АКАДЕМИЈА НАУКА И УМЈЕТНОСТИ
РЕПУБЛИКЕ СРПСКЕ

СРПСКА АКАДЕМИЈА
НАУКА И УМЕТНОСТИ

ALMA MATER EUROPAEA
THE UNIVERSITY FOR LEADERSHIP

ТЕХНИЧЕСКИ УНИВЕРСИТЕТ
ГАБРОВО

United Nations
Educational, Scientific and
Cultural Organization

State Commission of
Bosnia and Herzegovina
for UNESCO

XVIII МЕЂУНАРОДНИ НАУЧНИ СКУП
САВРЕМЕНИ МАТЕРИЈАЛИ 2025

ПРОГРАМ РАДА И
КЊИГА АПСТРАКАТА

XVIII INTERNATIONAL SCIENTIFIC CONFERENCE
CONTEMPORARY MATERIALS 2025

PROGRAMME AND
THE BOOK OF ABSTRACTS

Бања Лука, 11–12. септембар 2025. године
Banja Luka, September 11th to 12th, 2025

XVIII МЕЂУНАРОДНИ НАУЧНИ СКУП

САВРЕМЕНИ МАТЕРИЈАЛИ 2025

ПРОГРАМ РАДА
И
КЊИГА АПСТРАКАТА

XVIII INTERNATIONAL SCIENTIFIC CONFERENCE

CONTEMPORARY MATERIALS 2025

PROGRAMME
AND
THE BOOK OF ABSTRACTS

ОРГАНИЗАТОР НАУЧНОГ СКУПА

Академија наука и умјетности Републике Српске

СУОРГАНИЗАТОРИ

Српска академија наука и уметности
Alma Mater Europaea
Технички универзитет Габрово

ПОКРОВИТЕЉ НАУЧНОГ СКУПА

Министарство за научнотехнолошки развој и високо образовање

ОДРЖАВАЊЕ СКУПА СУ ПОМОГЛИ

УНЕСКО
Хемофарм Стада Група

ОРГАНИЗАЦИОНИ ОДБОР

Академик Драгољуб Мирјанић, предсједник
Академик Рајко Кузмановић
Проф. др Жељко Будимир
Академик Бранко Шкундрић
Академик Нећо Ђурић
Академик Есад Јакуповић
Проф. др Зоран Говедар, дописни члан АНУРС-а
Проф. др Илија Железаров
Проф. др Лудвик Топлак
Проф. др Зоран Рајилић
Проф. др Владо Ђајић

ORGANIZER OF THE CONFERENCE

Academy of Sciences and Arts of the Republic of Srpska

COORGANIZERS

Serbian Academy of Sciences and Arts
Alma Mater Europaea
Technical University of Gabrovo

UNDER THE PATRONAGE OF

Ministry of Scientific and Technological Development and Higher Education

THE SCIENTIFIC CONFERENCE HAS BEEN SUPPORTED BY

UNESCO
Hemofarm Stada Group

ORGANIZING COMMITEE

Academician Dragoljub Mirjanić, president
Academician Rajko Kuzmanović
Prof. Željko Budimir, Ph.D.
Academician Branko Škundrić
Academician Neđo Đurić
Academician Esad Jakupović
Prof. Zoran Govedar, corresponding member of ASARS
Prof. Iliya Zhelezarov, Ph.D.
Prof. Ludvik Toplak, Ph.D.
Prof. Zoran Rajilić, Ph.D.
Prof. Vlado Đajić, Ph.D.

НАУЧНИ ОДБОР

SCIENTIFIC COMMITTEE

Academician Dragoljub Mirjanić (ASARS)
Academician Branko Škundrić (ASARS)
Academician Jovan Šetrajčić (ASARS)
Academician Tomislav Pavlović (Serbia)
Academician Neđo Đurić (ASARS)
Academician Esad Jakupović (ASARS)
Academician Rostislav Andrievski (Russia)
Academician Milan Damnjanović, SANU (Serbia)
Academician Gerald Polack (USA)
Academician Stane Pejovnik (Slovenia)
Prof. Roumiana Tsenkova, Ph.D. (Japan)
Prof. Spomenka Kobe, Ph.D. (Slovenia)
Prof. Yukio Kosugi, Ph.D. (Japan)
Prof. Martin Chaplin, Ph.D. (Great Britain)
Prof. Đuro Koruga, Ph.D. (Serbia)
Prof. Lidija Matija, Ph.D. (Serbia)
Prof. Miomir Pavlović, Ph.D. (East Sarajevo)
Prof. Pero Dugić, Ph.D. (Banja Luka)
Prof. Dubravka Marković, Ph.D. (Serbia)

ЧЕТВРТАК, 11. СЕПТЕМБАР 2025. 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

ПЕТАК, 12. СЕПТЕМБАР 2025. ГОДИНЕ

08.30	Регистрација учесника научног скупа (АНУРС)
09.00	Отварање конференције
09.20	Пленарна предавања
13.00	Постер презентације
14.00	Дискусија
	Затварање конференције

THURSDAY, SEPTEMBER 11, 2025.

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

FRIDAY, SEPTEMBER 12, 2025.

08.30	Registration of the participants in the ASARS
09.00	Opening of the Conference
09.20	Plenary session
13.00	Poster presentations
14.00	Discussion
	Closing ceremony

ПЕТАК, 12. СЕПТЕМБАР 2025. ГОДИНЕ

FRIDAY, SEPTEMBER 12, 2025

СВЕЧАНО ОТВАРАЊЕ СКУПА
OPENING CEREMONY
(09.00– 09.20)

- Скуп ће отворити и учеснике поздравити министар за научнотехнолошки развој и високо образовање, проф. др Жељко Будимир

- Minister of Scientific and Technological Development and Higher Education, prof. Željko Budimir, Ph.D. will give an opening speech

- Поздравно обраћање гостију

- Welcome speeches of the guests

РАДНИ ДИО СКУПА

WORKING SESSION

(09.20 – 12.30)

ПЛЕНАРНА ПРЕДАВАЊА

PLENARY SESSION

(09.20 – 12.30)

9.20 – 9.40 Nenad Filipović
How Artificial Intelligence Can Help in Diagnosis and Therapy of Heart Diseases

9.40 – 10.00 Hristo Hristov
Study of the Rheological Properties of Some Essential Oils Used in Cosmetics and Pharmaceuticals

10.00 – 10.20 Duško Dudić
Changes in the Capacitance of Ecological Saline Solutions Due to Illumination

10.20 – 10.40 Domenico Guida
How Research Institutions and Forward-Thinking Enterprises Can Drive Development Through International Academic-Industrial Collaboration

10.40 – 11.10 Coffee Break

ПЛЕНАРНА ПРЕДАВАЊА

PLENARY SESSION

(09.20 – 12.30)

11.10 – 11.30 Predrag Dašić
Artificial Intelligence: State and Perspectives of Development and Application

11.30 – 11.50 Ivan Stevović
Ecology materials in the context of sustainable strategies and optimal resources management

11.50 – 12.10 Marija Pergal
Advanced Wearable Sensors Based on Mxene and Laser-Induced Graphene on Biocompatible Polymers

12.10 – 12.30 Dean Milanović
Exploring supramolecular diastereomers in Mechanically-Interlocked Carbon Nanotubes

ПОСТЕР ПРЕЗЕНТАЦИЈЕ
POSTER SESSION

(13.00–14.00)

1. Zoran P. Popović, Milan Damnjanović, Ivanka Milošević
   Mapping of Singular Points Associated with Topological Phase Transitions in the Deformation Space of Carbon Nanotubes

2. Suzana Apostolov, Dragana Mekić, Gorana Mrđan, Borko Matijević, Đenđi Vaštag
   Chromatographic Parameters in the Assessment of Lipophilicity and Toxicity of Thiocarbohydrazone Derivatives

3. Milenko Aćimović, Milica Balaban, Ljubica Vasiljević, Stevan Blagojević
   Application of Zeolite 4A in the Regeneration of Sunflower Oil after Thermal Degradation

4. Jelena Vuković, Duško Kostić, Srećko Stopić, Mitar Perušić, Nebojša Vasiljević, Slavko Smiljanić
   Investigation of the Effect of Contact Time on the Efficiency of Phosphate Removal From Aqueous Solutions Using Red Mud Slag

5. Gorana Mrđan, Dragana Mekić, Suzana Apostolov, Đenđi Vaštag, Jelena Lađljrević, Dušan Mijin, Borko Matijević
   Study of the Influence of Solvent and Structure on Intermolecular Interactions of Selected Cinnamic Acid Derivatives

6. Nebojša Vasiljević, Mitar Perušić, Srećko Stopić, Radislav Filipović, Duško Kostić, Jelena Vuković, Slavko Smiljanić
   Potential of Red Mud in Fenton Processes for the Degradation of Organic Pollutants in Water: A Mini Review

7. Njegoš Repić, Nebojša Vasiljević, Vladan Mićić
   Influence of Process Parameters on the Removal of Methylene Blue From Water by Bleaching Earth

8. Nikolina Palangetić, Vladan Mićić, Nebojša Vasiljević
   Comparison of Efficiency of Different Extraction Methods of Bioactive Compounds from Black Currant (Ribes nigrum L.)

9. Njegoš Repić, Nebojša Vasiljević, Vladan Mićić
   Influence of Process Parameters on the Removal of Methylene Blue From Water By Bleaching Earth

10. Jovan Škundrić, Indir Mujanić, Darko Knežević, Saša Laloš, Marko Lazarević, Danilo Đurica
    Evaluation of Linear Regression Model Application for Fault Detection in a Thermal Power Plant

11. Jovan Škundrić, Indir Mujanić, Darko Knežević, Saša Laloš, Marko Lazarević, Danilo Đurica
    Quantifying the Effect of Wind Direction on the Performance of Air-Cooled Condensers

12. Predrag Dašić, Raul Turmanidze, Giorgi Popkhadze
    Micro and Nano Machining of Modern and Smart Products

13. Marina Jokić, Predrag Dašić
    Application of Geogebra in the Teaching of Mathematics: Visualization of the Lotka-Volterra Model

14. Ivan Ristić, Vladan Mićić, Jelena Tanasić, Marija Kostić, Svetlana Pelemiš
    Microwave-Assisted Synthesis and Characterization of Citric Acid-Crosslinked Sodium Alginate Hydrogels: A Comparative Study with Chitosan-Alginate Systems

15. Dijana Mihajlović, Dijana Jelić, Dragana Blagojević
    Distribution, Content, and Origin of Heavy Metals (Cd, Cr, Mn, and Cu) in Soils within the Urban Core (Central Zone) of the City of Banja Luka

16. Dijana Jelić, Dijana Mihajlović, Dragana Blagojević
    Ecological and Health Risk of Lead from Soils in Children's Playgrounds and Green Areas of Banja Luka

17. Draženko Bjelić, Jelena Jovanović, Tijana Đuričić, Borislav N. Malinović
Application of Directive (EU) 2020/2184 on the Quality of Water Intended for Human Consumption

18. Nebojša Vasiljević, Marija Mitrović, Regina Fuchs-Godec, Bojan Gorančić, Milorad Tomić
Statistical Analysis of the Inhibitory Effect of Thyme Extract on Steel Corrosion in A 3% NaCl Solution

19. Zoran Petrović, Aleksandra Radulović, Pero Dugić, Sabina Begić, Dragana Kešelj, Sanja Panić
Investigation Into the Effects of Hydrochloric Acid Activation on Domestic Kaolin

20. Ivica Ristović, Nevena Stojković, Tamara Gavrilović
Application of Digital Twin Technologies in the Mining Industry

21. Slavica Maletić, Ivan Petronijević, Dragana Cerović, Mirjana Milić, Nataša Jović Orsini
Effect of Filler Concentration on the Dielectric Losses of Exfoliated Graphite/Epoxy Nanocomposites

22. Vanja Vojnović, Marko Spasenović, Dana Vasiljević-Radović, Darko Micić, Marija V. Pergal
Effects of Soft Segment Content and Laser-Induced Graphene on the Surface and Thermal Properties of Cross-Linked Polyurethanes

23. Dušica Krunić, Andrijana Bilić, Svetlana Pelemiš, Sanja J. Armaković, Stevan Armaković
Understanding the Interaction of the Drug Carvedidol and –Cooh Functionalized Carbon Nanocone: A DFT Study

24. Dragana Cerović, Ivan Petronijević, Slavica Maletić, Blanka Škipina, Biljana Paćanin, Dragana Grujić, Branka Ružičić
Influence of Lignocellulose-Based Biomass Type and Concentration in Polymer Matrix on Dielectric Properties

25. Stevo K. Jaćimovski, Dane Subošić, Jovan P. Šetrajčić
    Evaluation of Distribution Processes for Some Analytical Air Pollutant Models

26. Jovan P. Šetrajčić, Dušan I. Ilić, Nikola R. Vojnović
    Energy Spectra and Charging States of Nanoscopic Crystal Films

27. Dragoljub Lj. Mirjanić, Jovan P. Šetrajčić, Stevo K. Jaćimovski
    Bose-Einstein Condensation of Exciton Polaritons – Possibility of a Role in the Mechanism of High-Temperature Superconductivity

28. Stevo Jaćimovski, Jelena Lamovec,
    Dušan Ilić, Jovan P. Šetrajčić, Saša Mićin
    Graphene in a Magnetic Field

29. Dušan Ilić, Stevo Jaćimovski,
    Jelena Lamovec, Jovan P. Šetrajčić, Saša Mićin
    Klein Effect in Graphene

30. Ljiljana Tankosić, Svjetlana Sredić
    A Study on the Zeta Potential of Goethite, Quartz and Clay Minerals Depending on pH and the Presence of Inorganic Dispersants

31. Milan Pantić
    Some Analytical Results within the Generalized Ising Model in the Absence of a Magnetic Field

32. Stefani Kulebanova, Marija Stojcheva, Aleksandra Dedinec,
    Jana Prodanova, Aleksandar Dedinec, Ljupcho Kocarev
    Analyzing Media Narratives on Renewable Energy in Macedonia Using Sentiment and Topic Modeling

33. Ljubomir Majdandžić
    The European Green Plan and its implementation in the Republic of Croatia

34. Dragana Kostić, Mitar Perušić, Srećko Stopić, Ljubiša Balanović, Duško Kostić, Vladimir Damjanović, Radislav Filipović, Jelena Vuković, Nebojša Vasiljević
Thermal TGA-DSC Analysis of Red Mud in the Bayer Process

35. Tijana Ljubinac, Nebojša Vasiljević, Vladan Mićić
The Influence of Process Parameters on the Antioxidant Activity of Yarrow

36. Dušan Ješić, Pavel Kovač, Borislav Savković, Branko Štrbac, Branislav Dudić
Application of Scratch Test for Testing Coatings of Some Polymer Materials

37. Pavel Kovač, Borislav Savković, Dušan Ješić, Branislav Dudić
Using Hydrogen to Power Cars

38. Vladimir Lukić, Ljiljana Tanasić
Hydrogen Adsorption Kinetics on Activated Carbon Powders Doped with Nickel and Cobalt

39. Nikola Cekić
Ceramic Material on Architectural Facades

40. Dejan Tubić, Dušica Živanović, Bojana Mirković
Architectural Tradition as a Model for Theuse of Ecological Materiall

41. Aleksandra Ristić, Nebojša Vasiljević, Dario Balaban, Goran Tadić
Development and Validation of a Multicomponent Distillation Model: Combined Application of Matlab and Dwsim Software

42. Ljubica Brenjo, Olivera Klisurić, Jovica Nešić, Niko Radulović, Srđan Bjedov, Aleksandar Oklješa
Synthesis, Crystallographic, and in Silico Studies of a New Azidoxime

43. Vojkan Zorić, Radovan Radovanović, Vesna Petrović
Primary Short Circuit of Copper Installations as a Cause of Fire in Buildings

44. Biljana Pećanin, Slavica Maletić, Ivan Petronijević, Dragana Grujić, Branka Ružičić, Dragana Cerović, Blanka Škipina
Improving Electrode-Sample Contact Using Graphite Coating: A Study of Frequency-Dependent Admittance on Modified Bentonites

45. Fatima Živić, Strahinja Milenković, Nikola Kotorčević, Nenad Grujović
A Review of Key Performance Metrics for Piezoelectric Energy Harvesting

46. Isak Karabegović
Solar Energy as a Driver of Sustainable Development – Technological and Market Cooperation Accelerates the Transition

47. Snežana Topalović, Olivera Živković, Marina Stanojević
Digital Business Models for Smart Factories

48. Radmila Lišanin, Mitar Lutovac
Monitoring of Phenol in Surface and Groundwater of Serbia

49. Bogdan Milićević, Nenad Filipović
Evolutionary Strategies for Electrophysiological Parameters Estimation

50. Tijana Geroski, Lazar Dašić, Anđela Blagojević, Ognjen Pavić, Nenad Filipović
Evaluating the Potential of Vocal Features as Non-Invasive Biomarkers for Heart Failure

51. Darko Divnić, Dragoljub Mirjanić, Esad Jakupović, Zoran Ž. Avramović, Ivana Radonjić Mitić
Lifetime Analysis of Photovoltaic Technologies

52. Milutin Petronijević, Boban Veselić, Senad Huseinbegović, Martin Ćalasan, Ivana Radonjić Mitić
C-HIL Simulation of Home PV System

53. Ivana Radonjić Mitić, Milutin Petronijević, Dragoljub Mirjanić, Darko Divnić, Lana Pantić
Investigation of Partial Shading Influence on Photovoltaic Panels Performances

54. Momir Đurović
Energy Today and Tomorrow

55. Isak Karabegović
Solar Energy as a Driver of the Green Transition: The Path to a Sustainable Future

56. Đorđe Mirjanić, Milesa Srećković, Vladan Mirjanić, Svetlana Pelemiš, Aleksandar Bugarinović, Jovan Ciganović, Milica Vlahović, Aleksandar Kovačević
History (and Prehistory) of Pathogenic Cases of Teeth: Relevance to Medicine, Veterinary Science, and Nutrition of Living Organisms on Earth

57. Milesa Srećković, Aco Janićijević, Александра Janićijević, Zoran Karastojković, Radovan Gospavić, Snežana Stojičić, Vladimir Marković
Technological Aspects and Perspective on Material Modifications Relevant to Contemporary Issues Related to EEE Problems

58. Goran Kolarević, Dragoljub Mirjanić
Radiation Protection in the Design of a Brachytherapy Bunker for Iridium 192

59. Dražan Jaroš, Abel Bregman
Individual Approach for Delivering Correct Prescribed Dose for Electron Irradiation

60. Kremena Ivanova, Todor Yordanova, Desislava Djunakova, Zdenka Stojanovska
Detailed Survey of the Average Annual Radon Concentration in Lovech District, Bulgaria

61. Zoran Ćurguz, Dragoljub Mirjanić
The Influence of Geological Soil Composition on Radon Concentrations in Indoor Urban Areas of the Republic of Srpska

62. Jelena Isailović, Jasna Đerisilo, Miloš Gajić, Sandra Petković Papalazarou, Josip Išek, Miroslav Sofrenić
Presence and Control of Toxic Metal Emissions from a Thermal Power Plant in Serbia

63. Veronika Majová
Structural Effects of Deep Eutectic Solvents on Cellulosic Fibers: A Path Towards Sustainable Biomaterials

64. Dušica Živanović, Bojana Mirković, Dejan Tubić
Architectural Tradition as a Model for the Use of Ecological Materials

65. Marija Nikolić
Environment and Materials for Renewable Energy Sources

66. Jelena Dabić, Jelena Vuković, Nebojša Vasiljević, Slavko Smiljanić
Analysis of the Efficiency of the Flue Gas Desulfurization Process at the Ugljevik Mine and Thermal Power Plant

67. Mirjana M. Radanović, Marijana S. Regojević, Ljiljana S. Vojinović-Ješić, Marko V. Rodić, Berta Barta Holó
Unlocking the Functional Potential of Bis(Phenylhydrazones): Synthesis and Structural Elucidation of the First Fe(II) Complex with a 2,6-Diacetylpyridine-Based Ligand

68. Sanja Stojanović, Mike Barbeck, Stevo Najman
In Vitro Macrophages' Response to the Collagen Membranes of the Same Origin Produced by Different Manufacturing Processes

69. Sanja Stojanović, Danica Biberović, Milena Radenković Stošić, Biljana Božić Nedeljković, Jelena M. Živković, Mike Barbeck, Stevo Najman
Modulation of Macrophages' Response to the Collagen Membranes by Lipopolysaccharide

70. Stojko Vidović
Role of SIRT1 rs7069102 C>G Polymorphism in Acute Myocardial Infarction Risk: Evidence from a Republic of Srpska Cohort

71. Nada Čitaković, Marin Tadić, Ivana Janković
Magnetic Properties of Hematite Nanoparticles Synthesized by Solvothermal Synthesis Method

72. Nataša Trtić, Radmila Arbutina, Valentina Veselinović, Tijana Adamović, Željka Kojić, Saša Marin, Irena Kuzmanović-Radman, Adriana Arbutina, Olivera Dolić, Aleksandra Đeri
Oral Biofilm: Biological Material Causing the Leading Diseases of The Oral Cavity

73. Nataša Knežević, Marija Obradović, Olivera Dolić, Željka Kojić, Valentina Veselinović, Ognjenka Janković, Vladan Mirjanić, Vanja Krčić
The Influence of Oral Hygiene and Dietary Habits on the Success of the Bleaching of Endodontically Treated Teeth

74. Darko Manjenčić, Zorana Milosavljević, Mladen Nikolić, Predrag Pravdić, Milena Deljanin, Anja Manjenčić, Nevena Vukić, Vladan Mićić
Application and Importance of Masterbatch in Silicone Elastomers

75. Josipa Karij Trivunović, Ljubica Škrbić, Vladan Mirjanić
Dental Identification of Human Victims

76. Josipa Karij Trivunović, Ljubica Škrbić, Vladan Mirjanić
Bone Regeneration of Jaw Bones

77. Tijana Adamović, Ognjenka Janković, Valentina Veselinović, Nataša Trtić, Verica Pavlić, Jovana Lovrić, Jana Ilić
Smokeless Tobacco and Oral Health: Risks Associated with Snus and Nicotine Pouches

78. Anđela Gavran, Marija V. Pergal, Teodora Vićentić, Igor Pašti, Danica Bajuk-Bogdanović, Marko Spasenović
Laser-Induced Graphene on Pdms with Glycol Compounds as a Potential Wearable Sensor

79. Ognjenka Janković, Helena Golubović, Tijana Adamovic, Vladan Mirjanić
A Comparative Histological Study of Calcium-Silicate Cements for Direct Pulp Capping in Wistar Rats

80. Milica Tufegdžić, Predrag Dašić, Nevena Tufegdžić
Nanomaterials in Modern Dentistry: Applications, Benefits and Future Perspectives

81. Ljubiša Petrov
Toxicity of Nanodimensional Materials
as a Factor of Usability in Biomedical Engineering

82. Jelena Marić, Zlatko Maksimović
Ultrasound Contrast Agents: From Microbubbles to Molecular Imaging

83. Srđan Vuković, Danijela Rajić, Svetlana Pelemiš
Characteristic Nanoparticles as Drug Carriers

84. Božidarka Arsenović, Stanko Spasojević
Aspects of the Development and Use of Hydrogen
as an Alternative Propulsion Fuel in the Aviation Industry

85. Dane Marčeta, Anđela Jokić, Vladimir Petković, Gordana Globočki-Lakić
Utilization and Recovery Analysis of Oak Logs in a Modern Wood Processing Plant

86. Dijana Đurić, Neđo Đurić
Bioclimatic Analysis of the City of Bijeljina, for the Period 2019 – 2023

87. Jelena Zarić Kovačević, David Mitrinović, Nela Vujović, Marija Perović
Influence of Local Factors on the Deposition of Pleistocene Alluvial Sedimentsin the Lower Sava River Valley

88. Goran Trbić, Marko Ivanišević, Zoran Vujković,
Tatjana Popov, Slobodan Gnjato
Analysis of the Urban Heat Island of the City of Trebinje
Using Remote Sensing Products

89. Vladimir Lukić
Theoretical Principles of Looking at Problems in the Construction of Wind Farms Serbia

90. Darko Manjenčić, Zorana Milosavljević, Mladen Nikolić, Predrag Pravdić,
Milena Deljanin, Anja Manjenčić, Nevena Vukić, Vladan Mićić
Synthesis and Characterisation of Biodegradable Materials Based on Silicone Polymers

91. Darko Manjenčić, Zorana Milosavljević, Mladen Nikolić, Predrag Pravdić, Milena Deljanin, Bojan Slavić, Vladan Mićić
Air Pollution and Climate Change as Major Challenges to Environmental Sustainability

92. Predrag Pravdić, Violeta Dorđević
Eco-Materials and Eco-Technologies in Mechanical Engineering

93. Jelena Erić Obućina, Marina Karić
Simulation of Hydraulic System Components Using Matlab-Simulink Software

94. Sonja Ketin, Sanja Jevtić, Rade Vasiljević, Rade Biočanin, Marko Andrejić
Application of Remote Sensing for Assessing Surface Water Quality

95. Predrag Pravdić, Violeta Dorđević
Biomaterials in Modern Mechanical Engineering Industry

96. Predrag Pravdić, Violeta Dorđević
Ecologically Sustainable Materials – Their Applications and Environmental Impact

97. Predrag Dašić, Dragoljub Mirjanić, Esad Jakupović
Application of the Method of Generated-Content Using Artificial Intelligence (AIGC)

98. Rade Biočanin
Artificial Intelligence as a Unity of Good and Evil

99. Rade Biočanin, Vanja Gajić
Selection of New Materials and Procedures in the Treatment of Contaminated Land and Water Bodies

100. Borivoje R. Mirosavić
National Economies Between Liberalization and Intervention, in the Economy and Ecology, with Reference to the Republic of Serbia

ABSTRACTS

PLENARY PRESENTATIONS

HOW ARTIFICIAL INTELLIGENCE CAN HELP IN DIAGNOSIS AND THERAPY OF HEART DISEASES

Nenad Filipović[1,2]

[1]*Faculty of Engineering, University of Kragujevac, Kragujevac, Serbia*
[2]*BIOIRC, Bioengineering Research and Development Center, Kragujevac, Serbia*

Abstract: In silico clinical trials are set to transform medicine by enabling virtual testing and simulation, which streamline the development of medical devices and pharmaceuticals while reducing costs and duration. The SILICOFCM platform offers a innovative, multi-modular approach designed to optimize overall heart function and monitor the effectiveness of pharmacological treatments, aiming to decrease dependence on animal and human trials. It employs an integrated, multidisciplinary, and multiscale methodology to analyze patient-specific data, allowing the creation of personalized models that track disease progression. By combining data from various sources and scales with advanced computational techniques, SILICOFCM maps the flow of information from genetic mutations to organ dysfunction. The platform specifically targets hypertrophic (HCM) and dilated (DCM) cardiomyopathy through coupled macro- and micro-scale simulations utilizing finite element modeling of fluid-structure interaction (FSI) and molecular interactions within cardiac cells. This enables the simulation of left ventricular mechanics and the assessment of how different drugs influence electro-mechanical processes, including changes in calcium (Ca2+) handling and kinetic parameters. The overarching goal of the STRATIFYHF project is to develop and clinically validate an innovative AI-driven Decision Support System (DSS) to predict heart failure risk, support early diagnosis, and forecast disease progression—offering a paradigm shift in heart failure management across primary and secondary care. The DSS integrates patient-centered data from existing and emerging technologies, a digital patient library, and AI-based algorithms combined with computational modeling. Through workflows dedicated to improving heart performance and evaluating pharmacological effects, SILICOFCM and STRATIFYHF are paving new pathways to accelerate drug development and clinical testing.

Keywords: hear failure, insilico clinical trials, data mining, cardiovascular disease

Acknowledgement: This paper is supported by the projects that have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement *101080905* (STRATIFYHF project). This paper reflects only the author's view. The Commission is not responsible for any use that may be made of the information it contains.

STUDY OF THE RHEOLOGICAL PROPERTIES OF SOME ESSENTIAL OILS USED IN COSMETICS AND PHARMACEUTICALS

Hristo Hristov, Georgi Iliev and Plamen Bonev

dept. Power Engineering, Technical University of Gabrovo,
Center of competence "Smart mechatronic, eco-and energy-saving systems and technologies", Gabrovo, Bulgaria

Abstract: The processing of various liquids used in industrial production is accompanied by complex physicochemical, biological and mechanical processes, the detailed study of which allows the organization of objective control and management of the technological cycle of production. The rheological characteristics of cosmetics and pharmaceuticals are important for production, packaging, filling, and storage. The course of these processes, the design parameters of the working bodies of the relevant machines and devices, as well as the quality of the products obtained to a significant extent depend on the rheological properties of the processed materials. The main processes in which the rheological properties of the processed materials should be most fully taken into account are forming, mixing and transportation. When studying the indicated processes, a relationship is established between the rheological characteristics of the material and the technological parameters of its processing. One of the most significant properties of continuous media is viscosity. The article considers the main methods of measuring the viscosity of liquids with a rotational viscometer. This article presents results of a study of the rheological properties of essential oils /rose oil, lavender oil and peppermint oil/. *Thermo Scientific HAAKE MARS iQ Rheometer Air-bearing* was used to determine the dependences of viscosity change on temperature. Currently, in some reference materials, approximate values of the dynamic viscosity of essential oils can be found, but the exact numerical values at different temperatures are missing. The results obtained have practical value in technological processes and the design of machines and mechanisms that use essential oils.

Keywords: viscosity measurement, temperature, rheological properties, essential oils.

CHANGES IN THE CAPACITANCE OF ECOLOGICAL SALINE SOLUTIONS DUE TO ILLUMINATION

Duško Dudić[1,2], Richard O. Ocaya[3]

[1]*Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*

[2]*Department of Chemistry, University of the Free State, Phuthaditjhaba, South Africa*

[3]*Department of Physics, University of the Free State, Phuthaditjhaba, South Africa*

Abstract: Environmentally friendly methods of storing electrical energy are in the focus of industry and a large number of researchers. Electrolytic batteries, in which energy is stored in the electrolyte, show a pronounced degree of self-discharge compared to electrode-dependent batteries, which limits their application. In addition to electronics, electrolytic batteries are used in industry where there is a need for short-term intensive discharges and processes in which the interval between charge and discharge is not too large. Electrolytic batteries (supercapacitors) are often added as support for lithium batteries (urban transport vehicles). This presentation presents part of the research that goes towards discovering new and inexpensive environmentally friendly electrolytes that could replace the toxic electrolytes that are currently in use. The capacitive properties of salt aqueous solutions in a low-intensity electric field were examined, as well as the effect of illuminating the solution on the aforementioned properties.

Keywords: energy storage; electrolyte; electricity; ecology.

HOW RESEARCH INSTITUTIONS AND FORWARD-THINKING ENTERPRISES CAN DRIVE DEVELOPMENT THROUGH INTERNATIONAL ACADEMIC-INDUSTRIAL COLLABORATION

Domenico Guida[1], Dragoljub Mirjanić[2]

[1]*University of Salerno,*
Department of Industrial Engineering in Fisciano, Fisciano, Italy

[2]*Academy of Sciences and Arts of the Republic of Srpska, Banja Luka,*
Republic of Srpska, Bosnia and Herzegovina,

Abstract: This presentation is intended as a practical boost to academic–industrial collaboration between Italy and the Republic of Srpska, with the Academy of Sciences and Arts of the Republic of Srpska and the University of Salerno acting as lead partners in strategic alliances involving universities, research centers, and forward-thinking enterprises. The goal is to identify tangible opportunities for cooperation in sustainable energy, applied artificial intelligence, environmental protection, advanced manufacturing technologies, space applications, and territorial monitoring. Key opportunities include: the development of high-efficiency, low-impact energy systems; AI-driven solutions for environmental monitoring and industrial process optimization; additive manufacturing and advanced materials for aerospace; and integrated platforms for Earth observation and risk management. The initiative also highlights funding prospects through EU programs (Horizon Europe, Interreg, LIFE, Digital Europe) and Italy-Bosnia bilateral funds, as well as the fact that numerous Italian companies are actively seeking skilled professionals across all these sectors. These partnerships can further create remote work opportunities for Bosnian and Italian talent in software development, data analytics, and complex system management. The aim is to attract investment, address industry skill shortages, and strengthen strategic sectors, delivering measurable economic and social benefits for both countries.

Keywords: collaboration opportunities, Bosnia-Italy partnerships, energy, artificial intelligence, environment, manufacturing, space, EU funding, skilled workforce, remote work.

ARTIFICIAL INTELLIGENCE: STATE AND PERSPECTIVES OF DEVELOPMENT AND APPLICATION

Predrag Dašić

Engineering Academy of Serbia (IAS), Belgrade Serbia

Abstract: Artificial intelligence (AI) is a scientific discipline, or a multidisciplinary field that is most often considered a branch of computer science, dedicated to the models and performance of systems for functions related to human intelligence, such as reasoning and learning. A number of different definitions can be found for artificial intelligence (AI). This paper mentions another one: The ability of functional units to perform those functions that are usually associated with human intelligence, or. that people do with intelligence, such as reasoning and learning. The basic terms of artificial intelligence are defined by international standards ISO/IEC 2382-28:1995, ISO/IEC 2382-29:1999 and ISO/IEC 2382-31:1997.

The new concept of artificial intelligence is called Generative Artificial Intelligence (GenAI or GAI), which is capable of generating text, images, code, simulations, audio, videos or other data, to create new content, using generative models, often in response to queries. Generative AI models learn the patterns and structure of their input training data and then generate new data that has similar characteristics. Recent breakthroughs in this area have the potential to drastically change the way we approach content creation.

Improvements in transformer-based deep neural networks, especially Large Language Models (LLM), enabled the boom in generative AI systems in the early 2020s. This includes chatbots such as ChatGPT, Copilot, Gemini, DeepSeek, GPT, LLaMA, etc., AI text-to-image image generation systems such as Stable Diffusion, Midjourney, and DALL-E, and AI text-to-video generators such as Sora.

Also, in the new real world, everything is becoming digital, smart and virtual with a large admixture of different artificial intelligence (AI) technologies. And the future is predicted to be predominantly virtual, with artificial intelligence (AI) widely applied in all areas of human activity.

The combination of all the mentioned examples of developed models and GenAI systems in cooperation with Virtual Reality (VR) have, in the last 5 years, found great application in all areas of human activity. And their condition and perspectives of development and application are the goal of this paper.

Keywords: Artificial Intelligence (AI), software, Large Language Models (LLM), Virtual Reality (VR), knowledge.

ECOLOGY MATERIALS IN THE CONTEXT OF SUSTAINABLE STRATEGIES AND OPTIMAL RESOURCES MANAGEMENT

Ivan Stevović

Innovation Center of the Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Republic of Serbia

Abstract: The integration of ecological materials into sustainable strategies and resources management represents a fundamental approach towards environmental preservation and efficient utilization of natural and processed resources on the Globe. Ecological materials, characterized by minimal environmental footprint, recyclability, and renewability, enable implementation of circular economy principles in construction, industry, and everyday life. Their use contributes to reducing pollution, lowering energy consumption in production processes, and extending the lifecycle of products through reuse and recycling. This paper analyzes key aspects of the reuse of materials, with a focus on management strategies that ensure sustainable ecology material flows within economic systems. In particular, the role of management in designing policies that promote the transition from linear to circular models is emphasized. Sustainable strategies must include life cycle assessment (LCA) and eco-design to minimize negative impacts on ecosystems while maintaining economic competitiveness. Moreover, the selection of ecological materials affects the quality of life and health of the population, aligning environmental and social objectives with economic development goals. The results of the analysis conducted in this paper indicates that successful integration of ecological materials into resources management requires cooperation of researchers, producers, consumers, and policymakers, as well as education that raises awareness about environmental protection and responsible material use. Implementing these approaches contributes to building a resilient society based on sustainability, circular economy, and optimal resources management.

Keywords: environmentally friendly materials, reuse of materials, circular economy, sustainability, management.

ADVANCED WEARABLE SENSORS BASED ON MXENE AND LASER-INDUCED GRAPHENE ON BIOCOMPATIBLE POLYMERS

Marija Pergal,[1] Vanja Vojnović,[1] Ivan Pešić,[1] Milena Rašljić Rafajilović,[1] Stefan Ilić,[1] Gordana Tovilović-Kovačević,[2] Marko Spasenović[1]

[1]*Center for Microelectronic Technologies, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Serbia*

[2]*Institute for Biological Research "Siniša Stanković", University of Belgrade, Belgrade, Serbia*

Abstract: Flexible, biocompatible, and highly sensitive piezoresistive sensors based on MXene ($Ti_3C_2T_x$) and laser-induced graphene (LIG) represent an essential advancement for wearable electronics in biomedical applications. Polyurethanes (PUs) based on poly(dimethylsiloxane) (PDMS) segments have gained significant attention as substrates for sensors due to their excellent biocompatibility, superior elasticity, mechanical strength, and chemical stability. This lecture discusses innovative strategies in developing flexible strain and pulse sensors using MXene and LIG deposited on biocompatible PU substrates. PU-based composites were prepared via a two-step polyaddition reaction, tailoring their mechanical properties through controlled soft-to-hard segment ratios. MXene layers were successfully deposited onto PU substrates via spin coating, producing flexible strain sensors capable of reliable and reproducible responses to mechanical deformation. In addition, LIG synthesized using direct laser induction on polyimide and subsequent transfer onto optimized PU substrates with 50 wt.% soft segment (PU-50) demonstrated superior pulse-sensing capabilities and improved adhesion. Comprehensive characterization employing cytotoxicity assays, mechanical tests, scanning electron microscopy (SEM), infrared spectroscopy (FTIR), Raman spectroscopy, and electrical measurements confirmed the good biocompatibility of the substrate, mechanical and structural integrity, functional properties, and high sensitivity of the fabricated sensors. Cytotoxicity assays, employing endothelial cell cultures, verified the biocompatibility of the sensor materials, highlighting their potential in medical and wearable applications. This lecture integrates key findings from recent studies, emphasizing the synthesis, characterization, and performance evaluation of flexible strain and pulse rate sensors using advanced conductive MXene and LIG on biocompatible polymer substrates.

Keywords: biocompatible polymers, nanomaterials, MXene, LIG, advanced materials, wearable pulse rate sensors, strain sensors

EXPLORING SUPRAMOLECULAR DIASTEREOMERS IN MECHANICALLY-INTERLOCKED CARBON NANOTUBES

Dean Milanović, Sylwia Parzyszek, David Jiménez Merino, Alejandro López-Moreno, Emilio Manuel Pérez Álvarez

IMDEA Nanociencia, Spain

Abstract: Single-walled carbon nanotubes (SWCNTs) are interesting structures that have been studied for over three decades. Transforming them into mechanically interlocked carbon nanotubes (MINTs) by adding a macrocycle around them, is an interesting way of functionalizing them without affecting the structure of the nanotubes [1]. In recent years different synthetic strategies towards MINTs and their potential advantages for applications have been found [2], particularly in polymer reinforcement [3] and catalysis [4]. However, MINTs featuring chiral macrocycles have not been described to date. Such species would open to the possibility of studying the interaction between a chiral macrocycle and a chiral nanotube in MINTs.

In this communication, we show some examples of chiral U-shapes which we used to prepare MINTs with chiral macrocycles to study the diastereomers we obtained. In addition, we employed Aqueous Two-Phase Extraction (ATPE) to isolate the enantiomers of (6,5) SWCNTs [5] [6], and subsequently applied the same process to the corresponding MINTs. The obtained species were characterized by UV/VIS, PLE, CD, Raman spectroscopy and thermogravimetric analysis. Potential future applications and research might be focused on the application of the described reaction for enantiomeric enrichment or separation of SWCNTs.

Keywords: Carbon nanotubes, Mechanical bond, MINTs, ATPE, Chirality.

POSTER PRESENTATIONS

MAPPING OF SINGULAR POINTS ASSOCIATED WITH TOPOLOGICAL PHASE TRANSITIONS IN THE DEFORMATION SPACE OF CARBON NANOTUBES

Zoran P. Popović[1], Milan Damnjanović[1,2], Ivanka Milošević[1]

[1]*NanoLab- Faculty of Physics, University of Belgrade, Belgrade, Serbia*

[2]*Serbian Academy of Sciences and Arts, Belgrade, Serbia;*

Abstract: Homogeneous elastic deformations of single-walled carbon nanotubes (SWCNTs)—including torsion, axial, and circumferential strain—are experimentally accessible and preserve the symmetry of chiral nanotubes. Such deformations continuously modify atomic positions, causing the electronic band structure to evolve. Even slight perturbations can induce a transition from quasi-metallic to semiconducting behaviour.

Hamiltonian reparameterization under homogeneous deformation produces gap closing and reopening in the non-local inverse space, altering the SWCNT's topological parameters. The sequence of gap closures in adiabatic processes is governed by the order of the principal axis and the corresponding band dispersions. Singular points, where bands with with $\tilde{m} = 0$ or $n/2$ (for even n) re-open, can close the gap at the Γ or Π points of the Brillouin zone. Within the deformation space, specific pathways are energetically favored for reaching and crossing these singular points changing topological phase of system.

Keywords: carbon nanotube; symmetry; topological phase transition; deformations.

CHROMATOGRAPHIC PARAMETERS IN THE ASSESSMENT OF LIPOPHILICITY AND TOXICITY OF THIOCARBOHYDRAZONE DERIVATIVES

Suzana Apostolov, Dragana Mekić, Gorana Mrđan,
Borko Matijević, Đenđi Vashtag

University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia

Abstract: In recent years, the number of studies focused on the design and synthesis of compounds with biological and pharmacological potential has increased significantly. Special attention has been given to molecules with antitumor activity, including thiosemicarbazones and their homologues, thiocarbohydrazones. Since drug development is a complex, lengthy, and expensive process, its optimization in early stages often relies on the application of Quantitative Structure–Activity Relationship (QSAR) approach. By selecting appropriate molecular descriptors, it is possible to quantify the impact of structural modifications on compound's biological activity prior to synthesis, thus reducing the need for extensive experimental work. Lipophilicity, a key QSAR descriptor, was determined for thiocarbohydrazones by using a hybrid approach – computationally, through appropriate software tools (log$P$ as a standard measure of lipophilicity), and experimentally, by reversed-phase thin-layer chromatography (chromatographic parameters R_M^0 and m). The results indicated that the nature of the substituent had a greater effect on the chromatographic behavior of thiocarbohydrazones than the applied organic modifier. The correlation between chromatographically and computationally determined lipophilicity values, as well as the acute toxicity parameters (EC_{50}), was assessed by linear regression analysis. The obtained models showed satisfactory predictive performance.

Keywords: thiocarbohydrazones, chromatography, lipophilicity, toxicity.

APPLICATION OF ZEOLITE 4A IN THE REGENERATION OF SUNFLOWER OIL AFTER THERMAL DEGRADATION

Milenko Aćimović[1], Milica Balaban[2],
Ljubica Vasiljević[1], Stevan Blagojević[3]

[1]Faculty of Technology, University of East Sarajevo, Republika Srpska, B&H

[2]Faculty of Science and Mathematics, University of Banja Luka, Republika Srpska, B&H

[3]Institute of General and Physical Chemistry, Serbia

Abstract: Edible oils, particularly sunflower oil, play an important role in human nutrition due to their high content of essential fatty acids and fat-soluble vitamins. However, their susceptibility to oxidation and thermal degradation during cooking and repeated heating leads to a reduction in nutritional value and the formation of undesirable degradation products. In order to preserve the quality of used oil, the possibility of regenerating sunflower oil using zeolite 4A, known for its pronounced adsorption properties, was investigated. The results showed that heating the oil caused an increase in acid value, a rise in moisture and volatile matter content, as well as a decrease in saponification value, indicating progressive oil degradation. The application of zeolite 4A as an adsorbent for oil regeneration resulted in a significant improvement of oil quality, reflected in the reduction of acid value and moisture content, while the saponification value remained more stable compared to untreated oil. These findings confirm the high efficiency of zeolite 4A in removing degradation products and highlight its potential for use in the regeneration of edible oils. It is concluded that zeolite 4A represents an effective and readily available adsorbent that can contribute to extending the shelf life of oils, preserving their sensory and nutritional properties, and improving food safety. The obtained results provide a basis for further research in the field of edible oil regeneration using zeolites and other adsorbents.

Keywords: sunflower oil, thermal degradation, zeollite 4A, adsorption, regeneration.

INVESTIGATION OF THE EFFECT OF CONTACT TIME ON THE EFFICIENCY OF PHOSPHATE REMOVAL FROM AQUEOUS SOLUTIONS USING RED MUD SLAG

Jelena Vuković[1], Duško Kostić[1,2], Srećko Stopić[2], Mitar Perušić[1], Nebojša Vasiljević[1], Slavko Smiljanić[1]

[1]University of East Sarajevo, Faculty of Technology Zvornik, Zvornik, Republic of Srpska, Bosnia and Herzegovina

[2]RWTH Aachen University, Faculty of Georesources and Materials Engineering, Institute for Metallurgy and Metal Recycling, Aachen, Germany

Abstract: This paper presents the results of experiments investigating the use of red mud slag (RMS), obtained by carbothermal reduction of red mud, for phosphate sorption from aqueous solutions. Preliminary tests indicated that RMS has promising potential for phosphate removal. For the contact time experiments the fine fraction of the red mud slag (FRMS) was used, which is obtained by sieving the raw RMS, because this FRMS fraction showed the best results in preliminary assessment of the use of this material. The experiment was conducted on ten different contact times, from 1 hour to 54 hours, with an initial phosphate concentration of 9.698 mg/ L, sorbent dosage of 5 g/L and pH~3. According to the results, a fast change in efficiency was noted during the first three hours, the efficiency increased from ≈ 48% (after 1 hour) to ≈ 71% (after 3 hours), than slowly increased from ≈ 71% to ≈ 97% in the next 48 hours, when equilibrium was achieved. The maximum sorption capacity was 1.8894 mg/g, achieved at equilibrium time. The results indicate that FRMS has the potential to remove phosphate ions from aqueous solutions and that the contact time had a significant effect on the sorption efficiency at the beginning of the process (in the first 3h). In order to determine the kinetics of the process, it is necessary to carry out more detailed research.

Keywords: the red mud; carbothermal reduction; phosphate removal; the red mud slag; contact time; sorption efficiency.

STUDY OF THE INFLUENCE OF SOLVENT AND STRUCTURE ON INTERMOLECULAR INTERACTIONS OF SELECTED CINNAMIC ACID DERIVATIVES

Gorana Mrđan[1], Dragana Mekić[1], Suzana Apostolov[1], Đenđi Vashtag[1], Jelena Lađljrević[2], Dušan Mijin[2], Borko Matijević[1]

[1]Faculty of Science, Department of Chemistry, Biochemistry and Environmental Protection, University of Novi Sad, Novi Sad, Serbia

[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

Abstract: Today's scientists synthesize a large number of new compounds in order to investigate their potential biological activity and to find their practical applications. Testing the potential activity of new derivatives is always preceded by their complete physicochemical characterization. Of great importance in this area are the studies on the type, intensity and dominance of interactions present between the dissolved compound and the surrounding medium. In this work, using the method of multiple linear correlation of solvatochromic energies, intermolecular interactions of eleven cinnamic acid derivatives in selected solvents were examined. The influence of the solvent was analyzed using two solvatochromic models Kamlet-Taft's and Catalan's. In addition to the effect of the solvent, the influence of the structure of the tested compounds on the interactions obtained was also analyzed. This phenomenon was investigated by linear correlation of free energies, using the Hammett equation.

Keywords: biological activity, cinnamic acid derivatives, LFER, LSER, intermolecular interactions

POTENTIAL OF RED MUD IN FENTON PROCESSES FOR THE DEGRADATION OF ORGANIC POLLUTANTS IN WATER: A MINI REVIEW

Nebojša Vasiljević[1,2], Mitar Perušić[1], Srećko Stopić[3], Radislav Filipović[4], Duško Kostić[1], Jelena Vuković[1], Slavko Smiljanić[1]

[1]University of East Sarajevo, Faculty of Technology Zvornik, Zvornik, Republic of Srpska, B&H

[2]University of Novi Sad, Faculty of Technology Novi Sad, Novi Sad, Serbia,

[3]RWTH Aachen University, IME Process Metallurgy and Metal Recycling, Aachen, Germany

[4]"Nova Alumina" d.o.o., Zvornik, Republic of Srpska, B&H

Abstract: Fenton processes, in which hydrogen peroxide in the presence of divalent iron ion generates hydroxyl radicals ($^{\bullet}OH$), are widely used for the degradation of organic pollutants (phenols, antibiotics, dyes). In this review, red mud is analyzed as a cheap source of iron ions in Fenton processes. Raw red mud can be used without additional modifications, but to increase the catalytic efficiency, its modification is required, which includes chemical reduction, carbothermal treatment or doping with metals. Of particular importance are the photo-Fenton and electro-Fenton processes, in which red mud doped with Co, Sn or Ce, or in combination with reduced graphene oxide and biochar, allow the generation of not only hydroxyl radicals ($^{\bullet}OH$) but also singlet oxygen ($^{1}O_2$) and superoxide radicals ($^{\bullet}O_2^{-}$), achieving ≥99% pollutant removal. At the same time, the synthesized catalysts showed high stability and reusability. Based on a comparative analysis of more than 30 studies, it is concluded that red mud represents a cheap source of iron ions for heterogeneous Fenton processes, with significant potential for industrial application.

Keywords: Fenton process, hydroxyl radicals, organic pollutants, red mud.

INFLUENCE OF PROCESS PARAMETERS ON THE REMOVAL OF METHYLENE BLUE FROM WATER BY BLEACHING EARTH

Njegoš Repić, Nebojša Vasiljević, Vladan Mićić

University of East Sarajevo, Faculty of Tecnology Zvornik, Zvornik, Republic of Srpska, B&H

Abstract: In this work, the effect of temperature (15 – 45°C) and concentration of bleaching earth as an adsorbent (0.15 – 0.45 g/L) on the removal efficiency of methylene blue from water was investigated. The initial concentration of the dye was in the range of 10 – 20 mg/L, and the test was monitored at 9 given times, 2, 5, 9, 14, 20, 28, 39, 54 and 75 minutes. The greatest influence on the removal of the dye had the concentration of the adsorbent, because its increase increases the number of active sites. Thus, a removal efficiency of 75% is achieved after 75 minutes at 0.15 g/L of the adsorbent, while at 0.30 g/L the same effect is achieved after only 2 minutes. Increasing the temperature from 15 °C to 30 °C resulted in an increase in the efficiency due to an increase in the diffusion rate of methylene blue molecules, while a further increase to 45 °C did not significantly increase the efficiency because adsorption equilibrium was reached. Finally, it was observed that higher efficiency is achieved if the initial dye concentration is lower, because a high initial dye concentration leads to rapid saturation of the active sites.

Keywords: adsorption, bleaching earth, methylene blue, removal efficiency.

COMPARISON OF EFFICIENCY OF DIFFERENT EXTRACTION METHODS OF BIOACTIVE COMPOUNDS FROM BLACK CURRANT (*Ribes nigrum L.*)

Nikolina Palangetić[1], Vladan Mićić[1], Nebojša Vasiljević[1]

[1]*University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, B&H*

Abstract: This study investigated the efficiency of different extraction methods for isolating bioactive compounds from black currant (Ribes nigrum L.), with the aim of optimizing extraction conditions for obtaining phenolic-, flavonoid-, anthocyanin- and chlorophyll-rich extracts. Three extraction techniques were applied: maceration, ultrasound-assisted extraction, and shaker-assisted extraction. A total of 58 samples were extracted using ethanol and acetone at concentrations of 20%, 50%, and 80%, and at various solid-to-liquid ratios (1:15, 1:20, 1:25, 1:30). Extraction time was fixed at 30 minutes for both ultrasound and maceration, while shaker-assisted extraction was carried out for 30, 60, 90, 120, 150, 180, and 240 minutes. Quantitative determination of the compounds was conducted using spectrophotometric methods: Folin-Ciocalteu for total phenolics, aluminum chloride colorimetric assay for flavonoids, pH differential method for anthocyanins, and absorbance at specific wavelengths for chlorophylls.

The results showed that the extraction method had a significant effect on the yield of bioactive compounds. Ultrasound-assisted extraction with 50% ethanol and a 1:25 solid-to-liquid ratio resulted in the highest concentrations of phenolics and flavonoids. The highest anthocyanin content was achieved using the shaker extraction method with 50% ethanol, while acetone was more effective for chlorophyll extraction. These findings highlight the importance of optimizing extraction parameters according to the target compound group and intended application of the extract.

Keywords: anthocyanins, black currant, bioactive compounds, extraction methods, phenolics, ultrasound-assisted extraction.

INFLUENCE OF PROCESS PARAMETERS ON THE REMOVAL OF METHYLENE BLUE FROM WATER BY BLEACHING EARTH

Njegoš Repić, Nebojša Vasiljević, Vladan Mićić

University of East Sarajevo, Faculty of Tecnology Zvornik, Zvornik, Republic of Srpska, B&H

Abstract: In this work, the effect of temperature (15 – 45°C) and concentration of bleaching earth as an adsorbent (0.15 – 0.45 g/L) on the removal efficiency of methylene blue from water was investigated. The initial concentration of the dye was in the range of 10 – 20 mg/L, and the test was monitored at 9 given times, 2, 5, 9, 14, 20, 28, 39, 54 and 75 minutes. The greatest influence on the removal of the dye had the concentration of the adsorbent, because its increase increases the number of active sites. Thus, a removal efficiency of 75% is achieved after 75 minutes at 0.15 g/L of the adsorbent, while at 0.30 g/L the same effect is achieved after only 2 minutes. Increasing the temperature from 15 °C to 30 °C resulted in an increase in the efficiency due to an increase in the diffusion rate of methylene blue molecules, while a further increase to 45 °C did not significantly increase the efficiency because adsorption equilibrium was reached. Finally, it was observed that higher efficiency is achieved if the initial dye concentration is lower, because a high initial dye concentration leads to rapid saturation of the active sites.

Keywords: adsorption, bleaching earth, methylene blue, removal efficiency.

EVALUATION OF LINEAR REGRESSION MODEL APPLICATION FOR FAULT DETECTION IN A THERMAL POWER PLANT

Jovan Škundrić[1], Indir Mujanić[2], Darko Knežević[1],
Saša Laloš[1], Marko Lazarević[2], Danilo Đurica[2]

[1]*University of Banja Luka, Faculty of Mechanical Engineering, Republic of Srpska, B&H*

[2]*Elektrane Stanari d.o.o. Republic of Srpska, B&H*

Abstract: For the reliable operation of any complex system, including large-scale thermal power plants, real-time monitoring of operating parameters is essential. A high-quality and efficient monitoring system enables timely intervention when any of the parameters begins to significantly deviate from the optimal or calculated value. However, there are situations in which all parameters remain within acceptable limits, yet the plant does not operate entirely properly. In such cases, it is often difficult to detect and localize the problem, which typically manifests only through reduced efficiency or compromised operational stability. The application of machine learning methods, such as linear regression models, can be a valuable tool under such conditions. The core idea is that a well-trained regression model can timely detect and indicate even subtle anomalies in the operation of individual subsystems. This paper presents a possible approach to modeling the behavior of a properly functioning condensation system within a large thermal power plant, based on available process data. The study was conducted using data from the Stanari Thermal Power Plant, and linear regression was applied as the selected machine learning model.

Keywords: Thermal Power Plant, Fault Detection, Machine Learning, Linear Regression.

QUANTIFYING THE EFFECT OF WIND DIRECTION ON THE PERFORMANCE OF AIR-COOLED CONDENSERS

Jovan Škundrić[1], Indir Mujanić[2], Darko Knežević[1],
Saša Laloš[1], Marko Lazarević[2], Danilo Đurica[2]

[1]University of Banja Luka, Faculty of Mechanical Engineering, Republic of Srpska, B&H

[2]Elektrane Stanari d.o.o. Republic of Srpska, B&H

Abstract: Air-cooled condensers in large thermal power plants, in addition to offering numerous advantages over conventional water-cooled condensation systems, also possess certain specific characteristics that should not be overlooked. These characteristics primarily arise from the type of cooling medium used in such systems. They are not limited to the low density and low specific heat of air, but more importantly concern the stochastic nature of the thermodynamic parameters of the system's environment. The parameters that can most significantly compromise the stability of such condensers are air temperature, wind, and solar radiation. Among them, wind exhibits the most pronounced stochastic behavior. Generally, the impact of wind on the stability of an air-cooled condensation system is primarily associated with the intensity of lateral wind speed. However, depending on the specific spatial position of the condenser within the thermal power plant, wind direction – in addition to speed – can also play a significant role. For this reason, the focus of the present research is placed on determining the influence of wind direction on the degree of disturbance in the operation of an air-cooled condensation system, using the Stanari thermal power plant as a case study – currently the only large-scale thermal power plant with an air-cooled condenser in Eastern Europe.

Keywords: Air-cooled condenser, Thermal Power Plant, Power Generation Facility, Condensation, Wind.

MICRO AND NANO MACHINING OF MODERN AND SMART PRODUCTS

Predrag Dašić[1], Raul Turmanidze[2], Giorgi Popkhadze[2]

[1]Engineering Academy of Serbia *(IAS), Belgrade, Serbia*

[2]*Georgian Technical University (GTU), Faculty of Transportation and Mechanical Engineering, Tbilisi, Georgia*

Abstract: Micro and nano machining (μM and nM) represents a set of production technologies or processes to obtain parts or structures (products) of small dimensions with high precision. They are used for machining miniature parts of small diameter and/or length in the micro and nano scale, i.e. diameter ranging from a few nano/micrometers to several hundred nano/micrometers. Processing parameters (cutting speed, step, etc.) during nano/micro machining vary depending on the technological requirements, the size of the processing machine and the material of the workpiece. They are used for machining products for: nano and micro electronics; NEMS (Nano-Electro-Mechanical Systems) and MEMS (Micro-Electro-Mechanical Systems) systems; biomedical implants (stents, nano and micro needles, surgical tools); precise optics; automotive and aviation industry (sensors, fuel injectors); labs on a chip (LoC). The paper provides an overview of the development of micro and nano machining (μM and nM) of small dimensions in modern composite, smart and nano-materials for modern and smart products. An overview of calculations and mathematical modeling of the functions of cutting forces, tool wear and torque depending on the cutting mode and geometric parameters of micro and nano machining during the processing of small dimensions with various composite, smart and micro and nano materials was analyzed.

Keywords: machining, micro machining (μM), nano machining (nM), materials, modern products, smart products.

APPLICATION OF GEOGEBRA IN THE TEACHING OF MATHEMATICS: VISUALIZATION OF THE LOTKA-VOLTERRA MODEL

Marina Jokić[1], Predrag Dašić[2]

[1]*First Technical School, Kruševac, Serbia*

[2]Engineering Academy of Serbia *(IAS), Belgrade, Serbia*

Abstract: Mathematical models of population dynamics, such as the Lotka-Volterra predator-prey relationship model, represent a significant example of the application of differential equations in describing natural processes. This paper presents the visualization of the interaction between two populations, realized in the dynamic environment of GeoGebra. The designed applet enables interactive research of the influence of parameters on the development of populations, monitoring of oscillations around equilibrium points and observation of stable and unstable trajectories in the phase plane. This kind of visualization enables pupils and students to see the consequences of changes in the initial conditions and parameters of the model in an immediate way, thus enabling an understanding of the stability and dynamics of the system through multiple representations. The work indicates the didactic potential of GeoGebra and its importance in the teaching of mathematics and natural sciences.

Ključne riječi: GeoGebra, Lotka-Volterra model, visualization, multiple representations, mathematics teaching.

MICROWAVE-ASSISTED SYNTHESIS AND CHARACTERIZATION OF CITRIC ACID-CROSSLINKED SODIUM ALGINATE HYDROGELS: A COMPARATIVE STUDY WITH CHITOSAN-ALGINATE SYSTEMS

Ivan Ristić[1], Vladan Mićić[2], Jelena Tanasić[1], Marija Kostić[1], Svetlana Pelemiš[2]

[1]University of Novi Sad, Faculty of Technology, Novi Sad, Serbia

[2]University of East Sarajevo, Faculty of Technology, Republic of Srpska, B&H

Abstract: This study explores a fast and efficient microwave-assisted method for synthesizing sodium alginate (SA) hydrogels crosslinked with citric acid (CA), at mass fractions of 5, 10, and 15%. For comparison, conventional chitosan (CH)–alginate hydrogels were also prepared. While CH–SA systems are widely studied, microwave-synthesized CA–SA hydrogels remain largely unreported. Complete crosslinking of SA with CA was achieved within 7 minutes under microwave irradiation, whereas conventional heating led to incomplete gelation and structural disintegration. The resulting CA–SA hydrogels demonstrated pH-responsive swelling behavior, with the highest swelling observed at 15% CA and good structural stability across the pH range 3–8. FTIR spectra confirmed ester bond formation, while DSC analyses indicated increasing glass transition temperatures (Tg) with CA content (12–33 °C). Compared to CH–SA hydrogels, which exhibited optimal swelling at a 1:1 ratio and higher Tg values (50–57 °C), the CA–SA hydrogels offer tunable swelling characteristics and significantly reduced synthesis time. These findings highlight the potential of microwave-assisted CA–SA hydrogels as sustainable, pH-responsive materials for applications such as controlled drug delivery, with future work directed toward improving their mechanical robustness.

Keywords: green polymers, microwave-assisted synthesis, biopolymers, hydrogels.

DISTRIBUTION, CONTENT, AND ORIGIN OF HEAVY METALS (Cd, Cr, Mn, and Cu) IN SOILS WITHIN THE URBAN CORE (CENTRAL ZONE) OF THE CITY OF BANJA LUKA

Dijana Mihajlović[1], Dijana Jelić[2], Dragana Blagojević[2]

[1]University of Banja Luka, Faculty of Agriculture, Banja Luka, Republic of Srpska, B&H

[2]University of Banja Luka, Faculty of Science and Mathematics, Banja Luka, Republic of Srpska, B&H

Abstract: This study analyzed the distribution, content, and possible origin of heavy metals—cadmium (Cd), chromium (Cr), manganese (Mn), and copper (Cu)—in soils of the central urban area of Banja Luka. The aim of the study was to determine the potential soil contamination in urban zones, assess ecological risks, and identify the dominant sources of metals, either natural (geogenic) or anthropogenic (pollution resulting from human activities). Soil sampling was conducted at representative locations at two depths (0–20 cm and 20–40 cm) to assess the vertical distribution of elements. The results show that the average metal contents in both layers are relatively uniform: Cd (0.47 and 0.49 mg/kg), Cr (36.20 and 34.26 mg/kg), Mn (790.72 and 860.01 mg/kg), Cu (36.20 and 34.26 mg/kg). Comparison with global and European averages, as well as with previous studies in other regions of Bosnia and Herzegovina, indicates that the concentrations of the analyzed metals in Banja Luka soils are typical and do not suggest significant pollution. Spatial distribution does not show clear anomalies indicating anthropogenic sources of contamination. Based on the uniformity of content with depth and the low frequency of exceeding the maximum allowable concentrations, it can be concluded that natural, geochemical sources of the elements dominate. Soils in the central urban area of Banja Luka do not show signs of serious ecological contamination and, therefore, do not pose a significant risk to human health.

Keywords: heavy metals, ecological risk, anthropogenic sources, urban environments.

Acknowledgments: The authors thank the Ministry of Scientific, Technological Development and Higher Education of Republika Srpska, contract number 19.032/961-72/24.

ECOLOGICAL AND HEALTH RISK OF LEAD FROM SOILS IN CHILDREN'S PLAYGROUNDS AND GREEN AREAS OF BANJA LUKA

Dijana Jelić[1], Dijana Mihajlović[2], Dragana Blagojević[1]

[1]University of Banja Luka, Faculty of Science and Mathematics, Banja Luka, Republic of Srpska, B&H

[2]University of Banja Luka, Faculty of Agriculture, Banja Luka, Republic of Srpska, B&H

Abstract: The study includes the determination of the presence and concentration of lead in soils of children's playgrounds in the area of the city of Banja Luka, as well as the potential consequences for human health, especially children, and the overall impact on the urban ecosystem. Lead (Pb) is a toxic heavy metal that enters the environment through traffic, industrial activities, air pollution, and the use of leaded gasoline. Soil sampling was carried out at 21 locations across the city of Banja Luka to determine the content and levels of lead contamination. Soil samples taken from a depth of 0–20 cm were digested with concentrated nitric acid and hydrogen peroxide. Quantification of Pb in the extracts obtained after digestion was then performed using atomic absorption spectrophotometry. The obtained results indicate variations in Pb content ranging from 25.13 to 106.8 mg/kg, with an average content of 39.83 mg/kg. Only at one site was the Pb content found to be slightly above the maximum allowable concentration for this element according to the legislation of Republika Srpska (100 mg/kg). Additionally, the study included an ecological risk assessment (pollution index and geological enrichment factors), as well as a health risk assessment (evaluation of lead intake in children through dermal contact, ingestion, and inhalation). The results showed no ecological or health risk from Pb in the investigated soils.

Keywords: heavy metals, Lead (Pb), ecological risk, health risk, urban areas.

Acknowledgments: The authors thank the Ministry of Scientific, Technological Development and Higher Education of Republika Srpska, contract number 19.032/961-72/24.

APPLICATION OF DIRECTIVE (EU) 2020/2184 ON THE QUALITY OF WATER INTENDED FOR HUMAN CONSUMPTION

Draženko Bjelić, Jelena Jovanović,
Tijana Đuričić, Borislav N. Malinović

Faculty of Technology, University of Banja Luka, Banja Luka, Republic of Srpska, B&H

Abstract: Drinking water is a vital resource for public health and sustainable development, yet its quality is increasingly threatened by pollution, climate change, and emerging contaminants. Directive (EU) 2020/2184 on the quality of water intended for human consumption introduces stricter requirements for monitoring, risk management, and public transparency. This paper analyzes the content and significance of the Directive, with a focus on the challenges of its implementation in Bosnia and Herzegovina.

Special attention is given to harmful substances such as bisphenol A, PFAS compounds, and cyanotoxins, which pose serious risks to human health. The Directive introduces new water quality parameters, promotes access to water as a human right, and encourages the use of tap water to reduce plastic waste.

In conclusion, aligning national legislation with this Directive is essential for improving water quality, protecting public health, and achieving sustainable development goals.

Keywords: drinking water, EU Directive 2020/2184, pollutants.

STATISTICAL ANALYSIS OF THE INHIBITORY EFFECT OF THYME EXTRACT ON STEEL CORROSION IN A 3% NACL SOLUTION

Nebojša Vasiljević[1], Marija Mitrović[1], Regina Fuchs-Godec[2], Bojan Gorančić[1], Milorad Tomić[1,3]

[1]University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, B&H

[2]University of Maribor, Faculty of Chemistry and Chemical Engineering, Maribor, Slovenia,

[3]Engineering Academy of Serbia, Department of Technology and Metallurgy, Belgrade, Serbia

Abstract: In this paper, the inhibitory effect of thyme extract on the corrosion of two types of steel in 3% NaCl solution was investigated. Steel samples were immersed in 3% NaCl solution without inhibitor and solutions with 0.5, 1.0 and 1.5 g/L inhibitor (thyme extract), and the exposure times to the corrosive environment were 2, 4, 6, 8, 24, 48 and 168 hours. MINITAB 21 software was used to optimize and process the experimentally obtained results, and the analyzed parameters were corrosion rate (Km^-), corrosion depth index (π) and inhibitor efficiency (z). It was found that the use of inhibitors significantly reduces the corrosion rate and increases the protection efficiency, and the highest efficiency (z>85%) is at an inhibitor concentration of 1.5 g/L after 48 and 168 hours. Steel 2 showed higher resistance in the absence of inhibitors, while the addition of inhibitors significantly reduced the corrosion rate of both steels.

Keywords: green inhibitors, NaCl solution, statistical analysis, steel corrosion, thyme extract.

INVESTIGATION INTO THE EFFECTS OF HYDROCHLORIC ACID ACTIVATION ON DOMESTIC KAOLIN

Zoran Petrović[1], Aleksandra Radulović[2], Pero Dugić[3], Sabina Begić[4], Dragana Kešelj[1], Sanja Panić[5]

[1]Faculty of Technology, University of East Sarajevo, Zvornik, Bosnia and Herzegovina

[2]Faculty of General and Physical Chemistry, Belgrade, Belgrade, Serbia

[3]High Medical School of Health, Doboj, Doboj, Bosnia and Herzegovina

[4]Faculty of Technology, University of Tuzla, Tuzla, Bosnia and Herzegovina

[5]Faculty of Technology, University of Novi Sad, Novi Sad, Serbia

Abstract: Kaolin clays, due to their phaze and the chemical compozition ass well ass their potential for modification trough various processes, have a wide range off aplications. In this study, chemical activation of domestic kaolin from the „Crna Dolina" deposit near Prijedor (BH) was carried out under laboratory conditions using an 8% w/w hydrochloric acid (HCl) solution. The process parameters were as follows: temperature 95°C, contact time 180 minutes, and a kaolin to HCl ratio of 1:5. The effects of activation were evaluated by analyzing the composition, structural, textural, and morphological characteristics of the kaolin before and after activation using modern characterization techniques (XRD, FTIR, EDXRF, SEM/EDS, and BET).The activation resulted in slight changes in composition (an increase in SiO_2 content, and a decrease in Al_2O_3, Fe_2O_3, TiO_2, and K_2O oxides, with complete removal of CaO). The activated kaolin exhibited an approximately 55.0% increase in specific surface area, a 1.4-fold increase in adsorption capacity, and a 1.37-fold increase in the proportion of d_{50} particle size. Further research on the effects of acid activation of domestic kaolin should include the use of other inorganic acids or hydrochloric acid (HCl) at higher concentrations.

Keywords: Natural kaolin, Hydrochloric acid, Acid-activated kaolin, Composition, Structural characteristics, Textural characteristics, Morphological characteristics.

APPLICATION OF DIGITAL TWIN TECHNOLOGIES IN THE MINING INDUSTRY

Ivica Ristović[1], Nevena Stojković[2], Tamara Gavrilović[3]

[1]*University of Belgrade, Faculty of Mining and Geology, Belgrade, Serbia*

[2,3]*University of Prishtina with temporary headquarters in Kosovska Mitrovica, Faculty of Technical Sciences, Kosovska Mitrovica*

Abstract: A digital twin (DT) is a virtual model that accurately represents a real-world object, system or process. A digital twin (DT), in contrast to a static 3D model, is a live digital clone of a physical thing (object, process or system) that is connected to real data from sensors, simulations or other data sources with which it is possible to monitor and maintain the real state of that physical object, process or system in real time, predict its trends, performance or possible problems that may arise, optimize operations within them, etc. Digital twin technology (DT) has become, during the last decade, one of the most popular and modern information technologies (IT), and at the same time operational technologies (OT), on the way to increase the efficiency and performance of industrial enterprises. It was developed within the framework of new industrial and production trends: Industrial Revolution 4.0 (I4.0) and the Industrial Internet of Things (IIoT).

Digital twins (DT) are successfully used in all engineering fields, healthcare, medicine, etc. This means that in the last ten years, they have been recognized, also in mining, as part of engineering fields, because they allow operators to see, predict and optimize the entire production process of mineral extraction: from the pit to the processing plant, without stopping production or jeopardizing safety. For example these are operations: optimization of operations and processes to achieve maximum mineral production; integration of plant and equipment functioning; forecasting the mineral processing capacity of the given plant; monitoring of mineral production capacity; analysis of expected mineral utilization; analysis of the state of mining facilities and equipment, current accuracy, wear and tear of mill parts, etc., which is the goal of this paper.

Keywords: Digital twin (DT), mining, real world (RW), virtual model (VM), process, system.

EFFECT OF FILLER CONCENTRATION ON THE DIELECTRIC LOSSES OF EXFOLIATED GRAPHITE/EPOXY NANOCOMPOSITES

Slavica Maletić[1], Ivan Petronijević[1], Dragana Cerović[1], Mirjana Milić[2], Nataša Jović Orsini[2]

[1]University of Belgrade Faculty of Physics, Belgrade, Serbia

[2]VINČA Institute of Nuclear Sciences – National Institute of the Republic of Serbia

Abstract: In this study, dielectric properties of composites, based on epoxy resin (bisphenol-A-epoxy), with different weight percentage of exfoliated graphite (EG) of 1wt%, 3wt% and 5wt%, were investigated. Exfoliated graphite differs from other allotropic carbon modifications due to its cellular structure and the ability to bond three-dimensionally, through mechanical bonding. Dielectric measurements were carried out in a wide temperature interval (170-350 K) at test frequency of 3 kHz. Imaginary part of dielectric permittivity, was analyzed as a function of temperature and load content of filler EG. The relaxation peak, which is characteristics for epoxy, changes intensity and position with increasing weight percentage of EG. The significant changes in relaxation intensity and position observed in the composite with 5 wt% EG indicates the onset of a dielectric-semiconductor phase transition.

Keywords: dielectric permittivity, epoxy, exfoliated graphene, nanocomposites, dielectric loss.

EFFECTS OF SOFT SEGMENT CONTENT AND LASER-INDUCED GRAPHENE ON THE SURFACE AND THERMAL PROPERTIES OF CROSS-LINKED POLYURETHANES

Vanja Vojnović[1], Marko Spasenović[1], Dana Vasiljević-Radović[1], Darko Micić[2], Marija V. Pergal[1]

[1]Institute of Chemistry, Technology, and Metallurgy, University of Belgrade, Belgrade, Serbia

[2]Institute of General and Physical Chemistry, University of Belgrade, Belgrade, Serbia

Abstract: The versatile chemistry of polyurethanes (PUs) makes them suitable for a wide range of applications. In particular, surface topography and thermal behavior can be effectively tailored by adjusting the soft segment content (SSC) within the PU matrix. However, as an intrinsically nonconductive class of polymers, PUs are not suitable for electronic applications. With the increasing interest in polymer/graphene heterostructures, the formation of graphene conductive pathways on polymer surfaces has emerged as a promising approach to overcome this limitation. In this study, we systematically examined the effects of varying SSC (expressed in wt.%) in synthesized cross-linked PUs, as well as the influence of laser-induced graphene (LIG) transferred onto the PU surface on several key properties: surface roughness via atomic force microscopy (AFM), surface wettability using water contact angle (WCA) measurements, and thermal properties through differential scanning calorimetry (DSC). An increase in SSC led to a reduction in surface roughness and a concomitant increase in WCA, indicating enhanced hydrophobicity. The presence of LIG further augmented the hydrophobic character of the surface. The PU structure exhibited a pronounced effect on both glass transition (T_g) and melting temperatures (T_m), while LIG had a minimal impact on thermal properties. This research provides a framework for engineering the surface and thermal properties of PU-based materials for applications in flexible electronics and smart coatings.

Key words: polymers, composites, structure-property relationship, AFM, WCA, DSC

This research was supported by the Science Fund of the Republic of Serbia, #4950, Polymer/graphene heterostructures for physiological sensors – Polygraph.

UNDERSTANDING THE INTERACTION OF THE DRUG CARVEDIDOL AND –COOH FUNCTIONALIZED CARBON NANOCONE: A DFT STUDY

Dušica Krunić[1], Andrijana Bilić[2,3], Svetlana Pelemiš[4],
Sanja J. Armaković[2,3], Stevan Armaković[1,3]

[1]University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Serbia,

[2]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Novi Sad, Serbia

[3]Association for International Development of Academic and Scientific Collaboration (AIDASCO), Novi Sad, Serbia

[4]University of East Sarajevo, Faculty of Technology Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: Carvedilol is used for the treatment of cardiovascular diseases and belongs to the group of most commonly used drugs. However, carvedilol is characterized by low solubility and bioavailability. Addressing these limitations would represent a significant advancement in the field of medicine. Nanocones can interact strongly with biological molecules due to their shape, enabling efficient drug delivery to specific sites within the organism. In this work, using extended tight binding (xTB), density functional theory (DFT), and symmetry-adapted perturbation theory (SAPT) simulations, a computational analysis of the interactions of a –COOH functionalized carbon nanocone with the drug carvedilol is presented. Detailed analysis of these interactions contributes to the development of a new model for drug delivery.

Keywords: adsorption, β-blockers, drug delivery, DFT, SAPT0.

INFLUENCE OF LIGNOCELLULOSE-BASED BIOMASS TYPE AND CONCENTRATION IN POLYMER MATRIX ON DIELECTRIC PROPERTIES

Dragana Cerović[1], Ivan Petronijević[2], Slavica Maletić[2], Blanka Škipina[3], Biljana Pećanin[3], Dragana Grujić[3], Branka Ružičić[3]

[1]*Academy of Technical-Artistic Vocational Studies Belgrade, Higher Textile School for Design, Technology and Management, Belgrade, Serbia*

[2]*University of Belgrade, Faculty of Physics, Belgrade, Serbia*

[3]*University of Banja Luka, Faculty of Technology, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: The development of environmentally friendly materials from renewable resources that can be easily destroyed or recycled is increasingly becoming a task of today in order to preserve the environment and monitor sustainable development. This paper presents the preparation of composites by introducing different concentrations of lignocellulose-based biomass into an isotactic polypropylene matrix. Wheat, barley, rye and oat bran as so as corn granules obtained in Serbia were used as fillers. The influence of different filler concentrations of 20%, 30% and 40% on the dielectric loss factor (ε") and electrical conductivity (σ_{ac}) was analyzed. Measurements of dielectric parameters were performed at 13 test frequencies in the range from 30 Hz to 60 kHz at a temperature of 23°C. An increase in the values of the dielectric loss factor and electrical conductivity with an increase in the concentration of biomass filler was observed for all samples. With an increase in the frequency of the external field, a decrease in the value of the dielectric loss factor occurred, while the electrical conductivity increased for all samples.

Keywords: composite, biomass, dielectric loss factor, electrical conductivity.

EVALUATION OF DISTRIBUTION PROCESSES FOR SOME ANALYTICAL AIR POLLUTANT MODELS

Stevo K. Jaćimovski[1], Dane Subošić[1], Jovan P. Šetrajčić[2]

[1]*University of Criminal Investigation and Police Studies, Zemun – Belgrade, Serbia*

[2]*Academy of Sciences and Arts of Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: The term air pollution usually implies the presence of a certain concentration of gaseous and particulate pollutants in the atmosphere in a certain area. The presence and distribution of pollutants in the air is measured continuously and with the aim of protecting human health and the environment. Modeling the process of distributing pollutants in the air is a very important tool in researching the impact of pollution on the natural environment. Today, there are different approaches to the representation of air pollution modeling. This paper considers a physical model, where the distribution of pollutants in the air is found by solving the advective diffusion equation using both analytical and numerical methods. The results of these two procedures are compared with the results of measurements in the experiment, and based on certain parameters, it is determined which model gives more reliable results.

Keywords: Distribution of pollutants, physical model, analytical-numerical method, turbulent diffusion, atmospheric instability.

ENERGY SPECTRA AND CHARGING STATES OF NANOSCOPIC CRYSTAL FILMS

Jovan P. Šetrajčić[1], Dušan I. Ilić[2], Nikola R. Vojnović[2]

[1]*Academy of Sciences and Arts of Republika Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

[2]*University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Vojvodina – Serbia*

Abstract: The spectrum of energy states of elementary charges in crystalline nanoscale film structures (with different boundary parameters) was analyzed using the method of two-time and temperature-dependent Green's functions. The fundamental difference from unbounded structures is that the energy spectrum of charges in the film has two gaps and that their energy band is strictly discrete and narrower, and that it strongly depends on the boundary conditions of the film. The paper specifically studies the conditions for the appearance and distribution of localized charge states depending on the magnitude of the boundary parameters.

Keywords: Crystals, nanoscopic film structures, electrons/cavities, energy spectrum, localized states.

BOSE-EINSTEIN CONDENSATION OF EXCITON POLARITONS – POSSIBILITY OF A ROLE IN THE MECHANISM OF HIGH-TEMPERATURE SUPERCONDUCTIVITY

Dragoljub Lj. Mirjanić[1], Jovan P. Šetrajčić[1], Stevo K. Jaćimovski[2]

[1]*Academy of Sciences and Arts of Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

[2]*University of Criminal Investigation and Police Studies, Zemun, Serbia*

Abstract: Based on new results on the Bose-Einstein condensation of polaritons, a relatively old question arises: can these polaritons participate in the mechanism of superconductivity, as a substitute for phonons, and in what structures? Therefore, in this paper we will present a calculation – from the BCS theory of the "gap equation" with Frenkel polaritons that can be realized at metal-dielectric contacts. Here, a theoretical analysis of the influence of electromagnetic waves on the size of the energy gap of superconductivity is presented, and it is shown that its increase can be achieved only in a sandwich structure of metals and molecular dielectrics. The results show that the superconducting motion of new "Cooper" electron pairs is possible up to 200 K. Such an effect can be expected only for those electrons that are located in the very close part of the dielectric sandwich, which is approximately achieved in Cu-ceramic oxides.

Keywords: Molecular polaritons, superconductivity, electrons, energy states, critical temperature.

GRAPHENE IN A MAGNETIC FIELD

Stevo Jaćimovski[1], Jelena Lamovec[1], Dušan Ilić[2],
Jovan P. Šetrajčić[3], Saša Mićin[4]

[1]*University of Criminal Investigation and Police Studies, Zemun – Belgrade, Serbia*

[2]*University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia*

[3]*Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

[4]*Faculty of Security Sciences, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: The paper analyses the energy levels of charge carriers (electrons and holes) of a graphene monolayer located in a magnetic field perpendicular to its plane. Unlike in the non-relativistic 2D case, the charge carriers in graphene are massless particles travelling at high speed, so they must be treated as relativistic. The work shows that the spectrum of charge carriers in a magnetic field (Landau levels) is proportional to $\sqrt{n}$, where n is the quantum number, while the spectrum of non-relativistic 2D charge carriers is $\sim n$. One of the most striking features of Landau levels in graphene is the presence of zero-energy levels. The Landau levels found in graphene are highly degenerate. The multiplicity of their degeneracy is twice as high as in the case of the energy level $E = 0$, which is a key factor in explaining the anomalous quantum Hall effect in graphene.

Keywords: graphene, magnetic field, Landau energy levels, anomalous Hall effect.

KLEIN EFFECT IN GRAPHENE

Dušan Ilić[1], Stevo Jaćimovski[2], Jelena Lamovec[2], Jovan P. Šetrajčić[3], Saša Mićin[4]

[1]*University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia*

[2]*University of Criminal Investigation and Police Studies, Zemun – Belgrade, Serbia*

[3]*Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

[4]*Faculty of Security Sciences, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: The Klein effect consists of a relativistic particle travelling through a potential barrier of any height and width without the wave being attenuated. A tunnelling effect with a transmission coefficient T(E) = 1 is observed in graphene. The probability of passing through a rectangular barrier is equal to one if the resonance conditions for massive particles are met. Irrespective of the resonance conditions, a barrier of any height and width is completely transparent for normally incident massless electrons and almost transparent at angles of incidence close to zero. Due to Klein tunneling, it is not possible to localise the particles by an electrostatic potential, which is an obstacle to the technological use of graphene as an element for nanoelectronic devices.

Keywords: graphene, Klein tunneling, potential barrier, transparency.

A STUDY ON THE ZETA POTENTIAL OF GOETHITE, QUARTZ AND CLAY MINERALS DEPENDING ON pH AND THE PRESENCE OF INORGANIC DISPERSANTS

Ljiljana Tankosić, Svjetlana Sredić

University of Banja Luka, Faculty of Mining, Prijedor, Republic of Srpska, Bosnia and Herzegovina

Abstract: The knowledge of zeta potential is a very useful indicator of the stability of dispersed systems. This is especially important in many industrial processes, such as e.g. mineral processing, purification of water and many others. This article deals with the investigation of the electrokinetic behavior of goethite, quartz and clay minerals depending on pH and the presence of inorganic dispersants: sodiumhexamethaphosphate (SHMP), sodiumpyrophosphate (SPP) and sodium silicate (NS). All studies are conducted on natural samples, taken from Omarska iron mine (Bosnia and Herzegovina) by measuring the zeta potential. From the experimental results, it was found that the increase of the suspension pH resulted in an increase in the negative charge of all three tested samples. The clay did not show any isoelectric point (IEP). Quartz showed isoelectric points at pH about 2.6 and close to 2 in the absence and presence of sodium silicate in suspensions, respectively. Goethite showed isoelectric points at pH 6.7 and 4.95 in the absence and presence of sodium silicate in suspensions, respectively. An IEP could not be detected when the SHMP and SPP were used and the surface charge is negative from pH 2 to pH 12 in all tested samples. The addition of SHMP provided the highest negative zeta potential, i.e. the most stable dispersion, in all three tested samples.

Keywords: zeta potential, isoelectric point, goethite, quartz, clay, inorganic dispersants.

SOME ANALYTICAL RESULTS WITHIN THE GENERALIZED ISING MODEL IN THE ABSENCE OF A MAGNETIC FIELD

Milan Pantić

University of Novi Sad, Faculty of Sciences,
Department of Physics, Serbia

Abstract: In this work, a one-dimensional generalized Ising model on a monoatomic, equidistant lattice is analyzed, considering various interactions between spins of first and further neighbors. The Kramers–Wannier transfer matrix with double lattice translation is derived, enabling precise determination of the system's ground state. Phase diagrams encompassing all types of magnetic ordering are constructed, revealing a large number of triple points and lines of phase coexistence, in full agreement with Gibbs' phase rule. An effect analogous to overheating/underheating is observed, while phases at triple points are frustrated, indicating the occurrence of critical opalescence. Exact analytical expressions are derived for the Gibbs free energy, internal energy, heat capacity, and entropy, including the entropy at absolute zero. The results are compared with existing data, including those for two-dimensional lattices.

Keywords: Ising model,one-dimensional lattice, Kramers–Wannier transfer matrix, phase diagrams, triple points, Gibbs free energy, critical opalescence, heat capacity, entropy, magnetic ordering.

ANALYZING MEDIA NARRATIVES ON RENEWABLE ENERGY IN MACEDONIA USING SENTIMENT AND TOPIC MODELING

Stefani Kulebanova[1], Marija Stojcheva[1], Aleksandra Dedinec[1], Jana Prodanova[2], Aleksandar Dedinec[2], Ljupcho Kocarev[2]

[1]*Ss. Cyril and Methodius University, Faculty of Computer Science and Engineering, Skopje, Macedonia*

[2]*Macedonian Academy of Sciences and Arts, Skopje, Macedonia*

Abstract: This paper explores the evolution of media sentiment and thematic discourse around Renewable Energy Sources (RES) in Macedonia from 2017 to 2024. Drawing on over 9,500 news teasers retrieved from Time.mk, we apply FinBERT and BERTweet for sentiment analysis and Latent Dirichlet Allocation (LDA) for topic modeling. Our findings reveal a dominant neutral sentiment profile with notable positive sentiment peaks aligned with key regulatory developments and market shifts. Topic modeling further captures the transformation of discourse from centralized, policy-driven rhetoric toward decentralized, technologically mature themes, centered on solar expansion, public engagement, and institutional implementation. The outcome of this research contributes to understanding how public discourse on RES evolves over time, and its implications add value to the role of media in shaping societal perception and stakeholder's response to renewable energy transition.

Keywords: renewable energy, media discourse, sentiment analysis, topic modeling, Macedonia, FinBERT, BERTweet, natural language processing.

THE EUROPEAN GREEN PLAN AND ITS IMPLEMENTATION IN THE REPUBLIC OF CROATIA

Ljubomir Majdandžić

Faculty of Electrical Engineering,
Computer Science and Information Technology Osijek,
Josip Juraj Strossmayer University of Osijek, Croatia

Abstract: Natural resources should be used sensibly, and energy should be produced from renewable energy sources wisely and based on new scientific knowledge, technically and technologically demonstrated and proven. If we accept the logic of knowledge and wisdom of competent experts, so-called visionaries with a view to the future, who will work in the interests of environmental and nature protection, the European continent can become a continent with a minimal share of energy and energy imports.

Also, in projects of renewable energy sources, energy efficiency and environmental protection, as an interdisciplinary field, other sciences (e.g. social and human sciences, economics, law, philosophy, sociology, psychology, etc.) will increasingly participate in addition to technical ones. It must be clear to everyone that only through the coordination of all scientific disciplines is sustainable development and survival of planet Earth possible.

Keywords: European green plan, renewable energy sources, energy efficiency, environmental protection.

THERMAL TGA-DSC ANALYSIS OF RED MUD IN THE BAYER PROCESS

Dragana Kostić[1], Mitar Perušić[1], Srećko Stopić[4], Ljubiša Balanović[3], Duško Kostić[1], Vladimir Damjanović[2], Radislav Filipović[1,2], Jelena Vuković[1], Nebojša Vasiljević[1]

[1]University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, Bosnia and Herzegovina

[2]"Alumina" Factory LLC, Karakaj bb, 75400 Zvornik, Republic of Srpska, Bosnia and Herzegovina

[3]University of Belgrade, Technical Faculty in Bor, Bor, Serbia

[4]RWTH Aachen University, IME Process Metallurgy and Metal Recycling, Aachen, Germany

Abstract: In this study, thermal TGA-DSC analysis of red mud, a residue from bauxite leaching in the Bayer process, was conducted.

The samples were examined using chemical analysis methods to determine the content of red mud components such as SiO_2, Fe_2O_3, Al_2O_3, CaO, and TiO_2. Spectrophotometric and gravimetric methods were employed. Prior to this, XRD analysis was performed to identify the crystalline modifications and crystalline components present in the red mud, i.e., the mineral compounds that constitute red mud. This was done in order to monitor the expected changes occurring during heating and thermal treatment of the red mud.

Understanding the changes that occur during the heating and thermal treatment of red mud is essential, as this process involves dehydration, transformations in the crystalline structure of the components, and changes related to specific surface area. These factors are significant for metal reduction or for the potential application of red mud as an effective adsorbent material.

Keywords: bauxite, red mud, thermal analysis, TGA, DSC.

THE INFLUENCE OF PROCESS PARAMETERS ON THE ANTIOXIDANT ACTIVITY OF YARROW

Tijana Ljubinac, Nebojša Vasiljević, Vladan Mićić

Faculty of Technology, University of East Sarajevo, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: The aim of this study was to investigate the influence of key process parameters on the extraction of total phenolics, flavonoids, and anthocyanins from yarrow flower (*Achillea millefolium* L.), with the goal of optimizing the antioxidant potential of the obtained extracts and their potential application under industrial conditions. The investigated parameters included extraction time (5-90 minutes), solvent pH (1.5-12.5), plant material to solvent ratio (1:10-1:70), number of extraction cycles, and oscillation frequency during mixing (0-180 rpm). Extractions were performed using an ethanol solution, and quantitative analysis of total phenolics, flavonoids, and anthocyanins was carried out spectrophotometrically.

The results showed that all examined parameters had a significant impact on the content of target bioactive compounds. The highest contents of total phenolics (108.47 mg GAE/g), flavonoids (77.26 mg KaH/g), and anthocyanins (0.1122 mg Cy3G/g) were achieved under conditions of prolonged extraction time (up to 90 minutes), acidic pH (1.5–4.0), lower plant material to solvent ratio (1:10–1:20), and oscillation frequency of 120-150 rpm. The introduction of mixing significantly increased the yield of bioactive compounds compared to static conditions, while multiple-step extraction showed limited efficiency.

Keywords: antioxidants, anthocyanins, extraction, flavonoids, (poly)phenolics, yarrow.

APPLICATION OF SCRATCH TEST FOR TESTING COATINGS OF SOME POLYMER MATERIALS

Dušan Ješić[1], Pavel Kovač[2], Borislav Savković[2], Branko Štrbac[2], Branislav Dudić[3]

[1]*International technology Management Academy, Novi Sad, Serbia*

[2]*University of Novi Sad, Faculty of Technical Science, Novi Sad, Serbia*

[3]*Faculty of Management, Comenius University in Bratislava, Bratislava, Slovakia*

Abstract: Scratch test - a measure of the quality of tribological and protective coatings of various types (tribological and protective) is widely used in industry today. It is expected that in the coming years the use of coatings will increase, especially the application of new coatings on new materials, polymers. The group of materials duromiers are hard and brittle than plastomers and can withstand higher operating temperatures. Unsaturated polyester - UP was chosen, which has good mechanical, chemical, electrical insulation properties. Especially when reinforced with glass or other fibers. This material can be modified with various coatings and colors. Examples of the results of measuring the tribological characteristics of coatings achieved by measuring the aforementioned materials with the scratch test are shown in original diagrams.

Key words: Scratch test, acoustic emission, friction coefficient, polymers, coatings.

USING HYDROGEN TO POWER CARS

Pavel Kovač[1], Borislav Savković[1], Dušan Ješić[2], Branislav Dudić[3,4]

[1]*University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia*

[2]*International Technology and Management Academy – MTMA, Novi Sad, Serbia*

[3] *Comenius University in Bratislava, Faculty of Management, Bratislava, Slovakia*

[4]*University Business Academy, Faculty of Economics and Engineering Management, Novi Sad, Serbia*

Abstract: Hydrogen H_2 is the most common element in space and one of the most common on Earth. On Earth, it is found exclusively in bound form, that is, in various compounds. Today, hydrogen is considered one of the most serious candidates for the fuel of the future. It is a renewable fuel: because it can be produced from water, and the result of its use is again water, and of course energy.

Hydrogen production has been known for a long time and can be obtained by electrolysis of water. Electrolysis is carried out by passing a direct current between two electrodes in a container with an electrolyte (salt water). By passing current through the electrolyte, hydrogen is separated from the water and collected at the cathode, and oxygen at the anode. Hydrogen is then collected by special devices and stored in a special tank. Hydrogen turns into a liquid at a temperature of -253 °C and in this state, it is transparent, colorless and odorless, non-corrosive and its density is only 1/40 of the density of water. Such tanks require special construction and must be very well insulated. The main disadvantage is storage, because the tank needs to have a large mass in relation to the mass of hydrogen. Storage is carried out under a pressure of about 200 bars. Today, all developed countries are very intensively engaged in research into the use of hydrogen as an energy source.

Methanol batteries are already on sale. Methanol and water "burn" in the electrolyte to hydrogen (H_2) and carbon dioxide (CO_2). Electricity and oxygen (O_2) from the environment are generated in the electrolyte, and water is formed.

Modified standard cars with this power supply are already on the streets of Serbia and are used with reduced consumption and high efficiency.

Keywords: Energy, hydrogen, car, water, renewable sources.

HYDROGEN ADSORPTION KINETICS ON ACTIVATED CARBON POWDERS DOPED WITH NICKEL AND COBALT

Vladimir Lukić[1], Ljiljana Tanasić[1,2]

[1]*Faculty of Technical Sciences Brčko, University "Privredna Academy" Brčko*

[2]*Academy of Vocational Studies Šabac, Serbia*

Abstract: This paper describes kinetics of hydrogen adsorption process at 60 minutes and activated carbon powder into wich palladium be chemically deposited in non-isothermal and isothermal conditions. The same powder is doped with Ni and Co is the adsorption process, and tested in the same conditions. Isothermal measurements were carried out depending on the hydrogen pressure in the chamber without the presence of the adsorbent in the presence of the adsorbent at temperatures of $t_1=80^0C$, $t_2=100^0C$, $t_3=120^0C$ i $t_4=140^0C$. It is shown that in the first time interval at the four temperatures exists a linear dependence of $\ln(\Delta p)$ of the time τ. This finding confirms that in the first time interval the adsorption kinetics of hydrogen. The second time interval exists a linear dependence of $\Delta p=f(s^{1/2})$. This confirms that in the second time interval, the process of adsorption of the hydrogen diffusion. For both processes are determined by the activation energy aktivacije E_{kin} and E_{dif}.

Keywords: carbon; hydrogen; activation energy; adsorption rates; hydrogenation isotherm

CERAMIC MATERIAL ON ARCHITECTURAL FACADES

Nikola Cekić

Faculty of Architecture and Civil Engineering, Niš, Serbia

Abstract: Abstract Within the broad spectrum of façade systems used in contemporary eco-urban architectural design solutions for building appearance, ceramic materials have a significant advantage due to their many ecological, structural, artistic, and aesthetic functions. This paper emphasizes the importance of understanding the fascinating effect of diverse ceramic façade claddings on wall surfaces and their visual impact on users in the exterior, natural, and increasingly globalized, artifact-laden space. It particularly examines inspiring examples of completed projects around the world with specific sculptural character, where newly adapted ceramic technologies on façades and roof surfaces have contributed to moving beyond stereotypical, geometrically rigid forms and achieving an iconologically and artistically significant material value. This approach enabled an analysis of designers' efforts to articulate a different relationship between contemporary ceramic materials and eco-urban architectural forms, aiming to enhance users' sense of organic-cultural and visual integration with surrounding physical structures.

Keywords: ceramic façades","cladding","contemporary materials","eco-urban architectural form","space.

ARCHITECTURAL TRADITION AS A MODEL FOR THEUSE OF ECOLOGICAL MATERIALS

Dejan Tubić[1], Dušica Živanović[2], Bojana Mirković[3]

[1] *University of Priština, Faculty of Philosophy, Kosovska Mitrovica*

[2] *Academy of Technical-Artistic Vocational Studies, Belgrade, Serbia*

[3] *Academy of Technical-Artistic Vocational Studies, Belgrade, Serbia*

Abstract: Under the title Building Tradition as a Model for the Application of Ecological Materials, this paper considers the architectural heritage of Serbia from the aspect of the use of ecological materials. A wide spectrum of residential buildings, created under diverse geographical, topological, climatic, and ethnic conditions, indicates a possible continuity observable in their typological and morphological development. The aim of this paper is, through a chronological review of vernacular architecture originating in different parts of Serbia, to examine the potential of traditional building practices as a model for the application of ecological materials in the context of contemporary construction. Special attention is devoted to various constructive systems, such as: the brvnara (log-house) made of "prefabricated" wooden elements, the bondruk system consisting of a wooden framework filled with adobe, and massive load-bearing rammed earth walls; as well as to their influence on seismic stability, thermal and acoustic insulation, which improve the quality of dwelling and enable the integration of the building into the natural environment. Particular emphasis is placed on the traditional architecture of Western Serbia, the Morava region, and Vojvodina. The analysis also addresses the influences of geographical and ethnic factors on architectural expression, while pointing to the importance of craftsmanship knowledge in the formation of sustainable construction practices. The research indicates possibilities for the reinterpretation of these principles in accordance with contemporary ecological and technological requirements.

Keywords: architectural traditions, ecological material, charge, adobe, bondruk.

DEVELOPMENT AND VALIDATION OF A MULTICOMPONENT DISTILLATION MODEL: COMBINED APPLICATION OF MATLAB AND DWSIM SOFTWARE

Aleksandra Ristić[1], Nebojša Vasiljević[1], Dario Balaban[2], Goran Tadić[1]

[1] *University of East Sarajevo, Faculty of Technology Zvornik, Zvornik, Republic of Srpska, B&H*

[2] *University of Novi Sad, Faculty of Technology Novi Sad, Novi Sad, Serbia*

Abstract: In this paper, a mathematical model was developed and a simulation was performed of the distillation of a multicomponent hydrocarbon mixture, which is one of the intermediate fractions in the process of obtaining liquefied petroleum gas *(LPG)*. The model, implemented in the *MATLAB* program, is based on the methodology of calculations for pseudobinary mixtures and the use of fast analytical procedures.

The obtained results were validated by comparison with the *Shortcut Column (SC)* model of the *DWSIM* process simulator for fast column calculation, and then with the rigorous *Distillation Column (DC)* model. The application of the *SC* model showed extremely good agreement of the values of key process variables. The initial parameters derived from the *SC* optimization, when applied to the *DC* model, did not meet the strict product purity specifications, emphasizing the necessity of an iterative approach to design, i.e. a significant increase in the reflux ratio and, consequently, higher energy consumption for the reboiler and condenser. The research highlights the complementary roles of different simulation levels in process design, from preliminary screening to detailed engineering, emphasizing the critical trade-off between product purity and energy efficiency in distillation.

Keywords: modeling, multicomponent distillation, optimization, DWSIM.

SYNTHESIS, CRYSTALLOGRAPHIC, AND *IN SILICO* STUDIES OF A NEW AZIDOXIME

Ljubica Brenjo[1], Olivera Klisurić[1], Jovica Nešić[2], Niko Radulović[3], Srđan Bjedov[1], Aleksandar Oklješa[1]

[1]*Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia*

[2]*Military Technical Institute, Belgrade, Serbia*

[3]*Faculty of Sciences, University of Niš, Niš, Serbia*

Abstract: The development of modern energetic materials (EM) is a significant area of materials science research. Azidoximes are compounds that are attractive as potential EM because they contain the energetic azide group, and possess an oxygen atom from the oxime, which contributes to a better oxygen balance. They are usually used as precursors for the corresponding N-hydroxytetrazoles. These tetrazole derivatives contain, aside from a high nitrogen content, planarity, and high heat of formation, an oxygen atom in their structure, which results in a more positive oxygen balance. In contrast to tetrazoles, azidoximes are insufficiently researched as potential EM. In this work, the synthesis of (1Z,2E)-3-amino-N'-hydroxy-2-(hydroxyimino)-3-oxopropanimidoyl azide is described. The structure of the compound was confirmed by IR and NMR spectroscopy, and by single-crystal X-ray diffraction. Physicochemical parameters were obtained via theoretical calculations. Non-covalent interactions in the crystal were analyzed as well.

Keywords: Energetic materials, tetrazoles, azidoximes.

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grants No. 451-03-137/2025-03/ 200125 & 451-03-136/2025-03/ 200125).

PRIMARY SHORT CIRCUIT OF COPPER INSTALLATIONS AS A CAUSE OF FIRE IN BUILDINGS

Vojkan Zorić[1], Radovan Radovanović[2], Vesna Petrović[3]

[1]*Megatrend University, Serbia*

[2]*University of Criminal Investigation and Police Studies, Serbia*

[3]*College of Applied Technical Sciences in Novi Sad, Serbia*

Abstract: Frequent scientific controversies regarding short circuits as a cause of fires in copper installations in buildings are increasingly attracting the attention of the professional and scientific public. The authors conducted experiments under various conditions using samples of copper conductors of different properties from several real fire events in order to examine the cause of fires. The methods applied are the x-ray diffraction (xRD) method, the scanning electron microscopy (SEM/EDS) method, and the light polarization microscopy method. During the laboratory test, the authors followed the techniques of Russian scientists, which are used in the Russian Ministry of Emergency Situations (MES). The results obtained were statistically processed and indicate that in most cases of fires, the cause was precisely faulty electrical installation of copper conductors (due to mechanical damage, unprofessional installation, irregular inspections).

Keywords: Short circuit, forensics, X-ray diffraction, electron microcopy, polarization, experiment.

IMPROVING ELECTRODE-SAMPLE CONTACT USING GRAPHITE COATING: A STUDY OF FREQUENCY-DEPENDENT ADMITTANCE ON MODIFIED BENTONITES

Biljana Pećanin[1], Slavica Maletić[2], Ivan Petronijević[2], Dragana Grujić[1], Branka Ružičić[1], Dragana Cerović[3], Blanka Škipina[1]

[1]University of Banja Luka, Faculty of Technology, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

[2]University of Belgrade – Faculty of Physics, Belgrade, Serbia

[3]Academy of Technical and Artistic Applied Studies Belgrade, College of Textile Design, Technology and Management, Belgrade, Serbia

Abstract: The parallel plate method serves as one of the basic approaches in dielectric spectroscopy measurements. This method is based on placing a thin layer of dielectric sample between two electrodes, forming a capacitor-like structure. A key requirement for accurate measurements in this case is to ensure good contact between the electrodes and the sample over the entire surface. To ensure this, one of the most widely applied solutions is the use of conductive paste, which improves both the contact and the repeatability of the measurements. In this study, measurements were carried out on bentonite samples, a material known for its great swelling capacity and high sensitivity to moisture. To overcome the limitations associated with conductive paste due to these properties of bentonites, graphite layers were applied to the samples. The influence of the graphite coating, aimed at improving the electrode-sample contact, on the measurement results was systematically investigated. For the purposes of this study, admittance (Y) was selected as the quantity to be analyzed, with a focus on measuring the frequency-dependent behavior of conductance (G) and susceptance (B).

Keywords: dielectric spectroscopy, parallel plate method, graphite, bentonite.

A REVIEW OF KEY PERFORMANCE METRICS FOR PIEZOELECTRIC ENERGY HARVESTING

Fatima Živić[1], Strahinja Milenković[2,1],
Nikola Kotorčević[1], Nenad Grujović[1]

[1]*Faculty of Engineering, University of Kragujevac, Kragujevac, Serbia*

[2]*Institute for Information Technologies, University of Kragujevac, Kragujevac, Serbia*

Abstract: Green energy sources are essential for a sustainable future. Piezoelectric energy harvesting presents a promising approach to powering low-power electronics using ambient mechanical energy. Based on the reversible piezoelectric effect, mechanical stress induces electrical polarization, while applied electric fields cause mechanical deformation. This effect originates from non-centrosymmetric crystal structures that generate surface charges under strain. Energy conversion is governed by electromechanical constitutive equations, and materials used include natural crystals (e.g., quartz), ceramics (e.g., PZT, $BaTiO_3$), polymers (e.g., PVDF), and polymer-ceramic composites. Material selection critically affects electrical output, mechanical durability, and frequency response. This review focuses on key performance metrics for evaluating the effectiveness of a piezoelectric energy harvester, each reflecting a different aspect of its behavior and suitability for a given application. Key performance metrics include power output, conversion efficiency, resonant frequency, electromechanical coupling, mechanical quality factor, and fatigue resistance. A clear understanding of the underlying effects and these parameters is essential for optimizing efficient and reliable piezoelectric energy harvesters for sustainable applications.

Key words: piezoelectric materials, energy harvesting, performance metrics, electromechanical constitutive equations.

SOLAR ENERGY AS A DRIVER OF SUSTAINABLE DEVELOPMENT – TECHNOLOGICAL AND MARKET COOPERATION ACCELERATES THE TRANSITION

Isak Karabegović

Academy of Sciences and Arts of Bosnia and Herzegovina
Sarajevo, Bosnia and Herzegovina

Abstract: In a time marked by climate change and the depletion of natural resources, solar energy is increasingly recognized as a key driver of sustainable development. This paper analyzes the role of solar energy in the energy transition, focusing on its technical capabilities, economic benefits, and potential for job creation. Furthermore, it explores how the synergy between technological advancement and market mechanisms can accelerate the replacement of fossil fuels and contribute to the reduction of greenhouse gas emissions. The technical section outlines recent progress in photovoltaic technologies, improvements in solar panel efficiency, cost reductions in production, and the role of smart grids in integrating renewable sources into the energy system. Through an analysis of market trends, the importance of investments in renewable energy, subsidy mechanisms, tax incentives, and public-private partnerships in expanding solar capacity is emphasized. From an economic perspective, the paper explores the potential of the solar industry to create jobs—ranging from manufacturing and installation to maintenance and research. Utilizing available statistical data and models, the study demonstrates that investments in the solar sector yield multiple benefits: energy sovereignty, reduced dependence on fossil fuel imports, and the creation of new economic opportunities in both rural and urban areas. Case studies from countries that have successfully implemented solar strategies (e.g., Germany, Spain, and India) highlight key success factors and foreseeable obstacles that can be addressed proactively. Special attention is given to the role of public policy and regulatory frameworks that support the faster integration of solar energy, as well as the need for education and workforce retraining in accordance with the demands of the new energy paradigm. The paper concludes that synchronized efforts between technological development and market instruments are essential for accelerating the green transition. Solar energy, as a clean, renewable, and increasingly accessible resource, has the potential not only to replace fossil fuels but also to become a foundation for economic resilience and social equity in a post-carbon society.

Keywords: energy transition, solar energy, sustainable development, green jobs, market mechanisms, emission reduction.

DIGITAL BUSINESS MODELS FOR SMART FACTORIES

Snežana Topalović[1], Olivera Živković[2], Marina Stanojević[3]

[1]*Hospitality and Tourism School, 36210 Vrnjačka Banja,Serbia*

[2]*University of Kragujevac, Faculty of Economics, Kragujevac, Serbia*

[3]*University of Niš, Faculty of Economics, Niš, Serbia*

Abstract: Digital business models (DBM) are business models (BM) that use digital technologies (DT), such as: artificial intelligence (AI), virtual reality (VR), Internet of Things (IoT), cloud computing (CC), 5G wireless technologies, big data (BD), etc., to transform the traditional way of doing business into a digital one. DBM models create and deliver new business value, fundamentally changing the way businesses do business and interact with customers. These models often include rethinking, checking and improving traditional business strategies, organizational structures and basic capabilities and capabilities in order to achieve success in the digital business environment (DBE), digital economy (DE) and the digital revolution in general, which is happening and rapidly changing traditional concepts at the world level, in the last ten years. DBM models provide a large number of benefits in business operations, such as: rapid growth and scalability, high quality and consistency, optimal pricing, productivity, reliability, efficient management, operating costs, decision-making, etc. Some examples of DBM models are: electronic commerce; business-to-business (B2B); business between companies and consumers, i.e. business in which businesses sell products directly online to consumers (business-to-consumer – B2C); business directly to the consumer, i.e. brands that sell directly to consumers, bypassing traditional retailers (direct-to-consumer – D2C); subscription model (SM), on-demand model (ODM), freemium model (FM), platforms that facilitate the sharing of resources or for short the sharing economy (SE) etc.

Predictions are that in the very near future, every organization will have to adopt digital automation in all phases of business, in order to sustain itself in the new dynamic digital business environment (DDBE). Although the initial costs of introducing these digital models and technologies may seem high through e-management of business models in a very short time interval the costs will be recovered, and later will exceed the investment many times over, with minimal business errors, and the process becomes efficient at every stage.

Digital business models (DBM) for the creation of material (physical) products are widely used in new production systems and concepts, such as: intelligent manufacturing (IM), digital manufacturing (DM), cloud manufacturing (CM), smart manufacturing (SM), industry 4.0 and other components of smart factories (SF), for the production of smart products (SP), which is the goal of this work. Digital business models (DBM), apart from creating material (physical) products, are increasingly used and focus on providing services, which are often realized online through platforms. In doing so, platforms are often used to connect different stakeholders (customers, suppliers, etc.) and to facilitate the creation and exchange of value.

Keywords: business models (BM), digital business models (DBM), digital business environment (DBE), digital economy (DE), digital technologies (DT), smart factories (SF).

MONITORING OF PHENOL IN SURFACE AND GROUNDWATER OF SERBIA

Radmila Lišanin[1], Mitar Lutovac[2]

[1]Institute of Nuclear Sciences "Vinča", Serbia

[2]University of "Union - Nikola Tesla", Faculty of Management (FAM), Sremski Karlovci, Serbia

Abstract: Phenol is a priority pollutant due to its high toxicity, persistence and potential to adversely affect aquatic ecosystems and human health even at low concentrations. Phenol pollution of surface and underground water in Serbia primarily originates from industrial activities such as oil refining, petrochemical production, wood processing and the pharmaceutical industry. Despite regulatory frameworks aligned with the EU Water Framework Directive and national standards, monitoring practices often face challenges, including insufficient sampling frequency and absence of continuous monitoring systems. This paper provides an overview of current methods for the detection of phenols in water in Serbia, including spectrophotometric, chromatographic and biosensor techniques, and highlights their sensitivity and limitations. Available monitoring data show that phenol levels in several industrial zones periodically exceed the permitted values, which poses a risk for water supply and environmental safety. Control measures such as improved wastewater treatment technologies, stricter enforcement of emission standards, and real-time monitoring are considered essential strategies to reduce phenol pollution. The study highlights the need for harmonized monitoring protocols, integration of advanced analytical methods and stronger collaboration between industry, research institutions and the Environmental Protection Agency. Such an approach is crucial for ensuring safe water resources, protecting public health and achieving compliance with EU environmental standards.

Keywords: phenol, water quality, monitoring, pollution control, environmental protection.

EVOLUTIONARY STRATEGIES FOR ELECTROPHYSIOLOGICAL PARAMETERS ESTIMATION

Bogdan Milićević[1,2], Nenad Filipović[2,3]

[1]*Institute for Information Technologies, University of Kragujevac, Kragujevac, Serbia*

[2]*Research and Development Center for Bioengineering, Kragujevac, Serbia*

[3]*Faculty of Engineering, University of Kragujevac, Kragujevac, Serbia*

Abstract: Accurate estimation of electrophysiological parameters is essential for understanding and modeling the dynamic behavior of cardiac tissue throughout the entire cardiac cycle, which includes the phases of depolarization, repolarization, and the refractory period. These phases form the basis for the generation and propagation of action potentials that coordinate the rhythmic contractions of the heart. In this paper, we present a parameter estimation framework based on evolutionary strategies, specifically the Differential Evolution (DE) method, as a robust tool for identifying hidden parameters in nonlinear cardiac electrophysiology models. DE, as a population-based global optimization algorithm, is particularly well-suited for addressing problems characterized by high nonlinearity and dimensionality, which are inherent to biological systems.

Keywords: left ventricle, evolutionary computation, optimization, electro-physiology, action potentials.

Acknowledgement: This study has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101080905 (STRATIFYHF). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or granting authority – European Health and digital executive agency (HADEA). Neither the European Union nor the granting authority can be held responsible for them. This research was also supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, contract number [451-03-136/2025-03/200378 (Institute of Information Technologies, University of Kragujevac) and 451-03-136/2025-03/200107 (Faculty of Engineering, University of Kragujevac)].

EVALUATING THE POTENTIAL OF VOCAL FEATURES AS NON-INVASIVE BIOMARKERS FOR HEART FAILURE

Tijana Geroski[1,2], Lazar Dašić[2,3], Anđela Blagojević[1,2], Ognjen Pavić[2,3], Nenad Filipović[1,2]

[1]Faculty of Engineering, University of Kragujevac, Kragujevac, Serbia

[2]Research and Development Center for Bioengineering, Kragujevac, Serbia

[3]Institute for Information Technologies, University of Kragujevac, Kragujevac, Serbia

Abstract: This paper explores the potential of vocal features as non-invasive biomarkers for heart failure detection. Changes in voice may result from disruptions in the respiratory and cardiovascular systems, making voice a promising clinical signal. A standardized recording protocol was defined, consisting of five tasks: (1) reading a text at a normal speaking pace, (2) free speech for at least 30 seconds, (3) counting from 1 to 30, (4) counting down from 30 to 1, and (5) a maximum phonation task ("aaa" for as long as possible). From these recordings, various acoustic features are extracted, including phonation duration, number and length of pauses, pitch, loudness, mel-frequency cepstral coefficients (MFCCs), jitter, shimmer, and cepstral peak prominence (CPP). Clinical studies are currently underway to assess the effectiveness of this methodology and its applicability in real-world settings as a tool for early, non-invasive diagnosis and monitoring of heart failure. This approach could empower patient self-management and help reduce healthcare costs.

Keywords: heart failure, vocal biomarkers, voice analysis, non-invasive diagnosis.

LIFETIME ANALYSIS OF PHOTOVOLTAIC TECHNOLOGIES

Darko Divnić[1], Dragoljub Mirjanić[1], Esad Jakupović[1],
Zoran Ž. Avramović[2], Ivana Radonjić Mitic[3]

[1]Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, B&H

[2]University of Belgrade, Faculty of Transport and Traffic Engineering, Belgrade, Republic of Serbia

[3]University of Niš, Faculty of Sciences and Mathematics, Department of Physics, Niš, Republic of Serbia

Abstract: The global transition to renewable energy sources depends on the long-term reliability of photovoltaic (PV) technologies. Silicon-based solar panels are the basic technology for the transition to renewable energy sources, representing a long-term secure capital investment. A thorough understanding of their operational lifetime and degradation mechanisms is essential for optimizing the return on investment and ensuring the stability of these energy systems. This paper provides a comprehensive analysis of the average operational lifetime of commercial silicon solar panels, investigating the primary degradation pathways and factors that influence changes in their performance. Many studies have shown that PV panels typically have a functional lifetime of 25 to 30 years, during which their efficiency declines at an average rate of approximately 0.5% to 0.8% per year. Also, the quality of production, compliance with international standards and proper maintenance play a key role in extending this operational lifetime. In this way, PV panels, although they can continue to produce electricity for more than 30 years, their economic viability decreases as the output power falls below a commercially acceptable threshold. We conclude that, although silicon remains the industry standard with the longest lifespan, continued research into the stability of thin-film panels and perovskites could pave the way for more diverse and high-quality use of solar energy.

Keywords: solar panels, silicon, lifespan, degradation, photovoltaic systems, renewable energy.

C-HIL SIMULATION OF HOME PV SYSTEM

Milutin Petronijević[1], Boban Veselić[1], Senad Huseinbegović[2], Martin Ćalasan[3], Ivana Radonjić Mitić[4]

[1]*Faculty of Electronic Engineering, University of Niš, Niš, Serbia*

[2]*Faculty of Electrical Engineering, University of Sarajevo, Sarajevo, Bosnia and Herzegovina*

[3]*Faculty of Electrical Engineering, University of Montenegro, Podgorica, Montenegro*

[4]*Faculty of Science and Mathematics, University of Niš, Niš, Serbia*

Abstract: The widespread deployment of photovoltaic (PV) systems in urban areas poses new challenges for integration into the low-voltage grid, operation under variable meteorological conditions, and the impact of local disturbances. Research using Hardware-in-the-Loop (HIL) simulations, especially techniques with physically present controllers (Controller Hardware-in-the Loop - C-HIL), represents a powerful environment for testing and validating power electronics-based converter control strategies in real-world conditions without the risks and costs associated with field experiments. This paper presents the application of C-HIL simulation to analyze and optimize the operation of a home PV system integrated into an urban distribution grid. The conducted case studies address operational scenarios such as rapid changes in solar radiation, load fluctuations, and voltage disturbances, demonstrating the effectiveness of the C-HIL platform for assessing dynamic performance, voltage quality, and stability. The results confirm that C-HIL simulation can provide useful insights for the design of PV systems aimed at the safe and widespread deployment of distributed renewable energy sources in urban networks.

Keywords: real-time simulation, home PV system, urban distribution grid, grid inverters, C-HIL.

INVESTIGATION OF PARTIAL SHADING INFLUENCE ON PHOTOVOLTAIC PANELS PERFORMANCES

Ivana Radonjić Mitić[1], Milutin Petronijević[2], Dragoljub Mirjanić[3], Darko Divnić[3], Lana Pantić[1]

[1] Faculty of Science and Mathematics, University of Niš, Niš, Serbia

[2] Faculty of Electronic Engineering, University of Niš, Niš, Serbia

[3] Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Photovoltaic (PV) systems are usually mounted on the roofs or on building facades, thus partial shading caused by surrounding objects and debris is not rare. Even for ground mounted PV systems, installed in fields, passing clouds or trees can make partial shading issue, indicating that partial shading impact on PV panels performance should get more attention. Partial shading of PV panels can be induced by the presence of dust, leaves (or similar objects), bird droppings etc. on their front surfaces or by the shadows caused by surrounding buildings, objects, chimneys, clouds. When PV panels are partially shaded, they receive lower solar radiation intensity, and their performance decreases. Also, when partial shading occurs, PV panels may not get uniform solar radiation.The locations of partial shading on PV panels are variable and random. In this paper, results of an experimental investigation of the partial shading effects on optimally inclined monocrystalline silicon PV panels performances are shown. Results showed that the power of partially shaded PV panel reduced for 42.47% compared to the referent PV panel.

Keywords: PV panel; partial shading; power; I-V curve.

ENERGY TODAY AND TOMORROW

Momir Đurović

Montenegrin Academy of Sciences and Arts, Podgorica,Montenegro

Abstract: The energy consumption in the countries with lower levels of economic development is linked to well-being, what is not the case with high-income nations. The level of development affects human well being via negative externalities, too.

In solving these problems energy companies may control more precisely use of our home appliances by turning them on and off depending on (Credit: Getty Images) fluctuations in the weather or the time of day. It would mean a move from the "power-on-demand" way of consuming energy. Thus, it is certain that in future will happen the biggest change in the area of energy market and services, i.e. in consumers control over energy sources, and on energy consumption as well as in control of its cost, what will enlarge management activity.

Energy is one of the clearest examples of a geopolitical issue. Whilst intended to hurt the economies of the embargoed countries, this also forces importing countries to look elsewhere for their energy supplies. New energy technologies with digital possibilities will provide that the energy systems of the future will be more clean, cheap and efficient.

Keywords: energy demand, energy and environment, solutions for a renewable-powered future.

SOLAR ENERGY AS A DRIVER OF THE GREEN TRANSITION: THE PATH TO A SUSTAINABLE FUTURE

Isak Karabegović

Academy of Sciences and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina

Abstract: Solar energy is increasingly gaining significance as an essential part of sustainable development and the transition to cleaner forms of energy. Its application helps reduce dependence on fossil fuels, contributes to the reduction of harmful gas emissions, and offers numerous economic and ecological benefits. This paper examines the role of solar energy in creating a greener energy system, focusing on the technical, economic, and environmental aspects of its application. The paper begins by reviewing global capacities and current trends in solar energy usage, with special emphasis on technological advancements that enable greater efficiency of solar systems. It then analyzes financial aspects, including initial costs, subsidy opportunities, and the long-term profitability of investments in this technology. The ecological benefits of solar energy are also an important focus, ranging from reduced carbon dioxide emissions to preserving natural resources and improving air quality. One of the key elements of the paper is the evaluation of solar system efficiency, as precise measurement is essential for making informed decisions about their implementation and profitability. In this context, factors such as production capacity, efficiency, economic sustainability, and comparisons with other renewable energy sources are considered. The paper also addresses challenges—barriers related to infrastructure, financing, and regulatory frameworks continue to hinder the broader adoption of solar energy. Solar energy holds significant potential for transforming the energy sector toward a more sustainable model. However, to fully realize this potential, it is essential to continue the development of advanced technologies, ensure better integration of solar systems into existing grids, and enhance institutional and regulatory support. Systematic investment in innovation and strengthening international cooperation can significantly contribute to global efforts in combating climate change and ensuring energy stability.

Keywords: renewable energy sources, solar energy, energy efficiency, green transition, energy independence.

HISTORY (AND PREHISTORY) OF PATHOGENIC CASES OF TEETH: RELEVANCE TO MEDICINE, VETERINARY SCIENCE, AND NUTRITION OF LIVING ORGANISMS ON EARTH

Đorđe Mirjanić[1], Milesa Srećković[2], Vladan Mirjanić[1], Svetlana Pelemiš[3], Aleksandar Bugarinović[4], Jovan Ciganović[5], Milica Vlahović[6], Aleksandar Kovačević[7]

[1]Faculty of Medicine, Department of Dentistry, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

[2]Faculty of Electrical Engineering, University of Belgrade, Belgrade, Serbia

[3]Faculty of Technology Zvornik, Zvornik, University of East Sarajevo, Republic of Srpska, Bosnia and Herzegovina

[4]KBV DATACOM d.o.o., Belgrade, Serbia

[5]Vinča Institute of Nuclear Sciences, Belgrade, Serbia

[6]Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia

[7]Institute of Physics, Belgrade, Serbia

Abstract: The history (and prehistory) of pathogenic teeth cases, which is of interest to both medicine and veterinary sciences, along with their connection to the nutrition of living organisms on Earth, and the development of prosthetic aids for replacing bone tissue, is rich in numerous facts and assumptions. Opinions related to the development of modern diagnostic techniques for various organs and the preservation of "traces" have also evolved. Parts of elephant dental materials have been used for prosthetic aids in medicine and other fields. In the much more recent era, spanning at least a century, significant changes have occurred with the transition from metals to other materials of interest for dentistry and related prosthetic materials. Many materials have been developed for creation of teeth implants and various dentures, to replace natural teeth/bone material that is optimal for bonding with soft tissue. For laser techniques, ranging from diagnostics to the treatment of pathogenic conditions in soft and hard (bone) tissues, there has been a constant progress, as lasers have become much more common part of clinical practice, leading to a much higher number of interventions. Both the techniques and simulations for various conditions have significantly increased. In this paper, a selection of laser interventions is made for selected materials, such as metals or materials closer to natural bone structures, associated with the teeth, their overgrowth, filling materials, and mold creation. The study theoretically and experimentally analyses selected types of materialy by lasers, and for a certain

number of cases, attempts modeling, as well as the application of diagnostic methods for existing conditions or prediction of future cases. Special attention is given to the trend of using lasers with short and long pulses, analyzing both the positive and negative aspects of their interaction with tissues and prosthetic materials.

Keywords: materials, lasers, dentistry.

TECHNOLOGICAL ASPECTS AND PERSPECTIVE ON MATERIAL MODIFICATIONS RELEVANT TO CONTEMPORARY ISSUES RELATED TO EEE PROBLEMS

Milesa Srećković[1], Aco Janićijević[2], Александра Janićijević[3], Zoran Karastojković[3], Radovan Gospavić[4], Snežana Stojičić[5], Vladimir Marković[6]

[1]Faculty of Electrical Engineering, University of Belgrade, Belgrade, Serbia
[2]Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia
[3]Academy of Technical Vocational Studies Belgrade, Belgrade, Serbia
[4]Faculty of Civil Engineering, University of Belgrade, Belgrade, Serbia
[5]Ministry of Internal Affairs of the Republic of Serbia, Belgrade, Serbia
[6]Institute of Physics, Faculty of Science and Mathematics, University of Kragujevac, Kragujevac, Serbia

Abstract: The challenges faced by the current inhabitants of Earth in relation to EEE (Energy, Economy, Ecology) issues on a macroscopic level, lead to numerous demands tied to decades-long timeframes, which not only affect humans but also flora and fauna. Research works from past centuries, once considered insignificant, have suddenly gained new validation and relevance. Many predictions, based on both material and immaterial facts, are either being confirmed or requiring new assessments. Considering several qualities of operations that have become part of the technological solution methods, regardless of the title of "laser damage, as a parallel to some other Elion technique, several types of commercial type materials were chosen, on which several of the same operations were carried out, primarily through laser techniques, but also mechanical and other techniques. This also applies to the term modulation of surfaces, or volume, local (with the somewhat flexible concept of "local", including issues of forming the beam cross-section of quantum generators, from ~nm to practical over ~cm (or larger) dimensions. For detector materials based on plastics, crystals with various dopants, or other components of the system, several exposures were performed, and a detailed analysis was conducted regarding microscopic changes (both electron microscope and light) in the final sample, depending on the chosen geometries and dimensions. Simulations of the processes, in term of expected dimensions of laser impacts (damage areas), LAZ, and HAZ, were analyzed and compared with our experiments (experimental parameters) or other parameters from existing literature.

Keywords: materijals, lasers, simulations.

RADIATION PROTECTION IN THE DESIGN OF A BRACHYTHERAPY BUNKER FOR IRIDIUM 192

Goran Kolarević[1,2], Dragoljub Mirjanić[2,3]

[1]Polyclinic Medikol, Zagreb, Croatia

[2]Faculty of Medicine, University of Banja Luka, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

[3]Academy of Arts and Sciences of the Republic of Srpska, Republic of Srpska, Bosnia and Herzegovina

Abstract: Brachytherapy is a type of radiotherapy with closed radioactive sources that can be placed in body cavities, tumor (tissue) or in its immediate vicinity. In clinical practice, several radionuclide's are used (^{192}Ir-average energy of gamma radiation 0.37 [MeV], ^{60}Co-1.25 [MeV],...), of different energies, which requires specially designed bunkers with different thicknesses of protective walls. Bunkers should provide sufficient protection to limit the dose of ionizing radiation received by other patients, medical staff and the surrounding population to the permitted levels (0.3 [mSv/year]), while all walls, floors and ceilings represent the primary barrier. A safety door (lead) is also usually required if the maze is not included in the design. The aim of the study was to calculate the values of the primary barrier protection thicknesses for concrete, lead and steel in the case of application of ^{192}Ir as a brachytherapy source, based on IAEA recommendations. The calculation is based on an average workload: 40 patients (applications) per week, an average duration of 10 minutes to deliver an absorbed dose of 7.5 [Gy] at a distance of 1 cm from the source, a source activity of 370 [GBq] (10 [Ci]), a reference air kerma rate (RAKR) of 0.111 [mGy MBq^{-1} m^2 h^{-1}]. The design limit is 6 [μSv/week] for the public area (presence factor T = 0.1) at 3 [m] from the source treatment site. The resulting thickness of the barrier in all directions for concrete is 411.2 [mm], lead 43.3 [mm] ie 116.4 [mm] for steel. Environmental measurements (on the outer edges of all barriers) are used to check the level of protection achieved and detect possible errors.

Keywords: brachytherapy, protective barrier, iridium 192.

INDIVIDUAL APPROACH FOR DELIVERING CORRECT PRESCRIBED DOSE FOR ELECTRON IRRADIATION

Dražan Jaroš[1,2], Abel Bregman[1]

[1]*Department of Radiation Oncology, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands.*

[2]*Faculty of Medicine, University of Banja Luka, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: Introduction Patients that undergo electron irradiation sometimes require individual electron inserts that fit the corresponding applicator. In some cases, the blockage of the individual insert is large enough to cause dose differences between open field and the occluded field with the mould. In this project we aimed to establish at what occlusion percentage more than 5% dose difference occurred. Methods Absolute dose measurements were done with two different types of ion chambers, a plan parallel type chamber, PPC40 (PTW, Germany) and a cylindrical type chamber, cc13 (IBA, Germany). Measurements were performed under the same conditions. We used moulds from 10% to 90% field occlusion. In our institute, a 5% difference between delivered and prescribed dose for electron irradiation is considered clinically relevant. Therefore, results of more than 5% difference were recorded Results The next five tables show the measurement results where a dose difference of 5% was recorded between the open and occluded measurement for the range of occlusion percentages measured. Conclusion The dose difference of 5% between prescribed and delivered dose was already observed at small applicator sizes (6x6 cm) and a 50% blockage of the mould. Both ion chambers showed similar results. A workflow was implemented to measure every individual electron treatment for cases where the dose was expected to differ by more than 5%. The results from this study can be used to decide whether additional measurements and thereafter corrections to the number of MU prescribed are required.

Keywords: electron irradiation, individual electron inserts, field occlusion, dose difference, ionization chambers (PPC40, cc13), monitor units correction.

DETAILED SURVEY OF THE AVERAGE ANNUAL RADON CONCENTRATION IN LOVECH DISTRICT, BULGARIA

Kremena Ivanova[1], Todor Yordanova[1],
Desislava Djunakova[1], Zdenka Stojanovska[2]

[1]National Centre of Radiobiology and Radiation Protection, Sofia, Bulgaria

[2]Faculty of Medical Sciences, Goce Delcev University, Štip, Republic of North Macedonia

Abstract: This paper aims to analyze the spatial distribution of annual radon concentrations in dwellings within the Lovech district, Bulgaria. A detailed study of average annual radon concentration was conducted to identify areas with a higher potential for radon entry into buildings in the Lovech district. The surveyed dwellings were 683 number. The number of detectors used for the representative sample was determined based on their area, with an expected geometric mean deviation for a log-normal distribution at an accuracy level of 0.2 and a confidence level of 95%. For each municipality, adjustments to the number of detectors were made based on the number of dwellings and population. Passive long-term track detectors type RSFV were utilized, consisting of two CR-39 chips placed in cylindrical diffusion chambers for the RADOSYS system. Detectors were deployed at sampling sites for a full year, from March/April 2023 to March/April 2024, according to the measurement start time. The annual arithmetic mean radon level for ground-floor dwellings from the detailed survey during 2023–2024 is 104 Bq/m^3, with values ranging from 7 to 686 Bq/m^3. The geometric mean (GM) of the detailed survey results, with a one-year sampling period, is 79 Bq/m^3, with a standard geometric deviation of 2.17 and a median of 79 Bq/m^3. The hypothesis that radon levels in the Lovech district follow a log-normal distribution (KS, $p=0.24 > 0.05$) is confirmed. Data analysis by municipality, building type, number of floors, and presence of an underground floor revealed statistically significant differences. A model for the distribution of annual radon concentration in the area has been studied, which can be used to develop a detailed map of the region.

Keywords: radon, dwellings, track detectors, Lovech district, ground floor, annual concentration.

THE INFLUENCE OF GEOLOGICAL SOIL COMPOSITION ON RADON CONCENTRATIONS IN INDOOR URBAN AREAS OF THE REPUBLIC OF SRPSKA

Zoran Ćurguz[1], Dragoljub Mirjanić[2]

[1]*University of East Sarajevo, Faculty of Transport Doboj, Republic of Srpska*

[2]*Academy of Sciences and Arts Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: Radon research in the Republic of Srpska has been ongoing for the past 15 years and there are already significant results that can predict trends in indoor radon concentrations in cities in the Republic of Srpska. The connection between the geological composition of the soil and radon concentrations has shown a high degree of correlation, according to previous research. This paper describes radon concentrations in correlation with the geological composition of the soil in six cities. Areas with Neogene sediments showed very low levels of radon concentrations below 300 Bq/m^3, while areas where limestone and dolomite rocks are present are highly karstified - they form underground cavities, pits, sinkholes, caves that are suitable for radon deposition, and thus the measured concentrations in some places are up to 15 times higher than the recommended levels of 300 Bq/m3.

Key words: Radon, radon concentration, soil geology.

PRESENCE AND CONTROL OF TOXIC METAL EMISSIONS FROM A THERMAL POWER PLANT IN SERBIA

Jelena Isailović, Jasna Đerisilo, Miloš Gajić,
Sandra Petković Papalazarou, Josip Išek, Miroslav Sofrenić

Mining Institute Belgrade Ltd, Serbia

Abstract: This paper presents the results of concentration measurements of eleven toxic elements (As, Cd, Ni, Cu, Pb, Cr, Sb, Co, Mn, Tl, and V) in flue gas emissions from a solid fuel-fired thermal power plant in Serbia. The focus is on comparing the current national regulations with European Union standards (BAT-LCP, IED). The study shows that although Serbia is formally aligned with certain aspects of EU directives, there is still no specific legal framework regulating this type of facility. Consequently, there are no clearly defined emission limit values for all of the observed metals, nor are there requirements for continuous emission monitoring. In terms of technical equipment, most domestic power plants lack efficient flue gas cleaning systems, which is not in line with standards applied in developed countries. For heavy metal removal, Serbian thermal power plants mainly rely on electrostatic precipitators. In contrast, EU and U.S. facilities apply advanced multi-stage treatment technologies—including activated carbon injection, filtration systems, and wet scrubbers—that enable effective removal of most of the listed metals. The results indicate the need for regulatory improvements and technical modernization to reduce environmental risks and enable full implementation of best available techniques in Serbia's thermal energy sector.

Keywords: toxic element emissions, solid fuel thermal power plants, legal framework.

STRUCTURAL EFFECTS OF DEEP EUTECTIC SOLVENTS ON CELLULOSIC FIBERS: A PATH TOWARDS SUSTAINABLE BIOMATERIALS

Veronika Majová

Department of Wood, Pulp and Paper, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, Bratislava, Slovak Republic

Abstract: Deep eutectic solvents (DES) have emerged as promising green alternatives to conventional solvents in biomass processing, especially in the pulp and paper sector. This review summarizes recent findings on how DES treatments modify the structure and properties of cellulose fibers, with attention to changes in morphology, crystallinity, surface chemistry, and porosity in relation to solvent composition, pH, and processing conditions. DES-induced structural transformations affect not only delignification efficiency but also fiber accessibility, swelling behavior, and chemical reactivity, thereby expanding the potential for targeted functionalization. These modifications open pathways to advanced bio-based materials, including nanocellulose, fiber-reinforced composites, hydrogels, smart packaging, and high-performance barrier papers. Understanding the underlying mechanisms of fiber restructuring is essential for designing processes that balance efficiency, material performance, and environmental compatibility. By integrating current research across chemistry, materials science, and environmental engineering, this contribution highlights the transformative role of DES in enabling sustainable and circular technologies for the valorization of lignocellulosic biomass.

Keywords: deep eutectic solvents, cellulose fibers, modification, green processing, sustainable materials.

Acknowledgement: This work was supported by the call for doctoral students and young researchers of Slovak University of Technology in Bratislava to start a research career (Grant 23-04-04-B).

ARCHITECTURAL TRADITION AS A MODEL FOR THE USE OF ECOLOGICAL MATERIALS

Dušica Živanović[1], Bojana Mirković[1], Dejan Tubić[2]

[1]Academy of Technical and Artistic Applied Studies, Belgrade, Serbia

[2]Faculty of Philosophy, Department of Art History, University of Priština with temporary seat in Kosovska Mitrovica, Kosovska Mitrovica, Serbia

Abstract: Under the title "Architectural Tradition as a Model for the Use of Ecological Materials," this paper examines the architectural heritage of Serbia from the perspective of ecological material usage. A wide range of diverse structures, shaped by different geographic, historical, and ethnic conditions, reveals a potential continuity observable in their typological and morphological development. The aim of this work is to explore the potential of traditional architecture as a model for applying ecological materials in a contemporary context, by reviewing the typological and morphological development of both rural and urban buildings across various regions of Serbia. Special attention is given to construction systems such as timber frame (bondruk), log buildings (brvnare), and earthen techniques (including adobe and rammed earth), as well as their influence on housing quality, thermal and acoustic insulation, and integration with the natural environment. The paper focuses particularly on the traditional architecture of the Pomoravlje region, Vojvodina, and Western Serbia. It also analyzes the influence of geographic and ethnic factors on architectural expression and highlights the importance of craftsmanship in shaping sustainable building practices. The research points to possibilities of reinterpreting these principles in line with modern ecological and technological requirements.

Keywords: architectural tradition, ecological materials, rammed earth, adobe, timber frame.

ENVIRONMENT AND MATERIALS FOR RENEWABLE ENERGY SOURCES

Marija Nikolić

Ministry of Spatial Planning, Construction and Ecology, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: According to Ember (2024), over 40% of global electricity was generated from clean sources, with solar power as the fastest growing and most significant new energy contributor. This paper explores the link between the materials used in solar power systems and their environmental impact, within the framework of the Green Agenda for the Western Balkans 2050.

Through a life cycle analysis of photovoltaic (PV) systems, key materials (silicon, glass, aluminum, copper, lithium, polymers) are assessed for their recyclability and ecological footprint compared to fossil fuel sources. Special focus is placed on the environmental advantages of decentralized solar systems — such as air quality preservation, transmission efficiency, and reduced land degradation — relative to conventional infrastructure.

The paper emphasizes the role of circular economy principles in managing solar panel waste, advocating for robust take-back and recycling programs. When properly designed and located outside sensitive habitats, solar energy is arguably the most sustainable form of electricity production in the 21st century.

The conclusion highlights the importance of sustainable material use in achieving energy and climate goals, urging Western Balkan countries to accelerate the adoption of renewable energy technologies and align with EU environmental policies.

Keywords: renewable energy, photovoltaic systems, materials, environmental protection, green transition.

ANALYSIS OF THE EFFICIENCY OF THE FLUE GAS DESULFURIZATION PROCESS AT THE UGLJEVIK MINE AND THERMAL POWER PLANT

Jelena Dabić[1], Jelena Vuković[2], Nebojša Vasiljević[2], Slavko Smiljanić[2]

[1]Public Institution "Agricultural and Medical School Bijeljina", Bijeljina Republic of Srpska, Bosnia and Herzegovina

[2]University of East Sarajevo, Faculty of Technology Zvornik, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: The flue gases from coal fired thermal power plants, contains combustion gases (SO_2, NO_x, CO, CO_2) and fine particles of fly ash. The concentration of sulfur oxides in the flue gas depends on the sulfur content in the coal. The flue gas desulfurization (FGD) process at TPP Ugljevik utilizes a wet scrubbing method, where a limestone suspension serves as the absorbent medium for sulfur oxides, with gypsum as a byproduct. Comparative analysis of emission levels before and after the FGD system-installation indicates that the applied desulfurization technology is highly effective. The efficiency of the desulfurization plant ranged from 83.91% to 100%, depending on the inlet concentration of SO_2 in the flue gas. Estimates show that the FGD plant, depending on the intensity of operation, can annually remove between 7,000 and 55,800 tons of sulfur, with by-product gypsum production ranging from 3,660 to 29,280 tons. The implementation of this flue gas purification process significantly reduces the impact on the environment and ambient air pollution caused by sulfur oxides. For economic reasons, the plant is unfortunately unable to operate continuously.

Keywords: Flue gases, SO_2 emissions, desulfurization, wet scrubbing process.

UNLOCKING THE FUNCTIONAL POTENTIAL OF BIS(PHENYLHYDRAZONES): SYNTHESIS AND STRUCTURAL ELUCIDATION OF THE FIRST FE(II) COMPLEX WITH A 2,6-DIACETYLPYRIDINE-BASED LIGAND

Mirjana M. Radanović, Marijana S. Regojević,
Ljiljana S. Vojinović-Ješić, Marko V. Rodić, Berta Barta Holo

University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia

Abstract: The reaction of a warm methanolic solution of iron(II)-bromide and an acetone solution of 2,6-deiacetylpyridine-bis(phenylhydrazone) (L) gave dark red prismatic single crystals of the complex $[FeL_2]Br_2$. The composition and purity were elucidated via elemental analysis, and the coordination mode was determined based on FTIR spectra. The latter was confirmed by X-ray structural analysis. This complex is isostructural with previously synthesized complexes $[CuL_2]Br_2$ and $[CoL_2]I_2$ – all three complexes crystallize in the $C2/c$ space group and have very similar unit cell parameters. $[FeL_2]^{2+}$ lies on a two-fold rotation axis; thus, the asymmetric unit consists of one ligand molecule, a half of the Fe(II) ion, and one bromide ion. Fe(II) is situated in a very distorted octahedral environment formed by six nitrogen atoms of two ligand molecules, with *trans*-angles having the values of 146.81° and 173.43°. Due to steric factors, the phenyl rings of the ligand are twisted, which can be seen from the torsion angles of 141.42° for one and 155.27° for the other phenylhydrazone moiety. Besides, the complex is characterized by coupled TG-MS measurements.

Keywords: metal complexes, hydrazones, synthesis, characterization.

IN VITRO MACROPHAGES' RESPONSE TO THE COLLAGEN MEMBRANES OF THE SAME ORIGIN PRODUCED BY DIFFERENT MANUFACTURING PROCESSES

Sanja Stojanović[1], Mike Barbeck[2], Stevo Najman[1]

[1]*University of Niš, Faculty of Medicine, Niš, Serbia*
[2]*Berlin Analytix GmbH and University Medical Centre Rostock, Berlin and Rostock, Germany*

Abstract: Collagen-based biomaterials are widely used in regenerative medicine and tissue engineering due to their favorable characteristics such as biocompatibility and good interaction with cells for the successful regeneration of soft and hard tissues. Collagen-based biomaterials can also be used in for wound healing. These biomaterials can be used alone or in combination with other biomaterials and biologically active agents, depending on the desired outcome and target tissue. The response of cells and tissues to collagen biomaterials depends on the characteristics of the biomaterials themselves, but also on the origin of the collagen and the method of its processing in order to produce the final biomaterial. The aim of this study was to examine the response of macrophages to the collagen membranes of the same species and tissue origin but produced by different manufacturing processes, in direct contact culture in vitro. Two collagen membranes originating from porcine pericardium, native and a new transparent membrane produced by chemical treatment of the native membrane during the manufacturing process, were tested on RAW 264.7 macrophages. The cells were incubated with collagen membranes as well as in control media for 72 hours. The response of macrophages was analyzed by assessing their function using the MTT, Neutral red and NBT assays, and the morphological characteristics of macrophages were also examined using the light microscopy method. The results obtained show that the response of macrophages to the presence of the two collagen membranes of the same origin but produced by different manufacturing processes differs, and that the manufacturing process affects the functional state of macrophages. The observed differences may indicate different behavior of these membranes after implantation as well as their application in different situations in the field of regenerative medicine.

This research was supported by the Science Fund of the Republic of Serbia, #7617, Multilevel approach to study chronic wounds based on clinical and biological assessment with development of novel personalized therapeutic approaches using in vitro and in vivo experimental models – CHRONOWOUND and by the Ministry of Science, Technological Development and Innovation (Contracts No. 451-03-137/2025-03/200113).

Keywords: collagen membranes, manufacturing process, biomaterials, macrophages, regenerative medicine, wound healing.

MODULATION OF MACROPHAGES' RESPONSE TO THE COLLAGEN MEMBRANES BY LIPOPOLYSACCHARIDE

Sanja Stojanović[1,2], Danica Biberović[3], Milena Radenković Stošić[2], Biljana Božić Nedeljković[4], Jelena M. Živković[1], Mike Barbeck[5], Stevo Najman[1,2]

[1]*Department of Biology and Human Genetics, Faculty of Medicine, University of Niš, Niš, Serbia*

[2]*Department for Cell and Tissue Engineering, Scientific Research Center for Biomedicine, Faculty of Medicine, University of Niš, Serbia*

[3]*Neomedica d.o.o., Niš, Serbia*

[4]*University of Belgrade – Faculty of Biology, Belgrade, Serbia*

[5]*BerlinAnalytix GmbH, Berlin, and University Medical Centre Rostock, Rostock, Germany*

Abstract: Collagen membranes are widely used in the regeneration of both soft and hard tissues, and collagen-based biomaterials can also be used for wound healing. It is very important that these biomaterials are biocompatible but also that they interact with cells in a way that allows for adequate regeneration of the target tissue and the wound healing process. After implantation of biomaterials, the first cells to respond are macrophages, and their response depends on the inflammatory state of the tissue but also on the characteristics of the biomaterials themselves. The aim of this study was to examine the response of unstimulated and lipopolysaccharide (LPS)-stimulated macrophages to collagen membrane in direct contact culture *in vitro*. In this study, the collagen membrane derived from porcine pericardium was examined on RAW 264.7 macrophages. Cells were incubated with collagen membrane as well as in control media for 72 h. The response of macrophages was examined by evaluating their function using the MTT, Neutral red and NBT tests, and the morphological characteristics of macrophages were also examined using the light microscopy method. The obtained results indicate that the response of macrophages to the presence of a collagen membrane is different in the presence and absence of lipopolysaccharide, that is, it depends on whether the macrophages are stimulated by an inflammatory agent or not, but also that the presence of the collagen membrane itself can influence and change the functional state of stimulated macrophages. These results can be used as a strategy in tissue engineering to direct tissue and cell responses to biomaterials in order to achieve appropriate outcomes in tissue regeneration and the wound healing process.

This research was supported by the Science Fund of the Republic of Serbia, #7617, Multilevel approach to study chronic wounds based on clinical and biological assessment with development of novel personalized therapeutic approaches using *in vitro* and *in vivo* experimental models – CHRONOWOUND and by the Ministry of Science, Technological Development and Innovation (Contracts No. 451-03-137/2025-03/200113 and 451-03-136/2025-03/200113).

Keywords: collagen membranes, biomaterials, macrophages, lipopoly-saccharide, tissue regeneration, wound healing.

ROLE OF SIRT1 RS7069102 C>G POLYMORPHISM IN ACUTE MYOCARDIAL INFARCTION RISK: EVIDENCE FROM A REPUBLIC OF SRPSKA COHORT

Stojko Vidović

Medical Faculty, University of Banja Luka, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Acute myocardial infarction (AMI) is a leading cause of morbidity and mortality worldwide. The SIRT1 gene, known for its role in cardiovascular protection and metabolic regulation, may influence susceptibility to AMI. This study investigates the association between the SIRT1 rs7069102 C>G polymorphism and the risk of AMI in a cohort of patients from the Republic of Srpska. Methods: A total of 95 patients with clinically confirmed AMI and 95 healthy controls were genotyped for SIRT1 rs7069102 (C>G). Genotype frequencies were compared between cases and controls. Lipid profiles were analyzed only in the patient group. The dominant model (CG + GG vs. CC) and recessive model (GG vs. CC + CG) were used to assess risk. Odds ratios (OR) with corresponding p-values were calculated. Results: Carriers of at least one G allele (CG or GG) showed an approximately 2.29-fold increased risk of AMI compared to the CC genotype (OR 2.29, p=0.007). In the recessive model, homozygous GG individuals had a 1.73-fold increased risk relative to carriers of at least one C allele, although this difference did not reach statistical significance (OR 1.73, p=0.06). Lipid parameters within the patient group revealed variations that may correlate with genotype, warranting further longitudinal analysis during follow-up for clinical outcomes including echocardiographic changes, ejection fraction, and mortality. Conclusion: The SIRT1 rs7069102 G allele is significantly associated with an increased risk of AMI in this population. These findings highlight the potential role of SIRT1 genetic variants in AMI susceptibility and encourage further investigations into their impact on disease progression and prognosis.

Keywords: Acute myocardial infarction, genotype, SIRT1 gene.

MAGNETIC PROPERTIES OF HEMATITE NANOPARTICLES SYNTHESIZED BY SOLVOTHERMAL SYNTHESIS METHOD

Nada Citaković[1], Marin Tadić[2], Ivana Janković[1]

[1] *University of Defence, Military Academy, Belgrade, Serbia*

[2] *University of Belgrade, Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

Abstract: In this study hematite nanoparticles (α-Fe_2O_3) were synthesized by solvothermal synthesis method. The ability to tailor the morphology of hematite nanoparticles by optimizing synthesis conditions is of significant interest, as particle shape directly influences physicochemical properties, including surface reactivity, magnetic behavior, and optical properties. The morphology and particle sizes of the synthesized samples were investigated by scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The magnetic properties of the hematite nanoparticles were investigated across a broad temperature range (50–300 K) and under various applied magnetic fields (up to 1000 Oe) utilizing a vibrating-sample magnetometer. The magnetic properties exhibit a strong shape and size dependence, with higher coercivity (1725 Oe) in plate-like nanoparticles compared to irregular ones (235 Oe), remanent magnetization at 300 K from 0,061 emu/g to 0,122 emu/g and saturation magnetization at 300 K from 0,788 emu/g to 0,875 emu/g. It is well documented that the Morin transition temperature is significantly influenced by particle size, decreasing as the particle size decreases.

Keywords: Hematite, magnetic nanoparticles, solvothermal synthesis, scanning electron microscopy, transmission electron microscopy.

ORAL BIOFILM: BIOLOGICAL MATERIAL CAUSING THE LEADING DISEASES OF THE ORAL CAVITY

Nataša Trtić, Radmila Arbutina, Valentina Veselinović,
Tijana Adamović, Željka Kojić, Saša Marin, Irena Kuzmanović-Radman,
Adriana Arbutina, Olivera Dolić, Aleksandra Đeri

*University of Banja Luka, Faculty of Medicine, Banja Luka,
Republic of Srpska, Bosnia and Herzegovina*

Abstract: The causative agent of the leading oral diseases is biofilm. Biofilm is formed immediately after removal because the oral cavity has ideal conditions for its formation. The basis of the biofilm is bacteria that are immersed in a matrix of glycoproteins and lipids. This structure is very soft and sticky and is easy to remove from the surfaces on which it has formed. Streptococci are an integral part of the commensal microflora of the oral biofilm. In addition to physiological strains, pathogenic strains, Streptococcus mutans and Streptococcus sobrinus, trigger the development of caries. Furthermore, oral streptococci create conditions for late colonizers of the biofilm to settle and survive in the subgingival regions, leading to periodontitis. Untimely removal of the biofilm will cause oral diseases, and the propagation of biofilm colonizers into the circulation can cause systemic diseases.

Keywords: oral biofilm, oral diseases, systemic diseases.

THE INFLUENCE OF ORAL HYGIENE AND DIETARY HABITS ON THE SUCCESS OF THE BLEACHING OF ENDODONTICALLY TREATED TEETH

Nataša Knežević, Marija Obradović, Olivera Dolić, Željka Kojić, Valentina Veselinović, Ognjenka Janković, Vladan Mirjanić, Vanja Krčić

University of Banja Luka, Faculty of Medicine, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Introduction: In the tooth bleaching process, the primary focus is often placed on selecting an adequate bleaching technique and optimal agent concentration, while the significance of daily oral hygiene during and after the bleaching treatment is frequently underestimated. The quality of oral hygiene, along with patients' dietary habits, plays a significant role in the immediate success and long-term stability of the achieved tooth color. This study aimed to investigate the influence of oral hygiene, smoking, and the consumption of colored beverages on the success of bleaching endodontically treated teeth. Materials and Methods: The study included 30 endodontically treated teeth. In the first group, teeth were bleached using the walking bleach technique (10 teeth); in the second group, the in-office technique was used (10 teeth); and in the third group, teeth were bleached with a combined technique (10 teeth). Bleaching was performed using 30% carbamide peroxide and 35% hydrogen peroxide. All teeth were restored with the nanohybrid composite material Tetric EvoCeram (Ivoclar, Liechtenstein). Based on oral hygiene and dietary habits, patients were classified as having good/moderate/poor oral hygiene, as smokers/non-smokers, and as consumers/non-consumers of colored beverages. Before and after the bleaching treatment, the color of all teeth was determined using the Vita Classic shade guide. For statistical analysis, bleached teeth were analyzed based on the scale from the study by Ari et al. Results: Based on Fisher's exact test results, a statistically significant difference (p<0.05) in bleaching success was established among teeth with good, moderate, and poor oral hygiene. However, no statistically significant difference was found between smokers and non-smokers, or between consumers and non-consumers of colored beverages. Conclusion: The effectiveness of non-vital tooth bleaching is affected by the oral hygiene of the patients. However, smoking and colored beverage consumption had no impact on the success of the bleaching process.

Keywords: oral hygiene, smoking, colored beverages, carbamide peroxide, hydrogen peroxide, nanohybrid composite.

APPLICATION AND IMPORTANCE OF MASTERBATCH IN SILICONE ELASTOMERS

Darko Manjenčić[1], Zorana Milosavljević[1], Mladen Nikolić[1], Predrag Pravdić[1], Milena Deljanin[1], Anja Manjenčić[2], Nevena Vukić[3], Vladan Mićić[4]

[1] Academy Kruševac, Department of Technical and Technological Studies, Kruševac, Serbia

[2] University of Belgrade, Faculty of Medicine, Belgrade, Serbia

[3] University of Kragujevac, Faculty of Technical Sciences, Čačak, Serbia

[4] University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: This study explores the influence of masterbatch on the crosslinking of silicone elastomer. Siloxane-based composites were synthesized to optimize the final material properties. A masterbatch containing vinyl-functional siloxanes and silicon(IV)oxide as a filler was introduced to enhance mechanical properties and network topology. Fourier transform infrared spectroscopy (FTIR) was used for chemical structure analysis, while thermogravimetric analysis (TGA) assessed the thermal stability. The addition of masterbatches significantly improves the properties of silicone materials and makes them ideal for numerous medical applications.

Keywords: composites, masterbatch, mechanical properties, siloxane elastomers.

DENTAL IDENTIFICATION OF HUMAN VICTIMS

Josipa Karij Trivunović, Ljubica Škrbić, Vladan Mirjanić

University of Banja Luka, Faculty of Medicine, Study Program Dental Medicine Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Forensic dentistry is a field that applies dental knowledge to the identification of individuals and the resolution of legal and criminal cases. It is most often used when other identification methods are not possible, especially in cases of natural disasters, fires, or severe accidents. Teeth are extremely resistant to high temperatures and decomposition, and often remain the only recognizable part of the body.

Key areas of forensic dentistry include:

- Victim identification, by comparing dental records (X-rays, fillings, bridges, orthodontic appliances) with the dental condition of the discovered person.
- Bite mark analysis, which can help link a suspect to the crime scene based on tooth marks found on skin or objects.
- Age and sex estimation, where the development and wear of teeth, as well as jaw dimensions, can be used to approximate the person's age and sex.
- Injury assessment, particularly in the head and neck region, to determine the cause and mechanism of injury.

Techniques used in forensic dentistry include intraoral and panoramic X-rays, dental impressions and models, digital bite mark analysis, and DNA analysis from the dental pulp (when available).

Thanks to these methods, forensic dentistry is a valuable tool for police, courts, and investigative teams - especially when other identification techniques are unavailable or unreliable.

Forensic dentistry is considered one of the most reliable and cost-effective scientific methods for identifying victims of major disasters. Dental identification is based on the fact that no two oral cavities are the same, and each person’s teeth are unique. The post-mortem dental findings of a deceased person are compared with the antemortem dental documentation of a missing person to achieve a positive identification.

Keywords: forensic dentistry, human victim identification, dental records.

BONE REGENERATION OF JAW BONES

Josipa Karij Trivunović, Ljubica Škrbić, Vladan Mirjanić

University of Banja Luka, Faculty of Medicine, Study Program Dental Medicine Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Bone possesses an exceptional regenerative capacity, and most injuries heal without the formation of scar tissue. However, various local and systemic factors can compromise bone healing and result in the formation of bone defects. In such cases, surgical methods can be used to stimulate bone regeneration. Autogenous and allogeneic bone, xenogeneic grafts, and alloplastic materials - used either alone or in combination with membranes in the technique of guided bone regeneration (GBR) - have been employed for many years to restore bone tissue. Platelet-rich plasma (PRP), platelet-rich fibrin (PRF), and plasma rich in growth factors (PRGF) are preparations obtained by centrifugation of the patient's blood and represent an optimized blood clot. The use of platelet preparations can enhance the healing process by promoting neoangiogenesis, fibroblast proliferation, collagen formation, mitosis of mesenchymal stem cells, and osteoblasts.

Keywords: bone regeneration; GBR; platelet preparations; BMP.

SMOKELESS TOBACCO AND ORAL HEALTH: RISKS ASSOCIATED WITH SNUS AND NICOTINE POUCHES

Tijana Adamović[1], Ognjenka Janković[1], Valentina Veselinović[1], Nataša Trtić[1], Verica Pavlić[2], Jovana Lovrić[2], Jana Ilić[3]

[1]*Faculty of Medicine, Department of Dental Medicine, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*
[2]*Institute of Dentistry, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*
[3]*Public Health Centre, Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

Abstract: Smokeless tobacco products, such as snus and nicotine pouches, are increasingly used as an alternative to smoking traditional cigarettes. Although they are considered "safer," their use still carries significant risks to oral health. These products are placed in the oral vestibule, where nicotine and other harmful substances are absorbed into the bloodstream. The pouches contain numerous toxic and carcinogenic substances, including tobacco-specific nitrosamines (TSNAs), polycyclic aromatic hydrocarbons (PAHs), heavy metals, and aldehydes. Regular and prolonged use is associated with various changes in the oral mucosa, such as leukoplakia, nicotine stomatitis, inflammation, and gingival recession, as well as an increased risk of developing oral cancer. Although accurate data on the prevalence of these products in Bosnia and Herzegovina are still lacking, existing knowledge highlights the need for further research and preventive measures. Key strategies in combating the negative effects of smokeless tobacco include public education, raising awareness of the risks, and strengthening support for tobacco cessation programs. Timely action and public awareness campaigns can significantly contribute to the preservation of oral health, especially among young people who are increasingly turning to these products.

Keywords: smokeless tobacco, snus, nicotine pouches, oral mucosa, prevention.

LASER-INDUCED GRAPHENE ON PDMS WITH GLYCOL COMPOUNDS AS A POTENTIAL WEARABLE SENSOR

Anđela Gavran[1], Marija V. Pergal[1], Teodora Vićentić[1], Igor Pašti[2,3], Danica Bajuk-Bogdanović[2], Marko Spasenović[1]

[1]*Center for Microelectronic Technologies, Institute of Chemistry, Technology and Metallurgy, National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia*

[2]*University of Belgrade - Faculty of Physical Chemistry, Belgrade, Serbia*

[3]*Serbian Academy of Sciences and Arts, Belgrade, Serbia*

Abstract: Laser-induced graphene (LIG) has become the subject of extensive research over the past decade and has been explored and applied for applications in sports and medicine. Its excellent characteristics, such as good electrical conductivity, piezoresistivity, flexibility, and low-cost production, make it a suitable material for use in wearable electronics and sensors. Poly(dimethylsiloxane) (PDMS) has attracted attention as a substrate for wearable sensors due to its good biocompatibility, elasticity, and mechanical characteristics. However, due to the lack of carbon atoms in its structure, in order to induce graphene on it, PDMS needs to be modified with carbon-rich glycol compounds such as diethylene glycol (PDMS/DEG) and ethylene glycol (PDMS/EG). This paper presents the laser induction of graphene on a PDMS/DEG and PDMS/EG polymer composite, electronic testing, and physicochemical characterization. By optimizing laser parameters, LIG with the lowest electrical resistance was achieved, and it was observed that samples with diethylene glycol appeared visually better than those with ethylene glycol. Raman spectroscopy confirmed the formation of graphene through the presence of the characteristic D, G, and 2D bands. Complementary analysis via Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) further validated the structural and morphological features of the LIG. Characterization revealed that increasing the concentration of glycol compounds led to higher quality graphene. In the future, the developed PDMS/glycol-LIG composites hold significant potential for future applications in real-time physiological monitoring and for limb motion sensing.

This research was supported by the Science Fund of the Republic of Serbia, #4950, Polymer/graphene heterostructures for physiological sensors – Polygraph.

Keywords: Laser-induced graphene, PDMS, Glycol compounds, Wearable sensors, Raman spectroscopy, FTIR, SEM.

A COMPARATIVE HISTOLOGICAL STUDY OF CALCIUM-SILICATE CEMENTS FOR DIRECT PULP CAPPING IN WISTAR RATS

Ognjenka Janković[1], Helena Golubović[1],
Tijana Adamović[2], Vladan Mirjanić[1]

[1]*Medical Faculty, University of Banja Luka, Banja Luka, Bosnia and Herzegovina*

[2]*University of Banja Luka, School of Medicine, Dentistry Study Program, Banja Luka, Bosnia and Herzegovina*

Abstract: Maintaining pulp vitality is essential for long-term tooth health. Direct pulp capping is intended to promote reparative dentin formation and prevent pulp necrosis. This study aimed to evaluate the effects of new calcium silicate-based materials on the pulpal inflammatory response and dentin bridge formation using a Wistar rat model. A total of 18 Wistar rats (72 maxillary molars: 36 first and 36 second) were included and divided into two groups (A and B; n = 9). In Group A, Theracal LC was applied to the exposed pulp of the right maxillary molars, while Calxil was used on the left ones. In Group B, Biodentine was applied to the right molars, and MTA and Calxil were used on the first and second left molars, respectively. The Wilcoxon signed-rank test was used for statistical analysis. After 30 days, the lowest pulpal inflammatory response was observed with Theracal LC, followed by Biodentine, which had a similar rate of inflammation but with slightly more polymorphonuclear leukocytes. A statistically significant difference in inflammation levels was found between Theracal LC and Calxil ($p = 0.034$), and between Biodentine and Calxil ($p = 0.039$). The highest inflammatory response was seen with MTA. All tested materials showed a high capacity for inducing dentin bridge formation. In conclusion, the new calcium silicate materials demonstrated favorable biological behavior, with Theracal LC and Biodentine showing the least inflammation. All materials promoted reparative dentinogenesis, confirming their potential for use in direct pulp capping procedures.

Keywords: Pulp capping, Theracal, Biodentin, MTA.

NANOMATERIALS IN MODERN DENTISTRY: APPLICATIONS, BENEFITS AND FUTURE PERSPECTIVES

Milica Tufegdžić[1], Predrag Dašić[2], Nevena Tufegdžić[3]

[1]*Academy of Professional Studies Šumadija, Kragujevac, Serbia*

[2]*Engineering Academy of Serbia (IAS), Belgrade, Serbia*

[3]*SaTCIP Publisher Ltd, Vrnjačka Banja, Serbia*

Abstract: Nanomaterials, with structural elements ranging from 1 to 100 nanometers, represent a major advancement in modern dentistry. Their unique physicochemical properties - such as high specific surface area, enhanced reactivity, and potential for targeted functionalization - facilitate improvements across preventive, restorative, endodontic, periodontological, implantological, and diagnostic procedures. In preventive dentistry, they support enamel remineralization and long-term antibacterial protection, while in restorative materials they enhance esthetics, mechanical strength, and durability. In endodontics and periodontology, they promote effective biofilm removal and tissue regeneration, and in implantology they improve osseointegration and reduce infection risk. Additionally, nanobiosensors and fluorescent markers enable early detection of oral diseases. Despite these advantages, further research is required to establish their long-term biological safety and optimal clinical applications.

Keywords: nanomaterials, dental medicine, preventive dentistry, restorative dentistry, implantology, diagnostic procedures.

TOXICITY OF NANODIMENSIONAL MATERIALS AS A FACTOR OF USABILITY IN BIOMEDICAL ENGINEERING

Ljubiša Petrov

Innovation Center, Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia

Abstract: In biomedical sciences, the interaction between the materials used during the most diverse medical procedures and the tissues of a living organism is a basic prerequisite in terms of the usability of the used materials. The interaction between these two worlds depends on many factors, and the basic task of biomaterials science is to establish the possible conditions under which a harmful effect of materials on tissue can occur. This paper deals with issues of toxicity of nanodimensional materials as an elementary factor for determining its usability in medicine, from the aspect of understanding and measuring its biocompatibility. It can be considered that nanotoxicology is a separate scientific discipline, which has the task of determining whether and to what extent the properties of nanodimensional materials pose a danger to the organism, the individual health and the environment in which the individual is surrounded.

Keywords: nanotechnology, nanomedicine, biomedicine, toxycology, bio-compatibility, biotechnology.

ULTRASOUND CONTRAST AGENTS: FROM MICROBUBBLES TO MOLECULAR IMAGING

Jelena Marić[1], Zlatko Maksimović[2]

[1]JZU Hospital "Sveti Vračevi", Bijeljina, Republic of Srpska, Bosnia and Herzegovina

[2]ZU Specialist Center "MaxMedic", Bijeljina, Republic of Srpska, Bosnia and Herzegovina

Abstract: Ultrasound contrast agents (UCAs) have revolutionized diagnostic imaging by enhancing ultrasound signal quality through the use of gas-filled microbubbles or emerging submicron particles. These agents provide real-time, radiation-free imaging and are especially advantageous for patients with renal impairment. Second-generation UCAs, composed of inert gases like perfluorocarbons and stabilized by biocompatible shells, offer improved stability and imaging duration. Clinically, UCAs are widely used in cardiovascular and abdominal imaging, notably for echocardiography and liver lesion characterization, with expanding roles in vascular, oncologic, and pediatric applications. Their intravascular confinement, excellent safety profile, and non-nephrotoxic nature make them suitable for a broad patient population. Molecularly targeted microbubbles and novel nanodroplets further enhance diagnostic specificity and enable theranostic applications, including targeted imaging and drug delivery. While current clinical use is limited to microbubbles, ongoing research into submicron agents and molecular targeting suggests a promising future for UCAs in both diagnostics and therapy.

Keywords: Ultrasound contrast agents, microbubbles, diagnostic imaging, molecular targeting, theranostics, drug delivery.

CHARACTERISTIC NANOPARTICLES AS DRUG CARRIERS

Srđan Vuković, Danijela Rajić, Svetlana Pelemiš

University of East Sarajevo, Faculty of Technology Zvornik, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract:. Nanomaterials are increasingly finding application in systems for drug delivery into the human body. The use of nanomaterials enables faster drug absorption, more precise dosage control, and reduced toxic effects, while simultaneously increasing therapeutic efficacy. Nanoparticles can be synthesized from a variety of materials, including metals (e.g., gold, silver), metal oxides (e.g., titanium dioxide (TiO_2), silicon dioxide (SiO_2)), inorganic materials (carbon nanotubes, quantum dots), polymeric materials, lipids, and proteins. Among novel nanomaterials, particular attention is given to multifunctional liposomal nanoparticles, functionalized fullerenes, nanotubes, iron oxide nanoparticles, polymeric micelles, dendrimers, and polymeric microspheres. Controlled drug delivery aims to achieve maximum therapeutic effect while minimizing potential adverse effects. In the design of architectures for different types of block copolymers, advanced nanotechnological approaches have been applied with the goal of optimizing the efficiency of drug delivery and improving diagnostic methods. The toxicity of these materials and their biological impact represent key aspects of research within their medical application.

Keywords: nanoparticles, novel nanomaterials, drug delivery, toxicity.

ASPECTS OF THE DEVELOPMENT AND USE OF HYDROGEN AS AN ALTERNATIVE PROPULSION FUEL IN THE AVIATION INDUSTRY

Božidarka Arsenović[1], Stanko Spasojević[2]

[1]*"ORAO" A.D. for Production and Overhaul, Bijeljina, Republic of Srpska, Bosnia and Herzegovina*

[2]*Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia*

Abstract: In the last three decades, greenhouse gas emissions in international aviation have increased dramatically. Although aviation occupies a small share of global greenhouse gas emissions, it represents the fastest growing source of carbon dioxide emissions *(Carbon dioxide - CO_2),* which is why some new solutions are being sought that will reduce their impact on global warming that contributes to climate change. Reducing the impact of aviation on the climate is becoming a priority, which is why it is necessary to limit dependence on fossil fuels and find new alternative sources of energy. *Hydrogen, as an alternative source of energy,* both in our country and in the world, *is considered one of the future ecological onesmore acceptable sources of energy,* with the fact that it can be used as a *raw material*, *fuel and energy carrier*, and it also has wide application in industry, energy and transport. It is important to emphasize *that hydrogen does not emit carbon dioxide* and that it does not pollute the air during use, i.e. it is *considered a solution for decarbonization, both in aviation and in other industrial and economic sectors* (extremely important in the implementation of climate neutrality policy).

Key words: Hydrogen as an alternative fuel, aviation, airplanes.

UTILIZATION AND RECOVERY ANALYSIS OF OAK LOGS IN A MODERN WOOD PROCESSING PLANT

Dane Marčeta[1], Anđela Jokić[2], Vladimir Petković[1]
Gordana Globočki-Lakić[3]

*[1]Faculty of Forestry, University of Banja Luka, Banja Luka
Republic of Srpska, Bosnia and Herzegovina*

*[2]Polytechnic High School, Banja Luka, Banja Luka
Republic of Srpska, Bosnia and Herzegovina*

*[3]Faculty of Mechanical Engineering, University of Banja Luka, Banja Luka
Republic of Srpska, Bosnia and Herzegovina*

Abstract: This paper analyzes the quantitative and qualitative recovery of pedunculate oak (Quercus robur) logs processed in the modern sawmilling facility of "Drvoprodex" d.o.o. in Srbac, Bosnia and Herzegovina. The research was conducted through a combination of direct measurements during two operational shifts, encompassing 185 logs and company-maintained production records. Logs were classified into three quality grades, with detailed analysis of dimensions and produced assortments, including lamellae (grades A–C), rustic-grade elements (R class), and friezes. The overall recovery from debarked log volume reached approximately 30%, aligning with the lower end of typical industry expectations for oak flooring production. Friezes dominated in quantity (2,376 pcs), particularly in 70 mm width, while lamellae and R-class elements showed optimal yields at 135 mm and 215 mm widths. Regression analysis confirmed a statistically significant positive influence of log diameter on both recovery rate and daily processing volume. While advanced equipment such as a band saw head rig, CNC optimizer, and multi-blade rip saws are employed, several older machines occasionally limit throughput, underscoring the need for further modernization. Importantly, about 70% of the log volume remains as sawmill residue, including slabs, edgings, sawdust, and bark. Recommendations are made for systematic valorization of these co-products: coarse residues can be chipped for biomass energy or panel manufacturing, while sawdust and bark can serve for pellet production or biochemical extraction (e.g. tannins). Enhancing residue utilization would increase material efficiency and economic sustainability, aligning the mill with circular economy principles and near-zero-waste production goals.

Keywords: oak sawmilling, log recovery, wood processing.

BIOCLIMATIC ANALYSIS OF THE CITY OF BIJELJINA, FOR THE PERIOD 2019 – 2023

Dijana Đurić[1], Neđo Đurić[2]

[1] *Faculty of Civil Engineering Subotica, University of Novi Sad, Serbia*

[2] *Academy of Sciences and Arts of the Republic of Srpska, Bosnia and Herzegovina*

Abstract: Urbanization in the Republic of Srpska shows the greatest growth in the cities of Banja Luka and Bijeljina. Urban areas are constantly growing, while green areas have a decreasing percentage in the total distribution of land. Such a system leads to the creation of urban islands, which have a higher temperature compared to the environment and which represent unfavorable spaces for living.

This paper presents the method of bioclimatic analysis for the City of Bijeljina for the period from 2019 to 2023. The method used, UTCI, i.e. Universal Thermal Climatic Index, is an index of the heat budget as a function of physiological and meteorological parameters, which describes the physiological heat stress experienced by the human body in an attempt to maintain thermal balance with the surrounding external environment. The obtained results represent important data for the understanding of the eco-space of the researched area and as such should have their importance during any type of construction and alteration of the space.

Keywords: UTCI, bioclimatic index, urban environments, Bijeljina.

INFLUENCE OF LOCAL FACTORS ON THE DEPOSITION OF PLEISTOCENE ALLUVIAL SEDIMENTSIN THE LOWER SAVA RIVER VALLEY

Jelena Zarić Kovačević[1], David Mitrinović[2], Nela Vujović[3], Marija Perović[2]

[1]*Mining Institute Ltd. Belgrade, Batajnički put Belgrade, Zemun, Serbia*

[2]*Jaroslav Černi Water Institute, Belgrade, Serbia*

[3]*Institute for Technology of Nuclear and other Mineral Raw Materials, Belgrade, Serbia*

Abstract: The Quaternary period was characterized by cyclic climate change, with alternating cold and warm stages. A case study of the alluvial sediments at water supply wellfield of the City of Belgrade shows how climate change has influenced the formation of alluvial sediments in the riparian area of the Sava River (Sava River ditch, in the southeastern part of the Pannonian Basin). A stratigraphic analysis of the Quaternary sediments of two boreholes on the location a BGS water well is presented in the paper, along with the methods, results, indications and hypotheses about their origin and the characteristics of the strata in the context of Pleistocene climate change and the local tectonic setting. The results indicate that alluvial sedimentation and the characteristics of these sediments are predominantly determined by the tectonic and geological setting, as well as local conditions of the area surrounding the object locations, supported by lateral streams and tributaries.

Keywords: Pleistocene alluvial deposits, Sava River, Belgrade Groundwater Source, boreholes, water wells.

ANALYSIS OF THE URBAN HEAT ISLAND OF THE CITY OF TREBINJE USING REMOTE SENSING PRODUCTS

Goran Trbić[1,3], Marko Ivanišević[1], Zoran Vujković[2,3], Tatjana Popov[1], Slobodan Gnjato[1]

[1]Faculty of Natural Sciences and Mathematics, University of Banja Luka, Republic of Srpska, Bosnia and Herzegovina

[2]Faculty of Medicine, University of Banja Luka, Republic of Srpska, Bosnia and Herzegovina

[3]Academy of Sciences and Arts of the Republic of Srpska, Republic of Srpska, Bosnia and Herzegovina

Abstract: The phenomenon of urban heat islands is becoming increasingly pronounced and is one of the main reasons for the increase in air temperature in cities. The thermal regime of urban areas is different from peri-urban and rural areas, and is reflected in faster daytime heating and slower nighttime cooling. There are two main approaches to the study of urban heat islands - direct measurements of air temperature in the field and readings of temperatures from remote sensing products. The paper will analyze remote sensing products from the Landsat 8 satellite in order to determine differences in thermal characteristics of specific types of land use in the territory of the city of Trebinje. For the purposes of the analysis, a buffer zone was defined within a radius of 10 km from the central point of the city (geographical coordinates: 42.7112° N, 18.3436° E), which enabled the inclusion of urban, rural and natural areas. A total of 12 satellite images were collected and a time frame covering the summer months of 2024 (June 1 to August 31) was used. Given the sensitivity of thermal data to the presence of clouds, a cloud filter (CLOUD_COVER < 20%) was applied to ensure the quality of the input data. Additionally, a cloud mask and cloud shadows were implemented using the QA_PIXEL layer to remove contaminated pixels. The research results show that built-up areas have higher temperatures compared to other land use classes by more than 2°C. All analyses were conducted using open source software packages. The research results can be useful for various sectors such as public health, spatial planning, energy, water management, forestry and similar areas. In addition, the research results may contribute to future detailed studies aimed at defining local climate zones and thermal variations within them.

Keywords: Urban heat island (UHI), thermal regime, remote sensing (Landsat 8), land use, Trebinje, temperature differences, cloud filtering, open-source software, public health, spatial planning.

THEORETICAL PRINCIPLES OF LOOKING AT PROBLEMS IN THE CONSTRUCTION OF WIND FARMS SERBIA

Vladimir Lukić

BIN Commerce d.o.o., Belgrade, Serbia

Abstract: Wind is an inexhaustible source of environmentally friendly energy, whose global potential several times greater than the world's electricity needs. About 2% of incident solar energy is converted into wind. Although it has enormous power, which occasionally manifested in its destructive power, wind man can be an ally. Since ancient times, the wind is used for navigation by the vast sea, but also to drive the mills, saw mills and water pumps. Wind turbines, known as windmills, used over 1000 years ago, especially in Holandji, Denmark and the USA.

The aim of this paper is to present the basic principles and problems of vetroagregate, with attention to vetroagregatima that bind to the distribution network, and are an integral part of the power system (EPS). As the benefits of using wind energy are: high reliability in operation, no fuel costs, as well as environmental pollution, while the downside of high construction costs and the variability of the wind speed that affect the continuity of supply of energy. Development of electricity generation using wind power started in the 80s and 90s of the last century in response to the oil crisis and the number of accidents at nuclear power plants. Today in the world of household unabashed small wind turbines up to several tens of kilowatts, they can be used as a source of energy or as a primary energy source in areas where it is not possible to provide electricity in a different way (when used as a primary source of essential add a battery that stores energy when it generates more than consumption). Large wind turbines are often installed in wind farms and over transformers connected to the grid.

They are characterized by the movement of wind energy converted into energy with rotation, and the immediate outcome of their functions shaft that rotates and can run any operating condition. The wind is free and with modern technology can be successfully used. When building windmills over, do not produce the pollutants and harmful gases. Although windmills are very high, do not take up much room. This means that the country is about windmills can still be used. This is particularly the case in rural areas, where farming continues uninterrupted. Wind is actually a form of solar energy, so it has similar benefits in terms of clean energy, efficiency and reproducibility. Some studies claim that there is not enough wind to electricity supply one third of the world's needs. Small wind turbines can be used in remote places to power homes that are far removed from the network.

Keywords: energy, wind turbines, CO_2.

SYNTHESIS AND CHARACTERISATION OF BIODEGRADABLE MATERIALS BASED ON SILICONE POLYMERS

Darko Manjenčić[1], Zorana Milosavljević[1], Mladen Nikolić[1], Predrag Pravdić[1], Milena Deljanin[1], Anja Manjenčić[2], Nevena Vukić[3], Vladan Mićić[4]

[1]Academy Kruševac, Department of Technical and Technological Studies, Kruševac, Serbia

[2]University of Belgrade, Faculty of Medicine, Belgrade, Serbia

[3]University of Kragujevac, Faculty of Technical Sciences, Čačak, Serbia

[4]University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: In recent years, biodegradable polymers, especially those obtained from biorenewable resources, have become the subject of many scientific and industrial researches. The increasing environmental problems and demands of modern society are intensifying efforts in researching new polymer materials, which are environmentally friendly and functionally optimized. In order to improve the biodegradability properties of siloxane-based materials, ABA block copolymers consisting of poly(dimethylsiloxane) and poly(lactide) segments have been synthesized. This class of materials combines the biodegradability and strength of poly(lactide) with the elasticity and chemical stability of poly(dimethylsiloxane). The synthesis and characterization of copolymers with modified properties according to the requirements of the end application are presented in this paper. These materials are studied in various fields including biomedicine, materials engineering, and advanced packaging.

Keywords: biodegradable polymers, poly(lactide), sustainability, hydroxy-siloxan.

AIR POLLUTION AND CLIMATE CHANGE AS MAJOR CHALLENGES TO ENVIRONMENTAL SUSTAINABILITY

Darko Manjenčić[1], Zorana Milosavljević[1], Mladen Nikolić[1], Predrag Pravdić[1], Milena Deljanin[1], Bojan Slavić[1], Vladan Mićić[2]

[1]Academy Kruševac, Department of Technical and Technological Studies, Kruševac, Serbia

[2]University of East Sarajevo, Faculty of Technology, Zvornik, Republic of Srpska, Bosnia and Herzegovina

Abstract: There is an interdisciplinary connection between air pollution, the climate crisis, and sustainable lifestyles, as these represent some of the most complex challenges of this century. This review provides a detailed analysis of this relationship, primarily addressing carbon dioxide (CO_2) emissions from the combustion of fossil fuels as the main contributor to global warming, while also focusing on primary pollutants such as methane and ground-level ozone. These pollutants have a significant impact on climate alteration by generating greenhouse gases. The discussion is comprehensive, encompassing best practices ranging from conventional pollution control technologies to high-tech alternatives, including electric vehicles, the utilization of renewable energy sources, and green decentralized solutions. Additionally, it addresses policy-related aspects, such as the imposition of stricter emission standards, the enforcement of more robust environmental regulations, and the reassessment of certain economic measures. Furthermore, recent advancements in air protection, such as air ionization, solar-powered purification systems, and photocatalytic materials, are discussed among innovative technological solutions. These strategies vary according to local conditions and therefore exhibit different levels of effectiveness, yet remain evident as important tools for pollution mitigation.

Keywords: Air pollution, Climate change, Fossil fuel combustion, Pollutants, Green solutions.

ECO-MATERIALS AND ECO-TECHNOLOGIES IN MECHANICAL ENGINEERING

Predrag Pravdić, Violeta Dorđević

Academy of professional studies Kruševac, Department of technical and technological studies in Kruševac, Serbia

Abstract: In modern engineering, increasing attention is being paid to environmentally friendly materials and technologies that reduce the negative impact of industry on the environment. Eco-materials have become a key factor in reducing this negative impact, as they help minimize waste, energy consumption, and pollution. Eco-technologies also play a significant role in mitigating the environmental consequences of industrial processes. By using these technologies, industries can reduce their carbon footprint and improve sustainability. The integration of eco-materials and technologies is essential for achieving long-term environmental preservation and sustainable industrial practices. This contributes to the protection of the planet and ensures responsible development.

Keywords: eco-materials, eco-technologies, engineering, environment.

SIMULATION OF HYDRAULIC SYSTEM COMPONENTS USING MATLAB-SIMULINK SOFTWARE

Jelena Erić Obućina, Marina Karić

Academy of Professional Studies Šumadija (ASSŠ),
Department of Trstenik, Trstenik, Serbia

Abstract: Hydraulic components can be used in a large number of examples, such as: automotive industry, mechanical engineering, transportation devices and systems, construction and mining machinery, robots, etc. New designs of hydraulic components are increasingly made of modern and high-quality materials, with the following characteristics: higher operating accuracy, increased reliability, higher energy and higher efficiency. work regulations and characteristics, higher protocols and working pressure, higher power, longer service life and a wider area of application. For dynamic simulation of the behavior of hydraulic components and systems under different operating conditions and influencing signals, software systems and tools for that name are used. Of course, simulation allows engineers to observe the response system, identify potential problems such as oscillation or slow response times and analyze the impact of design changes without physical manufacturing. The most commonly used software system for dynamic simulation of the behavior of hydraulic components and systems is the MATLAB-Simulink software. It is intensively used in the design and analysis of hydraulic components and systems due to its capabilities in modeling, simulation and design of control systems. MATLAB-Simulink allows the creation of detailed models of hydraulic systems, including all hydraulic components, such as: servo valve, hydraulic cylinder and other related components, which is the goal of this work. This is achieved by representing each component as a block with defined mathematical relationships, encompassing the nonlinear dynamics inherent in hydraulic components and systems.

Keywords: hydraulic system components, hydraulic system, simulation, software, MATLAB-Simulink.

APPLICATION OF REMOTE SENSING FOR ASSESSING SURFACE WATER QUALITY

Sonja Ketin[1], Sanja Jevtić[1], Rade Vasiljević[1],
Rade Biočanin[2], Marko Andrejić[3]

[1]*Academy of Technical and Art Applied Studies Belgrade, Dpt. Railway College of Applied Sciences, Serbia*

[2]*The European Defendology Center, Banja Luka, Republic of Srpska B&H*

[3]*Faculty of Project and Innovation Management - Educons University, Belgrade, Serbia*

Abstract: The paper shows the importance of remote detection of water quality using platforms that are available to the public, and enable remote data collection, without going into the field. The paper presents the use of the Hydrology Tep platform, which presented water quality data for certain parameters clearly and easily accessible to the public. The results obtained showed an unfavorable water quality status for the observed examples, which confirmed the already established water quality status for the selected example according to the Serbian Water Quality Index – SQWI.

Keywords: water quality, remote sensing, Serbian Water Quality Index – SQWI, Hydrology Tep.

BIOMATERIALS IN MODERN MECHANICAL ENGINEERING INDUSTRY

Predrag Pravdić, Violeta Dorđević

Academy of professional studies Kruševac, Department of technical and technological studies in Kruševac, Serbia

Abstract: Biomaterials are materials designed to interact with biological systems, either as substitutes for natural tissues, in medical devices, or in industrial applications. In the mechanical engineering industry, biomaterials are used to manufacture implants, biocompatible coatings, sensors, and other components that require interaction with the biological environment. Their primary function is to replace or enhance the performance of traditional materials in conditions where biocompatibility, wear resistance, and long-term stability are required.

Keywords: biomaterials, mechanical engineering, environment.

ECOLOGICALLY SUSTAINABLE MATERIALS – THEIR APPLICATIONS AND ENVIRONMENTAL IMPACT

Predrag Pravdić, Violeta Dorđević

Academy of professional studies Kruševac, Department of technical and technological studies in Kruševac, Serbia

Abstract: Ecologically sustainable materials play a crucial role in preserving the environment and reducing the negative impact of industries on ecosystems. They are designed to have minimal impact on ecosystems while maintaining high performance in various applications. The use of these materials helps lower carbon emissions by reducing the need for energy-intensive production processes. There are numerous types of ecologically sustainable materials that are being used across various industries to reduce environmental impact.

Keywords: ecologically sustainable materials, environmental impact, technology

APPLICATION OF THE METHOD OF GENERATED-CONTENT USING ARTIFICIAL INTELLIGENCE (AIGC)

Artificial Intelligence Generated Content

Predrag Dašić[1], Dragoljub Mirjanić[2], Esad Jakupović[2]

[1]Engineering Academy of Serbia (IAS), Belgrade, Serbia

[2,]Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

Abstract: Artificial Intelligence Generated Content (AIGC) is a new content creation method that complements traditional content creation approaches such as: Professional Generated Content (PGC), User Generated Content (UGC) and Human Generated Content (HGC) with the help of Artificial Intelligence (AI). AIGC uses all the advantages of generative artificial intelligence (GAI or GenAI) and large language models (LLM), so it is presented and defined by a large number of authors and in a large number of publications as the same or also known as GAI. AIGC is a specific field of application of artificial intelligence (AI) and a promising technology with numerous applications, which focuses on artificial intelligence (AI) to imitate human creativity and expression to generate various forms of content, such as: text, images, audio content, videos, etc. To write content, they use methods: artificial intelligence assisted writing (AIAW) and artificial intelligence generated writing (AIGW). They are used for all areas of human activity, such as: natural-mathematical and engineering areas, social-humanistic areas, art, etc. AIGC technology appeared in 2023, and so far approximately one thousand publications have been published in WoS, Scopus and others. citation databases. Some of the applications developed as AIGC are: ChatGPT (Chatbot GPT (Generative Pre-Trained Transformer)) by OpenAI; DVD-GAN (DVD (Dual Video Discriminator) GAN (Generic Adversarial Network)) by DeepMind; GPT-Neo (GPT (Generative Pre-Trained Transformer) Neo) by EleutherAI; GPT-Neo-CRV (GPT-Neo (Generative Pre-Trained Transformer Neo) with CRV (Cross-Referential Validation)); LaMDA (Language Model for Dialogue Applications) by Google; SD (Stable Diffusion) from Stability.AI; StyleGAN (Style GAN (Generic Adversarial Network)) from NVIDIA; Turing-NLG (Turing NLG (Natural Language Generation)) by Microsoft etc. The aforementioned software systems and tools can play a useful role in the content creation process as assistants in content writing, with the caveat that they are not capable of producing original content if specific needs are required. However, it should also be noted that software tools such as contentdetector AI have been developed that can help identify and analyze content generated by artificial intelligence (AI), ensuring authenticity and originality.

Keywords: Artificial intelligence (AI), generative artificial intelligence (GAI or GenAI), large language models (LLM), artificial intelligence generated content (AIGC), content.

ARTIFICIAL INTELLIGENCE AS A UNITY OF GOOD AND EVIL

Rade Biočanin
Center for Strategic National Security Research, Belgrade, Serbia

Abstract: The current development of industrial societies, emphasized by economic factors and based on the irresponsible and irrational use of natural resources, disrupts the natural balance and exhausts limited resources. Such development is unsustainable because it causes soil, water and air pollution, destroying ecosystems and consuming large amounts of natural resources.

The ideals of the consumer society, human egocentrism, the pursuit of comfort and pleasure, the unrestrained race for money and material values, have brought humanity to a dead end. And without turning to the spiritual sphere, it is difficult to solve accumulated environmental problems.

Today, in this postmodern environment, the rise of ocean levels is accelerating, and coastal cities are at risk. Climate change causes ocean growth through two phenomena: accelerated melting of ice at the poles and increased levels of greenhouse gas emissions into the atmosphere.

Extreme events such as earthquakes, volcanoes, "tsunamis", large fires, floods, soil erosion, landslides, storms and tropical heat waves attract the attention of the media and the general public. Statistical analyzes show that the occurrence of these phenomena has increased due to climate change, first of all. Previously, the climate changed as a result of changes in natural circumstances.

The time we live in: New dilemmas, new scientific and practical solutions, a holistic approach and ideas through the dialogue of interested parties, above all. We must understand that the profession and science do not work only for themselves, what we do for ourselves, dies with us. What we do for others stays behind us and becomes immortal.

What is the reality of our "awake state" in this fraught time, with many environmental problems, above all, and what lies the power of IT technology and artificial intelligence?

One of the questions by which we define the conceptual-contextual field of our research is the meaning and significance of its subject in the current social moment. We are interested in whether and how extensive and multiple changes in global society from the end of the 20th and the beginning of the 21st century and their repercussions on the position and ways of life of young people diversify the conceptual apparatus of the research domain.

Keywords: Information technologies, artificial intelligence, expert systems, unity of good and evil, cyber warfare, environmental requirements, green chemistry.

SELECTION OF NEW MATERIALS AND PROCEDURES IN THE TREATMENT OF CONTAMINATED LAND AND WATER BODIES

Rade Biočanin[1], Vanja Gajić[2]

[1]*Center for Strategic Research of National Security, Belgrade, Serbia*

[2]*Center for Training of CBRN Personnel, Kruševac, Serbia*

Abstract: The global increase in the number of inhabitants as well as the rapid development of society imposes an increased demand for eco-sanitary water and agricultural land. Wastewater pollutes streams, rivers, lakes, seas and groundwater. Surface waters feed underground aquifers and thus renew the supply of underground water, which is the most valuable source of drinking water for humans. Impaired quality of surface water and increasing consumption of clean underground water threaten natural processes of self-purification, i.e. the quality and survival of drinking water sources. That's why water purification is a necessity, which gives impetus to research and development of new processing technologies, as well as a complete water resource management system is a prerequisite for sustainable development.

Keywords: contaminated land, wastewater treatment, water purification, aquifers, sustainable development, eco-sanitary water, self-purification.

NATIONAL ECONOMIES BETWEEN LIBERALIZATION AND INTERVENTION, IN THE ECONOMY AND ECOLOGY, WITH REFERENCE TO THE REPUBLIC OF SERBIA

Borivoje R. Mirosavić

University MB, Faculty of Business Law, Belgrade, Serbia

Apstract: In the first part of the article, it was stated that the article discusses the degree of state intervention in the economy and ecology, using legal-historical, historical, objective, descriptive, comparative, method and other methods, deductive and inductive reasoning. Then, a retrospective view of the issue of state intervention in the economy, a historical review of the origin and main experiences of the welfare state was presented. There are various theories about it, from physiocrats, liberalism, to Keynesian theory and a return to neoclassical economic theory.

In the next part, the economic and ecological situation in Serbia, the structure of land ownership, the relationship with the World Bank, and the World Bank's recommendations are presented. The conclusion is that time required the creation of theories, that in times of crisis and unemployment, the Keynesian theory has the advantage, and after overcoming it, the classical and neoclassical liberal theory appears.

In the conclusion, it is proposed to expand the competence of the Agency for the Economy on the model of Japan, Norway and some other countries. It is concluded that there is a need for state intervention in the economy in Serbia, but to preserve the market economy, freedom of business, entrepreneurship, competitiveness, and price freedom. It insists on subsidies for certain branches of industry, following the example of South Korea, the development of agriculture and subsidies for ecology.

Keywords: liberalism, market economy, welfare state, state intervention in the economy, and ecology.

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

Издавач
Академија наука и умјетности
Републике Српске

Publisher
Academy of Sciences and Arts
of the Republic of Srpska

Главни уредник
Академик Драгољуб Мирјанић

Editor in chief
Academician Dragoljub Mirjanić

Tehnički urednik
Даниел Грујић

Technical editor
Daniel Grujić

Веб уредник
Дарко Дивнић

Web editor
Darko Divnić

Штампа
Графомарк Лакташи

Printed by
Grafomark Laktaši

Тираж
200

Number of copies
200

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

620.1(048)

МЕЂУНАРОДНИ научни скуп "Савремени материјали"
(18 ; 25 ; Бања Лука)

Савремени материјали 2025 : програм рада и књига апстраката / XVIII међународни научни скуп, [Бања Лука] ; главни уредник Драгољуб Мирјанић = Contemporary materials 2025 : programme and the book of abstracts / XVIII international scientific conference ; editor in chief Dragoljub Mirjanić. - Бања Лука : Академија наука и умјетности Републике Српске, 2025 (Лакташи : Графомарк). - 133 стр. ; 21 cm

Текст на срп. и енгл. језику. - Тираж 200.

ISBN 978-99997-42-00-9

COBISS.RS-ID 143110913

ISBN 978-99997-42-00-9
9 789999 742009