LOST TOOTH IN A TEENAGER

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**Abstract**: GOAL: To show preparation of adhesive bridge with indirect method as the conditionally permanent fixed restoration, which can be replaced after the growth and development of child with a definite restoration -fixed prosthetic restoration.

CASE OVERVIEW: A fourteen year boy, accompanied by his mother came with pain in the upper left central incisor. Anamnesis shows injury of that tooth four years ago. Clinical examination shows fistula in region 21.

After the detailed clinical examination and registration of occlusal contacts with articulation paper, we decided to prepare adhesive bridge. Since 11 is an avital tooth, we decided to prepare bearing on supports, but with maximum saving of dental substance. We have imprinted upper and lower jaw in standard stock tray. In the laboratory we prepared working model and antagonist model. On isolated working model we placed appropriate length of impregnated fibers. We used GC everStick for the restoration.

CONCLUSION: Preparation of adhesive bridge is a simple, aesthetic and minimally invasive manner for the restoration of one permanent tooth in the anterior region.

**Keywords**: tooth avulsion, composite bridge, trauma rehabilitation.

## ATOMIC FORCE MICROSCOPY AS A TOOL FOR TESTING BIOMEDICAL SAMPLES AND ELIMINATION PROBE ARTIFACTS

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**Abstract**: One of the most perspective available technique for investigation of the composition, structure and properties of materials, is scanning probe microscopy (SPM), respectively its components scanning tunneling microscopy (STM) and atomic force microscopy (AFM). The advantage of the method is that they have no restrictions related to origin and composition of the material, and its possibilities to investigate vide variety of materials. This technique is used in multidisciplinary research in the field of medicine, pharmacy, dentistry, material science, etc., for study of biological samples, chemical compounds, pharmaceutical products, artificial tissues, implantology materials, and all other materials that have nanotechnological impact on application in these scientific fields. However, images obtained by AFM represent only approximation of the sample surfaces. This is because the probes have not perfect size and geometry, which leads to the appearance of artifacts. They are defined as characteristics that appear on the image and are not present on the sample. These effects caused by convolutions between the probe and sample can be corrected to a certain extent by mathematical manipulation of topographic data. The methodology used in this paper is based on algebra of sets, and basic tools of mathematical morphology. Mathematical algorithms for the "blind reconstruction" of the tip were used, and then in order to detect the parts of the sample surface which

is not available in real-time scanning deconvolution was applied. The limit of the real probe tip is calculated from the image, using the morphological limitations inherent in the recording process. The result acuired as an image of the reconstructed surface out of the used images, with the reconstructi-on of the real tip.

**Key words**: SPM, S TM, AFM, biomedicine, nanotechnology, tip-sample convolution, artifacts, surface reconstruction.

## USING NIR SPECTRUM OF SPENT HEMODIALYSIS FLUID TO PREDICT SERUM IRON LEVEL

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**Abstract**: Despite the prevalent use of recombinant human erythropoietin, anemia is a frequent finding in hemodialysis (HD) patients. The major cause of anemia in chronic renal disease is the lack of erythropoietin, which is the main stimulant of erythropoiesis. The prerequisite for the successful treatment is sufficient amount of iron that is incorporated into erythrocytes. Near-infrared spectroscopy (NIRS) is applied as a non-invasive on-line detection method of blood iron level from the spent HD effluent. The blood iron levels were presented in the form of a binomial variable, where 0 indicates an iron level below the normal limit (below 8 mmol/l) and 1 represents iron level within the reference range (8-30 mmol/l). We used Machine Learning (ML) algorithms: Random Forest (RF), Logistic Regression (LR), K-nearest neighbor (KNN), Support Vector Machine (SVM), Decision Tree Classifier (DT), and Gaussian Naive Bayes (NB) to classify blood iron levels. Area Under the Curve (AUC) and accuracy were utilized for model evaluation.

RF and KNN have shown the best classification accuracy in predicting blood iron level, while SVM, DT, NB and LR, showed average accuracy. AUC score of RF algorithm was 90% with an accuracy of 97%, and AUC score of KNN algorithm was 86% with an accuracy of 85%.

The NIRS with ML methods accurately predict iron levels in HD patients and thus can be used as a non-invasive assessment method.

**Key words**: Hemodialysis, Machine learning, spent dialysate, VIS-NIR, patient-specific.

## PREDICTING CRP LEVEL USING NIR SPECTRUM OF SPENT HEMODIALYSIS FLUID

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**Abstract**: Chronic inflammation contributes to the pathogenesis of several complications in hemodialysis (HD) patients. The high concentration of C-reactive protein (CRP) is an indicator of an inflammatory condition. The increase in serum CRP level is an independent determinant of cardiovascular events in long-term HD patients.

The aim of this study was to predict CRP level in HD patients from the matrix of the spent dialysate fluid using near infrared spectroscopy (NIRS). The serum CRP values were presented in the form of a binomial variable, where zero indicated a normal CRP level (below 6 mg/l) and one represented CRP level that is beyond the normal limit (above 6 mg/l). We used several Machine Learning (ML) algorithms: Random Forest (RF), Logistic Regression, KNN (K-nearest neighbor), Support Vector Machine (SVM), Decision Tree Classifier, and Gaussian Naive Bayes (NB) to classify CRP level within reference range and CRP level beyond the normal limit. These classifier methods were used on the same dataset, and Area Under the Curve (AUC) evaluation was performed.

RF and KNN have shown the best classification accuracy for the prediction of CRP blood level, while LR, SVM Decision Tree and NB, have shown average accuracy. AUC score of RF algorithm was 95% with accuracy of 91%, and AUC score of KNN algorithm was 91% with accuracy of 75%.

The NIRS method with ML algorithms can be used to predict CRP blood level in HD patients.

**Key words**: Hemodialysis, Machine learning, spent dialysate, VIS-NIR, patient-specific.

## EFFICACY OF PLATELET -RICH FINRIN (PRF) IN DONOR SOTE HEALING AFTER REMOVEL OF FREE GINGIVAL GRAFT (FGG)

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**Abstract**: The hard palate is a usual source of soft-tissue grafts for both periodontal and peri-implant plastic surgery procedures. The advantages of using an FGG technique are high predictability and relative ease of technique. The healing process at the donor site proceeds by secondary intention or granulating in and takes about two to four weeks depending on the width and thickness of the tissue removed. Many patients at the donor site experience traumatic and postoperative discomfort with occasional bleeding and delayed healing. The platelet rich fibrin (PRF) is one of the good options for the wound coverage of donor site after FGG so as to reduce the pain perception to patient and faster wound healing. After harvesting FGG, the experimental group (n = 15) received PRF clot membranes at the palatal wound and sutured with a polypropylene 5-0 horizontal mattress suture, and the control group (n = 15) was not put on the palate. The Landry Wound Healing Index (LWHI) and H2O2 bubbling test results for the complete wound epithelization (CWE) rates were recorded 1 and 2 weeks postoperatively. All patients were asked to record a visual analogue scale (VAS) value for pain and the number of analgesics taken during the 7 days after harvesting FGG. The LWHI improved significantly throughout the group 2 weeks postoperatively compared with the first week ($p<0.05$). There were statistically significant differences among groups at first and second week. The CWE ratios were 61.3% in the test group and 11.8% in the control group at 1 week, respectively. At 2 weeks, test group showed 100% CWE compared with 35.7% in the control group. The VAS score 1 day postoperatively was significantly higher in the control group ($p<0.05$). There was no significant differenceamong the groups at day 4. PRF palatal bandages significantly reduced postoperative pain and discomfort and in the short-term, PRF significantly promotes the re-epithelialization of the wound (on day 14).

**Key words**: Platelet rich fibrin, Free gingival graft, harvesting FGG, healing, donor site, periodontolgy plastic surgery.

## THE EFFICIENCY OF HYDROGEN PEROXIDE IN BLEACHING VITAL TEETH

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**Abstract**: INTRODUCTION: High concentrations of hydrogen peroxide are used for office bleaching vital teeth. The bleaching gel can be activated by chemical means, heat or light. Light activation of the bleaching agent accelerates the decomposition of hydrogen peroxide to the active oxygen and increases the bleaching

efficiency. The aim of this study is to evaluate the in vivo efficacy of hydrogen peroxide gel used for in-office bleaching, with chemical and light activation.

MATERIALS AND METHODS: The study involved 20 systematically healthy patients with good oral hygiene, no carious lesions, no large composite fillings in the frontal region, and no gingivitis. The color of the teeth was assessed by color key Shade Guide Ivoclar A-D, for all patients. We used a bleaching agent of 38% hydrogen peroxide (Pola office plus, SDI, Australia) in two sessions for 10 patients. The application of the gel during one session was performed two times in eight minutes. For the light activation, we used LED (Easy Lamp Plus, Signal) and 38% hydrogen peroxide (Signal Professional set) for 10 patients. During one session, the teeth are bleached twice in 12 minutes. A dark-light scale was used where each shade was assigned a number from 1 to 20, so that a statistical analysis of the data could be performed. Number one corresponds to the brightest color (BL1) while number 20 corresponds to the darkest color (C4). After the bleaching process, the color of the teeth was determined again.

RESULTS: Results showed that in office bleaching technique with chemical activation had a color change for four shades after the first treatment and in the second session had a color change for three shades. The results showed that in the office bleaching technique with light activation also had a color change after the first treatment for four shades and in the second session had a color change for three shades. Comparing the success of in the office bleaching technique without light activation and bleaching techniques with LED activation, it can be noticed that there is no statistically significant difference in the bleaching efficacy of these two techniques.

CONCLUSION: Both bleaching techniques showed the same efficacy in the bleaching process.

**Key words**: teeth whitening, hydrogen peroxide, vital teeth.

## THE EFFECT OF DIFFERRENT MATERIALS FOR DEFINITIVE OPTURATION OF ROOT CANAL ON POSTOPERATIVE PAIN, QUALITY OF ENDODONTIC FILLING AND DISCOLORATION OF TEETH

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**Abstract**: The aim of this elaboration was to establish the effect of different materials for definitive opturation (Syntex, Apexit plus, Endomethasone N) on postoperative pain, quality of endodontic filling and discoloration of teeth during opservation of two years period time.The clinical examination covered 30 patients,

gender equaly, age between 20 and 58. Targeted groups were devided on three subgroups by 10 teeth criteria and each teeth group has been optureted by differrent materials. The analysis showed filling quality of all tested materials was satisfying (Syntex 100%, Apexit plus 90%, Endomethasone N 100%). In terms of postoperative pain there was no statistically significant differences according to materials for definitive opturation. Out of total number, 60% of patients have not felt pain, 27% mild, 10% moderate and 3% have felt strong postoperative pain. The teeth color change was registered in 6% cases by the end of opservation period with no statistically significant differences according to tested materials. Based on clinical examination it can be concluded that success of all tested materials has been high.

**Key words**: materials for definitive opturation, postoperative pain, endodontic filing, discoloration of teeth.

## EFFICACY OF LOCAL USE OF PROBIOTICS AS AN ADJUNCT TO NON-SURGICAL PERIODONTAL THERAPY

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**Abstract**: **Background & Aim:** Periodontal disease is a chronic inflammatory disease caused by pathologic microorganisms. Standard parodontopathy therapy involves scaling and root planing (SRP) . Possible mechanisms of probiotics' action in periodontal disease are based on modifications of the pathogenic potential of microbial biofilm. Probiotics help in stimulating health promoting flora and also suppressing the pathologic colonization and spread periodontal disease. The aim of this study was to assess the clinical effect of *Bifidobacterium* and *Lactobacillus* probiotic lozenges, probiotic mouthwash, as an adjuvant to scaling and root planing (SRP) in the treatment of initial to moderate chronic periodontitis.

**Materials and Methods:** Thirty patients with initial to moderate chronic periodontitis were recruited and monitored clinically at baseline (before SRP) and 30 days following SRP. All patients were randomly assigned to group I (experimental group): SRP + probiotic ($n$=15) and group II (control group): SRP only ($n$=15). The probiotic mouthwash were used twice a day for 30 days. Clinical parameters, the probing pocket depth and clinical attachment level were measured on baseline and 30th day following SRP. The data were statistically analysed with one-way ANOVA test. Statistical significance was set at $p<0.05$.

**Results**: The clinical parameters were significantly reduced in both groups at the end of the study.

**Conclusion:** The present investigation showed that the adjunctive use of probiotics offers clinical benefit in terms of pocket depth reduction in initial to moderate pockets.

**Keywords:** probiotics, periodontitis, scaling and root planning.

## EVALUATION OF GINGIVAL MICROLEAKAGE IN CLASS II COMPOSITE RESTORATIONS: AN IN VITRO STUDY

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**Abstract**: Introduction/aim of this study was to assess the microleakage of class II restorations with different flowable composites liners.

**Materials and Methods**: 4o extracted human premolars teeth with class II cavity preparation (80 cavities) were divided into four groups and filled as follows: 1. Vertise flow +micro hybrid composite Herculite; 2. Surefil SDR flow+ micro-hybrid composite Herculite 3. Tetric flow + micro-hybrid composite Herculite 4. Control group micro-hybrid composite Herculite. Mesial cavities are polymerized with a classic but distal soft start technique of polymerization After that, the samples were immersed in a 0.5% AgNO3 solution and sectioned into the mesiodistal direction. Using a stereomicroscope (Nikon - Japan), with a magnification of 40x, gingival microleakage of cavities was examined. Data were analyzed using Fisher's and Student's tests.

**Results**: After using the conventional polymerization technique, all of three used flowable composites VF + Herculite, SDRF + Herculite, TF + Herculite were less gingival microleakage than control. This difference was statistically significant. After the application of the soft start technique of polymerization, only VF + Herculite and SDRF + Hercules showed a statistically significant reduction in gingival microleakage, while TF + Herculite showed a comparable control result, with no statistically significant difference. The soft start technique proved to be better than the conventional polymerization technique, but without a statistically significant difference.

**Conclusion**: Flowable composites in this study have reduced gingival microleakage and can be used as liners in the restoration of cavities of II class.

**Key words**: Microleakage; class II restoration; flowable composite; polymerization.

## CYTOTOXIC EFFECT OF NEWLY SYNTHESIZED NANOMATERIALS FOR POTENTIAL DENTAL APPLICATION

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**Abstract**: **Introduction**. Biocompatibility is an essential feature of any dental material. Few materials can be said to be biologically inert since most contain potentially harmful or irritating ingredients.

This study aimed to determine the cytocompatibility of newly synthesized nanomaterials based on calcium aluminates and calcium silicates for potential dental applications.

**Material and methods**. The cytotoxicity of calcium aluminate-based nanomaterials (ALBO-CA), calcium silicate (ALBO-CS) and calcium silicate hydroxyapatite (ALBO-CSHA) was examined using the MTT test on the human line of human fibroblasts (MRC-5) according to ISO standard (ISO 10993- 5: 2009) in comparison with the calcium aluminate cements EndoBinder (Binder was, São Carlos, SP, Brazil). For the analysis, the eluates of the investigated materials in the growth medium were diluted to a concentration of 4.7, 9.4, 18.8, 37.5 and 75, 0 mg. Qualitative verification of results was performed by a light microscope (Carl Zeiss). The mean values and standard deviations of the MTT test results were done in Microsoft Excel.

**Results.** All tested concentrations of ALBO-CA, ALBO-CS, and EndoBinder resulted in a high survival of cells in culture. The strongest cytotoxic effect was ALBO-CSHA with IC50 = 46.44 after the first cycle of testing; IC50 = 55.52 after the second cycle; or IC50 = 55.42 after the third repetition of the MTT test.

**Conclusion**: ALBO-CA and ALBO-CS nanomaterials have shown a cytocompatible effect comparable to EndoBinder. The obtained results are certainly encouraged to continue researching these materials in the future and other experimental studies.

**Key words**: nanomaterials; calcium aluminates; calcium silicates; cytotoxicity.

## INFLUENCE OF CHEMICAL PLAQUE CONTROL AGENTS ON THE COLOR STABILITY OF HYBRID NANOCERAMICS

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**Abstract**: Antiseptic and chemical plaque control agents are a very common part of periodontal disease therapy, as well as part of the treatment after fixed prosthetic rehabilitations. These antiplaque agents , due to their chemical content, can lead to discoloration and compromise the aesthetics of restorative materials.

The aim of this study is to investigate the color stability of two types of hybrid nanoceramic materials after exposure to two different plaque control agents: 0.2% Chlorhexidine digluconate (CHX) and Listerine®.

MATERIAL AND METHOD: A total of 60 samples (Group A -30 Cerasmart GC and Group B - 30 Lava ™ Ultimate CAD / CAM Restorative) samples (10 mm X 2 mm discs) were prepared. Groups A and B were divided into three subgroups (n = 10). Samples were immersed in distilled water (control group), CHX or Listerine, once daily for 3 minutes. 7 days after immersion, the samples were washed with distilled water, and subjected to color measurement. Evaluation of the color and its change was performed with a SpectroShade, Micro, MHT, Verona, Italy spectrophotometer and through the CIELab (Commission Internationale de l'Eclairage) system. The color change (ΔE * ab) was determined based on CIE L *, a *, and b *. All results were statistically processed using Mann-Whitney and Kruskal-Wallis tests.

RESULT: Color change was registered with all experimental groups. The ΔE * ab values were changed after immersion in CHX and Listerine® in both sample groups (CeraSmart and VitaEnamic), but with no statistically significant difference ($p < 0.001$). No statistically significant difference was found after immersion of the samples in distilled water. The ΔE values were highest after immersion in CHX, followed by Listerine® and distilled water.

CONCLUSION: Chemical control plaque agents can cause discoloration of nanohybrid ceramic materials, thereby compromising aesthetics. Additional Caution should be exercised when using mouthrinse antiseptic agents.

**Key words**: color, spectrophotometer, CIE lab, chlorhexidine, hybrid nanoceramics, Listerine, color stability

## DIGITAL IMAGING ANALYSIS OF THE EXTRAEMBRYONIC STRUCTURES

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**Abstract**: Introduction: Recent studies indicate that morphometric parameters of extraembryonic structures are factors that may be associated with pregnancy complications. Placental and umbilical cord morphometry has been performed using digital image analysis in recent studies. The aim of this study was to determina-

te the morphometric parameters of extraembryonic structures using digital image analysis.

Material and methods: The digital imaging analysis of the twenty five placentas and umbilical cords were performed using Image Analysis LAS V 4.3 software.

Results: The length of the placentas was 190,60 mm ± 31,16 mm (mean ± standard deviation). The width of the placenta was 166,61 mm ± 20,80 mm. The placental surface area was 24413,80 mm 2 ± 6558,50 mm 2. The insertion of the umbilical cord to the placenta was central in 50 %, peripheral in 38 % and marginal in 12 % of analyzed placentas. The average distance of the umbilical cord insertion from the nearest placental margin was 37,10 mm ± 29,68 mm. The umbilical cord diameter at the insertion site was 20,72 mm± 6.62 mm. The diameter of the umbilical cord two centimeters from the insertion site was 12,18 mm ± 3,67 mm.

Conclusion: Digital image analysis enables obtaining the objective morphometric parameters of the extraembryonic structures. The obtained morphometric parameters of the extraembryonic structures for our population are comparable to results of previous studies. This opens further placental research directions for the development of the screening method.

**Key words**: digital imaging, morphometry, extraembryonic structure, digital imaging, morphometry, extraembryonic structure.

## ANALYSIS OF PROTECTIVE EFFECTS OFXYLITOL ONTOOTH ENAMEL

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**Abstract**: Carbonated beverages are inseparable partof contemporary nutrition,whose consumption starts from the earliest age, but more and more data sends a serious warningto their harmful effecton general health, especiallyconnection with the obesityepidemic. Many developed countries have adopted regulations on their additional taxation, such as on tobacco. Harmful effect on dental tissues is also certainly proven, as a result of double effect of sugar and lowpH. Therefore, the possibility of enamel protection is verypopular. Natural polyalcohol, xylitolhas been thoroughly examined for a long time as a factor that inhibits metabolismof cariogenic bacteria. Lately, there is also informationon its direct interference with the process of remineralisationof hydroxylapatitelattice. The aim of the study was to examine the

extent to which xylitol preventssurface damage of the enamel caused by the direct effect ofacideogenic carbonated beverage.

The test was carried out using SEM. The extracted teeth were kept for 24 hours in10% xylitol solution (experimental group), and in solution of artificial salvia(control group). Then, both groups were kept in Coca Cola solution at37 °Cfor12 hours and then returned to the original solution for 12h. Samples where then prepared for the analysis.

The analysis showed significantly smaller areas of direct destruction of crystal latticewhen treated with xylitol, which suggests the stimulation of remineralisation process. New zones of crystal accumulation have been observed.

The conducted research indicates possible protective role of xylitol when consuming carbonated beverages, which requires additional clinical and structural research.

**Key words**: xylitol, SEM, soft drinks, enemal demineralisation.

## THE HARDEST SUBSTANCE IN HUMAN BODY AND ITS WEAR OFF TOOTH ENAMEL

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**Abstract**: Dental erosions are defined as an irreversible loss of hard dental tissue caused by long-lasting and repetitive acid action, which dissolves the surface layer of hydroxyapatite crystal structure and fluorapatite, and the aggressive noxis not being created by the bacteria. Dental erosions can also be classified as occupational diseases. People who taste wine or carbonated drinks on a daily basis, as well as the people who are professionally engaged in swimming can spot this type of defect on their own teeth. Evaporation of industrial acids in battery factories, sanitary materials, or crystalline glass can also lead to dental erosions. Aim: The purpose of this study was to determine the frequency of dental erosion in patients under antihypertensive therapy and compare them with the frequency of dental erosion in patients who did not take the same therapy. Material and method: This research involved 62 respondents, aged from 20 to 70. Patients were classified into two groups, the experimental group with 31 patients being on a therapy with antihypertensive medications for more than 5 years, and the other one, control group, with 31 patients not being on the mentioned therapy. The subjective dental anamnesis obtained from the patients was noted along with tooth status, soft tissue intraoral examination and the degree of erosive changes according to BEWE index (Basic Erosive Wear Examination). Results: Comparing the statistical significance

in difference between erosive index value of all teeth, there is obvious statistical difference of the average value. In the experimental group ($p<0.05$), higher values of tooth erosion index were noted in comparison with the control group. The average value in the experimental group is 2.25, while in the control group it is 1.37. Conclusion: Erosive lesions are present in both experimental and control group respondents, with dental erosion being more explicit with patients who use antihypertensive medications.

**Key words**: dental enamel,dental erosions,antihypertensive.

## NEW APPROACH TO DETECTION OF ABNORMAL CERVICAL CELLS

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**Abstract**: Optomagnetic Imaging Spectroscopy demonstrated high percentages of accuracy in biological sample classification, namely cervical, oral and colon samples. It enables detection of abnormal tissue and cells, and thus can be used as a diagnostic tool in screening programs. Papanicolaou smears and liquid based cytology samples were analyzed in previous studies on cervical cancer detection by Optomagnetic Imaging Spectroscopy and it was shown that this method can differentiate normal healthy tissue from the cancer tissue. So far, only binary classification of the cervical samples was performed based on optomagnetic spectra of the samples. In this paper, classification of the Papanicolaou smears into four groups (II, III, IV and V Papanicolaou groups) was tested with the Random Forest classification model that demonstrated interclass sensitivity of 49.25%, 58.97%, 50%, 44.44% for II, III, IV and V Papanicolaou group respectively, and specificity of 65.26%, 54.76%, 98.70% and 98.69% for II, III, IV and V Papanicolaou group respectively.

**Key words**: Optomagnetic Imaging Spectroscopy; Cervical cancer; reening test.

# DIFFERENCE IN CONTACT ANGLE VALUES AMONG CALCIUM SILICATE AND CALCIUM ALUMINATE DENTAL CEMENTS

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**Abstract**: **Introduction** Liquid tends to spread on a solid surface of the material. The contact angle presents the inverse relationship with wettability (surface free energy); the lower contact angle, better wettability. Different liquids may be used for contact angle measurement.

**Aim**

The aim of this study was to compare contact angles among different calcium silicate and calcium aluminate dental cements, obtained with glycerol, citrated human blood and diiodmethane.

**Materials and methods**

We used four groups of different calcium silicate and calcium aluminate cement discs (MTA, Portland, calcium aluminate + strontium fluoride and calcium aluminate + strontium carbonate). One sessile drop (2μL) of tested liquid (glycerol, citrated human blood and diiodmethane) was gently put on the surface of the investigated specimens and photographed with microscope camera. All images were analysed with computer programe Image J with Contact angle analyser.

**Results**

The calcium aluminate + strontium fluoride showed statistically lower contact angle compared to MTA and Portland using citrated blood drop ($p<0.05$). Likewise, calcium aluminate + strontium carbonate revealed significantly lower contact angle compared to MTA and Portland cement. ($p<0.05$).

On the other hand, using glycerol drop, significantly higher contact angles were recorded among calcium aluminate + strontium fluoride and both MTA and Portland ($p<0.05$). Eventually, diiodmethane drop showed no statistical difference in contact angle values among the materials.

**Discussion**

Wettability could be indirectly connected to surface roughness of the material. Our results showed significantly better wettability with calcium aluminate cements compared to calcium silicate based cements (MTA, Portland). These results indicate that calcium aluminate cements could possess smoother surface and lower surface free energy than MTA and Portland.

**Key words**: calcium silicate, calcium aluminate, dental cement, MTA, Portland.

## BIOMATERIALS IN DENTISTRY

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**Abstract**: The development of new biocompatible materials and/or existing material composition and progressing techniques is expected to broaden the diversity of applications of biomaterials in dentistry field in upcoming years. The progress in materials research including dentin bondings, impression materials, luting cements, glass ionomers, glass carbomers, composites, and ceramics clearly requires an improved understanding in multiple disciplines, as well as the development of new design methodologies in order to obtain better properties in biologic performance and better biocompatibility.Researchers in the field of dentistry have explored the potential of nanoparticles in existing therapeutic modalities with moderate success. Nanotechnology in dental material sciences started with the introduction of microfills. In regards to biomaterials, nanotechnology has gained an increasing interest by researchers, particularly in case of dental implants. The use of biomaterials and implant therapy in dentistry is becoming a more popular and acceptable procedure for the replacement of both single and multiple teeth. Procedures have evolved for maintaining and regenerating bone to provide an optimal environment for subsequent implant placement. The growing interest in the dental applications of nanotechnology is leading to the emergence of a new field called nanodentistry.

**Key words**: biomaterials; nanotechnology; dentistry; dental materials

## CLINICAL SIGNIFICANCE OF CAPILLAROSCOPY IN RHEUMATIC DISEASES

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**Abstract**: Capillaroscopy is a simple and non-invasive morphological method that, under magnification (which can range from 10 to 1000 times), observes small blood vessels - capillaries located in the nails of the upper extremities. Based on the appearance of the capillary loops, it is possible to discern the differences between normal capillaries of healthy individuals and capillaries in individuals with microvascular disorders. It is important in the early detection of systemic connective tissue diseases, and is used in assessing the severity and monitoring of the progression of systemic connective tissue diseases (systemic sclerosis, systemic lupus erythematosus, Sjogren's syndrome, etc.). It is used in monitoring the effects and success of therapy for these diseases.

**Key words**: capillaroscopy, rheumatology, diagnosis.

## DIAGNOSTIC VALUE OF TRIPLE-PHASE BONE SCINTIGRAPHY IN DIAGNOSIS OF OSTEOMYELITIS AT CHILDREN

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**Abstract**:Osteomyelitis is a bacterial infection of the bone, most commonly caused by the spread of the pathogen through the blood. Osteomyelitis in childhood is a serious condition that can potentially endanger a patient's life. Therefore, early diagnosis and treatment is the most important factor in the prognosis of this disease. Three-phase bone scintigraphy is one of the most appropriate methods for early diagnosis of this disease. It is a method based on the application of a radioactive preparation - a radiopharmaceutical, which then accumulates in the target organ, in this case the bone. The radiopharmaceutical emits gamma rays, which are detected by a gamma camera, and with the help of a computer we get an bone image. The most commonly used radiopharmaceutical is Technetium 99m pertechnetate. There are 3 phases of this search: angiographic, tissue and bone. The advantages of this method are: early stage disease detection, suitable for multifocal and poorly localized changes, about 100 times lower radiation dose compared to x-ray.

**Key words**: osteomyelitis, children, diagnosis, scan.

## RADON IN THE WATER

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**Abstract**: Man and his environment are constantly exposed to the effects of ionizing radiation. Most of this radiation comes from natural and artificial radionuclides, and the biggest radioecological problem is the 222Rn radioactive gas. Natural radioactivity comes from unstable radioisotopes that were present during the formation of the Earth, and are present today. According to the research by UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation) it is estimated that the radiation dose, which comes from natural radionuclides and to which man is exposed, is 2.4 mSv per year. Natural sources of radioactivity are cosmic radiation and Earth crust that contains primordial radioactive elements including those that are sources of radon (uranium). Radon is a natural inert radioactive gas without smell and taste. It is soluble in water and can easily diffuse with the gaseous and aqueous phase and in this way forms significant concentrations. The techniques and methods most commonly used to detect and determine the activities of radon in water are alpha spectrometry, gamma spectrometry and measurement techniques on a liquid scintillation detector. Throughout epidemiological studies, the World Health Organization has provided convincing evidence of the correlation of exposure to indoor radon and the development of lung cancer. Radon and its decomposition products are considered to be the second cause of lung cancer after consuming tobacco.

**Key words**: zračenje, radon, voda, detekcija, rak.

## THE IMPACT OF CREATINE MONOHYDRATE ON BODY WEIGHT OF SWIMMERS

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**Abstract**: The subject of research is the effect of creatine monohydrate on the weight of the swimmer. The test was carried out on a sample of 40 swimmers of members of the Academic Swimming Club "April 22" divided into two groups and ages 21-25 years. All subjects are male and of good health. Respondents

belonging to this population are in the zenith of morphological and motor development and are well motivated to advance in swimming.

The measurements were made at the end of May and the end of June 2008, at the Recreation Center Srpske Toplice (water temperature 28 degrees C). Respondents were initially measured on body weight after 21 days of taking creatine.

The main goal of the work is to determine whether taking creatine, a duration of three weeks, has significant differences in the increase in body weight of the swimmer. The results of the study analyzed by t-test show that differences in body weight have significant statistical significance.

**Key words**: creatin, nutrition supplement, body weight, swimming, statistical analysis.

## ANALYSIS OF THE CONTENTS OF CALCIUM, MAGNESIUM AND TOTAL HARDNESS IN PURIFIED WATER AND WATER FOR INJECTION

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**Abstract**: Water is one of the most frequently used raw materials in pharmaceutical industry. Water for pharmaceutical purposes includes the two primary water types: purified water and water for injection. Drinking water used for obtaining purified water is not official in pharmacopoeia. Depending on quality prescribed for a certain product preparation, various water types and procedures have been used to prepare pharmaceutical industry water. Possible ways to obtain water for pharmaceutical purposes are: reverse osmosis, demineralization, electrodeionization, ultrafiltration, distillation. Reasons for the widespread use of water lie in the facts that it is capable of dissolving a great number of therapeutic substances, compatible with a large number of substances, appropriate to be used from a physiological aspect given that it is an integral part of the cell and the major component of body fluids and whenever the drug is administered in the form of an aqueous solution, reabsorption is rapid and complete, it also has suitable physical-chemical properties. Calcium and magnesium are the most common sources of water hardness. In this study, analysis results of 15 samples of water were obtained using pharmacopoeial methods for pharmaceutical purposes. Results showed that 86.6% of water samples were accurate and 13.3% did not have appropriate calcium content, magnesium content and total hardness values.

**Key words**: analysis, water, calcium, magnesium, hardness.

## THE HEALTH SIGNIFICANCE OF ALUMINUM IN DRINKING WATER

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**Abstract**: Aluminum, Al, is present in natural waters. It is hydrolyzing metal and comparatively insoluble in neutral pH conditions. However, under acid or alkaline conditions and/or in presence of complex agents its solubility changes, opening the possibilities for biochemical transformations. The ecological consequences are considered of increased concentrations of dissolved Al. Al in soil and water has various forms differing relative to the chemical and biological reactions. Al has always been considered a benign element. There are no indications of Al affecting the public health under normal conditions but too high doses of aluminum can cause serious health problems.

The effect of Al in water is described, e g. the Al salts which are generally used in the public water supply systems. The Al compounds are used as coagulates in the raw water treatment. The residual Al has always been low in the water. The paper presents the results of research on the application of aluminum polychloride.

The water purification process is optimized in relation to the values of the muteness and color of water and the amount of residual Al. Aluminum coagulants have significant advantages over other coagulants

**Key words**: aluminum, nature, drinking water, coagulation.

## ECONOMIC UTILIZATION OF SURFACE AND GROUNDWATER AS NATURAL RESOURCES IN INDUSTRY

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**Abstract**: The purpose of this paper is to emphasize the importance of utilisation of water as natural resource in the industry. Water is a liquid that is essential for the life of all living beings. Need for water is increasing every day. Climate changes and severe droughts have further reduced the amount of water on land, particularly surface water. Due to reduced amount of water on land, there was a need for the use of groundwater, which usage is more expensive. Water has higher use in industrial production. Large number of industrial production processes would be impossible without water. Water used in industrial production is usually

economically exploited. The amount of water discharged after completion of industrial production process is mainly polluted. Such water is classified as wastewater which is not appropriate for re-use. The new industrial production processes require re-use of new amount of water from nature, which indicate the utilization of water in industry. This paper provides high number of useful information about water (types of water), about economy and technology in the water system, about key elements of the proposal for increase of economic efficiency, about mission and vision of water sector, information about the involvement of surface and groundwater in various branches of industry, as well as information about the amount of discharged wastewater from various branches of industry. There are also basic concepts of wastewater, as well as the information on water management in the industry. Subject of this paper is related to water as natural resource which utilization contributes to the development of industry and economic progress.

**Key words**: surface water, groundwater, economy, industry, wastewater.

# ORAL PRESENTATIONS
# THE ROUND TABLE "THE INFLUENCE OF RADON AND TORON TO THE HEALTH OF POPULATION"

# USMENE PREZENTACIJE
# ОКРУГЛИ СТО "УТИЦАЈ РАДОНА И ТОРОНА НА ЗДРАВЉЕ СТАНОВНИШТВА"

## THE IMPORTANCE OF RADON RESEARCH IN ITALY

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**Abstract**:Indoor radon is the main contributor to the exposure of the human population to natural sources of ionizing radiation, and one of the main causes of lung cancer. This is why many countries invest a lot of effort to make national surveys of indoor radon and to identify radon-prone areas, as well as to adopt related regulations and mitigate radon in homes and workplaces, so the population could be protected from the radon exposure and in that way ensured the health of population.

The radon research contributes in general to the field of environmental protection, medicine − the field of oncology (radiotherapy) and illegal transboundary shipment of nuclear and radioactive materials.

**Key words**: indoor radon, population health, radioactive material.

## RADON SURVEY IN THE BUILDINGS OF PRE-UNIVERSITY EDUCATION IN MONTENEGRO

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**Abstract**: In the framework of the national project MNE9005, funded by the International Atomic Energy Agency and the Government of Montenegro, radon survey was performed during the academic year 2016/17 (September − June) in all 519 buildings of the pre-university education in Montenegro - 376 buildings of primary and 51 of high schools, 81 kindergarten buildings, 4 buildings of resource centers and 7 of student dormitories. Radosys detectors (RSFV type) were placed in all classrooms, playrooms and offices on the ground floor, as well as in some rooms on the first floor. Number of deployed detectors was 4078, of which 3793 were basic and 285 control detectors (paired with basic detectors approximately at every 12$^{th}$ location). After exposure period, 11.4% of the detectors were lost or damaged.

Average 9-month radon activity concentrations were obtained for 3345 sampled rooms in 507 buildings. Their mean values AM = 243 Bq/m$^3$ and GM = 142 Bq/m$^3$ are more than twice higher than the corresponding annual average values for 953 dwellings in Montenegro − AM = 110 Bq/m$^3$ and GM = 58.3 Bq/m$^3$, obtained in the national indoor radon survey. Average radon concentrations above of 300 Bq/m$^3$ are found in 23.3% of all sampled rooms in educational institutions and in 3.4% of all rooms they were above 1000 Bq/m$^3$, whereas in the Montenegrin homes these percentages are 7.9% and 0.6%, respectively, which means 3 to 5 times lower.

Radon was measured in 2855 ground-floor rooms in 468 educational buildings. The obtained average 9-month radon concentrations are in range from 3 Bq/m$^3$ to more than 3600 Bq/m$^3$, while mean values for all these rooms are AM = 261 Bq/m$^3$ and GM = 152 Bq/m$^3$. Radon concentrations in the educational buildings, averaged over all sampled ground-floor rooms of the building, range from 16 Bq/m$^3$ to 2810 Bq/m$^3$, with AM = 275 Bq/m$^3$. There are 135 (or 28.8%) buildings with average indoor radon concentrations on ground floor above 300 Bq/m$^3$, and 18 (or 3.8%) buildings where they are above 1000 Bq/m$^3$.

It can be concluded that, on average, radon concentrations in educational institutions are significantly higher than in Montenegrin homes, and that each fourth building of pre-university education in Montenegro has an issue with radon exposure of children and educators in it. This is probably due to the type of construction of educational institutions (usually spacious low-rise structures) and a relatively high average age of these buildings. Poslala mejl

**Key words**: radon survey, educational institutions, ground-floor rooms.

# DIURNAL AND SPATIAL VARIATIONS OF RADON AND ITS INFLUENCE ON IONIZATION OF THE NEARGROUND ATMOSPHERIC LAYER

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**Abstract**: The most abundant and efficient source of air ionization in the lower layer of the atmosphere is radon. As an alpha emitter, radon plays cruciant role in the earth atmospheric electricity. Besides physical, radon and ions have a significant biological role concerning human health: radon is health hazard while the ions are beneficial ingredient of the air we breathe. Measurements were made using continual radon monitor Rad-7 and air ion counter CDI-06. Diurnal and spatial variations of both atmospheric constitutens are mutually related and dependant mostly on radon exhalation potential, meterological parameters, aerosol concentration and formation of temperature inversion layer. Indoor concentrations are related to radon accumulation and partiallz influenced by external radon concentration.
**Key words**: radon, air ions, ionization, atmophere, air, natural radioactivity.

# THE INDOOR RADON AND THORON CONCENTRATIONS IN SCHOOLS OF SKOPJE (REPUBLIC OF NORTH MACEDONIA) AND BANJA LUKA (REPUBLIC OF SRPSKA) CITIES MEASURED BY RADUET DETECTORS

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**Abstract**: Radon ($^{222}$Rn) and thoron ($^{220}$Rn) are natural radioactive gases, generated in the terrestrial materials. They are the main sources of public exposure to ionising radiation in indoor environment worldwide. Differences in half-lives of

$^{222}$Rn ($T_{1/2}$=3.8 d) and $^{220}$Rn ($T_{1/2}$=55.6 s) lead to its different indoor behavior. Several studies of indoor $^{222}$Rn and $^{220}$Rn in Northern Macedonia have been performed, starting with measurements in dwellings in 2008 and continuing with measurements in schools during 2012. The surveys in the Republic of Srpska began later (in 2011) with the simultaneous $^{222}$Rn and $^{220}$Rn measurements in the dwellings and schools of Banja Luka cities. This paper, as a result of our cooperation, summarizes the results and general conclusions obtained from $^{222}$Rn and $^{220}$Rn measurements in schools of capitals. In both cities, the measurements were made using Raduet − nuclear tracer detectors; deployed at distances: >0.5m (Skopje) and 0.2m (Banja Luka); and exposed in a period: March 2012 - May 2012 (Skopje) and April 2011 -May, 2012 (Banja Luka). Results for $^{222}$Rn and $^{220}$Rn concentrations in both cities have a log-normal distribution. The $^{222}$Rn geometric mean value of 71 Bq/m$^3$ in Skopje are higher than in Banja Luka city (GM = 50 Bq/m$^3$). Among other factors that affect $^{222}$Rn variations, this difference could be related to the different exposure time of detectors. Furthermore, the dispersion of the $^{222}$Rn results in each city expressed through geometric standard deviation is relatively low: GSD = 2.13 (Skopje) and GSD = 2.11 (Banja Luka) indicating relatively homogeneous data sets. The $^{220}$Rn concentrations in Banja Luka (GM = 51 Bq/m$^3$) were higher than in Skopje (GM = 11 Bq/m$^3$). It is obvious that in the case of $^{220}$Rn, the exposure period did not play a significant role. One of the reasons for this difference could be the position of the detectors as well as the different building materials in the schools. On contrary, the dispersion of the $^{220}$Rn results in Skopje (GSD = 3.38) was greater than in Banja Luka (GSD = 2.07).

**Key words**: radon, thoron, gas, school.

## RADON CONCENTRATIONS IN EDUCATIONAL INSTITUTIONS (SCHOOLS AND KINDERGARTENS) IN REPUBLIC OF CROATIA

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Radon concentrations in educational institutions (schools and kindergartens)are systematically measured by track etched detectors from 2012 and it is still ongoing. Detectors are exposed for a year in every playroom in kindergartens and selected classrooms and offices (such as: libraries, teaching staff offices, administrative offices etc.) evenly distributed across areas and floors in schools. In total, around 6000 radon detectors in 874schools and 341 kindergartens were exposed. The obtained average radon concentrations were higher than the reference value

(300 Bq $m^{-3}$) in 14.5% of kindergartens and 16.7% of schools.At fifteen selected locations where radon concentrations were elevated,continuous radon measurements are conducted by TSR3 radon detectors with 1-hour time resolution.The observed daily variations of radon concentrations in these objects (schools and kindergartens) showed strong dependence on increased natural ventilation during working hours. It means that radon concentrations significantly decrease in the morning and early afternoon and consequently increase at night and during weekends. Despite these variations, due to very high maximum values during nights and short period of working time in some schools, radon levels are during working hours, in average15% less than during the entire measurement period. Consequently, estimation of effective doses received from radon and its short-lived progeny-are also decreased by 15% using radon concentrations corrected on working hours. Daily variations of radon concentrations and their influence on corrected radon concentrations during working hours show the need for revision of the protocol for radon measurements in schools and kindergartens introducing two step measurements in those objects with elevated radon levels. This will be proposed as a part of activity within existing national Radon Action Plan.

**Key words**: Radon concentrations, schools, radon measurements, radon detectors, Radon Action Plan.

## MEASUREMENT OF RADON ACTIVITY CONCENTATION IN BUILDING MATERIALS USED IN BOSNIA AND HERCEGOVINA

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**Abstract**: Man is permanently exposed to ionizing radiation due to the presence of naturally occurring radioactive materials (NORM) in the environment. Various technological processes for the processing and use of materials containing natural radionuclides yield materials of increased natural radioactivity (TENORM). The largest contribution to irradiation with natural sources of ionizing radiation is the exposure of the population to radon indoors, which originates from the disintegration of $^{226}$Ra and $^{224}$Ra contained in the soil beneath the buildings and building materials. Depending on the type of building materials, exposure to radon in indoor work and living spaces can be over a thousand times greater than in open space. No valid and comprehensive radiological investigations of building materials have been performed in Bosnia and Herzegovina, which would guarantee their safety and dosimetric accuracy for installation in residential and industrial buildings, highways, as well as their application for other purposes. The quantification of radon levels, which comes from building materials, is a necessary and very important

segment of global protection for the protection of the population from ionizing radiation. This paper presents the first results of a study of the radon activity concentration in building materials used in Bosnia and Herzegovina. Measurements were made using a professional Alpha GUARD system. The mean values of the activity concentration of the exhaled radon of exploratory building materials varied from 10 Bq/m$^3$ to 101 Bq/m$^3$.

**Key words**: Building materials, Radon activity concentration, Radon exhalation rate.

## LONG-TERM MEASUREMENTS OF EQUILIBRIUM EQUIVALENT RADON AND THORON PROGENY CONCENTRATIONS IN REPUBLIC OF SRPSKA DWELLINGS

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**Abstract**: The long-term measurements of radon and thoron equilibrium equivalent concentrations (EERC and EETC) were carried out the first time in Republika Srpska in 25 schools of its capital Banja Luka and in its wider surroundings. After this successful survey the measurements continued using the same type of the LR115 nuclear track detectors, i.e., Direct Radon Progeny Sensors/Direct Thoron Progeny Sensors (DRPS/DTPS), which were deployed in the 36 dwellings nearby the investigated schools. The aim of this study was to give possible scientific contribution considering an explanation of EERC and EETC behavior in indoor environment. The detectors were exposed for one year period at 15–20 cm distance from the walls. The EERC and EETC were found to vary in the range from 6.3 to 14.4 Bqm$^{-3}$ and from 0.10 to 1.1 Bqm$^{-3}$, with geometric mean 9.3 and 0.36, respectively. The same variance of EER and EET concentrations, measured in living and bedrooms of buildings built with different construction

materials as well at different floors, have been obtained. The insignificant correlations between EERC and EETC, shows that these concentrations appeared to be independent in investigated dwellings. The calculated ratio of EETC to EERC ranged from 0.01 to 0.16 with the geometric mean of 0.04.

**Key words**: EERC, EETC, indoor, dwelings.

## ACTIVITIES ON THE LEGAL FRAMEWORK FOR THE PROTECTION AGAINST THE RADON IN BOSNIA AND HERZEGOVINA

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**Abstract**: The legal framework for the protection against the radon in Bosnia and Herzegovina (hereinafter: B&H) is outdated. It covers the works involved in the practices with ionizing sources but does not clearly defines the activities which could involve NORM.

The exiting regular program on monitoring does not include measurements of the radon concentration. Therefore, they are performed on investigation basis or by the order of the third party. Also exiting action limit is on 1000 Bq/m3 of 222Rn in the air as well as the conventional conversion factor for 222Rn is outdated. Even though, the protection against the radon exposure goes beyond the radiation protection field, the building codes, the legal framework on air quality, and many other relevant legislations in B&H do not include the recommendation on protection against radon.

As the B&H is a member of the IAEA and potential candidate for EU membership, activities of the State regulatory agency for radiation and nuclear safety (hereinafter: SRARNS), include activities on improvement and extension of the legal framework for protection against the radon exposure. This means the creation of new Regulation on monitoring of radioactivity in B&H, more precise legislation on activities which could involve NORM, more accurate action limit and state-of-the-art the conventional conversion factor for 222Rn. Also, better coordination between relevant authorities (such as health, building, education, environment, occupational protection, etc.) on this topic is in progress. The most important activity 222Rn matter is the national technical cooperation project with the IAEA TC for the cycle 2020-2021. Through this project B&H will gather first comprehensive measurements of the radon concentration from the whole territory in systematic way. The result of this project will help to create a first versions of the database and map re the radon concentration. The working group, made of the representatives of the relevant institutions, will have to decide which following

steps B&H's government will need to do to enable its citizens healthier living and working environment when it comes to the protection against the radon exposure.

**Key words**: radon, legal framework, legislation, public, occupational, radon concentration, systematic, investigation, project, the conventional conversion factors, NORM, international standards, environment, limit, radionuclide.

## THE RESERACH OF RADON IN THE INSTITUTIONS OF REPUBLIC OF SRPSKA

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**Abstract**: The research of radon in Republic of Srpska is going on since 2011. In 2018 year the research has been done in 82 buildings (mostly in schools and kindergartens) in 15 municipalities of Republic of Srpska. The annual concentration of radon have been measured in 185 indoor rooms. The measuring period was one year, so the seasonal variation could be avoided.

The preliminary results of this research showed us that minimal value of radon concentration was 84 Bq/m$^3$ $^{and}$maximal 4 244 Bq/m$^3$, which is at the same time the higher measured value at all of these locations. It is important to highlight that in six indoor spaces value has been higher than 1 000 Bq/m$^3$, and in 23 buildings was over 300 Bq/m$^3$. In 25% of buildings where more than one floor has been followed, the average concentration of radon was higher on the first floor than on the underground. As it was expected, the variability between the rooms at the same floor was higher on the underground (middle = 22%) than on the first floor (middle CV=14%). Even that most of rooms of 300 Bq/m$^3$ (maximal reference level set by Directive 2013/59/ Euratom) were situated on groundfloor (30 of 32), in one of the buildings the over limit was found only on the first floor. These research will contribute to the improvement of health aspects as well as to preparation of radon atlas for Republic of Srpska.

**Key words**: indoor radon, groundfloor , underground, first floor.

*N O T E S*