Book of Abstracts

EUROINVENT
ICIR 2022

International Conference on Innovative Research

May 26th to 27th, 2022
Iasi – Romania

Organized by:

- **Romanian Inventors Forum**
- **Faculty of Materials Science and Engineering, The "Gheorghe Asachi" Technical University of Iasi, Romania**
- **ARHEOINVEST Platform, Alexandru Ioan Cuza University of Iasi**
- **Centre of Excellence Geopolymer and Green Technology CEGeoGTech), Universiti Malaysia Perlis (UniMAP)**
- **Department of Physics, Czestochowa University of Technology, Częstochowa, Poland**

With support of:

- **Universiti Malaysia Terengganu**
- **International Federation of Inventors' Associations - IFIA**
- **World Invention Intellectual Property Associations – WIIPA**

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EUROPEAN EXHIBITION OF CREATIVITY AND INNOVATION

EUROINVENT

IAŞI – ROMANIA

XIVth Edition, 26th - 28th May 2022

Euroinvent is a Festival of innovation, a joint event promoting creativity in European context, by displaying the contributions of consecrated schools from higher education and academic research and also of individual inventors & researchers. ***The 2022 edition is organized in hybrid mode due to COVID pandemic.***

Under the auspices of EUROINVENT we organize:

1. **Inventions and Research Exhibition**

   http://www.euroinvent.org/

2. **International Conference on Innovative Research**

   http://www.euroinvent.org/conference

3. **Technical-Scientifical, Artistic and Literary Book Salon**

   http://www.euroinvent.org/events-2/book-salon/

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   http://www.euroinvent.org/events-2/art-expo/

Event purposes:

- Dissemination of research results;
- partnerships and agreements;
- Creating and developing new research ideas;
- Technology transfer;
- Implementation of inventions,
- Scientific recognition.

The exhibition welcomes you to display inventions (patented in the last 7 years or have patent application number). A special section is held for innovative projects.

EUROINVENT International Conference on Innovative Research (ICIR) will bring together leading researchers, engineers and scientists will present actual research results in the field of Materials Science and Engineering.

euroinvent@yahoo.com

Foreword

This volume contains the information of the ICIR Euroinvent 2022 Conference and the abstracts of selected peer-reviewed papers. The event was held on-line in Iaşi, România from 26th to 27th of May 2022.

The ICIR Conference is organized under the auspices of EUROINVENT. Euroinvent is a joint event promoting creativity in a European context, by displaying the contributions of consecrated schools from higher education and academic research and also of individual inventors and researchers.

The EUROINVENT International Conference on Innovative Research (ICIR) brings together leading researchers, engineers and scientists who will present actual research results in the field of Materials Science and Engineering.

The conference aims to provide a high level international forum for researchers, engineers and scientists to present their new advances and research results in the field of materials science and engineering.

The volume covers all the aspects of materials science, from synthesis and characterization of materials to procedures and technologies for materials engineering, as well as materials application and their involvement in the life sciences.

All the papers have been reviewed by two expert referees in their relevant topic disciplines. The papers selected for the volume depended on their quality and relevancy to the conference.

The editors hope that this volume will provide the reader a broad overview of the latest advances in the field of materials science and engineering, and that they will be a valuable references source for further research.

The editors would like to express their sincere appreciations and thanks to all the committee members of the ICIR 2022 for their tremendous efforts. Thanks also to the publishers for supporting the publication of the full articles.

Finally, the editors would like to thank all the authors for their contribution to this valuable volume.

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Program of EUROINVENT ICIR Conference
ORAL PRESENTATION

*Palace of Culture Iasi – **Voievozilor Hall***

DAY 1 – THURSDAY MAY 26	
9.00	Participants registration
11.00	**EUROINVENT Opening Ceremony**
12.00	**ICIR Opening Ceremony**
12.15	**KEYNOTE SPEAKER SESSION** Chairman: Prof. Dr. Petrica VIZUREANU Prof. Dr. Mohd Mustafa Al Bakri ABDULLAH Prof. Dr. Ion SANDU
12.15	**Keynote Speaker – Florin MICULESCU** *Sustainable Technologies for Products Fabrication based on Ceramic and Composite Biomaterials for Bone Reconstruction*
12.45	**Keynote Speaker – Abilio P. SILVA** *Modelling of Elastic Modulus and Thermal Conductivity of Ceramic Composites Using 3D Representative Volume Elements*
13.15	***Special Guest - MDPI***
13.35	***Snacks & Refreshments Break***
14.30	**Session 1** Chairman: Prof. Dr. Florin MICULESCU Prof. Dr. Abilio P. SILVA
14.30	**Keynote Speaker – Mohd Mustafa Al Bakri ABDULLAH** *Recent Progress in Geopolymer Construction Materials Research: Processing and Performance*
15.00	**Horea Florin CHICINAS** - *Influence of Dissolved Oxygen Content on the Properties of Aqueous Milled WC-Co Powders*
15.15	**Nur Syahirah Mohamad ZAIMI** – *A short Review on the Influence of Antimony addition to the Properties of Lead-Free Solder Alloy*
15.30	**Alexandra CSAPAI** - *Study of the Effect of Dielectrophoresis on the Formation and Growth of Bacterial Biofilms in Microfluidic Bioreactors*
15.45	**Ahmad AWANA** - *Effect of Molybdenum Addition to Aluminum Refined by Titanium plus Boron on its Welding*
16.00	**Laurențiu BUDĂU** - *Sustainability Study of Wooden Masonry Blocks used in Structural Walls in Seismic Areas*
16.15	**Siti Farahnabilah Muhd AMLI** – *Microstructure, Wettability and Microhardness of Sn-0.7Cu0.5Ni-xBio on immersion Tin Surface Finish*
16.30	**Natalia ENACHE** - *CO_2 Efflux Measurements on Aquatic and Terrestrial Ecosystems In The Context Of Climate Change*
16.45	***Refreshments Break***
17.00	**Session 2 – Online Presentations** Chairman: Prof. Dr. Marcin NABIALEK Prof. Dr. Costica BEJINARIU
17.00	**Invited Speaker – Yulia IVASHKO** *New Approaches to Restoration Activities*
17.15	**Invited Speaker – Wojciech SOCHACKI** *The New Concept of Power Transmission To The Entomopter Wings*
17.30	**Invited Speaker – Lidia BENEA** *Tribocorrosion: A Degradation of Metallic Materials and Biomaterials in Biomedical and Industrial Applications*
17.45	**Seiji YAMAGUCHI** - *Bioactive and Antibacterial Titanium Induced with Strontium and Iodine by Solution and Heat Treatment*
17.55	**Silvia NOAPTES (ANGHEL)** - *Chitosan as Biomaterial- an Overview of Functionalisation with Plants Extract*
18.05	**Iuliana COSTEA (NOUR)** - *Synthesis and Characterization of Novel Heterocyclic Chitosan Derivatives with Antimicrobial Potential*
18.15	**Elena Roxana AXENTE** - *The Effect of Nano-ZrO_2 Dispersed Phase into Cobalt Plating Electrolyte on Layer Thickness and Current Efficiency*
18.25	**Nicoleta BOGATU** - *Enhancement of Corrosion Resistance Properties of Electrodeposited Ni/nano-TiC Composite Layers*
18.35	**Veaceslav NEAGA** - Corrosion Assessment of Zr-E125 Alloy in Ringer's Solution for Medical Prosthesis
18.45	**Hanaa HACHIMI** - *Optimization Inspired by Nature and Applications*
18.55	**Iuliana PAUN** - *Benzyldimethyltetradecylammonium Chloride Surfactant Removal from Wastewater Using a Hybrid Technology*
19.05	**Youmna ELHISSI** - *New Technologies in Moroccan University, an Innovative Approach of Governance*
19.15	**End of Conference Day**

Program of EUROINVENT ICIR Conference
ORAL PRESENTATION

*Palace of Culture Iasi –**Voievozilor Hall***

DAY 2 – FRIDAY MAY 27	
8.00	**Session 3 – Online Presentations** Chairman: Dr. György DEÁK Dr. Wan Mastura Wan IBRAHIM
8.00	**Andrii DIMITRENKO** - *Restoration, Operation and Inclusion of Museums in Large Cities with Noise Load*
8.10	**Dumitru DEONISIE** - *Aspects Regarding the Conception, Design and Realization of Recuperative Burners*
8.20	**Yulia IVASHKO -** *State-Of-The-Art Technologies of Imitation of Mural Painting from the Kyivan Rus and Baroque Periods in the Reconstructed …*
8.30	**Florin Stefan PETCU -** *Experimental Results on the Implementation and Use of Recovery Burners*
8.40	**Iuliana PAUN -** *ZSM-5 Nanomaterial for Adsorption of Benzyldimethyl-dodecylammonium Chloride from Wastewater*
8.50	**Cristina Monica PAPA -** *In Vivo and in Vitro Biological Activity of some Unexploited Regional Products from the Spontaneous Flora of Romania*
9.00	**Session 4** Chairman: Prof. Dr. Andriana SURLEVA Prof. Dr. Iulian ANTONIAC Prof. Dr. Rafiza Abdul RAZAK
9.00	**Invited Speaker – Mariusz WINIECKI** *Prototype of Biomimetic Multi-Spiked Connecting Scaffold for New-Generation of Non-cemented Resurfacing Endoprostheses*
9.30	**Adriana Gabriela PLAIASU** - *Overview on Plasma Electrolytic Oxidation of Magnesium Alloys*
9.45	**Edith Roxana MOLDOVAN -** *Morphological Analysis of Laser Surface Texturing Effect on AISI 430 Stainless Steel*
10.00	**Yang DING** - *Fresco Wall Painting and its Regional Modifications*
10.15	**Adrian Victor LAZARESCU -** *Analysis Regarding the Mechanical Properties of Alkali-Activated Fly Ash-Based Geopolymer Concrete Containing Spent ...*
10.30	**Alexandru Florin PITROACA** - *Glazed Elements in Constructions. Evaluation Methods of Characteristics and their Impact on Energy Performance*
10.45	**Răzvan AIRINI -** *Development of a Methodology for Monitoring SARS-COV-2 RNA in Wastewater in Romania. Evaluation of two Methods of Quantifying …*
11.00	**Mohd Izrul Izwan RAMLI –** *Influence of Sintering Temperature on the Pore Structure of an Alkali Activated Kaolin base Geopolymer*
11.15	**Răzvan MATACHE -** *Identification of Sturgeon Behavior in Different Hydromorphodynamic Conditions Resulting from the Implementation of …*
11.30	**Cornelia BAERA -** *Research on Valorization of Spent Garnets as Addition in Cementitious Materials – Preliminary Experimental Evaluation*
11.45	**Mircea MEREA -** *Comparison Study of the Efficiency of Multiple Thermal Insulations Using the Dynamic Method*
12.00	**Alexandru PASCU** - *Influences of the Nozzle Shape on Bead Appearance and Morphology in Coaxial Laser Cladding*
12.15	**Raluca ISTOAN -** *Increasing the Sustainability of Construction Sector by Developing New Products Based on Biomass and Renewable Polymers*
12.30	**Marius Nicolae BABA -** *Three-point bending response of Nylon 12 obtained by Fused Filament Fabrication (FFF) versus Selective Laser Sintering (SLS)*
12.45	**Luminita PLESA -** *Recycling Plastic Wastes in Order to Obtain New Building Materials*
13.00	**Raluca PRANGATE -** *Mathematical Modeling of Body Mass for Specimens of Beluga Tagged and Monitored in Time Framed 2011-2020 in the Danube*
13.15	***Refreshments Break***
13.30	**Awards Ceremony and Conference Closure**
15.00	**Workshop – Recmine – Eramin 3 Project**
18.30	**Cocktail dinner - Restaurant – HOTEL CIRIC**

THE „GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IASI
Faculty of Materials Science and Engineering

The "Gheorghe Asachi" University of Iasi is an excellent choice for the highschool graduates, who wish to embrace a carrier in the attractive field of engineering. The eleven faculties of the university are well equipped and have renowned specialists.

The Faculty of Materials Science and Engineering at the "Gheorghe Asachi" Technical University of Iasi has the mission to train specialists for the materials engineering, mechanical engineering and industrial engineering fields, through a 4-year programme (B.Sc.), Master Courses and Ph.D. Programmes. Also, our faculty is involved in the scientific research programmes, as well as in life-long education programmes for professionals that wish to extend their expertise. Besides the formative activity, research in various fields, focused to multi-disciplinary national and international co-operation is highly valued.

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ROMANIAN INVENTORS FORUM

Romanian Inventors Forum (FIR), as a professional association of dialog and representation, has the purpose to support, stimulate, develop and valorize the scientifically, technically and artistically creativity. Under the aegis of FIR, Romanian Inventors have participated at more than 50 World Invention Exhibitions, where their creations have been awarded with orders, prizes and medals. The performance of Romanian inventics is renowned in the whole world, that is the reason why FIR became member in different international clubs, associations and federations, with special contributions.

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Universiti Malaysia Perlis (UniMAP) is Malaysia's 17th public institution of higher learning. It was approved by the Malaysian Cabinet on May 2001. Originally known as Kolej Universiti Kejuruteraa Utara Malaysia (KUKUM), or Northern Malaysia University College of Engineering, it was renamed as Universiti Malaysia Perlis (UniMAP) in February 2007. The first intake consisted of 116 engineering students who started classes on June 2002. Currently, UniMAP has approximately 15,000 students and a workforce of more than 1,900 academic and non-academic staff members. It offers 21 undergraduate programs that lead to Bachelor in Engineering, one undergraduate programs that leads to an Engineering Technology degree and two undergraduate programs that lead to a Bachelor in Business. We also offer six Diploma in Engineering programs and 13 postgraduate programs that lead to the Master of Science in Engineering and PhD degrees.

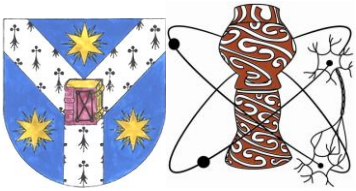
Center of Excellence Geopolymer & Green Technology (CEGeoGTech) lead by Vice Chancellor Universiti Malaysia Perlis (UniMAP), Professor. Dr. Kamarudin Hussin. CEGeoGTech located at the School of Materials Engineering, Kompleks Pusat Pengajian Jejawi 2, Taman Muhibbah, 02600 Arau, Perlis. CEGeoGTech has been established on July 2011 with the intention to induce innovation in green material technology among researchers in Universiti Malaysia Perlis. CEGeoGTech are able combining their expertise and skills in various fields to support the academic structure in the generation of human capital that contributes to the development of high quality research. This center also can become a pillar of academic activities, especially regarding research, development and innovation. CEGeoGTech have 8 fields of research includes:

- Geopolymer
- Polymer Recycling
- Electronic Materials
- Ceramic
- Electrochemistry Materials & Metallurgy
- Environmental
- Manufacturing and Design
- Green ICT

Laboratory of Scientific Investigation and Cultural Heritage Conservation

ARHEOINVEST Platform, Alexandru Ioan Cuza University of Iasi
„Alexandru Ioan Cuza" UNIVERSITY OF IASI

The Alexandru Ioan Cuza University of Iași is the oldest higher education institution in Romania. Since 1860, the university has been carrying on a tradition of excellence and innovation in the fields of education and research. With over 38.000 students and 800 academic staff, the university enjoys a high prestige at national and international level and cooperates with over 250 universities world-wide. The Alexandru Ioan Cuza University became the first student-centered university in Romania, once the Bologna Process was put into practice. Research at our university is top level. For the second year in a row, the University is placed first in the national research ranking. Striving for excellence, the university takes unique initiatives to stimulate research quality, to encourage dynamic and creative education and to attract the best students to academic life.



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Czestochowa University of Technology, Częstochowa, Poland
Department of Physics

Czestochowa University of Technology (CUT) is the largest state university in the region funded in the 40's last century. It is also the only one having full academic rights, i.e. it has the right to confer the title of doctor and university professor (habilitated doctor). During its scientific and educational activities, it has become an inherent part of Poland's history and tradition, of Czestochowa region and the city itself. In nationwide rankings of the state institutions of higher education, we are among the top universities in Poland of a similar profile.

POLI
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CUT has a reputation for being a modern and well-equipped school which offers a wide range of courses and a high level of education. The excellent quality of our teaching and research and the unrivalled academic knowledge and experience of our academic staff make studying at CUT a stimulating and invaluable experience. The University also prides itself on having good student infrastructure, a wide range of high-standard laboratories and lecture rooms to support research and teaching as well as three halls of residence, its own publisher and a modern main library and faculty libraries.

All accepted papers, after the peer review, from EUROINVENT 2022 International Conference on Innovative Research will be published in:

Materials, Coatings, Micromachines, Applied Sciences, Magnetochemistry (MDPI Publisher – Indexed by Web of Science – ISI and Elsevier SCOPUS)

Archives of Metallurgy and Materials (Indexed by Web of Science – ISI and Elsevier SCOPUS, **IF 0.586**)

IOP: Conference Series (indexed by Web of Science)

European Journal of Materials Science and Engineering (Indexed by DOAJ, Chemical Abstracts, CiteFactor)

International Journal of Conservation Science (Indexed by Web of Science – ISI and Elsevier SCOPUS)

Keynote Speaker

Florin MICULESCU, PhD

Professor Eng.
Department of Metallic Materials Science and Physical Metallurgy
Faculty of Materials Science and Engineering
University Politehnica of Bucharest, ROMANIA

Florin Miculescu is Full Professor at the Materials Science and Engineering Faculty from University Politehnica of Bucharest, România. He has participated in five postdoctoral stages in Europe and USA and applied his expertise in various research projects related to materials science, engineering and technology (being manager of 8 national and over 50 projects for private companies in the last 15 years). His research activities are also presented in over 130 papers indexed in Web of Science Clarivate Analytics (WoS cumulative impact factor as main author is >150), h-index is 24 (WoS) 24 (Scopus), 27 (GoogleScholar), 13 books and book chapters, 1 edited book, 2 patents. He is an Editorial Board Member of 3 WoS indexed journals, Guest Editor of 3 WoS indexed journals and reviewer of over 20 WoS quoted journals in Materials Science topics. He is the President of the Materials Engineering and Science Committee from the National Council for the Attestation of Titles, Diplomas and Academic Certificates – CNATDCU. He received more than 30 awards for his contribution in science.

SUSTAINABLE TECHNOLOGIES FOR PRODUCTS FABRICATION BASED ON CERAMIC AND COMPOSITE BIOMATERIALS FOR BONE RECONSTRUCTION

This talk will outline a comprehensive presentation of three different manufacturing technologies for value-added bone reconstruction products derived from naturally-synthesized ceramic and composite materials. The optimized, eco-friendly and sustainable conversion of bioresources led to the isolation of the mineral component from natural bones and to the preparation of HA/TCP based biomaterials from calcium carbonate precursors. Based on these bioceramics, with and without the addition of natural porogen agents, the developed procedures facilitated further the fabrication of 3D products with tuneable morphology, porous architecture (regular/irregular pore distribution, interconnected channels, variable tortuosity degree) and mechanical features that will allow a proper vascularization, body fluid flow and long-term resistance for large bone defects regeneration. The last strategy reffers to the feasible and homogenous blending of the natural ceramics and PLA materials in view of composite filaments extrusion, as future naturally-derived additive manufacturing feedstock material. Here, the ceramic particles acted as surface adjuvant and mechanical reinforcement of the polymeric matrix.

Keynote Speaker

Abilio P. Silva, PhD

Professor Eng.
Centre for Mechanical and
Aerospace Science and Technologies
Dep. of Eletromechanical Engineering
Faculty of Engineering
University of Beira Interior, Covilhã, Portugal

Abílio Silva is Associate Professor at the Department of Electromechanical Engineering at the University of Beira Interior, Portugal, and coordinator of materials group of the Centre for Mechanical and Aerospace Science and Technology (www.aerospace.ubi.pt). Coauthor of 57 scientific articles, 3 books, 1 book chapter and more than 100 oral presentations at scientific conferences. His research interests are in the field of composites materials, nanotechnologies and multifunctional materials. In particular, he develops research activities related with advanced multiphase ceramics, polymeric matrix composites and biomaterials. He also has achievements in reuse of mineral waste in ceramic matrix and numeric modelling of multiphase microstructures.

MODELLING OF ELASTIC MODULUS AND THERMAL CONDUCTIVITY OF CERAMIC COMPOSITES USING 3D REPRESENTATIVE VOLUME ELEMENTS

A methodology to reconstruct three-dimensional microstructures, representative of real ceramics is proposed for several ceramic composites. Applying these representative volume elements (RVE) finite element analysis was implemented in order to calculate:
1) the effective elastic modulus of zirconia toughened alumina (ZTA). The effects of the RVE size, grain shapes and the compliance with the isotropic condition is also verified. In these ZTA zirconia fractions higher than 10 vol.% lead to bi-continuous microstructures which make the elastic properties deviate from the Voigt limit due to the increased number of contacts between zirconia grains.
2) the effective elastic modulus using isotropic elastic model and anisotropic on specific set of crystallographic planes of orthorhombic $CaZrO_3$ and cubic MgO. Two RVE's with edge lengths of 14 and 17 μm shows that on isotropic approach the results are perfectly aligned while the anisotropic model shows a difference of 6.5%.
3) thermal conductivity of three composite of $CaZrO_3$/MgO and two single-phase ($CaZrO_3$ and MgO). The FEM results showed no differences for the 3 spatial directions of the RVE, nor for the different edge lengths (11, 14 and 17 μm). Results are statistically coincident with the experimental ones and showing sensitivity to temperature variation.

Keynote Speaker

Mohd Mustafa al Bakri ABDULLAH, PhD

Professor Dr, PTech, MMSET, AAE
Faculty of Chemical Engineering & Technology
Universiti Malaysia Perlis (UniMAP)
Malaysia

Mohd Mustafa Al Bakri Abdullah, currently he is Professor at Universiti Malaysia Perlis (UniMAP); Area of expertise are concrete processing and testing, geopolymer concrete, green concrete, composite, ceramic, and polymeric concrete. Between 2005 and April 2021, he was appointed several positions such as College Principal, Deputy Dean (Students Affair), Dean (Centre of Diploma Studies, Director (Research Management Centre) and the highest position is an Acting Deputy Vice Chancellor (Research & Innovation) starting 2020 until May 2021. He was awarded Top Research Malaysia (TRMS) in 2013 and received several awards from international and national organizations based on his geopolymer research. Now he is one of the specialists in the geopolymer field and established Center of Excellence Geopolymer & Green Technology (CEGeoGTech), UniMAP the only geopolymer center in ASEAN. This center is number one in ther world for geopolymers based on publications. He also has research funding and collaboration with King AbdulAziz City Science & Technoloy (KACST) Saudi Arabia, European Commission, University of Plymouth UK, Liverpool John Moores University UK and also with few more universities from Greece, Poland, Romania and Indonesia. His achievements include more than 630 journal publications based on Scopus Database (with 36 h-index), and more than 35 books and 40 patents of his research product. He has appointed as Research Advisor to State University of Makassar Indonesia and Associate Researcher in Technical University of Iasi (TUIASI) & Technical University of Cluj-Napoca, Romania and University of Chemical Technology and Metallurgy (UCTM), Bulgaria.

RECENT PROGRESS IN GEOPOLYMER CONSTRUCTION MATERIALS RESEARCH: PROCESSING AND PERFORMANCE

The development of geopolymer research is to step ahead towards searching for green materials with the purpose to minimize or replace the use of ordinary Portland cement (OPC) and emissions of carbon dioxide (CO2). The production method applied is significant and user and eco-friendly with lower consumption of energy. The potential of source materials in a wide range of slag, natural clay, waste and natural Al–Si minerals possibly will provide as potential source materials for the production of geopolymer. current research on geopolymer demonstrates how geopolymer products display superior properties good for many applications including as a new building materials (lightweight concrete, insulating concrete, lightweight brick, lightweight aggregate, a new steel fiber reinforced concrete), a new materials for road base application, as a repair materials, a new materials for corrosion application, a new filler in piping application, as underwater concrete materials, a low sintering temperature ceramic, as reinforced material in solder alloy, lightweight ceramic application and also high strength paste application. The advancement made in the various research of science and technology has helped us to have equivalence or a better quality of existing product. The characteristic and performance of geopolymer products has proved for better thermal insulation properties, higher fire resistance, lower processing temperature, low permeability, good chemical resistance, excellent in acid and salt environment.

Invited Speaker

Yulia IVASHKO, PhD

Professor PhD Habil
Kyiv National University of Construction and Architecture,
Kiev, Ukraine

Dr. Ivashko graduated in 1993 from the architectural faculty of the Kiev Civil Engineering Institute. Since 1997 to 2011 worked at the "Ukrrestavratsiya" Corporation. Since 1994 has been working at the Department of Basement of Architecture and Architectural Design, teaches the history of Ukrainian and modern world architecture, prepares Post-graduate students. In 1997 defended Ph.D. thesis in the specialty "Theory and history of architecture and restoration of architectural monuments". In 2013 defended thesis of Doctor of science. In 2018, the degree of Doctor of science was nostrified at the Cracow University of Technology named T. Kosciuszko. Ivashko Yulia is the author of over 600 scientific and popular science articles. Deputy Head of Joint Programs of Scientific Cooperation of Kyiv National University of Construction and Architecture and Crakow University of Technology named T. Kosciuszko, University of Łódz (Republic of Poland), Vasile Alexandri University in Bacău (Romania), Zhejiang University of Technology (China). Participates in joint projects with Polish, Chinese, Hungarian and Romanian scientists. Four projects have state Ukrainian registration.

NEW APPROACHES TO RESTORATION ACTIVITIES

New approaches in restoration activities require the involvement of the principles of project decision-making interactive process, as evidenced by international experience and the experience of the Ukrrestavratsiia Corporation. The application of the system analysis methodology, structural and logical models of architectural monuments improves the quality of diagnosis of the causes and nature of damage and helps to determine effective methods and technologies of restoration. It is important to develop a structure of information support for restoration activities, a system for monitoring the protection and restoration of monuments, creating and maintaining expert systems in the field of restoration: diagnostic systems, data interpretation, problem solving, technological solutions and assessment of possible consequences, improvement and streamlining of the provision, composition and content of a set of research and design work in parallel with the training and retraining of specialists-restorers and the development of the state program for the protection of immovable cultural heritage. It is necessary to develop the information structure of the expert system of restoration works.

Invited Speaker

Mariusz WINIECKI, PhD

Assistant Professor
Chair of Constructional Materials and Biomaterials, Institute of Materials Engineering
Kazimierz Wielki University, Bydgoszcz, POLAND

Dr. eng. Winiecki is an Assistant Professor in the Chair of Constructional Materials and Biomaterials of Institute of Materials Engineering at the Kazimierz Wielki University in Bydgoszcz, Poland. Co-author of 46 scientific papers, 1 book chapter, and 4 books (1 scientific monograph and 3 lecture scripts) with around 220 citations. His research interests are in the field of biomaterials engineering in particular engineering of bone-implant interfacing design and implants surface functionalization towards improving the conditions for osseointegration. He has achievements in works of the interdisciplinary research group that have designed, prototyped, and manufactured in the selective laser melting technology, and developed through the bioengineering research, the essential innovation in fixation of components of a new generation of entirely cementless resurfacing hip arthroplasty endoprostheses in the subchondral trabecular bone by means of the biomimetic multi-spiked connecting scaffold.

PROTOTYPE OF BIOMIMETIC MULTI-SPIKED CONNECTING SCAFFOLD FOR NEW-GENERATION OF NON-CEMENTED RESURFACING ENDOPROSTHESES

Resurfacing arthroplasty (RA) endoprostheses are a bone-tissue-preserving option offered for relatively young and active patients with advanced osteoarthritis. Cement fixation is a worldwide recognised fixation standard for femoral components of the current generation RA endoprostheses. To avoid complications caused by the excessive penetration of cement into the periprosthetic bone and accomplish long-term biological fixation, non-cemented femoral components appear to be an attractive option. The essential innovation for a fixation method of components of RA endoprostheses in periarticular trabecular bone by means of the original biomimetic multi-spiked connecting scaffold (MSC-Scaffold) was designed, developed, and prototyped, through bioengineering research by the bioengineering-clinical research team from Poland. This new kind of fixation method for RA endoprostheses, characterized by its biomimetism, respecting the microstructure of periarticular trabecular bone, opens a new generation of the first biomimetic RA endoprostheses, which can be applied for most diarthrodial joint arthroplasties (hip, knee, shoulder, elbow, etc.) used in orthopaedic surgical treatment.

Invited Speaker

Wojciech SOCHACKI, PhD

MSc.Eng, PhD, DSc, Associate Professor
Czestochowa University of Technology,
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Wojciech Sochacki MScEng, PhD, DSc is a CUT professor and head of Mechanics and Machine Design Fundamentals Department at the Czestochowa University of Technology. In the years 2014-2016, he was the head of the doctoral studies at the Faculty of Mechanical Engineering and Computer Science. Currently, he is also a member of the University Council of the Czestochowa University of Technology. He obtained a postdoctoral degree in technical sciences in 2009 based on the monograph entitled "Dynamic stability of discrete-continuous mechanical systems as models of working machines". His research interests concern modeling, analysis, and experimental research in the field of vibrations and dynamic stability of working machines and their components, with particular emphasis on a mobile cranes and dynamic stability of columns. He also deals with modeling and testing vibrations of damped machines and their components. In addition, he carries out works in the field of design and construction of micro air vehicles (entomopters). For several years he has been also interested in phonics in research. He is the author and co-author of over 100 scientific articles, 3 monographs, 4 chapters in monographs, and 3 academic handbooks.

THE NEW CONCEPT OF POWER TRANSMISSION TO THE ENTOMOPTER WINGS

Potential applications of entomopters (flying miniature robots) include observation, control, and supervision of e.g. construction investments, internal monitoring of pipelines (especially with small diameters), identification of damage caused by natural disasters, battlefield supervision, and inspection of inaccessible areas (forestry, environmental protection), geodesy, etc. For many years scientific centers from various countries have presented many solutions for the forced motion of entomopter wings. The purpose of this presentation is to discuss the structure of the mechanism for transmitting the power to the wings of an entomopter to simultaneously perform the flapping motion and control the angle of attack of the wings. The simulation model allowed for the observation of the system operation and verification of the adopted kinematic assumptions. The correct operation of the proposed solution has been proved by building a prototype of the mechanism and conducting experimental tests. The proposed mechanism is characterized by simplicity and allows for miniaturization while ensuring reliable operation with a reduced power requirement in the drive of the mechanism.

Invited Speaker

Lidia BENEA, PhD

Professor PhD Chem.
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Lidia Benea is Professor and Ph.D. Supervisor in Materials Science and Engineering at the Research Centre Interfaces – Tribocorrosion and Electrochemical Systems, Dunărea de Jos University of Galati, Romania (www.cc-ites.ugal.ro), member of the National Council for Attesting Titles, Diplomas and University Certificates (CNATDCU), Ministry of Education and Research, România. Author and co-author of 291 scientific articles, 106 being in ISI journals and proceedings volume, cumulating an Impact Factor of 174.76, 23 books and books chapter and more than 350 presentations at scientific conferences. Her research interests are in the field of composite coatings, biomaterials and multifunctional materials and nanomaterials. In particular, she develops research activities related with nanostructured hybrid layers metallic and polymeric matrix composites and biomaterials. She also has achievements in electrochemical methods applied to materials characterization and environmental protection.

TRIBOCORROSION: A DEGRADATION OF METALLIC MATERIALS AND BIOMATERIALS IN BIOMEDICAL AND INDUSTRIAL APPLICATIONS

Tribocorrosion is a degradation of metallic materials and biomaterials resulting from the synergistic action of chemical or electrochemical corrosion and mechanical wear or fretting. The synergistic effects between wear and corrosion are processes that lead to accelerated material losses. A wide range of corrosion-resistant metallic materials and biomaterials are based on the formation of a passive oxide film on the surface which serves to provide an obstacle to the charge transfer (electronic) between the relatively active material and the corrosive environment in which the material work. The formed passive film can be removed by friction and therefore corrosion can take place at the interface without any resistance barrier constituted by the passive film. This interaction between electrochemical and wear corrosive effects significantly increases material loss. It will be much higher than the sum of the loss of material under pure corrosion without friction with the loss of material by friction (pure wear). The paper presents a review of the results obtained in the laboratory by our group regarding the tribocorrosive behavior of some biomaterials in the physiological environments specific to the human body in implants and of some composite layers for the protection of the materials used in industrial environments.


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SECTION 1

SYNTHESIS AND CHARACTERIZATION OF MATERIALS

Combined 3-Components Phosphate and Organic coatings on Zinc Surfaces

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Abstract. In recent years, the production of galvanized sheet steels with organic coatings applied to its surfaces has considerably expanded. Phosphating of the zinc surfaces raises its roughness and surface tension, providing high adhesion of subsequent organic coatings and respectively, significant increasing of their protective properties. The paper presents the results obtained in the investigation of combined anti-corrosion coatings, including formation of phosphate films on galvanized steel surfaces followed by the application of three types of paint and varnish coatings. The indicators characterizing the phosphating preparation (density, pH, conductivity, acid capacity) were determined as well as the thicknesses of the coatings were measured. The chemical composition of phosphate films was determined by the help of EDX-analysis, and the morphology and topography were defined by means of SEM. The adhesion, elasticity and impact toughness of the organic coatings, with and without phosphating treatment of the zinc surfaces were measured. The corrosion resistance of combined coatings in a model sodium chloride solution was also determined.

Keywords: zinc surfaces, phosphatizing, zinc, nickel, calcium phosphates, organic coatings, protective coatings.

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Microstructure and Properties of Reinforced Lead-free Solder Joint

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Abstract. This research investigates the addition of reinforcement particles to the microstructure of lead-free solder alloy in developing a high-strength solder interconnect. Besides conventional cross-sectioned imaging of microstructure in the solder joint, advanced characterization techniques such as synchrotron radiation real-time imaging were used to study the in-situ growth behavior of the primary $(Cu,Ni)_6Sn_5$ intermetallic during the soldering process of the solder joint. The mechanical properties of a solder joint were determined by a lap shear test. Results show that the addition of reinforcement was able to refine the microstructural formation, resulting in smaller primary $(Cu,Ni)_6Sn_5$ intermetallic in lead-free solder joints. The synchrotron micro-X-ray fluorescence (XRF) results indicated the homogenous distribution of elements in the bulk lead-free solder region. With significant improvement to the solder joint strength, these solder systems are potential lead-free solder material candidates for high strength solder interconnects application.

Keywords: lead-free solder, solder joint, microstructure, reinforcement, synchrotron.

Analysis Regarding the Mechanical Properties of Alkali-Activated Fly Ash-Based Geopolymer Concrete Containing Spent Garnet as Replacement for Sand Aggregates

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Abstract. Worldwide, research on the production and optimization of geopolymer materials is fundamentally motivated by the need, identified both in the global ecological context and at national level, to implement the principles of Sustainable Development, with sustainable consumption of resources, to capitalize on existing waste and prevent the generation of new ones. On the other hand, rapid industrial growth has witnessed the ever-increasing utilization of sand from rivers for various construction purposes, which also disturbs the environment. Recycling of garnets and their use as replacement for sand aggregates could provide an ecological solution for the production of the alkali-activated fly ash-based geopolymer binders. The aim of this paper is to study the possibility of using spent garnet as replacement for sand aggregates in the production of alkali-activated fly ash-based geopolymer binder using Romanian local raw materials and to stdudy its influence on the mechanical performances of the binder.

Keywords: fly ash, circular economy, sustainable development.

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Sealing Capacity of Structural Mortar with Integral Crystalline Waterproofing Admixture

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Abstract. Since the development of Portland Cement (19th century), all over the world have been using the Cementitious composites. The composites have proven their remarkable capacity for autogenic self-healing, even in the traditional / initial forms. Self-healing can have a major impact on the durability of concrete structures, especially with the structures exposed to severe conditions. Developing new techniques and concepts has been the motive of a significant research in the recent decades. The major factors influencing the process are the composition of the mixture, the age of the concrete, the presence of water and the shape and width of the cracks. In addition, the natural / intrinsic capacity and the potential for autogenic healing can be stimulated. When partially replacing the contained of Portland cement, mineral additives can significantly improve autogenous curing by continuous hydration. Also the Limestone powder, hydrated lime and the marble paste are sustainable substitutes for cement and increase the calcium content inside he composites. Incorporating additives in the concrete like Integral crystalline waterproofing the crystalline chemicals that react in the presence of water can generate thin crystals capable of filling pores, capillaries and micro-cracks. The crystals continue to grow inside the concrete, as long as the moisture remains present. The chemical reaction, known as crystallization is caused by the crystalline chemicals that remain inactive until another dose of water is present, after the concrete has dried. The precipitation of calcium carbonate was favored by the crystalline mortars and blasting additives that have higher pH values. Self-sealing potential of ICW additives in early ages provides the experimental evidence of this research.

Keywords: mortar, crystalline admixture, self-healing.

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The Effect of Nano-ZrO_2 Dispersed Phase into Cobalt Plating Electrolyte on Layer Thickness and Current Efficiency

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Abstract. The paper presents the obtaining of nanocomposite layers having a cobalt matrix with zirconium oxide nanoparticles (mean diameter 30 nm) through the process of electro-deposition. The electrolyte suspension is prepared by adding ZrO_2 nanoparticles in a sulfate-chloride cobalt electrolyte at a concentration of 0 and 10 gL^{-1}.
The nanoparticles are maintained in a uniform suspension with the magnetic stirrer. ZrO_2 ceramic nanoparticles as a dispersed phase in the cobalt deposition electrolyte modify the mechanism of its electro-crystallization, so they participate in this process by increasing the rate of cobalt deposition, confirmed by the thickness of the nanocomposite layers obtained and the current efficiency during the electro-co-deposition process. The paper presents some of the comparative results obtained regarding the thickness of the layers, the efficiency of the current and the inclusion of the nanoparticles in the nanocomposite layer depending on the current density. The analysis of Co/nano-ZrO_2 nanocomposite layers with the help of optical light microscopy highlights the good degree of adhesion of the layers to the metal substrate made of 304L stainless steel.

Keywords: ZrO_2 nanoparticles, cobalt matrix, nanocomposite layer

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Al, Si, Ca, Fe and Mg Chemical Distribution of Different Sodium Hydroxide Molarity on Fly Ash/Dolomite-Based Geopolymer

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Abstract. Geopolymers are an inorganic material in an alkaline environment which is synthesized with alumina-silica gel. The structure of geopolymers consists of an inorganic chain of material and a covalent-bound molecular system. Currently, Ordinary Portland Cement (OPC) has caused carbon dioxide (CO_2) emissions which causes greenhouse effects. This analysis investigates the impact on fly ash/dolomite-based geopolymer with various molarities of sodium hydroxide solutions which are 6M, 8M, 10M, 12M and 14M. The samples of fly ash/dolomite-based geopolymer were prepared with the usage of solid to liquid of 2.0, by mass and alkaline activator ratio of 2.5, by mass. The samples were tested on the compressive strength, density, water absorption, morphology and elemental distributions. From the results, the usage of 8M of NaOH gave the optimum properties for the fly ash/dolomite-based geopolymer.

Keywords: Geopolymer; Molarity; Fly Ash; Dolomite; Elemental distribution;

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Enhancement of Corrosion Resistance Properties of Electrodeposited Ni/nano-TiC Composite Layers

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Abstract. The paper presents novel results with the effects of dispersed nano titanium carbide particles (50 nm mean diameter) into nickel-plating electrolyte on corrosion behavior of nanocomposite layers obtained. The Ni/nano-TiC layers are compared with pure nickel layers obtained at the same electrodeposition parameters at 60 $mA \cdot cm^{-2}$ current density and 8 minutes deposition time. The comparative corrosion performances are investigated using a three-electrode electrochemical cell in a solution, which simulates the primary water circuit of Pressurized Water Reactors (PWRs) (mixed boric acid with lithium hydroxide). Open circuit potential and electrochemical impedance spectroscopy are the electrochemical methods used on an electrochemical workstation connected at electrochemical cell as well as at a PC with a software to drive the experimental work. The results clearly revealed enhanced corrosion properties of Ni/nano-TiC hybrid layers as compared to pure Ni layers.

Keywords: composite layer, nano-TiC dispersed particles, nickel matrix

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A Short Review on The Influence of Antimony Addition to The Properties of Lead-Free Solder Alloy

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Abstract. For long time, Sn-Pb solder alloys have been used extensively as the main interconnection materials in the soldering. It is no doubt that Sn-Pb offers many advantages including good electrical conductivity, mechanical properties as well as low melting temperature. However, Pb is very toxic and Pb usage poses risk to human health and environments. Owing to this, the usage of Pb in the electronic industry was banned and restricted by the legislation. These factors accelerate the efforts in finding suitable replacement for solder alloy and thus lead-free solder was introduced. The major problems associated with lead-free solder is the formation of large and brittle intermetallic compound which give rise to the reliability issues. Micro alloying with Sb seems to be advantageous to improve the properties of existing lead-free solder alloy. Thus, this paper reviews the influence of Sb addition to the lead-free solder alloy.

Keywords: Lead free solder, solid solution, microalloying, antimony

Corrosion Assessment of Zr-E125 Alloy in Ringer's Solution for Medical Prosthesis

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Abstract. The diversity of the existing alloys on the market, with biotolerant, anticorrosive properties or other opportune physical-mechanical characteristics in the field of medical prosthesis, allows us to research the zirconium alloy with nobiu, especially the Zr-E125 alloy. Which in turn, was recommended as indispensable in the field of nuclear energy, chemical or aerospace industry.
This alloy, in the form of medical implants, offers antibacterial and hypoallergenic effects, thus eliminating the possibility of developing inflammatory processes in patients with systemic diseases.
However, in order to justify the priority of using this alloy in medical implantology, it is necessary to test the anticorrosive properties in the Ringer's solution, an artificial analogue for human blood, considered the most corrosive body fluid. For Zr-E125 samples, in situ electrochemical measurements were applied for 2 days, thus being part of the hematoma formation stage and the inflammatory response of a physiological process of bone regeneration.
In conclusion, the Zr-E125 alloy shows a positive and stable trend according to the potential of the open circuit, but with a modest corrosion rate in the form of pitting, deduced from the analysis of the polarization resistance and cyclic voltammetry data.

Keywords: Medical prosthesis, Zr-E125 alloy, corrosion, Ringer's solution, electrochemical measurements.

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Influence of Aperiodic Stiffness Distribution on Dynamic Stability of Bernoulli-Euler Beams

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Abstract: The study investigated the impact of the stiffness distribution in modular aperiodic Bernoulli-Euler beams on their dynamic stability. The analysis was performed for the first five iterations of the Severin chain, Thue-Morse chain, copper Fibonacci chain, nickel Fibonacci chain and circular chain. The first stage of the work was the formulation of the boundary problem, next its solution, and then the dynamic stability analysis of beams. For each analyzed case, the system of differential equations was determined using the Hamilton principle. Then, its solution along with the boundary conditions allows to determine the set of natural frequencies and shape functions. Then, the coefficients a and b of the Mathieu equation were determined, which, using the Strutt chart, allowed to determine the influence of the stiffness distribution on the dynamic stability of the tested systems. The performed works can be used to reduce the chance of the phenomenon of parametric resonance, which will increase the safety of machines whose elements can be modeled as Bernoulli-Euler beams.

Keywords: Bernoulli-Euler beams, dynamic stability, Mathieu equation, aperiodic structures, stiffness distribution.

The Influence of Medium Motion in Phononic Crystals on the Propagation of Mechanical Waves

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Abstract: The distribution of materials inside the phononic crystal significantly affects the propagation of mechanical waves. There are material distribution configurations that prevent the propagation of mechanical waves in a given frequency range. This phenomenon is called the phononic band gap and occurs due to diffraction and destructive interference of waves inside the crystal. In many centers, research is carried out on the design of the structure of phonic crystals in such a way that the band gap occurs for the given frequency distribution or that its width is as large as possible. The study analyzed mechanical wave transmission in phononic structures made of PLA in the air as medium. It was investigated how the air movement influences the occurrence and shifts in the frequency domain of the bandgaps. The research was carried out with the use of the Finite-Difference Time-Domain (FDTD) algorithm. The analysis included quasi two-dimensional regular lattices, where the influence of the lattice constant and the unit cell filling factor on the occurrence of the band gap at different medium flow velocities was investigated. The mechanical wave propagated at right angles to the propagation of the mechanical wave.

Keywords: phononic structures, moving medium, band gaps, FDTD.

The Properties of Ground Granulated Blast Furnace Slag Lightweight Aggregate (GLA) At Various Molar Ratio and Its Application in Concrete

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Abstract. As the demand in non-renewable of natural resources such as aggregate are increasing in worldwide, new production of artificial aggregate should be developed. This paper elaborated on the use of ground granulated blast furnace slag (GGBS) as replacement materials in green artificial lightweight aggregate (GLA) development through cold bonding method. An admixture used was a combination of ADVA Cast 203 and Hydrogen Peroxide as to enhance the quality of GLA. The newly GLA then were examined based on specific gravity test, water absorption test, aggregate impact test, and aggregate crushing test as to identify the optimum percentage mixture. Thus, the overall results possess a significant potential value as to be implementing in concrete (GCLA) development. The GCLA then examined through compressive strength test, and the result indicates the high strength lightweight concrete of 37.19 MPa is produced with a density of 1845.74 kg/m^3 which can be classified as a lightweight concrete.

Keywords: cold bonding, ground granulated blast furnace slag (GGBS), artificial aggregate, Aggregate Impact Value (AIV), Aggregate Crushing value (ACV).

An New Mathematical Formulation to Study the Three-Dimensional Mechanical Behavior of Anisotropic Shells: Modeling and Computational Solutions

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Abstract. In this paper, a mathematical formulation to study numerically the mechanical behavior of laminated composite shell is developed using a Kirchhoff-Love based kinematic shell equations. The laminate constitutive relation obtained by applying this shell model, contains some new mechanical couplings as extensional-twisting-shearing, extensional-twisting, Gauss bending-twisting-shearing related to the third fundamental form present in the kinematics of shell model used here. These couplings can be ignored when the shell become thicker. Ignore them into account in the design optimization and analysis of LCS can lead to considerable errors both from a physical and mechanical point of view. We therefore propose here to use for the interlaminar study a new complete constitutive relation integrating all these mechanical couplings. Based on the study of the influence of the additional couplings, we propose several mathematical formulations related to the study which can overcome several problems encountered in the laminated shell theory. On increasing the thickness ratio of the shell, we show the influences of these couplings on mechanical behavior, buckling shape, critical buckling pressure and failure of ply of composite tube by using computational tool and in several tests. The analysis of thickness ratio of composite tube shows difference between Kirchhoff – Love - based, Reissner – Mindlin - based anisotropic shell models when the tube become thicker

Keywords: constitutive relations, laminated composite shells, mechanical couplings, optimum design, analyze of LCS, computational solutions.

Two-Dimensional High Order Roe-Type Method for a Morphodynamic Problem on Triangular Mesh

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Abstract: In this paper, we develop a high-order finite volume scheme on unstructured mesh for a Saint-Venant-Exner model with friction source term. With the presence of the friction term, many fully discrete schemes are not well-balanced. The strategy often used is to decouple the problem into two sub-problems, one of which containing the friction term is solved by an implicit technique. Another method is to use Taylor development in time but this technique lost in some nonconservative problems. These strategies applied to Roe-based schemes are sometimes unsuccessful and the resulting schemes are not robust. Some physical properties of the scheme can be lost during the simulations. In this paper we develop a well-balanced fully discrete scheme integrating directly the friction source term. A Runge-Kutta based technique is used to achieve this. A reconstruction technique presented here leads to a well-balanced, preserving-positivity and shock-capturing scheme. Our numerical modeling strategy allows us to efficiently solve non-conservative problems with friction source term with high-order and in any dimension on general meshes. The proposed scheme is seen as predictor corrector method. Finally, some numerical tests are presented to predict the propagation position of the wave front, the magnitude of bed erosion and the position of the hydraulic jump. The comparison between the results based on our numerical scheme and those from the literature show a good agreement.

Keywords: Saint-Venant-Exner equations, Roe method, MUSCL-type reconstruction, well-balanced, preserving-positivity shock-capturing scheme, unstructured mesh.

Study on Behavior of Electrical Insulating Materials Combined with Conductive Elements

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Abstract: The study presents the research results on the identification of technical and safety requirements specific to work equipment made of electrical insulation materials combined with conductive elements, to guarantee safety in use. The national technical norms for live work stipulate that the work equipment used for electrical installations must be certified from the point of view of safety and health at work. Research study shows the behavior of various electrical insulation materials combined with conductive elements under the influence of mechanical, electrical, thermal and environmental factors to verify and certify the safety function that must be guaranteed in use. The research results consist of the development of the experimentation and evaluation methodology concerning the legal regulations in force and the evaluation of compliance with the technical and safety requirements identified for work equipment that is provided with electrical insulation materials combined with conductive elements — occupational health of workers and a safe work environment.

Keywords: materials, electrical insulation, conductor, safety, work

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Identifying the Structure of a Plaster Mortar Mixtures on the Basis of NMR Investigations

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Abstract. Starting from the concept of sustainable development, the research program aims to establish a waste management by reducing the construction materials used in the preparation of plaster mortars. Thus, the chosen material, respectively the used paint plays an important role in replacing the main components of the plaster mortar recipe. Following the research in the laboratory of the Faculty of Construction, it was concluded that used paint can replace water or cement in the recipe in different percentages, a fact recorded in an article published in early 2022 [1]. In the future, this research can help reduce the raw materials used to make plaster mortars, an ambitious plan and a step towards the transition to the circular economy. By reducing the number of raw materials by recycling used paint, we protect the environment. During the investigations, the 3 mortar recipes: CSIV, CSIV10C, CSIV20P are presented from the point of view of nuclear magnetic resonance NMR.

Keywords: NMR investigations, plaster mortars, waste management, recycling used paints, circular economy, sustainable development

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Investigation of Microstructural Development in Mortars with Recycled Paper Ash Used as Cement Replacement, Using NMR Relaxometry

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Abstract: For the investigation of porous media with applications in the field of civil engineering on concrete and mortar, NMR technology is used, with emphasis on the sensitivity of 1H hydrogen protons to pore filling fluids. NMR technology was used to highlight the changes that replacing cement with recycled paper ash powder in mortar recipes brings at a molecular level. The samples are analyzed during 56 days, at predetermined deadlines depending on the evolution of cement compounds hydration. Ability of recycled paper ash to replace cement in its role as binder is analyzed and the results obtained from mechanical tests are correlated with the structure and volume of pores in the control samples.

Keywords: NMR investigations, recycled paper ash, green mortar.

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Acknowledgment:

This paper was supported by the Project “Entrepreneurial competences and excellence research in doctoral and postdoctoral programs - ANTREDOC”, project co-funded by the European Social Fund financing agreement no. 56437/24.07.2019

The Small Addition Influence on Magnetic Properties of Amorphous $Fe_{86}Zr_7Me_1Cu_1B_5$ (Where Me = Mo, Nb) Ribbons

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Abstract: This paper presents the results of an investigation the influence of the small addition (Mo or Nb) on microstructure and the magnetic properties of $Fe_{86}Zr_7Me_1Cu_1B_5$ (where Me = Mo, Nb) alloy. The microstructure was investigated using Mössbauer spectroscopy. The transmission Mössbauer spectra for investigated alloys are typical for ferromagnets. It was found on the basis of analysis of distribution of hyperfine field induction (Bhf) that the alloy containing Nb is characterized with greater atomic packing density. This is confirmed by greater value of the average induction of hyperfine fields for this alloy. Magnetic measurements were performed using a vibrating sample magnetometer (VSM) using magnetic fields of up to 2 T. After the introduction of Mo alloy element, the deterioration of soft magnetic properties as observed. This alloy characterizes the smaller value of the saturation magnetization. Moreover, this alloy has the higher value of coercive field.

Keywords: magnetic properties, spectroscopy, amorphous alloy

Effects and Comparison of the Characteristics of Ni-Cr and Co-Cr Dental Alloys

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Abstract. Due to the increasing research on biocompatibility and the use of dental alloys for bridges, crowns and prostheses, it was decided to compare the corrosion effects and mechanical properties of two samples based on Co-Cr and Ni-Cr, using metallography, electrochemical and three-point bending tests. Before applying the study techniques, the surfaces of the samples were prepared by cutting, mounting and subsequent polishing. This last step was performed using progressive grain silicon carbide grinding papers and 0.1 micrometers alumina suspension [1]. Also, the samples were then immersed in an ultrasonic machine to remove all traces of dirt and chemically etched. After the application of the techniques, the metallographic test showed the crystalline structures of both dental alloys, as well as some porosities and defects. In the corrosion potential test, the samples tend to passivate and, when applying the Electrochemical Impedance Spectroscopy technique, it was observed that the corrosion resistance increases the more positive the applied potential and the higher the impedance and phase angle values, so the Co-Cr alloy presents a better corrosion resistance. On the other hand, in the three-point bending test, the Co-Cr alloy has the lowest modulus of elasticity values.

Keywords: biomaterial, corrosion test, metallographic test, three-point bending test, dental alloys.

References:

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Influence of Dissolved Oxygen Content on the Properties of Aqueous Milled WC-Co Powders

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Abstract. The research aims to develop a novel and safer milling route to produce Hard Metals. Considering the riscs associated when milling of fine partiles under organic solvents especially the increased fire and explosion risks, we propose the milling under aqueous milling media in order to diminish the risks associated with fire hazards, however, keeping the oxidation level at a minimum. The samples have been sintered in an industrial sintering oven under vacuum at 1380°C subsequent to milling and drying. The characterization of the materials has been done by X-ray diffraction, scanning electron microscopy, particle size analysis, optical microscopy and with a magnetometer. The obtained results indicate that appropriate properties of the powders after milling and drying as well as the desired biphasic (Co-WC) phases were obtained after sintering, thus proving the feasibility of such a route, and diminishing certain fire hazards.

Keywords: cemented carbides; hard metal; milling; drying; sintering; agglomerate.

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Influence of Corrosion on Thermo-Mechanical Contact Fatigue in Rolling Conditions With Low Amplitude Sliding

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Abstract: The paper presents some aspects concerning mechanical contact fatigue and corrosion wear and the links of these two kinds of wear in the common deterioration of the contact layer. The surface state, for both presented areas, is analyzed using scanning electron microscopy (SEM Vega Tescan LMHII, SE detector) and energy dispersive spectroscopy (EDS Bruker) in order to confirm the double action of corrosion and wear during the experimental test. 2 and 3D insights were taken from the worn area, corrosion compounds were identified and analyzed. Linear and cyclic potentiometry were performed on the base materials after the OCP was established in salt solution. When the level of the thermal and the mechanical stress are located at the same depth under the contact surface the resulting stress is greater and has the opportunity to develop the first crack to the surface. The metallic material surface presents a double type of corrosion: one based on oxidation and the other one based on oxidation plus wear (tribo-corrosion), the difference is being given by the material quantity and type involved.

Keywords: Thermo-mechanical contact fatigue, corrosion wear, Jacq thermal anomaly.

Structural and Chemical Modification of Hot Rolled CuAlBe Alloy

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Abstract. Explosion protection is of particular importance for safety as explosions also endanger the health of workers due to the uncontrolled effects of flames and pressure, the presence of harmful reaction products and the consumption of oxygen in the ambient air breathed by workers. CuAlBe alloy is proposed as a solution for mechanical actuators such as gears that work in environments with possible explosive atmosphere. Made of CuBe master alloy and pure aluminum in a induction furnace the material present large grains in melted state. After the hot rolling (heated 300s at 850 °C) of the ingots small variation of chemical composition was observed based on the oxidation of the material, appearance of small cracks on the edges and a preferential orientation of the grains along the lamination direction. Scanning electron microscopy (SEM), optical microscopy (OM) and atomic force microscopy (AFM) were used to characterize the microstructural states of CuAlBe as melted or laminated.

Keywords: anti-spark material, SEM, AFM, EDS, XRD rolling

Swelling Properties and Water Vapor Permeability of Some Compositions Based on Biopolymers and Essential Oils

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Abstract. The research works aimed to develop and characterize hydrogel-type therapeutic systems for the treatment of skin lesions type bedsores. The recipes were made of biopolymers, medical grade additives, and essential oils and antibiotics were used as antimicrobial active substances. An important property of transdermal therapeutic systems in contact with skin lesions is the swelling of the hydrogel due to the absorption of biological fluids at the same time as the release of the active principles to the affected area. Testing for swelling ratio (SD) and solubility (WS) in demineralized water was determined in a 24-hour experiment considering the initial and final masses of the samples, according to the method of Shen et al. Water vapor permeability (WVP) was measured according to the method described by Limpan et al. The evolution of the experimental data shows that in the first four hours the samples absorbed water in a proportion of approximately 58.75%. Throughout the experiment, the samples did not degrade completely, but increased in size by about 48%.

Keywords: hybrid nanocomposite layer, nano-ceo$_2$ dispersed particles, tribo-corrosion, wear volume loss, electrodeposition.

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Biodegradation Evaluation of some Magnesium-based Alloys type Mg-Zn-Zr-Ag before and after Synthetic Hydroxyapatite Coating using RF-Magnetron Sputtering

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Abstract. Magnesium based alloys are very promising biocompatible materials for temporary orthopedic trauma implants, having tensile strength properties similar to natural bone. The main issue to be solved in the case of these alloys is their rapid degradation in human body conditions before the healing of the bone fracture. In this paper, we investigated the biodegradation rate of two magnesium-based alloys from Mg-Zn-Zr-Ag system, experimentally codified MZZA1 and MZZA2, before and after coating with synthetic hydroxyapatite (HAP) using the RF-magnetron sputtering method. Immersion tests and electrochemical corrosion tests were performed on the experimental samples to determine the effect of synthetic hydroxyapatite deposition on biodegradation and, implicitly, the rate of biodegradation of these coated and uncoated alloys in simulated body fluid (SBF).

Keywords: hydroxyapatite, coating, Mg-Zn-Zr-Ag alloys, RF magnetron sputtering

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EURO
INVENT

SECTION 2

PROCEDURES AND TECHNOLOGIES FOR MATERIALS ENGINEERING

Aspects Regarding the Conception, Design and Realization of Recuperative Burners

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Abstract. This article presents the main aspects of the conception, design and realization of some recuperative burners of own conception. The starting point of the article is the operating principle of this specific type of combustion plant. This operating principle is based on the preheating of the oxidizer (combustion air) by taking over an important part of the enthalpy of its own flue gases. Based on this principle, the self-contained recovery burner has an energy efficiency that consists in reducing the specific consumption of fuel (natural gas) by about 25-35%. Also, the use of this specific type of combustion plant ensures other functional advantages such as: a higher temperature in the hearth (due to a complete combustion), the reduction of the durations of the technological cycles for carrying out the different processes. The article also presents some functional parameters of a type-dimensional range of self-contained recovery burners.

Keywords: recuperative burner, conception, design, realization.

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Experimental Results on the Implementation and Use of Recovery Burners

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Abstract. The article presents the main aspects of the implementation, use and pilot and industrial experiments of some self-contained recovery burners. The results of pilot and industrial experiments of these burners have argued and quantified their energy efficiency. This efficiency consists mainly in an economy of specific fuel consumption (natural gas and / or coke gas) of approx. 25-35%. Other advantages of using recuperative burners are: ensuring a higher temperature in the hearth, reducing the duration of the processing cycle and thus increasing labor productivity. All these advantages of using recuperative burners are based on their operating principle, which consists in preheating the oxidizer (combustion air) by recovering an important part of the enthalpy of its own flue gases. This recovery is done in an energy recuperator designed right in the body of the recuperative burner. Due to this important aspect, the recovery burner is part of the Primary Energy Recovery (REP) category.

Keywords: recuperative burner, pilot experiments, industrial experiments, efficiency.

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Bioactive and Antibacterial Titanium Induced with Strontium and Iodine by Solution and Heat Treatment

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Abstract. In the orthopedic and dental fields, conferring antibacterial and bone formation capabilities on titanium (Ti) remainds challenging. We have shown that strontium (Sr) and iodine (I) could be effectively introduced into Ti surface by a solution and heat treatment to form Sr- or I-containing calcium titanate [1,2]. The former exhibited promotion of new bone formation while the latter showed antibacterial activity to various types of bacteria such as MRSA, *S.aureus*, *E.coli* and *S. epidermidis*. In the present study, we developed a novel combined solution and heat treatment that simarutaneously incorporates 3.5-12.9% of strontium and 1.6-6.9% of iodine into Ti to produce two in one biointerface. The amounts of Sr and I induced into Ti were controlled by adjusting pH in the solution treatment; the higher pH, the higher Sr and lower I were incorporated into Ti surface. The treated Ti surface with the optimized condition showed 8.3% Sr and 2.6% I and released 0.2 ppm of Sr and 0.7 ppm of I within 7 days. Although the released amount of iodine was lower than that from the I-containing calcium titanate, the treated Ti exhibited a strong antibacterial activity toward *S. aureus* in the antibacterial test according to ISO22196 standard, again. Futhermore, the treated Ti formed apatite in a simulated body fluid wihin 3 days, assuming good bone-bonding ablity. It is expected that the Sr- and I-containing Ti equipped with both antibacterial and bone formation capabilitities will be particularly useful for orthopedic and dental implants.

Keywords: iodine, strontium, Ti implant, antibacterial, apatite formation

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Influence Of Sintering Temperature on The Pore Structure of An Alkali Activated Kaolin Based Geopolymer

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Abstract. Kaolin-based geopolymer materials are viable alternatives for producing high-strength ceramics material. Producing high-performing kaolin ceramics using the conventional method requires a high processing temperature (over 1200 °C). However, properties such as pore size and distribution are affected at higher sintering temperatures. Therefore, knowledge regarding the sintering process and related pore structure on alkali-activated kaolin geopolymer ceramic is crucial for optimizing the properties of the abovementioned materials. The pore size can be analyzed using neutron tomography, while its distribution can be observed using synchrotron micro-XRF. This study elucidates the pore structure of alkali-activator kaolin at various sintering temperatures. The experiments showed the presence of open-pore and closed pores in the alkali-activated kaolin geopolymer ceramic. The distributions of the main elements within the geopolymer ceramic edifice were found with Si element combined with the Al map allowed for the identification of the kaolin geopolymer. The result also confirmed that increasing the sintering temperature to 1100°C resulted in the alkali-activated kaolin geopolymer ceramic having large pores, with an average size of ~80 μm^3 and a layered porosity distribution.

Keywords: pore structure, kaolin, geopolymer, ceramic, synchrotron.

Geopolymerization Reaction, Mechanism, Microstructure, And Chemistry of Slag Waste Materials: A Review

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Abstract. Slag waste materials have emerged as one of remarkable geopolymer binder over the past decade. Review papers on various type of slag waste-based geopolymer are uncommon, and the prominence has been given to process chemistry, reaction mechanism, and the material properties, while the carbonation and current application were briefly presented. This review aims to fill the gap conducting a comprehensive literature study and critical evaluation on microstructural, crystallographic, and chemical bonding analysis on slag waste-based geopolymer. Analysis exhibited that chemical element influenced the mechanical performance and microstructural properties. This review manifests the remarkable potential of slag-waste based geopolymer in high-added value application.

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Keywords: Slag waste material, alkali-activated, geopolymer, material science

Microstructure, Wettability and Microhardness of Sn-0.7Cu-0.05Ni-xBi On Immersion Tin Surface Finish

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Abstract. The influence of Nickel (Ni) and Bismuth (Bi) addition on the solderability of Sn-0.7Cu and Sn-0.7Cu-0.05Ni coating has been investigated in this paper. The annealing method was proposed to control free solder thickness by controlling the ratio of free solder and interfacial IMC. The relationship between the solderability and free solder thickness were obtained from the Gen3 balance testing. The result reveal that the wettability of Sn-0.7Cu solder coating on Cu substrate can be improved by addition of 0.05wt.% Ni into Sn-0.7Cu. For solderability investigation, the solder coated Cu substrate were used to study the solderability of Sn-0.7Cu-0.05Ni-xBi using globule mode. The Sn-0.7Cu-0.05Ni solder coated substrate resulted with better solderability compared to Sn-0.7Cu. The Bi addition were found precipitated along the interfacial IMC layer which dissolves in Sn due to solid solution strengthening that believed to influence the solderability of solder coating.

Keywords: Sn-0.7Cu, microstructure, microhardness, solderability

Overview on Plasma Electrolityc Oxidation of magnesium alloys

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Abstract. The present paper presents the different dependencies of the Plasma Electrolityc Oxidation (PEO) process, first of all depending on the composition of the substrate, the electrolyte used, the applied electrical regime, as well as the way of their interaction, with direct implications on the properties designed to satisfy concrete applications for magnesium alloys. Magnesium-deformable alloys are of particular interest for the manufacture of parts for the automotive industry due to the possibility of obtaining a more homogeneous structure and better mechanical properties, compared to cast parts. Also, magnesium alloys find its place to a broad range of aerospace, industrial, electronic, biomedical, commercial and sport-related applications. In general, the interactions of the substrate / electrolyte combination with the electrical regime are complex and still the subject of ample research. Because, unlike other electrolytic surface treatment methods, PEO results in the formation of high-strength ohmic layers, they affect, especially in the case of current-controlled regimes, the extent to which the predefined electrical pulse is projected correctly in the setting experimental data.

Keywords: magnesium alloys, PEO, applications, industry, process.

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Influence of Heat Treatment on the Mechanical Properties of Alkali-Acvtivated Fly Ash-Based Binders with Marble Dust Substitution

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Abstract. Marble waste contains a high level of calcium, which is obtained from the cutting process in marble production. The properties of geopolymer binders are influenced not only by the amount of alkali activators, their ratio, the molarity used, and the Si and Al content of the mineral additives used in the mixture, but also by the duration of the heat treatment and the heat treatment temperature. This study aimed to produce alkali-activated geopolymer binders based on fly ash and marble dust. Alkali-activated geopolymer pastes were made both with heat treatment for 24h at 70ºC and without heat treatment at (23±2)ºC. SEM-EDX properties and their mechanical properties (bending and compression) were studied in order to understand the effect of the heat treatment on their mechanical properties. The experimental results showed reduced mechanical strength performance for the samples produced without heat treatment, but also revealed elements of microstructural and compositional changes.

Keywords: fly ash, marble dust, heat treatment, geopolymer.

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New Materials and Technologies (Biodentrut Project)

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Abstract. Prosthetic devices are often used in dental practice, and they provide treatment options for a wide range of diseases, including coronary dental lesions, reduced or partially edentation, and a variety of other disorders. In addition to their excellent biocompatibility, metal-ceramic restorations have a number of characteristics that distinguish them from other prosthetic alternatives [1,2]. These characteristics include optimal mechanical properties due to the metal framework and dimensional stability. To describe novel Co-Cr-Mp alloys (Mp–Ru, In, Pt, Au) and to identify new strategies to improve adhesion between metal and ceramic components, the Biodentrut project set out to do research on both. Five institutions were involved for three years: 2018-2020. During the reporting period, the "Grigore T. Popa" University of Medicine and Pharmacy in Iași, which was involved in the project, performed three stages of work that included five scheduled activities. The non-destructive testing [3], of the cast frameworks made of different classical Co-Cr alloys was the primary goal of the project's first stage, which was to determine the applicability limits of the findings in the dental office or dental laboratory by means of macroscopic examination. This included investigating the behavior of the new alloys during the casting procedure and after coating with ceramic materials. To achieve the projected objective for the 2020 phase, three research directions have been followed: the clinical aspects of providing fixed prosthetic restorations, which were carried out using DentSim simulation technology (DenX Ltd), the technological aspects for casting fixed prosthetic restorations and the finite element method (FEM).

Keywords: Co-Cr alloys, metal-ceramic restorations, the finite element method

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Increasing the Sustainability of Construction Sector by Developing New Products Based on Biomass and Renewable Polymers

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Abstract. In order to increase the sustainability of the construction sector, one of the most important research directions in recent years has been the development of new building materials. As the construction industry is considered one of the most polluted sectors, the main focus of researchers is to find new ways to shift away from traditional materials towards green materials. These materials are usually derived from waste or unlimited natural-organic resources and have the role to reduce the environmental impact of the construction sector. Reaching the objective of a sustainable industry through the process of developing sustainable building materials is not about restricting the total amount of construction but paying more attention to how the new materials are designed and the traditional materials are rethought, as clean and energy efficient alternatives. The utilization of biomass in the composition of building materials present the new products as low-embodied energy materials that reduce energy use and greenhouse gas emissions. Based on this premise, the research will provide a detailed analysis of the studies carried out in the last five years, focusing on summarizing information on new materials developed, tracking the characteristics tested and highlighting proposed technologies for producing sustainable materials.

Keywords: green building materials, materials market, biomass

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Influence of Isothermal Annealing on Structure and Magnetic Properties in High Magnetic Field of Bulk Amorphous Plates

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Abstract: This paper presents studies relating to the influence heat treament on magnetic properties of the $Fe_{65}Co_{10}Y_5B_{20}$ plates. The amorphous sample was prepared by suction casting method. The amorphicity of the investigated alloy, in the as-quenched state and after annealing process was verified using X-ray diffractometry and Mössbauer spectroscopy. On the basis of numerical analysis of the primary magnetization curves, the type of structural defects having influence on magnetization in high magnetic fields were determined. The spin wave stiffness parameter was also calculation. It was observed that the heat treatment, carried out below crystallization temperature leads to irreversible structural relaxations.

Keywords: heat treatment, magnetic properties, amorphous alloys

Good Soft Magnetic Properties in Bulk Amorphous Alloys Obtaining Using Injection Casting Method

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Abstract: In this paper are presented results for special kind of materials called soft magnetic amorphous materials. Specimens for investigations were prepared using arc melting method. Obtained materials had shape of plate with 0.5 mm thickness and 100 mm2 areas. The structure of the samples was tested using X-ray diffractometry. All samples was in the amorphous state. Each specimen exhibit good soft magnetic properties what was confirmed with measurement using vibrating sample magnetometer. These materials may be use in electrical devices and in the electronic equipment's. The low core losses are require in this type of materials what is sources of their applications.

Keywords: magnetic alloys, amorphous materials

The Effect of Vibrations and Environment Temperature on the Cooling Characteristics of Quenching Media

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Abstract. Quenching technology requires the use of media with different cooling intensities and various shapes of cooling curves that show different particularities compared to that of conventional media such as water, oil or emulsions. The use of synthetic quenching media is relatively new and also has multiple advantages such as non-flammability, safety in use and low cost. In this study, the cooling media tested was obtained by mixing 2 wt% carboxymethyl cellulose with 2 wt% NaOH in one liter of water. Moreover, three different temperatures (20°C, 40°C and 60°C) of the quenching media were evaluated. By dissolution in water, a synthetic solution with low viscosity, surfactant and lubricant was obtained. Because carboxymethyl cellulose is a biodegradable organic material, that is obtained as a by-product in the manufacture of paper, a basic substance with a preservative effect was added. Using the described conditions, the cooling curves for the synthetic media were measured between 800°C and 50°C. Accordingly, the variation of the cooling rates and the heat transfer coefficient between each thermal interval was calculated. According to this study, both the variation diagram of the heat transfer coefficient and the diagram of the cooling rates, during the cooling stages give important indications regarding the use of a liquid cooling medium for quenching. The temperature of the quenching media, as well as the degree of vibration, significantly modify the cooling characteristics of the studied conditions.

Keywords: quenching media, synthetic cooling media, vibrations

Benzyldimethyltetradecylammonium Chloride Surfactant Removal from Wastewater Using a Hybrid Technology

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Abstract. The treatment of wastewater with organic compounds having emerging properties, such as surfactants (e.g benzyldimethyltetra-decylammonium chloride), is poorly carried out, which leads to their discharge into surface waters, where they can cause endocrine disrupting effects and the ability to induce in the environment excessive development of resistan microbial strains. Nowadays surfactants removal from wastewater is done by apply biological treatment followed by physical treatments. If, in addition to biological and physical processes, an efficient photocatalytic degradation process is applied, the removal of these compounds increases a lot. This paper aims to resolve the problem of wastewater of treatment containing quaternary ammonium salts, which are difficult to degrade biologically and, in some cases, even toxic, by describing an experimental study which integrates chemical photocatalytic (TiO_2/UV) and biological treatments for removal of benzyldimethyltetradecylammonium chloride from wastewater.

Keywords: TiO_2, quaternary ammonium salt, wastewater treatment.

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Morphological Analysis of Laser Surface Texturing Effect on AISI 430 Stainless Steel

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Abstract. Laser surface texturing is a method to obtain micro-structures on the materials surface for: improving tribological performances, wetting behavior, surface treatment and increasing adhesion [1]. The material selected for LST is ferritic stainless steel AISI 430, distinguished by the low cost in manufacturing, corrosion resistance and high strength at elevated temperature. The present study addresses to new pattern designs (crater array, ellipse and octagonal shapes). The patterns are applied on the stainless-steel surface by a non-contact with high quality and precision nanosecond pulsed laser equipment. Effect investigation of laser parameters of thermal affected area and micro-structures is accomplished by morphological analysis (SEM+EDS). The parameters of the laser micro-patterning have a marked influence for the results, creating microstructures groove-type sections with different depths and recast material.

Keywords: morphological analysis, laser surface texturing, ferritic stainless steel, surface patterns.

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Influences of the Nozzle Shape on Bead Appearance and Morphology in Coaxial Laser Cladding

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Abstract. Nowadays, there is increasing interest on laser cladding technology and obtaining clad layers with enhanced mechanical properties. This study addresses to laser cladding technology using the nickel-based powders and continuous laser beam. The laser deposition bears more specific parameters besides the laser power and beam characteristics. The cladding nozzle geometry and the laser focus related with the powder are specific parameters that influences the appearance and morphology of the cladding layer [1]. The experimental tests were carried out using the Coherent F1000 continues laser generator and the Precitec WC 50 cladding module with three different cladding nozzles.
The results show that shape of the cladding nozzles have a crucial impact on the microstructure and dilution with the substrate. It was determined that by optimisation of the pocus point in relation with the powder steam the dilution between the materials can be tuned.

Keywords: laser cladding, cladding nozzle, focus point

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Millisecond Pulsed Laser Welding of AISI 316

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Abstract. Nowadays, there is an increasing demand for AISI 316 stainless steel for automotive, medical, aerospace, for tool manufacturing and for nuclear industry [1]. Compared with continuous beam laser welding, pulse temporal shape, pulse duration and the repetition rate are fundamental parameters that have a direct influence on the quality on the welded joint [2]. The laser welding of AISI 316 stainless steel thin sheets by millisecond pulsed laser will be analysed within this research by addressing to pulsed laser parameters influence on the geometry and appearing of the welding joint. The influence of laser power, pulse duration and repetition rate were determined by tracking fusion lines on specimen's plates and butt weld stainless steel welding were obtained by using the determined optimal welding parameters. All the parameters have a major influence on the geometrical appearance of the weld bead.

Keywords: laser welding, AISI 316, Parameters

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Substrate Texture Influence on the Dry Sliding Wear Behaviour of WC-CoNiCr Plasma Spray Coating

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Abstract: The mechanism in which the coatings made by thermal spraying adhere to the substrate is in most cases of a mechanical nature, thus being dependent on the morphology of the substrate surface [1]. This paper study how the texture of the substrate influences the behavior of dry sliding wear, a behavior based on the adhesion to the substrate of the analyzed coatings. For this purpose, a CoNiCr matrix powder (with a hardness of about 55 HRC), densified with polygonal hard particles from WC (with a hardness of about 1900HV), was chosen for atmospheric plasma spraying. This special matrix composition ensures wear resistance up to 700°C, providing at the same time excellent corrosion resistance [2]. For the substrate, a rectangular profile made of low-alloy steel was chosen, the surface of which was textured by mechanical abrasion, in order to obtain different degrees of roughness: sample S1 - Ra1 = 1.59µm, sample S2 - Ra2 = 2.32µm, sample 3 - Ra3.1 = 1.25 µm, Ra3.2 = 3.88 µm. In the case of sample 3, the texturing was done on one direction, with an elongated profile, so that the effect of the main direction of dry sliding wear on the quality of the coating could be studied. The tests were performed on an Amsler test machine, at constant load, for 1 hour.

Keywords: WC-CoNiCr coating, substrate texture, plasma spray coating

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Microhardness and Elastic Properties Evaluation of WC-TiC Coatings Obtained by Arc Spraying Process

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Abstract. Fulfilling the basic role of hard thermal sprayied coatings is closely related to the value of its microhardness. The quality of such a layer depends on several variables, the main categories being: spray method, spray parameters and the materials used (chemical composition of the coating materials, quality and texture of the substrate). The cored wire has as main hard elements WC (about 26%) and TiC (about 6%), the rest of the chemical elements present being: Cr (14%), Ni (4.5%), B (1.87%), Si (1.25%) and the Fe balance. The micro-hardness was evaluated both in the section of the layer and on its surface, previously prepared by grinding to reduce the as-coated roughness. Both the conventional method, with optical evaluation of the resulting imprint (with CV-400DAT digital microdurimeter) and the method based on recording the forcess generated during the indentation with simultaneous measurement of the load - depth curve (with UMT 2M-CETR microtribometer) were used. In order to evaluate the cohesion of the coated layer, scratch tests with progressive loading (5N, 10N, 15N and 20N) were performed on the same microtribometer.

Keywords: microhardness, WC-TiC hard particles, arc spraying process.

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Phosphate Conversion Coating – A Short Review

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Abstract. Phosphating is the process of depositing, by conversion, a layer of insoluble phosphate compounds, on the metal's surface. Although phosphate coatings have been studied since the early nineteenth century, they are not only still being studied, but are an area of interest due to their many applications. The advantages of these types of coatings are well known, such as the low cost of the deposition process, the improvement of corrosion resistance properties, and the improvement of wear resistance and adhesion of further deposited layers such as paint. All this, leads to studies on the constant improvement of the properties of the phosphate coating, by modifying the parameters of the phosphating process, as well as by modifying/replacing the substances used in the phosphating solutions with "environmentally friendly" solutions. Also due to these advantages, several researchers are studying the possibility of using phosphate coatings in fields such as civil engineering or medical (biomaterials coatings). This paper aims to present some essential aspects of phosphating and to bring to the fore the latest research on "eco-friendly" phosphating solutions and the possibility of using the phosphating process in other fields, such as the medical field. Also, the paper aims to discuss the possibility of eliminating/reducing the harmful effect that the use of phosphating has on the environment.

Keywords: conversion coatings, phosphate, review, corrosion properties.

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Identification of Data Affected by Aberrant Errors in the Study of the Milling Process on Aluminum Alloys

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Abstract. In this scientific paper it is presented the statistical analysis of the experimental data obtained by the study of the influence of the cutting parameters exerted in end-milling process on the surface roughness. The surface roughness parameter is measured in the cutting feed direction and against it. The parameters of the cutting process, the number of levels and their values were established. Based on these parameters, the research was designed on a complete factorial experiment, randomized with seven blocks. The surface roughness values were measured using a roughness tester. The research method used involved the Romanovski test. The aim of this test was to identify the data affected by aberrant errors, to remove them from the samples and then to repeat the tests for the remaining data strings until all values met the conditions imposed by the test.

Keywords: cutting process, surface roughness, aberrant error, Romanovki test.

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Verification of the Random Nature of the Experimental Data in the End-Milling Process of Aluminum Alloys

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Abstract. From a theoretical point of view, the research made during this paper was carried out starting from the study of the connections between different factors and parameters used in the milling process. From an experimental point of view, it started from the organization and development of the physical cutting process, the cutting regimes to be analyzed were established, after which the surface roughness was determined and measured. In this way, the connections between the factors and the parameters pursued in the research resulted. The main purpose of this research is to verify the randomness of the measured data samples related to the quality of the milled surface of the analyzed aluminum alloy. The research method was approached using the Young's test. The conclusions highlighted the importance of adopting this way of research and opened new directions of study.

Keywords: alluminum alloy, end-milling, cutting process, surface roughness, data, Young's test.

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Influence of Nanostructuring by Severe Plastic Deformation on Tensile Strength for Aluminum Samples, Al_99.50

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Abstract. The paper highlights the influence of granulation to nanostructuring finishing on flow resistance, tensile strength and elongation at break as mechanical properties of aluminum semi-finished products, Al_99.5, by applying multiaxial forging. For nanostructuring we chose cyclic forging in closed matrix (CCDF) as a method of severe plastic deformation. The method was patented by A.K. Ghosh in 1988, [Ghosh, 1988]. The tensile test was performed on the universal test machine Instron 3382, the software used was Bluehill IXTM.

Keywords: nanostructuring, severe plastic deformation, tensile strength.

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Wear Resistance Increasing of 3D Printed TiALV Alloy by Plasmanitridation

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Abstract. This work aimed to modify the surface of Ti6Al4V (Ti64), made additive manufacturing, particularly selective laser melting (SLM), to improve hardness and wear properties. Furthermore, a correlation between the investigated properties and the treatment types was drawn. Surface modification was achieved by plasma nitridation under three different duration (2 hours, 12 hours and 24 hours). The microhardness and the wear coefficient of the surfaces were measured and determined after the plasma nitridation process. The results show, compared to the SLM samples 405 HV0,5, an increase in hardness after the different duration plasma nitridation process. Specifically, the highest hardness value of 450 HV0,5 was achieved by 24 hours of plasma nitridation. The lowest hardness values were achieved with 2 hours of plasma nitridation 410 HV0,5. However, the wear coefficient showed a significant decrease for the surface treated samples. The results confirm that the use of a plasma nitridation as a function of the treatment time significantly improves the hardness and wear coefficient of the treated samples.

Keywords: wear resistance, additive manufacturing, plasma nitridation, Ti6Al4V, microhardness.

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SECTION 3

MATERIALS APPLICATIONS

Effect of Molybdenum Addition to Aluminum Refined by Titanium plus Boron on its Welding

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Abstract. Welding Aluminum is very important in engineering, particularly in the aircraft and automobile industries. Its recommended properties include high thermal conductivity, high coefficient of thermal expansion, high hydrogen solubility, oxide coating e.g. high strength-to-weight ratio, electrical conductivity. On the other side, Aluminum has some properties that affect its mechanical behavior, for example, surface finish, tear resistance, mechanical strength, and thermal resistance. Therefore, adding rare materials with specific amounts in the casting process before the solidification is a powerful technique used to enhance these characteristics by adding these rare materials that are useful for affecting the welding properties and avoiding defects. AL-Ti is commercially available with Al-15% Ti. This paper investigates the effect of Mo addition to commercially pure aluminum refined by Ti-B on its weldability. The obtained results are presented and discussed.

Keywords: welding, molybdenum, aluminum refined, titanium, boron, mechanical characteristics.

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Synthesis and Characterization of Novel Heterocyclic Chitosan Derivatives with Antimicrobial Potential

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Abstract. New chitosan derivatives are interesting materials for biomedical applications because of their potential of antimicrobial activity, biocompatibility, biodegradability and non-toxicity[1,2]. Two dypiridium salts of as N,N' bis-dibromide(p-bromofenacil)- 4, 4'- bipyridinium and dibromide of N,N' bis-(p-bromofenacil)-1,2-bis(4-pyridyl) ethane were used for the chitosan functionalization. Chitosan derivatives structure were analysed by UV-vis absorption spectroscopy, Fourier transform infrared (FTIR) spectroscopy, elemental analysis and scanning electron microscopy (SEM). Chitosan derivatives were evaluated for the antioxidant potential and the results revealed that they could exhibited improved antioxidant activity compared with chitosan and it is due to the salt's N-heterocyclic structure. Overall, the N-heterocyclic chitosan derivatives-based hydrogels open a perspective in biomedical applications.

Keywords: chitosan derivates, dypiridium salts, structure, antimicrobial.

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Comparison Study of the Efficiency of Multiple Thermal Insulations Using the Dynamic Method

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Abstract. With the advent of new energy restrictions, it is very important to find the best compromise between the price of the thermal insulation material and energy savings because, sometimes, the initial cost of a thermal rehabilitation seem to be very high. The purpose of this study is to see the differences of the heat energy demand for a multi-story residential building in Romania using 14 different types of thermal insulations materials. The energy demand is determined using the dynamic method with an energetic simulator for buildings which can determine the energy consumption for heating, ventilation, air cooling, lightning and hot water.

Keywords: thermal insulation, dynamic-method, thermal resistance, energy consumption.

Glazed Elements in Constructions. Evaluation Methods of Characteristics and their Impact on Energy Performance

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Abstract. Glazed elements play an important role in total energy consumption of buildings. They significantly influence total energy consumption through energy consumption for heating and cooling, ventilation and lighting. To optimize these consumptions, the glazed elements must be treated taking into consideration several characteristics, namely: thermal transmittance, degree of transparency and solar factor. Moreover, the choice of glazed elements must be studied and calibrated by the type of building but also by location, from a climatic point of view. The purpose of this paper is to highlight the main characteristics of glazed elements and the ways in which these can be measured. The equipment and its operation are presented as well as examples of measurements performed on different types of glazed elements. Also, the paper presents a case study that includes the thermal balance performed on a building in Timisoara taking into account the characteristics of the measured glazed elements. In order to highlight their importance, a parametric study of the transmittance and the solar factor was performed, taking into account the investment costs, respectively, the cost over the life of the investment.

Keywords glazed elements, energy consumption, transmittance, SHGC.

Sustainability Study of Wooden Masonry Blocks used in Structural Walls in Seismic Areas

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Abstract. The concept of sustainability has become a priority in the construction field, especially in terms of carbon dioxide emissions. Taking into account the latest European directives and the restrictions that must be imposed to reduce the global warming process, both the technology of execution and the materials used in the execution process must be correlated in order to reduce carbon dioxide emissions. Currently, in Romania constructions with low height regime are constructions with vertical structure of load-bearing masonry. At the same time, these types of construction represent the majority of new construction types in Romania. Considering both the type of vertical masonry structures and the need to apply the principles of sustainability, in the Romanian construction market are used a series of brick blocks with vertical gaps made of wood. Wood not being considered a sustainable material can be easily used also in the situation of applying the principles of sustainability. Currently these wooden blocks are used in non-structural elements. Taking into account the fact that Romania is a seismic country for the structural assurance of buildings with masonry structure, their seismic compliance must also be taken into account. The evaluation and study of these ceramic blocks is carried out in two phases, Phase I of theoretical research and evaluation using software and computer programs and Phase II, the realization of experimental tests. This paper represents the first step of the research phase as well as the elements to be tried and at the same time represented a theoretical study regarding the adaptation of these wooden blocks so that they are also used for structural elements.

Keywords: sustainability, materials, wood, theoretical study, wooden blocks, structural elements.

Use of Bottom Ash from Biomass Combustion in Reclamation of Disturbed Terrains

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Abstract. The possibilities for the use of bottom ash from biomass (straw) combustion for the reclamation of strongly acidic mine soils were studied. The ash shows high potential for use on acid soils due the alkaline pH, high content of organic matter and nutrients - total N, P2O5, K2O. Vegetation experiment with different bottom ash content is performed to be proven this possibility. The experiment shows that the addition of bottom ash leads to the neutralization of strongly acidic mine soils, but at the same time leads to salinization with an increase in the percentage of bottom ash. The optimum quantity of bottom ash for use is 5 % of the amount of soil.

Keywords: bottom ash, mine soil, reclamation, soil improver.

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Utilization of Used Tires and LDPE (Low-Density Polyethylene) Plastic Waste as Basic Materials for Concrete Brick

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Abstract. Tires and LDPE plastic wastes are wastes that are non-biodegradable and require further processing to decompose. If it is not processed, it will pollute the environment and disrupt the life of various organisms. Tires and LDPE plastic waste can, however, be used as a mixture for making concrete bricks that contribute best in building infrastructure development by applying the principle of recycling. The addition of a mixture of used tire waste and LDPE plastic waste is useful for improving the physical properties and pavement content of concrete bricks and preventing the depletion of natural resources, achieving an Eco-Friendly program and making the cost of concrete bricks relatively cheaper. Concrete bricks are made with a mixture of used tire waste and LDPE plastic waste with 6 samples of different compositions. The quality of concrete brick is seen from three aspects, namely density, porosity and water absorption. The best quality of concrete bricks was obtained in sample 6 with a composition of 750 grams of used tire powder, 750 grams of LDPE plastic waste, 500 grams of coarse aggregate, 200 grams of cement and 750 ml of oil to obtain a density of 1129.252/1280, 864 kg/m^3, 0.5% porosity, 0.434 % water absorption. The results showed that the addition of a mixture of used tire waste and LDPE plastic waste resulted in better quality concrete bricks achieved by increasing the density of concrete bricks and reducing the porosity and water absorption values produced.

Keywords: concrete brick, waste tires, LDPE plastic waste, density, porosity, water absorption.

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Mechanical and Corrosion Behavior of Two High Entropy Alloys (HEA) for Medical Applications

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Abstract. A base alloy is designed, a high entropy multicomponent equiatomic alloy with pure elements (99.95%), formed by the Cr, Co, Fe, Mo and Ni system, LAS1, and from this alloy a new alloy is obtained by adding one more element, Zr, which we call LAS3. Both alloys were remelted by voltaic arc (VAR), to study the mechanical and corrosion behavior that allows us to consider its use as a medical material. One ingot of each alloy is produced by arc melting in an inert argon atmosphere and six remelting operations are performed on each of these alloys to ensure homogeneity. The modulus of elasticity E of each of these alloys is calculated by a three-point bending test. For this purpose, strands are cut from each of the samples and tested in an Electroforce_3100 machine applying a maximum load of 22 Newton. At least 10 tests are carried out with each of the alloys designed, the mean, $\bar{x}$ of the values obtained is calculated, as well as the standard deviation m. A linear polarization test is also carried out to calculate the corrosion rate. A BioLogic SP_150 potentiostat is used and for the electrochemical tests a 3.5 wt.% NaCl is employed. Beforehand, the samples are subjected to an open-circuit potential for 24 hours and also to Electrochemical Impedance Spectroscopy.

Keywords: high entropy alloy, corrosion, three-point flexion, arc melting.

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Study of the Effect of Dielectrophoresis on the Formation and Growth of Bacterial Biofilms in Microfluidic Bioreactors

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Abstract. Miniaturized devices provide a substantial advantage in the screening, characterization, isolation, and separation of biological cells in deleterious biofilms. Shorter processing times, smaller quantities of samples and reagents, higher resolution and sensitivity, and overall reduced costs turned micro-scale analysis systems into attractive solutions for the investigation of biofilms in the biomedical industries. This paper presents a comparative study on the effects of dielectrophoretic forces on the formation and growth of different types of bacterial biofilms inside PLA microfluidic bioreactors obtained through Additive Manufacturing. Using electrodes disposed asymmetrically inside the microfluidic device, the influence of the non-uniform electric field upon the formation and growth of biofilms was determined using bacterial suspensions of Staphylococcus aureus, Pseudomonas aeruginosa, Enterococcus faecalis, and Klebsiella. The formation of the biofilm was determined using optical coherence tomography (OCT) imaging and ImageJ software, the topography of the biofilms was analyzed through scanning electron microscopy (SEM), and the quantitative analysis was done using an adjusted microtiter plate technique.

Keywords: dielectrophoresis, bioreactors, microfluidic systems, biofilms, additive manufacturing.

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Evaluation of Premature Degradation of a Hydrogen Gas Injection Pipe from the Benzene Hydrogenation Installation

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Abstract. Abstract. The object of this study is establishment of the causes leading to the damage of an important pipeline in operation from the gasoline hydrofining installation of a refinery. This ensures the injection of hydrogen gas on the effluent path from the reactor, being considered a responsible pipeline in operation. Its premature drilling forced the shutdown of the benzene hydro refining plant with all the consequences. The next step was to inspect the affected area and decide to replace the entire upstream branch of the pipeline positioned downstream of the regulating valve. For the research aspect, samples were taken in order to perform specific analyzes attesting to the causes that led to the advanced corrosion of the pipe. The following steps have been completed: macroscopic examination of the elbow section with localized discontinuity (pore) and sampling of corrosion products from the inner surface of the pipe; analysis of the compositional and structural data of the metallic material from which the pipe is made and their comparison with those provided in the material standard prescribed in the project; detailed analysis of the area with discontinuity (pore) located in the welded joint by macroscopic, microscopic analysis and associated hardness tests; analysis of samples with chemicals and corrosion taken from inside the pipe by fluorescence and X-ray diffraction; evaluation of the corrosion processes that affected the pipeline route. The aggressive character of the corrosion processes, characterized by the corrosion rate of approx. 1 mm/year, was as well favored by a faulty construction solution of the pipeline route.

Keywords: degradation, pipe corrosion, steel damage

ZSM-5 Nanomaterial for Adsorption of Benzyldimethyldodecylammonium Chloride from Wastewater

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Abstract. The zeolites have been used as absorbents to replace existing methods for removing organic contaminants from wastewater, as they are expensive. The adsorption efficiency depends on the nature of adsorbents used, the wastewater composition, and operating parameters. Benzalkonium chlorides are cationic surfactants widely used as cosmetic and cleaning products. Benzyl dimethyl dodecyl ammonium chloride (BDC-12), together with benzyldimethyltetradecyl ammonium chloride and benzyl dimethylhexadecylammonium chloride are the most used benzalkonium chlorides. Benzyldimethyldodecyl ammonium chloride, is a cationic surfactant that shows antimicrobial activity against Gram-negative bacteria Pseudomonas fluorescens. It is also used as corrosion inhibitor, as well as synergist to increase the toxicity of the pesticides against various pests. The adsorption of cationic surfactants on zeolite-type adsorbent materials gives rise to the formation of new organo-zeolite adsorbent materials which are used to remove non-polar or weakly polar organic substances which could not be adsorbed on the solid surface of the zeolite. This paper shows the effectiveness of ZSM-5 zeolite adsorbent for the process of benzyldimethyldodecylammonium chloride surfactant removal from wastewater.

Keywords: ZSM-5, quaternary ammonium salt, wastewater treatment.

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Morphological Characterization on Al_2O_3 Coatings Used for Armor-Grade Steel

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Abstract. Thin hypereutectoid alloyed steel sheets are widely used in military domain for protective components. Many militaries armored vehicles are exposed to dynamic and impact loads, and they are designed to defeat hardened core projectiles. This paper discussed the morphological and microstructural characterization to Al_2O_3 ceramic layer deposited by atmospheric plasma spraying technique (APS method) on HARDOX steel, an armor-grade steel. In order to evaluate the morphology and microstructure of the coatings, optical and scanning electron microscopy and XRD analysis were used. For atmospheric plasma deposition, Al_2O_3 powder were used with a particle size between 10-60 microns and were performed 12 passes on each side of the sheet. The preliminary results shown a compact layer having a trigonal crystalline structure.

Keywords: armor-grade steel, Al_2O_3 coating, APS method, microscopy.

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Metallographic Study and Corrosive Behavior of Titanium Alloys for their Use in Medical Applications

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Abstract. The study aims to characterize two alloys in order to evaluate if they can be used for medical applications, these alloys have the following compositions: A1 (93.2% Ti, 4% Fe, 2% Al, 0.8% V) and A2 (96,5% Ti, 3% Mn, 0.6% Al, 0.2% V). Information on the behavior of the samples was obtained, studying how the composition of the materials and the presence of iron or manganese has an effect on the corrosion resistance when submerging them in a Ringer Lactate solution after covering the samples in epoxy resin, polishing using carbide emery paper of progressive value of grith (800 to 2500) and a 0.1 alpha alumina suspension applied on a polishing cloth in order to obtain a mirror finish. The corrosion potential of the samples was analyzed in order to study how the phenomenon of corrosion occurs in each sample. In order to compare which one of the two materials posseses a better resistance to the effects of corrosion, studies of electrochemical impedance spectroscopy were performed for different values of potential. Images of the surfaces of the alloys after applying Kroll reactive were obtained through the use of a microscope in which 100 magnifications was applied in order to reveal the structure of the surface.

Keywords: speed, corrosion, metallography, Kroll, microscope.

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Recycling Plastic Wastes in Order to Obtain New Building Materials

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Abstract. This paper presents the development of new types of construction materials using plastic waste. According to the European Court, plastic waste from various sectors such as the automotive, electronics, agriculture and construction sectors is a growing problem and is damaging to both terrestrial and marine media. Thus, every year, between 4.8 and 12.7 million tons of plastics reach the oceans. According to most of the research studies, plastic wastes have the potential to replace the natural aggregate at specific percentages. This paper proposes the reuse of this waste as reinforcement in masonry mortars, using plastic waste in various proportions. The experimental program follows the characteristics of masonry mortars both in terms of the behavior of fresh mortar and in terms of mechanical strength. The results obtained showed a better performance of mortars reinforced with plastic strips, both in terms of flexural strength and compressive strength.

Keywords: recycling, plastic waste, PET bottles, sustainable development, masonry mortars.

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Research of Titanium-Based Alloys for Biomedical Applications

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Abstract. Biomaterials play an important role in many aspects of the contemporary medical field through considerable progress over time. The study of titanium alloys has been and is an intense concern of researchers with the aim of improving them, of the mechanical, chemical and biological characteristics imposed on implant materials. The article presents a comparison between the structural properties of the Ti15Mo alloy obtained by two different manufacturing technologies (vacuum arc melting and selective laser melting additive manufacturing). Alloys were examined by optical microstructure, electronic microstructure, X-ray diffraction (XRD) and indentation tests. This study provides an insight of established the future research and manufacturing processes on Titanium metal production vs. Titanium powder metallurgy. The obtained results indicate Ti15Mo alloy obtained by SLM with very good mechanical properties, recommending them for future orthopedic medical applications.

Keywords: new biomaterials, titanium alloys, characterization.

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The Role of Process Parameters on the Mechanical Properties of 3D Printed PLA

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Abstract. 3D printing is a technology used on an ever-increasing scale, which makes it easier to obtain parts with complex geometry. The printing process is very complex because, in addition to the variables introduced by the various materials that are used, there is a multitude of process parameters: printing direction, layer thickness, infill level, filament feed rate, printing temperature, printing bed temperature, etc. Each process parameter influences the mechanical properties of the 3D-printed structure, which is why it is necessary to define the range of possible values where the effect is maximum. In this paper it was studied the effect of two process parameters on the mechanical properties of the 3D-printed samples. Using a commercially PLA filament (produced by Prussia), we made several sets of 3D-printed samples, using three different printing directions of the print head: 0, 22,5 and 45. The infill parameters in the printing program are the rectilinear path and the degree of filling of 100. The second process variable was the overflow; thus, six different degrees were used: 90%, 95%, 100%, 105 %, 110%, 115%. The thickness of the printed layer is standardised, i.e., 0.2mm. The test samples (realized according to ISO 572-2) were subjected to tensile tests on an Instron 3382 machine, and the results were interpreted comparatively. It has been observed that there are variations of the mechanical properties, dependent on the chosen parameters and, in addition, the filling path is crucial in achieving optimal strength structures without tensile stress concentrators.

Keywords: 3D print process, overflow, mechanical resistance.

Theoretical Study on the 21st Century Pavement: The Evaluation of the Defining Factors of the Commercial Pedestrian

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Abstract. The accelerated urban development of the last decades has favored the vital importance considered for interventions on exterior pavements. The necessary changes, considering the requirements of the last 10 years, when pedestrian transport is encouraged detrimental to individual or even common mechanized urban travelling, determines changes in the character of certain streets and squares in city centers, in terms of car or hybrid traffic to strictly pedestrian traffic. These changes require certain characteristics of the exterior floors, such as the finishing material, in terms of strength, durability, slip resistance, wear, etc., adjacent to the aesthetic factor and the ability of the global solution to be successfully included in the historical and urban context of the actual location area. The present paper intents a pertinent analysis of the essential factors: economic, aesthetic and related to the physical-mechanical resilience, social and aesthetic, considered in the evaluation and decision-making process related to exterior pavement development, in the context of the 21st century and also considering two distinct poles of comparisons: two Romanian cities with distinct historical background, Timisoara and Constanta respectively.

Keywords: exterior flooring, aesthetics, material, durability, defining factors.

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In Vivo and in Vitro Biological Activity of some Unexploited Regional Products from the Spontaneous Flora of Romania

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Abstract. Plants with therapeutic potential are a rich source for the inhabitants of a country, and Romania is among them, having a diverse flora not only from plants but also from fungi. The new trends in the field of biopharmaceuticals are also addressed to studies related to topical administration, representing a great advantage, the research done determines the biological activites, *in vivo* and *in vitro*.This study refers to the *in vivo* and *in vitro* biological activity of *Lactarius piperatus*, *Centaurea cyanus* and *Ribes rubrum*. The anti-inflammatory effect was studied and the anthocyanins, proanthocyanidins and phenols of each plant determination.
The study also monitored the manufacture of a hydrating cosmetic product and the completion of a patch test under dermatological control, to confirm the skin compatibility of the investigational product in a panel of healthy human subjects after a single application under maximizing and controlled experimental conditions.

Keywords: biological activity, in vitro, in vivo, cosmetic product, dermatology.

Study on Effect of Recycle Brass Filled Epoxy Mould Insert for Rapid Tooling

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Abstract. Rapid Tooling is able to produce complex prototypes directly from three-dimensional CAD software in flexible materials like polymer, wax, and paper without the need for special fixtures or tools but it only withstands low volume of production. Instead of 3D printing that has limitations in complexity detail on product such as snap fit and hard tooling that have expensive cost of mould production due to tough material like NAK80 or P20 Mould Steel. The current technology and researches used epoxy filled by various metal filler such as Aluminum (Al) or Copper (Cu) to enhance the mechanical properties of rapid tooling mould. Considering the good thermal conductivity and its reusable, the machining waste of brass will act as metal filler and reinforcement to epoxy in this study. The purpose of the study is to investigate the effect of recycle brass filler mixed with epoxy resin as mould inserts for Rapid Tooling (RT) in injection moulding application and evaluate an optimum ratio of brass filler particle to obtain the optimum physical and thermal properties such as compressive strength, density, and thermal conductivity. Based on the previous researches, adding metal filler as brass in epoxy material is expected to improve the compressive strength and density. Significantly, this study will encourage the used of recycle material such as metal waste from machining to turn it into a product offer great help in environmental sustainability.

Keywords: machining waste, rapid tooling, injection moulding, mould inserts, metal epoxy composite.

Low Temperature Fabrication of Nepheline Ceramics-based Geopolymer

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Abstract. The focus of this study is the fabrication of innovative and sustainable ceramic-based geopolymer with improved low temperatures performances. Kaolin was mixed with liquid sodium silicate (Na2SiO3) and 12M of sodium hydroxide (NaOH) solution using aluminosilicate/activator ratio of 0.24at a ratio of 1:1 and Na2SiO3/NaOH ratio of 0.24 to synthesise kaolin geopolymer. The effect of sintering profile on the microstructure, pore evolution and flexural strength were investigated. The heating exposure aided consolidation and created a fairly uniform microstructure, resulting in a smooth surface texture. In comparison to the unheated geopolymer, 3D pore distribution showed a significant increase in the range size of ~30 µm with the appearance of isolated and intergranular pores. The flexural strength at 1200 °C with heating rate of 5°C/min and was increased by 32.4 % to 85.4 Mpa. The sintering process has an impact on the final microstructure formation thus improved the characteristic of nepheline ceramic-based geopolymer.

Keywords: geopolymer, ceramic-based geopolymer, nepheline, sintering, tomography.

Mechanical Performance of OPC Concrete Mortar with Addition of Rice Husk

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Abstract. Most of the rice husk is disposed with no further concern and this has caused waste disposal problems. Rice husk burning can be hazardous to one's health and the environment. Rice husk is commonly used as an addition in concrete mixtures in concrete technology. This report studies on the effect of rice husk addition on the properties of concrete mortar. Specimens were made by mixing various percentages of rice husk in a mortar. The experiment was performed by adding 0%, 3%, 5% and 7% rice husk into the mixture. The compressive strength, density, and water absorption were examined after being soaked in water for 7 and 28 days. From the results, it is concluded that the higher percentage of rice husk used, will decreased the compressive strength and density due to the main characteristics which are porosity and lightweight but increase in water absorption.

Keywords: mechanical performance, OPC concrete, rice husk.

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Effect of Varied Solid to Liquid Ratio of Metakaolin/Sludge Geopolymer Adsorbent on Cu^{2+} Removal

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Abstract. Increase in the industrial activities is linked to an increase in the sludge generation. The majority of industrial sludge is disposed of through energy-intensive processes such as incineration and landfilling. This leads to environmental pollution and putting more pressure on the sludge management strategies. Thus, the aim of this research was to develop an amorphous metakaolin based geopolymer with the incorporation of two types of industrial sludge (S1,S3) that could be employed as an adsorbent for removing copper (Cu^{2+}) from aqueous solution through adsorption process. The effect of varied solid to liquid ratio (S/L) on the geopolymerization process and also towards removal efficiency of Cu^{2+} was studied. The raw materials and synthesized geopolymer were characterized by using x-ray fluorescence (XRF), x-ray diffraction (XRD), scanning electron microscope (SEM), Fourier transforms infrared spectroscopy (FTIR) and Brunau-er-Emmett-Teller (BET). Finally, this work clearly indicates that the industrial sludge can be utilized in developing low cost adsorbent with high removal efficiency.

Keywords: geopolymer, metakaolin, sludge, adsorbent, adsorption.

Research on Valorization of Spent Garnets as Addition in Cementitious Materials – Preliminary Experimental Evaluation

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Abstract. Abrasive waterjet (AWJ) material processing represents a relatively new and extremely efficient method in the specific industries, implying various applicability areas, attributed to different materials, with different properties and domains of use. Besides numerous advantages of the AWJ cutting and generally material processing technique, it also involves the waste generation: the abrasive sands are converted into sludge material, collected into recipients and further on, after natural drying, they become waste dumps randomly deserted. The rapid growth of the population, recorded mainly in urban areas, determines an increasing demand on housing facilities and consequently, on concrete production and aggregates consumption. Aggregates and sand, mainly exploited from riverbeds or quarries, represent exhaustible natural resource for which substitution solution needs to be found, in order to control and reduce their extraction from the natural landscape. The present paper offers a preliminary overview regarding the possibility of incorporating SG wastes of local production in usual cement-based materials, as partial substitute of the aggregate, for the double purpose of waste management implementation and natural resources protection, in the transition towards the implementing the Circular Economy concept in the Romanian industry.

Keywords: abrasive waterjet (AWJ) material processing, Spent Garnets (SG), concrete, waste management, Circular Economy.

SECTION 4

MATERIALS & LIFE SCIENCE

Fresco Wall Painting and its Regional Modifications

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Abstract. The research work aims at analysis of the regional specific features of fresco wall painting. Comparison of ancient Chinese and Kyivan Rus frescoes and shows their differences; proves that the borrowed art (introduced Buddhist in China and Byzantine in Kyivan Rus) undergoes modifications in the technique of execution and plot-image concept on the local ground. The study aims to analyse the source base and, based on its processing, field surveys and existing practical restoration experience, to determine the characteristics of production technologies and restoration techniques of Kyivan Rus mural painting. The scientific novelty of the research lies in the introduction into a wide scientific circulation of narrow-profile restoration documentation of the historical and architectural monuments of the pre-Mongol era in Ukraine, which are included in the UNESCO World Heritage List.

Keywords: Kyivan Rus frescoes, regional features, production technology, UNESCO the World Heritage List; cultural heritage, conservation and restoration.

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Using denture base for local treatment with vit B12 versus parenteral treatment-a new approach

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Abstract. Depending on the clinical context, objectives, and treatment requirements, a variety of prosthetic devices capable of artificially reconstructing the dental arches in a manner as customized as possible can be utilized in the treatment of complete edentation. The purpose of this study is to compare the efficacy of general vitamin B12 treatment vs the efficacy of local treatment accomplished through full dentures. The study was performed on a group of patients of Dental Faculty in Iasi. Because cyanocobalamin deficiency is typically treated parenterally, the current study proved the superiority of local treatment with complete dentures obtained through the crosslinked polymerization method, a much easier and less expensive way to perform the same treatment in the same time period.

Keywords: dentures, vitamin B12, denture base, acrylate, crosslinked polymerization.

State-of-the-Art Technologies of Imitation of Mural Painting from the Kyivan Rus and Baroque Periods in the Reconstructed St. Michael Golden-Domed Cathedral in Kyiv

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Abstract. The research work deals with the issue of destroyed architectural monuments restitution that remains disputable. Based on compliance with the world practice of restitution that is recognized at the legislative level, an example of restitution of a unique object of Ukraine is described – St. Michael's Golden-Domed Cathedral in Kyiv, destroyed in the 1930s and completely reconstructed nowadays by the specialists of Ukrrestavratsiia Corporation. The work focuses on state-of-the-art technologies of mural painting for imitation ancient Rus frescoes and baroque mural paintings. Taking into consideration that photographic materials and evidence of interior decoration were not sufficient, and the fact that the cathedral and monastery are functional, that imparted its peculiarity and called for painting the murals using up-to-date durable painting technologies, instead of the sophisticated and less durable technique of the ancient Rus frescoes, mural painting was used in the image-bearing system of frescoes, but in the state-of-the-art techniques of Keim's process or mineral painting. The possibilities of strengthening and monitoring cracked masonry structures that are the base of reconstructed frescoes are also presented.

Keywords: restitution, destroyed architectural monuments, St. Michael's Golden-Domed Cathedral, state-of-the-art mural painting technologies.

The Purification of the Most Abundant Proteins from Royal Jelly (Apis Mellifera)

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Abstract. Royal jelly (RJ) is a complex beehive product which is important for larval development and queen nutrition in the hive and may also have positive effects on human health according to some cell culture and animal studies. The most abundant proteins in RJ belong to the Major royal jelly proteins family (MRJPs) which represent up to 90% of the total proteins. The aim of the present study was to purify the most abundant proteins found in RJ by chromatographic methods. These proteins were fractionated by using cation exchange chromatography at pH 4.0 and hydrophobic interaction chromatography at pH 7.0. MRJP1 was purified from RJ by ion exchange chromatography as both monomer and oligomer.

Keywords: royal jelly, protein purification, chromatography, MRJPs, apalbumin.

Use of Historical Painting Concepts by Modern Methods in the Restoration of Architectural Monuments

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Abstract. The research work presents a scientific overview of examples of monumental painting in recreated and restored objects in recent decades. Examples of monumental painting in the figurative concept of Kyivan Rus fresco, baroque painting and academic painting of the period of classicism and historicism of the 19th century are selected. The technologies of such monumental painting are described, while preserving the figurative concept, but on the basis of modern materials and technologies, which makes such paintings more resistant to negative external influences and more durable.

Keywords: monumental painting, historical figurative concepts, reconstruction of destroyed objects, modern materials and techniques, durability, longevity.

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Chitosan as Biomaterial- an Overview of Functionalisation with Plants Extract

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Abstract. Chitosan as natural biomaterial is used in tissue engineering and regenerative medicine as a biomaterial alone, as well as in combination with other polymers. The recent research to obtain functionalized chitosan has also focused on the use of environmentally friendly natural resources, introducing different plants, for which new properties and applications in various modern fields have been highlighted[1]. The use of hydro-alcoholic extracts and essential oils from plants to the production of functionalized chitosan-based materials (membranes, films, nanoparticles) shown improved antimicrobial properties and the use of these materials in various fields (medicine, food, industry, cosmetics and environment). The most valuable sources of natural compounds come from plants, being represented by a wide class of phenolic substances that can appear in all parts of plants in fresh or in dried form, extracts or essential oils from seeds, nuts, fruits, vegetables, leaves, roots or even from the stem and bark[2]. The characterisation of membranes and films incorporating chitosan and plants extracts are referring of physical characterisation, structural, morphological structure, mechanical and biological properties based on their antimicrobial potential.

Keywords: chitosan, biomaterial, plants extract, membranes, films.

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Restoration, Operation and Inclusion of Museums in Large Cities with Noise Load

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Abstract. The research work reveals the features of the functioning of historical buildings, redesigned for a museum function. The specificity lies in the fact that most of these museums are located in large cities with a number of environmental problems and noise load, which negatively affects both the state of structures and decor. On the example of two objects - the former Poltava provincial zemstvo (Poltava Museum of Local Lore) and the Palace of Israel Poznansky (Museum of the City of Lodz), the restoration work carried out with an emphasis on the restoration of wall paintings in the interiors is characterized. Considerable attention is paid to the problem of reasonable adaptation of historical buildings for use by people with disabilities, including the problem of familiarization with the museum exposition of people with visual impairments.

Keywords: museum objects, historical buildings, restoration, noise loads, people with limited mobility.

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Modern Technologies in Restoration of Architectural Monuments (on the Example of St. Volodymyr's Cathedral in Chersonesos)

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Abstract. The research work is devoted to the analysis of the use of modern materials in the restoration of architectural monuments (on the example of St. Volodymyr's Cathedral in Chersonesos (in modern Sevastopol). The work structures historical facts related to the history of the cathedral and the description of its architecture, identifies problems with the state of emergency of the cathedral before the restoration work, presents a comprehensive system of the entire list of activities and analyzes the state of restored elements in the post-restoration period. This proves that in some cases the use of modern technologies and materials in the reproduction and/or restoration of architectural monuments is rational and acceptable.

Keywords: restoration, St. Volodymyr's Cathedral in Chersonesos, modern technology, modern materials.

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Water Conservation and River Water Quality of the Bulgarian Black Sea Tributaries

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Abstract. This paper analyzes the current state of quality of the main Bulgarian tributaries of the Black Sea. Component analysis of the main physicochemical indicators according to Ordinance N-4/2012, as well as the content of some of the most common heavy metals in Bulgarian rivers was performed**.** The land cover and land use analysis of the region was made. The results show that river water is mainly polluted by wastewater from utilities and agriculture. The participation of heavy metals in the pollution of river waters in this region of the country is not very high and is reported only in some of the monitoring points. The waters of the Veleka river near the village of Sinemorets have the most favorable hydro-chemical characteristics, while the waters of the Dvoinitsa river at the point before flowing into the Black Sea have the worst.

Keywords: water quality, land cover, land use, tributaries, wastewater, agriculture

Olive Vegetation Waters (OVWs): Characteristics, Treatments and Environmental Problems

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Abstract. The present work aims to analyze the various aspects relating to the olive-vegetation waters (OVWs) with particular reference to environmental problems. As is known, the olive-vegetation waters are one of the most polluting by-products of the oil industries. They are produced in large quantities and have a very high polluting potential. For this reason, a deep and detailed analysis of the production chain up to the correct and lawful disposal of olive-vegetation water is reported. This analysis clarifies all the steps in the production of olive oil, which is the main product, but also of the olive-vegetation waters, which are one of the by-products of this industry together with pomace. A general overview of the regulatory legislations relating to the disposal of OVWs is addressed. The chemical characteristics of the vegetation waters, with particular reference to polyphenols, which are the most important compounds of the vegetation waters, are described. Finally, a list of the various treatment methods is drawn up, based on precise technical and analytical considerations.

Keywords: olive-vegetation waters (OVWs); bio-phenols; polyphenols.

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Water Quality Assessment and Conservation of the River Water in Regions with Various Anthropogenic Activities in Bulgaria: A Case Study of the Catchments of Topolnitsa and Luda Yana Rivers

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Abstract. Water quality describes the physical, chemical and biological status of water. In order to assess the quality of river water and in relation with the anthropogenic effects, natural state and future uses the best way of preventing pollution is to capture pollutants before they are able to reach the watercourse. The evaluation of the quality of water bodies, including the surface water in rivers, is of fundamental importance to the study and use of river water. Depending on Directive 2000/60/EC - Water Framework Directive (WFD) to achieve a "good condition" of all water bodies and Ordinance N-4 on characterization of surface water 2012 and Ordinance on environmental quality standards for priority substances and some other pollutant (Ordinance EQSPSSOP 2010) of Republic of Bulgaria a lot of variables are required to be determined. In this study were used sixteen physicochemical parameters: pH, electrical conductivity (EC), dissolved oxygen (DO), biochemical oxygen demand (BOD_5), ammonium ($N\text{-}NH_4$), nitrate ($N\text{-}NO_3$), nitrite ($N\text{-}NO_2$) and phosphate ($P\text{-ortho-}PO_4$) and such heavy metals as Cu, Fe, Mn, Pb, As, Zn, Cd and Ni. The article reveals how these wide variations in different parameters can be reduced to a single number through applying a CCME WQI method, thereby making it quite convenient to comment on the overall quality of the water sample from its pollution point of view. The results based on this index and obtained from this research would be useful to the large public and even to land-use planners and environmental management agencies for monitoring and reducing the water pollution, especially for such regions defined as an ecological "hot spot" for many years.

Keywords: water quality, physicochemical parameters, heavy metals

Analysis of the Immune Status of Museum Employees to Assess the Level of Damage to Their Health

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Abstract. The purpose of this paper was to assess the immune status of employees in a Romanian museum and to improve the assessment of high-risk factors for the prevention of occupational diseases. The analyzes were performed before the pandemic and involved 58 museum employees, including 49 women and 9 men. Simple radial immunodefusion plates were used to determine IgA, IgM, IgG immunoglobulins and C3 and C4 components of the complement system (SC). A 96-well ELISA kit was used to determine IgE. The results of the leukocyte formulas showed changes compared to the reference values, for 95% of the participating volunteers, in at least one of the analyzed indicators. Admitting the importance but also the limitations of existing legislation, as well as the need for efforts to improve it, it follows that the analysis of the results of this study and other similar research is a source of potential improvements in the legal framework and specific practices.

Keywords: risk assessment, immune status, workers, museum.

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Research on the Exposure of Workers in a Courier Company to the Exhaust Emissions of Diesel Engines

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Abstract. The paper presents the research on the development of a method for analysis of elemental carbon from Diesel emissions in the workplace based on existing methods and studies on the exposure of workers in a courier company to emissions of Diesel engines in the context of occupational exposure limit in Directive (EU) 2019/130 on the protection of workers from the risks related to exposure to carcinogens or mutagens at work. It is estimated that more than 3.6 million workers in Europe are exposed to Diesel emissions. Occupational exposure takes place mainly in mining, construction, transport, agriculture and other activities using Diesel vehicles and equipment. New data on the carcinogenicity of Diesel engine emissions and the change in their classification from potentially carcinogenic (Group 2B) to carcinogenic (Group 1), as well as the high number of workers exposed to these types of chemical pollutants, highlighted the need to set occupational exposure limits for emissions Diesel engines in the work environment.

Keywords: carcinogens, diesel engine emissions, worker exposure monitoring.

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Image Processing Method for Measuring the Shutter Speed of Film Cameras

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Abstract. In photography, there are three exposure parameters: the shutter speed, the aperture, and the film sensitivity (ISO). In modern cameras, the camera body is responsible for setting the shutter speed (i.e., exposure time) and the ISO, while film cameras set only the shutter speed, therefore it is their main performance parameter. The shutter mechanism in most film cameras is mechanical, involving the use of springs. The springs wear in time, leading to the decalibration of the shutter speed, which become longer than the designed value. The accurate measurement of the shutter speed is thus a very important performance evaluation process that allows a proper estimation of the camera's market value. A recent study of the shutter speed measurement methods is given in. This paper presents an innovative method that allows the precise measurement of a camera's shutter speed using image processing, unlike the ones presented in. It involves the recording of the mechanical shutter during the exposure process using a high-speed camera, then applying an image processing algorithm on each of the recorded frames to automatically determine the exposure time. The method also measures additional performance parameters like the speed of each shutter curtain and the variation of the gap between the shutter curtains when using a very short exposure time (high shutter speed), in the case of focal plane shutters. The paper presents the experimental setup, the image processing algorithm and the results obtained when testing different film cameras.

Keywords: exposure time, shutter speed, image processing, automation, camera.

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Research and Modeling of Drive and Entomopter Flight Control

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Abstract. The aim of the work is modeling and analyze the mechanism of power transmission to the wings of an entomopter and the flight control system of such an object. As regards the analysis of the power transmission to the wings of the entomopter, a simulation model was made, which allowed for the observation of the system's operation and verification of the adopted kinematic assumptions. The correct operation of the proposed solution has been proved by building a prototype of the mechanism and conducting experimental tests. The proposed mechanism is characterized by simplicity and allows for miniaturization while ensuring reliable operation with a reduced power requirement in the drive of the mechanism. The essence of the analyzed entomopter flight control system is the ability to control the mutual relationship between the direction of the lift force generated by the flapping of the wings and the direction of gravity. If the lift and gravity forces directions coincide, the entomopter can only lift up. The presented entomopter flight control system, consisting of two stepper motors and a control mass, allows to change the angle between the lift and gravity forces.

Keywords: power transmission mechanism, entomopter, flapping, angle of attack, wing, flight control system.

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Optimization Inspired by Nature and Applications

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Abstract. Optimization is a pervasive discipline in several research fields of engineering science. This presentation consists of two parts; the first is of linear programming; how to design and reformulate a problem and provide resolution or simulation tools such as the Simplex method, the second part is dedicated to unveil some algorithms for complex optimization using algorithms inspired by nature like ant colony, genetic algorithm or cuckoo search.

Keywords: Optimization, Linear Programming and Heuristics.

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High-Resolution NMR and MALDI-MS Molecular Profiling of Craft Beers

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Abstract. Beer is a complex aqueous mixture of organic and inorganic compounds, such as carbohydrates obtained from barley or wheat malts, hops and yeast, ethanol, proteins, vitamins, and minerals. Phenols and their derivatives obtained by chemical interactions with biogenic amines, together superior alcohols and amino acids, are the other compounds present in minor proportions in beer, Phenolic components possess high antioxidant activities, and regulate the oxidative stability of beer, although bitterness of this beverage originates from hops. Since these antioxidants can produce beneficial effects on the human health after consumption, it is challenging to have in hand the molecular profiles of beers, in order to investigate their contents in bioactive compounds. Today, a significant number of small producers have strongly invested in craft beers, produced by using different hop blends, starting materials that are rich in phenolic antioxidants. The present work discloses an instrumental analytical method which enables the rapid obtainment of the molecular profiling of craft beers. In this investigation, high-resolution NMR experiments coupled to MALDI-MS and MS-MS analysis were applied for the "beeromic" analysis of craft beers produced in Calabria (the Southern part of Italy). The spectral data, together simple antioxidant tests, confirmed that this kind of beer predominantly contains the hop bitter metabolites humolones and isohumolones, also highlighting the presence of phenols and phenolamides that are known for their bioactivity against cancer.

Keywords: beeromic, craft beers, antioxidants, humolones, isohumolones, phenols, NMR, MALDI-MS.

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Alkaloid Content in Crude Extracts and Their Fractions of Prosopis Laevigata and Vachellia Schaffneri Leaves

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Abstract. Natural products are a source of compounds with a wide variety of chemical structures and bioactivities, for example, many anticancer agents such as placlitaxel or vincristine have been isolated from plant sources and show an alkaloid nature. In traditional medicine, plant species from the genera *Vachellia* and *Prosopis* are commonly used to treat cancer. The objective of the present work was to obtain crude extracts and fractions from *Prosopis laevigata* and *Vachellia schaffneri* leaves. The concentration of total alkaloids was determined spectrophotometrically using the bromocresol green method[1], with atropine as standard, and the extraction yield was determined in each extract and their fractions. The total alkaloid content in *P. laevigata* crude extract was 16.53 ± 1.19 mgAE g^{-1} of dry biomass with an extraction yield of 2.64 ± 0.42 % with respect to the dry weight (DW). For *V. schaffneri* crude extract, the total alkaloid content was 9.80 ± 1.09 mgAE g^{-1} and 2.58 ± 0.18 % DW of extraction yield. Both extracts were separated into fractions using column chromatography, where 35 fractions were recovered from each, and analyzed by thin layer chromatography; fractions with a similar profile were mixed resulting in 8 representative fractions for each species. The total alkaloid content present in the fractions of both species was in a range from 0.010 to 2.22 mgEA g^{-1}. For *V. schaffneri*, fraction 4 had the highest alkaloid content with respect to the other fractions (2.22 ± 0.042 mgEA g^{-1}), while in *P. laevigata*, fraction 5 had the highest alkaloid content (1.40 ± 0.130 mgEA g^{-1}). Therefore, it would be worth to evaluate the cytotoxic bioactivity of fractions with highest alkaloid content.

Keywords: Alkaloids, *P. leavigata*, *V. schaffneri*, spectrophotometry**.**

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Plant Avalable Potassium and Phosphorus in Arable Soil: A Comparative Study of Testing Methods

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Abstract. Determination of soil fertility status is based on determination of plant available nutrients which occur in several forms. This strongly challenges the choice of extracting solution and detection technique. Deriving a mathematical model for data recalculation would allow relating the results of different methods without loss of agronomical validation data. This comparative study was aimed at assessing the relationship between two methods for determination of plant available potassium and phosphorus in arable soil. Soil K and P were extracted followed a diluted double acid (Mehlich 1) and an acetate/lactate methods (ALM). Potassium in the obtained extracts was determined by flame AES and phosphorus - by molybdenum blue spectrophotometry. To compare the results obtained by the both extraction methods, the uncertainty of measurement of each method was assessed following the single laboratory validation and quality control approach. The uncertainty was found to be 2 mg/kg as P_2O_5 and 6 mg/kg as K_2O. The results from the comparative analysis of 140 arable soil samples showed a correlation between Mehlich-1 and ALM extracted P and K within uncertainty limits. Based on the recalculated values of extractable K and P, the fertility status of 70 % of soil samples were correctly classified, 10 % with acceptable error and 20 % could not be classified. The study showed that Mehlich-1 and ALM methods provided comparable results for studied range of soil samples. However, determination of soil fertility status based on recalculated results should be made with caution as it could be highly influenced by soil type.

Keywords: plant available K, plant available P, Mehlich-1, lactate-acetate extraction, molybdenum blue method, flame AES, soil testing.

CO_2 Efflux Measurements on Aquatic And Terrestrial Ecosystems in the Context of Climate Change

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Abstract. Ecosystem-based approaches to climate change mitigation involves the use of ecosystems carbon storage and sequestration services. For this purpose, comprehensive CO2 efflux (Reco) measurements of the wetland and terrestrial ecosystems were performed in the adjacent area of Bucharest, by applying two complementary methods using close chambers: dynamic by respiration chamber and static by injection kit. For the evaluation and comparison in time, the measurements were performed simultaneously with the two methods at relevant time intervals. The results of the both practices have been inter–compared in the established plots. The aim of this paper is to highlight the values of Reco measured on days when extreme temperatures and precipitations were recorded. The data set from the selected days was statistically analysed in comparison with the recorded measurements during the corresponding season. The results highlight the response of CO2 efflux in relation with daily meteorological parameters, for analysing the ecosystems storage and carbon sequestration in the context of climate change. In addition, the analysis performed contributes to the uncertainty reduction for the independent use of the two methods as a monitoring tool for greenhouse gases exchanges between ecosystems and atmosphere.

Keywords: CO_2 efflux, close chamber, injection kit, weather anomalies.

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Study on Some Old Metallic Artefacts

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Abstract. The study of the old artefacts is very important for understanding ancient cultures and their traditional manufacturing, also the commercial routes for trading these kinds of goods. By analyzing the composition and the manufacturing technique we can evaluate the archeometallurgical context by positioning the source of raw materials. Also, this can help the specialist to use compatible materials when restoring it.

Keywords: old metallic artefacts, bronze, brass.

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New Technologies in Moroccan University, an Innovative Approach of Governance

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Abstract. The university system in general and university governance in particular have undergone profound structural changes. However, the university's relationship with its environment is currently undergoing far-reaching transformations, in particular the university culture which is much more open to the various stakeholders without sacrificing academic and scientific autonomy. University governance can be defined as a set of mechanisms and processes that contribute to the transparent and responsible establishment of the university's structuring projects in the fields of training, research and innovation. On the other hand, Information and communication technologies (ICT) have evolved thus creating new opportunities aimed not only at reaching higher levels of development but also at reducing the number of traditional obstacles. In this sense, this technological revolution encourages University to adopt an innovative approach of sharing and communication to meet the needs of its socio-economic environment but also to Develop a culture of communication and information by putting an end to traditional practices that limit the dissemination of information and clear decision taking. In this article, we will try to observe the experience of a Moroccan university in the use of new technologies and innovation on its various activities and its impact on its own governance.

Keywords: Moroccan University, Governance, New Technologies, Innovation.

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Development of a Methodology for Monitoring SARS-CoV-2 RNA in Wastewater in Romania. Evaluation of Two Methods of Quantifying Its: RT-qPCR vs. ddPCR

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Abstract. COVID-19 is a contagious disease that occurs in humans caused by infection with the SARS-CoV-2 virus. Originally emerged in Wuhan, from Hubei Province, China, SARS-CoV-2 has spread rapidly around the world, causing more than 250 million infections and more than 5 million deaths, according to the WHO. In order to effectively combat this pandemic, a methodology must be found to be able to predict, early detect and monitor the extent of infections, which is vital for reducing the risk of transmission. Monitoring of SARS-CoV-2 in wastewater to detect and quantify the virus, to estimate the number of infected subjects in a population in a given area has proven to be very promising. Wastewater monitoring has already been implemented in several European countries, as well as in Australia, China and the United States. Although the presence of SARS-CoV-2 in wastewater has been reported in several studies and is being given special attention, a standard procedure for monitoring SARS-CoV-2 in wastewater is still missing. Our goal is to design and propose, based on information reported already in the literature, an efficient methodology for detecting and quantifying SARS-CoV-2 RNA in wastewater. In addition, we also performed a comparison based on performance characteristics of the two methods used to detect and quantify SARS-CoV-2 RNA in wastewater, reverse transcription-quantitative polymerase chain reaction (RT-qPCR) and droplet digital PCR (ddPCR).

Keywords: SARS-CoV-2; wastewater surveillance; RT-qPCR; RT-ddPCR.

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The Influence of Sintering Temperature on the Microstructure of Coal-ash Based Geopolymers

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Abstract. Currently, one of the main challenges of civil engineering and science materials engineers is to develop a sustainable substitute for Ordinary Portland Cement (OPC). While the most promising solution is provided by geopolymerisation technology, most of the studied geopolymers are based on natural raw materials (kaolin). The metakaolin is mainly preferred because of its rapid rate of dissolution in the reactant solution, easy control of the Si/Al ratio, and white color. However, its high cost prevents it from being widely used in geopolymer composites or other compositions that can become an industrial alternative for OPC. Several studies have shown that geopolymers with good performance can also be made from secondary basic materials (industrial wastes such as coal ash or slag). This explains why countries with rapidly developing economies are so interested in this technology. These countries amass significant amounts of industrial waste and lack a well-developed recycling infrastructure. Therefore, the use of these by-products for geopolymer manufacturing could solve a waste problem while simultaneously lowering virgin raw material usage. This study evaluates the microstructural evolution of coal ash-based geopolymers with mine tailing's addition exposed at different temperatures during curing. Accordingly, X-ray diffraction analysis, scanning electron microscopy, and energy dispersive X-ray analysis were involved to highlight the phase transition and morphological particularities of room cured and sintered samples.

Keywords: geopolymers, sintering, mine tailings, ecofriendly concrete.

Mathematical Modeling of Body Mass for Specimens of Beluga Tagged and Monitored in Time Framed 2011-2020 in the Lower Danube

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Abstract. Sturgeons are distributed exclusively in the northern hemisphere of the Earth and are an important group in the evolution and classification of fish, being a longlived group of vertebrates, which have successfully maintained their morphological characteristics for over 200 million years, but now, according to the IUCN Red List of Endangered Species (IUCN), sturgeon species around the world are threatened with extinction. From a taxonomic point of view, the family Acipenseridae comprises five genera with 25 species and of these 6 are native in the Lower Danube. As knowledge on the behavior and ecology of sturgeon species is limited this study analyzes the information volume accumulated during 2011-2020 by the team of experts of the National Institute for Research and Development for Environmental Protection and proposes a model for calculating the body mass of the beluga specimens tagged and monitored according to morphobiometric parameters. Studies are limited in time due to the alarming decline of these species; out of the 6 species of native sturgeon, only 4 are currently found in the Lower Danube.

Keywords: Acipenseriformes; beluga sturgeon; Danube River; monitorig.

Modelling of Particulate Matter (PM10) During High Particulate Event (HPE) in Klang Valley, Malaysia

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Abstract. Particulate matter (PM_{10}) is the key indicator of air quality index (API) in Malaysia and Southeast Asia during haze. PM_{10} emanation is believed to cause the strongest harm to public health and environment. Therefore, it is very important to develop PM_{10} prediction model for the future to give the early warning to the public. A database with hourly PM10 concentration together with other trace gases and weather parameters were obtained from Department of Environment (DOE) Malaysia. The dataset were obtained from 2012 to 2016 at two study areas located in Klang Valley, namely, Petaling Jaya and Shah Alam. The association of PM_{10} concentration between other trace gases and weather parameters were measured using Pearson Correlation Analysis and Principle Component Analysis. From the result obtained, PM_{10} correlated with ozone (O_3), carbon monoxide (CO) at the both study areas. Three models were developed to predict the concentration of PM_{10} for the next day, next two days and next three days using high concentration of PM_{10} during high particulate event (HPE). The best prediction model for PM_{10} concentration for all study areas is Artificial Neural Network (ANN).

Keywords: air quality modeling, particulate matter, high particulate event, artificial neural network, multiple linear regression.

Identification of Sturgeon Behavior in Different Hydromorphodynamic Conditions Resulting from the Implementation of Hydrotechnical Arrangements

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Abstract. The aim of this research was to evaluate the results obtained by ultrasonic tagging of sturgeon species and to collect field data for the period 2019-2021. Thus, an analysis was made of the information collected from the beginning of the period and also will be presented the migration capacity of sturgeons in the area of hydrotechnical arrangements and the possibility of passing areas in different hydromorphodynamic conditions highlighted by collecting bathymetry data. This research aims to present the situation of sturgeon species tagged with ultrasonic transmitters since the beginning of the study, both in terms of evolution by species, their migration capacity in the area of hydrotechnical arrangements and the identification of potential swimming speeds taking into account the feeding and rest periods, respectively. At the same time, in addition to the results proposed in the study, an assessment was made of the pressures that may adversely affect the conservation status of sturgeon species and the proposed measures.

Keywords: sturgeon, bathymetry, migration, ultrasonic, tagging.

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Air Ambulance Simulation Training Effectiveness Research

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Abstract. At the beginning, intermediate air medical rescue professional training, in the past mostly to teach the main theory, but less chance of actual boarding simulation training. The study was conducted by the National Defense Medical College to provide students with practical boarding drills and experience the importance of teamwork in high-altitude operations, "Aeromedical Ambulance Simulator Training Course". A total of 80 questionnaires were distributed, and 58 questionnaires were returned as valid questionnaires. SPSS18.0 statistical software for analysis, the study found the following:
1. First, the air ambulance training before and after the disaster medical rescue and air evacuation knowledge and attitudes are significantly different, the other skills are some significant differences.
2. Air ambulance training and disaster medical rescue and air evacuation knowledge, attitude and skills are significantly correlated.
3. There were significant differences in knowledge, attitude and skills among different demographic variables.
4. According to the training effectiveness data, the construction of the "Airborne Medical Ambulance Simulator Cabin Classroom" can effectively assess the actual medical training effectiveness of the trainees, and effectively improve the quality of professional ambulance for the future air ambulance service.

Keywords: Air medical aid, Disaster Medicine Rescue

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A Study on International Communication Standards and Performance Standards for Smart Water Quality Sensors

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Abstract. At The world is now building an artificial intelligence (AI) water quality management system to detect water quality accidents at an early stage and predict water quality vulnerable areas in advance beyond measuring the water quality. In other words, by applying big data analysis and artificial intelligence technology to the conventional water quality measurement system that monitors water quality in real time, an artificial intelligence-based water quality measurement and water quality prediction system is built at the same time, and drones and unmanned ships are also introduced. It means implementing water quality management. Water quality accident prediction based on artificial intelligence measures water quality throughout the site of use through intelligent spatial analysis based on the integrated water quality database. On the other hand, the location of the site detected through artificial intelligence is displayed on the comprehensive monitoring screen, and special management such as on-site monitoring, replacement of consumables, and maintenance is carried out to prevent water quality accidents. In particular, the prediction accuracy of artificial intelligence is to create an algorithm for predicting future values by learning the characteristics and patterns of accumulated data. It depends on the function of the smart sensor itself. However, until now, there has been no international standard for smart sensors, so it was difficult to establish system interlocking or modularization for each manufacturer and site. Therefore, we present the most important standard communication standards for smart water quality sensors in the field and international standard performance specifications for smart sensors, and this research data is provided to all organizations engaged in water quality around the world for water quality measurement and prediction system data system for AI application.

Keywords: water quality sensor, smart water quality sensor, artificial intelligence water quality monitoring, remote water quality detection

Three-point Bending Response of Nylon 12 Obtained by Fused Filament Fabrication (FFF) versus Selective Laser Sintering (SLS)

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Abstract. This study analyses the three-point bending behavior of Nylon 12 (PA12) 3D printed specimens produced using fused filament fabrication (FFF) and selective laser sintering (SLS) technologies. The bending strength and flexural elasticity moduli were determined following ISO 173 specifications to assess the effect of different technologies on the mechanical behavior of the three-point bending specimens produced by employing three build orientations (i.e., 0°, 45°, and 90°) within the vertical plane of printing platform. One-way ANOVA analysis, Tukey's HSD, and Games-Howell tests are considered to assess the statistical variability of experimental data and compare the mean values of bending strength and flexural moduli. The testing results for the three orientations under question show notable differences either in terms of strength or elasticity response at a significance p-level of 0.05.

Keywords: three-point bending, bending strength, flexural modulus, Nylon 12, Fused Filament Fabrication (FFF), Selective Laser Sintering (SLS).

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