Book of Abstracts

EUROINVENT
ICIR 2021

International Conference on Innovative Research

May 20th to 21st, 2021
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**

Editors:

Andrei Victor SANDU, Mohd Mustafa Al Bakri ABDULLAH,

Petrică VIZUREANU, Marcin NABIALEK, Che Mohd Ruzaidi GHAZALI, Ion SANDU

ISSN Print 2601-4580
ISSN On-line 2601-4599

Editors:
Andrei Victor SANDU
Mohd Mustafa Al Bakri ABDULLAH
Petrică VIZUREANU
Marcin NABIALEK
Che Mohd Ruzaidi GHAZALI
Ion SANDU

Technical Editors:
Lecturer PhD.Eng. Manuela Cristina PERJU
Lecturer PhD.Eng. Dragos Cristian ACHITEI
Assist. PhD.Eng. Diana Petronela BURDUHOS NERGIS
Assist. PhD.Eng. Dumitru Doru BURDUHOS NERGIS

Copyright © 2021
All Rights reserved to the Editors

All the abstracts are provided by the authors.
No major corrections were applied by editor.

EUROPEAN EXHIBITION OF CREATIVITY AND INNOVATION

E U R O I N V E N T

IAŞI – ROMANIA

XIIIth Edition, 20th - 22th May 2021

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 2021 edition is organized 100% online 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/

4. **European Visual Art Exhibition**

   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 2021 Conference and the abstracts of selected peer-reviewed papers. The event was held on-line in Iaşi, România from 20th to 21st of May 2021.

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 2021 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.

Scientific Advisory Board

Prof.Dr. Ion SANDU
Alexandru Ioan Cuza University of Iasi, Romania – President
Prof.Dr. Mohd Mustafa Al Bakri ABDULLAH,
Malaysian Research & Innovation Society, Malaysia
Prof.Dr. Lidia BENEA
Dunarea de Jos University of Galati, Romania
Prof.Dr. Katarzyna BLOCH
Czestochowa University of Technology, Poland
Prof.Dr. Kosta BOSHNAKOV
University of Chemical Technology and Metallurgy, Sofia, Bulgaria
Prof.Dr. Antonio CANDEIAS
University of Evora, Portugal
Prof.Dr.Eng. Dan CASCAVAL
Gheorghe Asachi Technical University of Iasi, Romania
Prof.Dr. Christian CODDET
Universite de Technologie Belfort-Montbeliard, France
Prof.Dr. Che Mohd Ruzaidi GHAZALI
Universiti Malaysia Terengganu, Malaysia
Prof.Dr. Kamarudin HUSSIN
Universiti Malaysia Perlis, Malaysia
Prof.Dr. Marcin NABIALEK
Czestochowa University of Technology Poland
Prof.Dr.Eng. Catalin POPA
Technical University of Cluj-Napoca, Romania
Prof.Dr.Eng. Cristian PREDESCU
Politehnica University Bucharest, Romania
Prof.Dr.Eng. Cornel SAMOILA
Transilvania University of Brasov, Romania
Prof.Dr.Eng. Neculai Eugen SEGHEDIN
Gheorghe Asachi Technical University of Iasi, Romania
Prof.Dr.Eng. Mihail Aurel TITU
Lucian Blaga University of Sibiu, Romania
Prof.Dr. Jerzy J. WYSLOCKI
Czestochowa University of Technology, Poland

Chairman

Prof. Dr. Eng. Petrica VIZUREANU
The “Gheorghe Asachi” Technical University of Iasi, Romania

Event Coordinator

Assist.Prof.Dr.Eng. Andrei Victor SANDU
Romanian Inventors Forum &
The “Gheorghe Asachi” Technical University of Iasi, Romania

Technical and Organizing Committee

Assoc.Prof. Dr.Eng. Dragos Cristian ACHITEI
Gh. Asachi Technical University of Iasi, Romania

Assoc.Prof. Dr.Eng. Madalina Simona BALTATU
Gh. Asachi Technical University of Iasi, Romania

Assist.Prof.Dr.Eng. Doru Dumitru BURDUHOS-NERGIS
Gh. Asachi Technical University of Iasi, Romania

Assist.Prof.Dr.Eng. Diana Petronela BURDUHOS-NERGIS
Gh. Asachi Technical University of Iasi, Romania

Assoc.Prof.Dr.Eng. Bogdan ISTRATE
Gh. Asachi Technical University of Iasi, Romania

Assoc.Prof.Dr.Eng. Mirabela Georgiana MINCIUNĂ
Gh. Asachi Technical University of Iasi, Romania

PhD Vasile PELIN
Al. I. Cuza University of Iasi, Romania

Assoc.Prof. Dr.Eng. Manuela Cristina PERJU
Gh. Asachi Technical University of Iasi, Romania

Assoc.Prof. Dr.Eng. Ioan Gabriel SANDU
Romanian Inventors Forum & Gh. Asachi Technical University of Iasi, Romania

S.R. II. Dr. Viorica VASILACHE
Al. I. Cuza University of Iasi, Romania

PROGRAM

DAY 1 – THURSDAY MAY 20	
10.00	**ICIR Opening Ceremony**
KEYNOTE&INVITED SPEAKER SESSION 1	
10.15	**Keynote Speaker – Adam Zieliński** *The Study Of The Evolution Of The Microstructure, Mechanical And Creep Properties Of Austenitic Stainless Steels After Long-Term Ageing*
10.45	**Invited Speaker – Abdul Rahman SALISA** *Construction Of Kuala Terengganu City Work Route Driving Cycle Using K-Means Clustering Method For Energy Consumption And Emissions Analysis*
12.00 – 14.00 EUROINVENT OFFICIAL Grand Opening	
KEYNOTE&INVITED SPEAKER SESSION 2	
15.00	**Keynote Speaker – Marcelo Henrique Prado da Silva** *Niobophosphate Glasses For Ballistic Applications*
15.30	**Invited Speaker – Julia MIRZA-ROSCA** *Structure And Properties Of Electron Beam Melting Titanium Alloys For Medical Devices*
SESSION 1	
16.05	**Chiara ABATE** - *Removal of Hg^{2+} and CH_3Hg^+ by a poliphosphonate ligand: a speciation study for application in natural waters*
16.20	**Aurel Mihail ȚÎȚU** - *Experimental Research Using the Finite Element Method on the Influence of the Cutting Tool Geometry on Temperature and Stresses in a Specific Cutting Process Presenter*
16.35	**Ovidiu-Darius JUCAN** - *Mechanical properties of some WC-Co / PA12 samples made via Indirect Selective Laser Sintering (SLS) and Sinter-HIP*
16.50	**Adrian Victor LAZARESCU** - *Improving Indoor Air Quality by Using Sheep Wool Heat Insulation*
17.05	**Stela GEORGIEVA** - *Speciation analysis of arsenic in copper electrolyte baths using liquid-liquid extraction and ICP-OES method detection*
17.20	**Horea Florin CHICINAS** - *Consolidation and characterization of hard metal powders milled under dichoromethane*
17.35	**Iulian ANTONIAC** - *Corrosion behaviour of some biodegradable composites based on magnesium powders obtained by SPS*
17.50	**Ana Maria ROMAN** - *Analyze of the corrosion rate of FeMn-Si biodegradable materials*
End of Conference Day	

Session 1 Chairmen	Session 2 Chairmen	Poster Session Chairmen
Prof. Marcelo Henrique PRADO DA SILVA	Prof. Lidia BENEA	Prof. Catalin POPA
Prof. Iulian ANTONIAC	Prof. Julia MIRZA-ROSCA	Prof. Nicanor CIMPOESU

PROGRAM

	DAY 2 – FRIDAY MAY 21
09.00	**Start of second day of the Conference**
	KEYNOTE&INVITED SPEAKER SESSION 3
09.05	**Keynote Speaker – Ruxandra Vidu** *Innovative Nanotechnologies Developed For Energy And Water*
09.35	**Invited Speaker – Dariusz GRZESIAK** *Effects Of A Reinforcing Phase Share On The Surface Structure Parameters Of The Tic/H13 Mmc Synthesized By The Slm Technology*
	SESSION 2
10.05	**Edit Roxana MOLDOVAN** - *Geometry characterization of AISI 430 stainless steel microstructuring using laser*
10.20	**Suriani Mat JUSOH** - *Effect of Fibre Contents toward Manufacturing Defects and Interfacial Adhesion of Arenga PinnataFibre Reinforced Fibreglass/Kevlar Hybrid Composite in Boat Construction*
10.35	**Laurentiu DRAGUS** - *Corrosion Assessment of Nickel - Base - Dental Alloys in Ringer Biological Solution studied by Electrochemical Techniques*
10.50	**Warid Wazien Ahmad ZAILANI** - *Eggshell Powder (ESP) as Low-cost Adsorbent for Wastewater Treatment*
11.05	**Robert CIOCOIU** - *Performances of RENE 41 as hot-copper extrusion die material*
11.20	**Petru LISNIC** - *Fluorine-doped SnO2 thin films in solar cell applications. Morphological, optical and electrical proprieties*
11.35	**Andrei BERBECARU** - *Research on the Degradation Process of Railway Rails Due to Lifespan Exceeding*
11.50	**Dominika KUSNIERZ-KRUPA** - *Methods of Conservation the Residential and Public Architecture of the 19th -early 20th Century. Examples of Kiyv and Cracow*
12.05	**Lidia BENEA** - *The Contribution of Electrochemistry for a Better Understanding of the Degradation by Tribocorrosion of Metallic Implant Materials*
12.20	**Catalin PANAGHIE** - *Preliminary results of in vitro tests on new biodegradable metallic material based on ZnMgY*
12.35	**Duarte Félix MACEDO** - *Analysis of the Effect of Doped Metal Ions in the Tricalcium Phosphate Bioceramic*
12.40	**Nicoleta SIMIONESCU (BOGATU)** - *Current Density and Time Effect Applied During Electro-codeposition Process on Resulted Cobalt Matrix Reinforced with Nano-CeO_2 Particles*
12.55	**Alexandra CSAPAI** - *Study on the effect of in situ surface treatments of medical microfluidic systems obtained through Additive Manufacturing*
13.10	**Veaceslav NEAGA** - *Corrosion Reactivity in the Pre-clinical Study of 316L and 321 Stainless Steel for Dentistry Applications*
13.25	**Cristian PANTILIMON** - *Preliminary Structures Assessment of some TRIP Steels*
13.40	**Andrii DMYTRENKO** - *Ways of Performance and Preservation of Monumental Art Works on the Facades of Architectural Monuments of the 19th – Early 20th Century*
13.45	**Mihail Aurel ȚÎȚU** - *Experimental study by the influence of the cutting edge radius of the tool in the cutting process simulation using the finite element method*
	CONFERENCE CLOSURE AND AWARDS CEREMONY

POSTER SESSION is available at:

http://www.euroinvent.org/conference/program/poster-session/

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.

Contact:
Blvd D. Mangeron 41A,
RO - 700050, Iaşi, România
Tel: +40.232. 230009
web: www.sim.tuiasi.ro

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.

Contact:
Str. Sf. P.Movila 3, L11, III/3
RO - 700089, Iaşi, România
Tel: +40.745.438604,
e-mail: euroinvent@yahoo.com
web: www.afir.org.ro

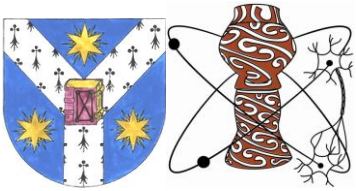
Universiti Malaysia Perlis (UniMAP) is Malaysia's 17th public institution of higher learning. It was approved by the Malaysian Cabinet on May 2001. Originally known as Kolej Universiti Kejuruteraa Utara Malaysia (KUKUM), or Northern Malaysia University College of Engineering, it was renamed as Universiti 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.



Contact:
Blvd. Carol I no. 11,
Corp G demisol
RO - 700506, Iaşi, România
e-mail: ion.sandu@uaic.ro
web: www.uaic.ro

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.

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 2021 International Conference on Innovative Research will be published in:

Coatings (MDPI Publisher – Indexed by Web of Science – ISI and Elsevier SCOPUS, **IF 2.436 – Q2**)

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

Acta Physica Polonica A (Indexed by Web of Science – ISI and Elsevier SCOPUS, **IF 0.545**)

IOP: Journal of Physics: Conference Series (indexed by Elsevier SCOPUS , sent for evaluation to Web of Science – ISI)

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

Marcelo Henrique Prado da SILVA, PhD

Associate Professor
Military Institute of Engineering – IME
Rio de Janeiro, Brazil

Marcelo Prado is a metallurgical engineer with M.Sc. and Ph.D. on Metallurgical and Materials Science Engineering from the Federal University of Rio de Janeiro (UFRJ, Brazil). Part of the Ph.D. was performed in the Interdisciplinary Research Centre in Biomedical Materials (IRC, Queen Mary and Westfield College, University of London). Marcelo Prado performed a post doctoral research at the National Institute of Biomedical Engineering (INEB), at University of OPorto, Portugal. Marcelo Prado is currently an Associate Professor in the Military Institute of Engineering (IME, Brazil), being also in chief of the Electron Microscopy Laboratory. He was the President of the International Society for Ceramics in Medicine (ISCM) in 2008 and is currently a permanent member of the Executive Committee of the ISCM. Develops researches on bioceramics synthesis and processing, bioactive glasses and composites and is involved in related researches as supervisor, member of scientific committee of conferences, referee of scientific journals, and international societies.

NIOBOPHOSPHATE GLASSES FOR BALLISTIC APPLICATIONS

The potential of a niobophosphate glass was investigated with respect to the ability to act as a ceramic shield for multi-layer shields. The glass was designed to have the following molar composition: 30% Nb2O5– 30% P2O5– 20% CaO – 20% CaF2. Glass, heat treated glass (glass ceramic) and alumina-reinforced with glass samples were used as the ceramic component for multi-layer shields. Ballistic tests were performed in order to assess the residual velocity of the projectile. The results from the residual velocity tests indicated higher energy absorption for the glass-reinforced alumina samples, in comparison to pure alumina, indicating a promise use of this glass for ballistic applications.


EURO®
INVENT

Keynote Speaker

Adam ZIELIŃSKI, PhD

Professor
Managing Director
Łukasiewicz Research Network
– Institute for Ferrous Metallurgy,
Poland

Prof. Adam Zieliński is CEO Director at the Łukasiewicz Research Network - Institute for Ferrous Metallurgy. Expert in the area of materials engineering. He is well versed in materials for service at elevated temperatures, in high-temperature creep resistance, in the creep tests, and in diagnostics of the high pressure power-, chemical-, and petrochemical installations. He collaborates closely with the power boilers manufacturers, as well as the power industry repair plants in the area of the power installations diagnostics, residual life and damage processes. He is an author and coauthor of ca. 150 scientific publications worldwide including more than 4 publications in the Philadelphia list, he won 15 awards. He is an author and coauthor more than 400 research and expertise on the direct instructions of the energy industry and petrochemical industry. Prof. Adam Zieliński has h-index 15 in Web of Science, 17 – in Scopus and 22 in Google Scollar.

THE STUDY OF THE EVOLUTION OF THE MICROSTRUCTURE, MECHANICAL AND CREEP PROPERTIES OF AUSTENITIC STAINLESS STEELS AFTER LONG-TERM AGEING

The increase in the efficiency of power units, among others by improving the steam parameters, required a kind of revolution in the field of materials for power engineering. The so-called bainitic steels as well as 9-12%Cr martensitic steels were developed and implemented in the power industry. Martensitic steels may operate at max 620°C, and higher parameters require, due to low corrosion resistance of 9%Cr steels and low microstructural stability of 12%Cr steels, the application of creep-resistant austenitic steels. One of the modern grades in this group of materials are austenitic steels. The introduction of a new steel grade in the power engineering requires adequate knowledge, which is usually preceded by thorough research under the laboratory and industrial conditions. One of the main criteria determining the usefulness of a specific material in the given part of boiler is the stability of its microstructure and mechanical properties at given temperature of expected service. This research fills in this gap of information by presenting the results of investigations of microstructure and properties of the austenitic steel after long-term ageing at 650, 700 and 750°C

Invited Speaker

Abdul Rahman SALISA, PhD

Associate Professor
Faculty of Ocean Engineering Technology and Informatics
Universiti Malaysia Terengganu, MALAYSIA

Dr. Salisa is an Associate Professor and act as Deputy Dean in Faculty of Ocean Engineering Technology and Informatics of the Universiti Malaysia Terengganu, Malaysia. She also as an advisor of the Energy Storage Research Group (ESRG) Universiti Malaysia Terengganu and also member of Renewable Energy and Power Research Interest Group (REPRIG) Universiti Malaysia Terengganu. She is an author and co-author of 32 publications with around 135 citations. Her research interests are in Hybrid Electric Vehicles, innovation powertrain, simulation and modelling, energy management strategy, driving cycle's development, and optimization.

CONSTRUCTION OF KUALA TERENGGANU CITY WORK ROUTE DRIVING CYCLE USING K-MEANS CLUSTERING METHOD FOR ENERGY CONSUMPTION AND EMISSIONS ANALYSIS

One of the major contributions of air pollution is vehicle's exhaust gas emissions. Unfortunately, the vehicles demanding keep increasing. This increment however will affect the vehicle performance in terms of pollutant generated. Thus, Plug-in hybrid electric vehicle (PHEV) is introduced as one of the promising vehicles to reduce fuel consumption and exhaust gas emissions instead of conventional engine vehicles. In order to analyse the fuel rate and emissions, the driving cycle is a very important element. Driving cycle plays a vital role in the production and evaluating the performance of the vehicle. Driving cycle is a speed-time data set and as an important input for vehicle emission models. The objectives of this research are to characterize and validate the parameters of work route driving cycle in Kuala Terengganu (KT) city with existing driving cycles, to construct the KT city work route driving cycle using *k*-means clustering method, and to analyze the energy consumption and exhaust emissions of KT city work route driving cycle using Advanced Vehicle Simulator (ADVISOR) and Vehicle System Simulation Tool Development (AUTONOMIE) software. The methodology handles three major assignments, which are route selection, data collection utilizing on-board measurement method and driving cycle construction utilizing *k*-means clustering method. MATLAB software will be used to produce the final driving cycle and ADVISOR and AUTONOMIE software will be used to analyze fuel consumption and exhaust gas emissions. The obtained results will demonstrate that the proposed work route driving cycle in KT city prevents the over-use of fuel and the increase of air pollution.

Invited Speaker

Dariusz GRZESIAK, PhD

Assistant Professor
Department of Manufacturing Technology
Faculty of Mechanical Engineering and Mechatronics
West Pomeranian University of Technology Szczecin, POLAND

Dr. Grzesiak is an Assistant Professor in the Department of Manufacturing Technology of the West Pomeranian University of Technology Szczecin, Poland. Coauthor of 39 scientific articles, 3 book chapters, and 3 patents with over 900 citations reported by WoS (H-index 14). His research interests are in the field of mechanical and material engineering and additive manufacturing, especially Selective Laser Melting technology. His main activities are focused on the 3D printing of metallic materials (e.g. stainless steel, tool steel, Ti alloys) by using various process parameters and feedstock powder preparation. He also has achievements in metal matrix composites development (e.g., TiC or TiB2) and biomaterials, such as pure Mg, CoCr alloy, Bioglass 45S5, processed by SLM in order to extend the biomedical applicability of this promising technology.

EFFECTS OF A REINFORCING PHASE SHARE ON THE SURFACE STRUCTURE PARAMETERS OF THE TIC/H13 MMC SYNTHESIZED BY THE SLM TECHNOLOGY

The article presents the result of research in which the evolution of the surface topography (ST) of a nanocomposite material obtained by selective laser melting of a mixture of an H13 tool steel powder and a nanocrystalline titanium carbide was analyzed. Characteristic, normalized features describing the ST were analyzed as a function of the volumetric share of the strengthening phase and spatial orientation of the measured surface in relation to the building direction. Both, the height parameters, which are the basic parameters describing the state of the ST, as well as the spatial parameters, which describe the features related to the degree of isotropy of the obtained surfaces, were analyzed. The obtained results clearly show that even a small content of the strengthening phase in the nanocomposite has a negative effect on the ST, in most cases qualifying the part for additional machining.

Invited Speaker

Julia MIRZA-ROSCA, PhD

Professor
Department of Mechanical Engineering
University of Las Palmas de Gran Canaria, Spain

Dr. Mirza-Rosca is Professor in the Mechanical Engineering Department of Las Palmas de Gran Canaria Universit, Canary Islands, Spain. Head of Nanoscience and Nanomaterials Laboratory, Director of Nanomaterials and Corrosion Research Group. Co-author of 66 publications with around 1200 citations. Her research interests are in the field of the materials science, corrosion of all types of materials, microstructure and biocompatibility of new materials, nanomechanical testing and surface treatments of materials. Prof. Mirza Rosca has h-index 12 in Web of Science.

STRUCTURE AND PROPERTIES OF SOL-GEL MATERIALS SYNTHESIZED ON THE BASE OF SILICON PRECURSORS AND HETEROPOLYSACHARIDE

One of the most critical issues in orthopedic regenerative medicine is the design of bone implants and scaffolds that replicate the biomechanical properties of the original bones. Metals and their alloys have a long history of application in the human body because of their good mechanical strength, biocompatibility and corrosion resistance. But the devices made of metals and alloys are usually much stiffer than natural bone, leading to bone resorption and sometimes failure of the metallic devices. Most of the current implant metallic materials have higher elastic moduli than those of bones and the most effective method to reduce the elastic modulus is to modify the porosity of the devices. Traditional methods for obtaining open-cell porous metals include liquid state processing (direct foaming, spray foaming, etc), solid state processing (powder metallurgy, sintering, etc.), electro-deposition and vapour deposition. Selective laser melting (SLM) and electron beam melting (EBM) are computer-controlled fabrication processes based on layer-wise manufacturing principles. Mandibular prosthesis and other personalized devices fabricated by EBM are presented. It is demonstrated that the porous implants not only mimic the human bones but also satisfy the multifunctional requirements for any bone defect reconstruction.

SECTION 1

SYNTHESIS AND CHARACTERIZATION OF MATERIALS

Corrosion Reactivity in the Pre-clinical Study of 316L and 321 Stainless Steel for Dentistry Applications

Veaceslav NEAGA[1], Lidia BENEA[1,*]

[1] Competences Centre: Interfaces-Tribocorrosion and Electrochemical Systems (CC-ITES), Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.

[*]lidia.benea@ugal.ro

Abstract. Now, the use of any medical device based on metals or alloys, especially intended for dentistry applications, is impossible without preclinical evaluation of its anticorrosion properties. Today, the use of stainless steels with AISI standardization, with predilection 316L and 321, are preferred for ergonomic reasons due to their high operational reliability and optimal mechanical properties for functionality over time. In this regard, 316L and 321 stainless steels are tested for comparison in the solution that simulates human saliva with different pH. Stainless steel samples were subjected to corrosion in Fusayama-Meyer and Carter-Brugirard saliva. In-situ electrochemical measurements were applied, such as the open circuit potential (OCP) and electrochemical impedance spectroscopy (EIS). The results show that the corrosion resistance of 316L is superior to 321 in saliva solution at both pH values..

Keywords: Corrosion, electrochemical methods, stainless steel, human saliva.

References:

[1] V. Neaga, L. Benea, A. Alexandru, 316L Stainless Steel Alloys for Orthodontic Application: Effect of Fluorinated Toothpaste on the Corrosion Behavior in Human Saliva, *Int. J. Electrochem. Sci.*, 15, (2020), 9568–9578.

Acknowledgements: This work is supported by the project ”ANTREPRENORDOC”, in the framework of Human Resources Development Operational Programme 2014-2020, financed from the European Social Fund under the contract number 36355/23.05.2019 HDR OP/380/6/13 – SMIS Code: 123847.

Preliminary Structures Assessment of some TRIP Steels

Mircea Cristian PANTILIMON[1], Andrei Constantin BERBECARU[1,*], George COMAN[1], Mirela Gabriela SOHACIU[1] , Ruxandra Elena DUMITRESCU[1], Ecaterina MATEI[1], Andra Mihaela PREDESCU[1], Sorin CIUCĂ[1,*], Ioana Arina GHERGHESCU[1], C. PREDESCU[1]

[1]University Politehnica of Bucharest, Faculty of Materials Science and Engineering, 313 Splaiul Independen.ei, 060042, Bucharest, Romania

[*]andrei.berbecaru@upb.ro
[*]sorin.ciuca@upb.ro

Abstract. Automotive industry is constantly interested in building cars made of light and high strength parts in order to reduce the emission levels, the fuel consumption and minimize the effects of a car crash. Some parts may be made of lighter materials, but the steel ones must compensate the strength needed for the car body. Research is made for finding new materials showing high strength combined with high ductility. Among them, TRIP steels are of great interest, efforts being made to improve their characteristics. A new composition of such a steel is presented, its features being compared with those of three other steels of the same class and category. Optical microscopy at different magnifications is performed, together with Vickers hardness test. Structural particularities are found for each tested steel, justified by their own chemical compositions. The new steel reveals important characteristics: besides the mainly bainitic structure, it has both larger ferritic areas and amounts of retained austenite, making him proper for futher study.

Keywords: TRIP steel; retained austenite; car body material.

Corrosion Assessment of Nickel - Base - Dental Alloys in Ringer Biological Solution studied by Electrochemical Techniques

Laurentiu DRAGUS[1,2], Lidia BENEA[1,*]

[1]Competences Centre: Interfaces-Tribocorrosion and Electrochemical Systems (CC-ITES), Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.
[2]Faculty of Medicine and Farmacy, Dunarea de Jos University of Galati, 35 Alexandru. I. Cuza Street., RO-800010, Galati, Romania

[*]lidia.benea@ugal.ro

Abstract. The aim of this paper is to study the corrosion behavior of Nickel - Base - Dental Alloys in Ringer biological fluid. The Nickel base alloys are widely used for medical purposes, especially for prosthetic works in the field of dentistry. The applied electrochemical methods are Open Circuit Potential (OCP), Linear Polarization (LP) during time of immersion in order to calculate the polarization resistance (R_p) and corrosion rate (V_{corr}). Potentiodynamic Polarization (PD) diagrams were performed to appreciate the passive domain. The electrochemical studies has shown that the alloy has a corrosion behavior similar to a passivating alloy, displaying an extensive passivity area due to formation of an oxide film. The alloy surface micrographs performed before being subject to the electrochemical tests, displayed an homogeneous surface, showing some pores, probably formed during the processing procedure.

Keywords: corrosion, biocompatibility, dental alloys, dental bridge, electrochemical methods.

References:

[1] A. Banu, O. Radovici, M. Marcu, The alloying influence on corrosion behaviour of chromium surgical alloys, *Revue Roumaine de Chimie*, 53(10), (2008), 947–953.

Obtaining and Analyze of a New Aluminium Bronze Material Using Induction Furnace

Romeo Gabriel CHELARIU[1], Nicanor CIMPOESU[1,*], Teodora Irina BIRNOVEANU[1], Ramona CIMPOESU[1], Petrica VIZUREANU[1], Costica BEJINARIU[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 41 "D. Mangeron" Street, 700050, Iasi, Romania

[*]nicanor.cimpoesu@tuiasi.ro

Abstract. Bronze with aluminium alloys have nice properties and represent a solution for applications as contact material based on their good strength and fret resistance. These materials are usually applied to obtain equipment components, like bearings, gears and worm gears. A possible danger atmosphere is mention as a combination of hazardous gaseous with air, mist or powders were, after a spark appear the flame spreads to the whole mixture. Copper-berilyum alloys are recognized as non-sparking materials and many tools used in possible dangerous athmosphere are made of this alloy. In this article we present few preliminary results from the obtaining and analyze of a new alloy based on CuAlBe. The material was made in a vacuum induction furnace from CuBe master alloy and high purity aluminium. The alloys obtained were analyzed by chemical composition point of view (energy dispersive spectroscopy and X-ray diffraction), microstructure (optical and electronic microscopy), mechanical properties (microhardness, Young modulus and contact stiffness) and corrosion resistance.

Keywords: aluminum bronze, gears, non-sparking alloy.

References:

[1] X. Liu, D. Huang, C. Yan, Y. Zhou, W. Yan, Multi-directional forging and aging treatment effects on friction and wear characterization of aluminium-bronze alloy, *Materials Characterization,* 167, (2020), 110511.

The Contribution of Electrochemistry for a Better Understanding of the Degradation by Tribocorrosion of Metallic Implant Materials

Lidia BENEA[1,*]

[1]Competences Centre: Interfaces-Tribocorrosion and Electrochemical Systems (CC-ITES), Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.

[*]lidia.benea@ugal.ro

Abstract. Tribocorrosion is defined as a degradation of materials subjected to combined action of a mechanical processes and a corrosive environment. Material degradation due to the mechanical loading may occur under a variety of interactions between surfaces that are in abrasion, fretting, sliding, rolling or erosion contacts. The synergy resulting from combined action of corrosion and wear can provoke a larger material loss than expected, if testing the two degradation processes separately. This synergy effect can be split into parts of increased mechanical wear due to electrochemical corrosion or an increase of corrosion due to mechanical wear. Tribocorrosion finds applications in almost all areas of biomedical implants as the interaction of biomedical chemicals on implants, evaluation of degradation of arch-wire or dental implants). The functionality of a surface is often at the heart of the success or otherwise of engineering systems. Therefore, the electrochemical techniques such as open circuit potential, polarization diagrams and electrochemical impedance spectroscopy measurements are the essential tools for the degradation study of the metallic implant materials by tribocorrosion process. In this paper there are presented few results obtained by open circuit potential and electrochemical impedance spectroscopy measurements from studies performed on the behavior of tribocorrosion.

Keywords: tribocorrosion, biological fluids, titanium alloy, stainless steel, electrochemical methods.

References:

[1] L. Benea. E. Danaila, P. Ponthiaux, Effect of titania anodic formation and hydroxyapatite electrodeposition on electrochemical behaviour of Ti–6Al–4V alloy under fretting conditions for biomedical applications. *Corrosion Science*, 91, (2015), 262–271. doi:10.1016/j.corsci.2014.11.026.

Experimental Research Regarding the Rolling Technology of the Fe-Ni Alloys

Marian BORDEI[1], Beatrice TUDOR[1]

[1]Materials and Enviromental Quality Research Center (CMM), Faculty of Engineering, Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania

[*]mbordei@ugal.ro

beatrice.tudor@ugal.ro

Abstract. In the domain of the equipment and apparatus construction, a permanent preocupation wordwide is ensuring technical performances and high fiability in exploatation. The growth of the users exigence in this field led to producing high quality materials such as iron-nickel alloys having a high nickel content. Modifying the nickel content of the iron-nickel alloys, we may obtain alloys with a coefficient of expantion similar to the following materials: china, platinum, glass, fact that permits their welding. The nickel also determines a significant growth of the iron magnetic permeability. The theoretical and experimental researches had the aim of obtaining cold rolled strip, thin (2,8 mm) and narrow (86 mm) from iron-nickel alloys with 41% Ni (low content of C: 0,02-0,04%; 58% Fe; under 1% other elements: Mn, Si, Cu, Cr, Al), these alloys having special elasticity, magnetic or thermic properties, used in the measurement equipment construction.

Keywords: iron-nickel alloy, cold rolling technology, mechanical characteristics.

Consolidation and Characterization of Hard Metal Powders Milled under Dichoromethane

Horea-Florin CHICINAȘ[1,2*], Darius Ovidiu JUCAN[1], Rares Vasile GĂDĂLEAN[1,2], Glad CONȚIU[1,2], Ana COTAI[1], Catalin Ovidiu POPA[1]

[1]Materials Science and Engineering Department, Technical University of Cluj-Napoca, 103-105 Muncii Avenue, 400641 Cluj-Napoca, Romania
[2]SC Gühring SRL, 32 Constructorilor Street, 407035 Apahida, Romania

[*]horea.chicinas@stm.utcluj.ro

Abstract. The research work presents the developing a novel safer processing route for the development of cemented carbides. Processing of fine particles under organic solvents presents significant explosion risk. The milling under dichloromethane (DCM) reduces the risks associated with fire hazards, as well as the problem of particle size agglomeration, which are most encountered during processing of such materials. After milling and drying, the samples have been sintered in an industrial sintering oven under vacuum at 1380°C. 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 results of the present work reveal appropriate properties of the powders after milling and drying as well as the desired biphasic (Co-WC) phases 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.

References:

[1] V.I. Stanciu, V. Vitry, F. Delaunois, Influence of the milling parameters on the sintering behaviour of WC-co composites. *Materials and Manufacturing Processes,* 35, (2020), 811-816.
[2] H.F. Chicinas, D.O. Jucan, R.V. Gadalean, G. Contiu, T.F. Marinca, P. Götze, A. Eckert, C.O. Popa, Influence of milling media on the properties of some hard metal powders. *International Journal of Refractory Metals and Hard Materials,* 96, (2021), 105470.

Analyze of the Corrosion Rate of Fe-Mn-Si Biodegradable Materials

Ana-Maria ROMAN[1], Romeu CHELARIU[1], Ramona CIMPOEȘU[1*], Ionuț ȘTIRBU[1], Iulian IONIȚĂ[1], Marius Mihai CAZACU[2], Bogdan Anton PRISECARIU[3], Ciprian PARASCHIV[3]

[1]Faculty of Materials Science and Engineering, Gheorghe Asachi Technical University of Iasi, Prof.dr.doc. D. Mangeron no. 41 Street, 700050 Iasi, Romania.
[2]"Gheorghe Asachi" Technical University of Iasi, Department of Physics, 700050 Iasi, Romania
[3]"Grigore T. Popa" University of Medicine and Pharmacy of Iassy, 16 Univ. Street, Iasi, 700115, Romania.

[*]ramona.cimpoesu@tuiasi.ro

Abstract. New iron (Fe) - based alloys have particularly important mechanical properties as well as a faster degradation rate (0.44 mm/year) than pure Fe. The Fe-based alloy with manganese led to the appearance of new austenitic alloys, with the antiferromagnetic property pursued, resulting in compatibility with the magnetic field as that of MRI. Due to the non-toxicity of Mn in the cardiovascular system, it has made it a suitable alloying element to produce biodegradable materials for stents. In a thermostatic chamber at 37 °C for 24, 48 and 72 hours we analysed the corrosion behaviour of the biodegradable Fe-Mn-Si alloy by immersing it in Ringer electrolyte solution (NaCl, KCl, $CaCl_2$, $NaHCO_3$ and $MgCl_2$) The immersion chamber allowed the samples to be turned 180° every 12 hours. Chemical composition details were obtained using energy dispersive X-ray spectroscopy (EDX) Esprit PB-ZAF automated software and item list analyzed with Bruker detector connected to electron microscope scanning equipment (SEM) -VegaTescan LMH II. The surface area of the samples was analyzed at 24, 48 and 72 hours after immersion in Ringer's solution by optical (OM), electronic (SEM) and chemical composition determinations (EDX). Linear Tafel curves present the variation of the corrosion current with the modification of the experiment potential and cyclic potentiometry present the general corrosion character of the experimental samples behavior in Ringer solution. Due to the interaction between the alloy and the liquid medium a change in the pH was observed.

Keywords: biodegradable materials, Fe-Mn alloy, degradation rate.

Obtaining and Analyze of Zro_2-Al_2O_3 Ceramic Layers on Metallic Substrate

Marian LUȚCANU[1], Margareta COTEAȚĂ[1], Daniela Lucia CHICET[1], Cristina Delia NECHIFOR[2], Mihai Marius CAZACU[2], Petronela PARASCHIV[1], Bogdan ISTRATE [1], Nicanor CIMPOEȘU[1,*]

[1]Faculty of Materials Science and Engineering, Gheorghe Asachi Technical University of Iasi, Prof.dr.doc. D. Mangeron no. 41 Street, 700050 Iasi, Romania.
[2]Department of Physics, "Gheorghe Asachi" Technical University of Iasi, 700050 Iasi, Romania

[*]nicanor.cimpoesu@tuiasi.ro

Abstract. Ceramic layers present an increasing interest in many industrial and medical applications based on their excellent properties of high hardness, corrosion (electro-corrosion) and temperature resistance [1]. Atmospheric plasma spraying (APS) represents a proper technique for ceramic layers deposition based on the high temperature of the powders, high surface covered during deposition (robotic powder gun). In this case ceramic layers from Metco ZrO_2 and Al_2O_3 powders mixture (25/75; 50/50 and 75/25) were obtained after five passes on low carbon steel substrate. The sample surfaces were finished by mechanical grinding (320, 800, 1200 and 2000). Powders mixtures and the surface of ceramic thin layers were analyzed through: scanning electron microsopy, atomic force microscopy and optical microscopy. In order to understand the effect of surface wettability of the ceramic layers, before and after grinding the surface, three different liquids were used. Vickers micro-hardness was realized on the substrate and on the ceramic layers. The results present a good homogeneity of the ceramic layer, an improvement of the micro-hardness and a modification of wettability of the surface after the mechanical grinding.

Keywords: ceramic layer, finishing surface, atmospheric plasma spraying, SEM, EDS, AFM.

References:

[1] S.M. Dezfuli, M. Sabzi. Deposition of ceramic nanocomposite coatings by electroplating process: A review of layer-deposition mechanisms and effective parameters on the formation of the coating. *Ceramics International,* 45, (2019), 21835–21842.

Preliminary Results of in Vitro Tests on New Biodegradable Metallic Material Based on ZnMgY

Cătălin PANAGHIE[1], Ramona CIMPOEȘU[1], Marcelin BENCHEA[1], Ana-Maria ROMAN[1], Vasile MANOLE[1], Adrian ALEXANDRU, Nicanor CIMPOEȘU[1,*], Marius Mihai CAZACU[2]

[1]Faculty of Materials Science and Engineering, Gheorghe Asachi Technical University of Iasi, Prof.dr.doc. D. Mangeron no. 41 Street, 700050 Iasi, Romania.
[2]Department of Physics, "Gheorghe Asachi" Technical University of Iasi, 700050 Iasi, Romania

[*]nicanor.cimpoesu@tuiasi.ro

Abstract. Biodegradable materials represent a new class of biocompatible materials with applications in many medical cases where the support must be provided only for a certain period. Beside well-known magnesium based biodegradable alloys and iron-based materials a novel system gains much attention for medical applications with degradation period between those of Mg and Fe which are based on zinc. The main concern on zinc applications is based on his poor mechanical properties. In this sense we intend to improve the zinc alloy characteristics through addition of magnesium and yttrium. In this article is presented the obtaining of ZnMgY alloy and some basic characteristic investigations like chemical composition (energy dispersive spectroscopy – EDS and X-ray diffraction XRD), microstructure (scanning electron microscopy - SEM and optical microscopy - OM), immersion behavior in Dulbecco + bovine serrum solution (mass loss and surface degradation), pH variation during the first 72 hours of immersion, electro-corrosion behavior (potentiostat with a three electrodes cell) and micro-hardness of the experimental alloy comparing to Zn and ZnMg materials. The alloy was obtained from high purity Zn, Y and MgY master alloy in an induction furnace in Ar atmosphere. Five re-melts were done in order to realize a good chemical and structural homogeneity and the results were highlighted by NDT penetrating powders. An improvement of micro-hardness of Zn by alloying and a modification of immersion behavior and of electro-corrosion resistance are presented by results.

Keywords: biodegradable, Tafel, potentiostat, SEM, pH, EDS.

Correlation between Microstructure and Electrochemical Properties of Al-Si Alloys

Mirabela Georgiana MINCIUNA[1,2],
Petrica VIZUREANU[1,2*],
Andrei Victor SANDU[1,2], Dragos Cristian ACHITEI[1,2]

[1]"Gheorghe Asachi" Technical University of Iasi, Blvd. Mangeron, No. 51, 700050, Iasi, Romania
[2]Center of Excellence, Geopolymer & Green Technology (CeGeoGTech), School of Material Engineering, Universiti Malaysia Perlis (UniMAP), Perlis, Malaysia

[*]peviz2002@yahoo.com

Abstract. The composition and structural modification of aluminum alloys influence their strength, tribological properties and structural stability. Aluminum is a metal with excellent mechanical properties and has introduced a revolution to many technological fields. Though much lighter than other metals, it possesses very high mechanical strength, which is the reason why it is so much used in many technological fields. Furthermore, it is very resilient to various forms of corrosion and entails minimal maintenance costs. The phase composition of the structure as well as the characteristics of the elementary cell of each identified phase was established by X-ray diffraction, and the main objective was to determine the compositional phases, microstructure and microcomposition of the alloy. Based on the cyclic voltammograms it can be said that on the OCP interval (+ 1.5 V … -1.1V), after the breakthrough potential is an intensification of the anodic process by the pronounced increase of the current density, in these conditions the Al-Si alloy has low values which means that it has a better corrosion resistance.

Keywords: aluminum alloys, microstructure, X-ray diffraction, corrosion, Evans diagrams.

References:

[1] H. Chun, M. Chun, M.C. Deng, Influence of Heat Treatment on Corrosive Property of 5083 Aluminum Alloy, *Advanced Materials Research*, 779 - 780, (2013), 205-211.

MALDI MS/MS Study of the As(III)-Thiol Interaction: Arsenite Complexes with Glutathione, Glutathione Disulphide and other Thiol Ligands

Anna NAPOLI[1*]

[1]Dipartimento di Chimica e Tecnologie Chimiche. Università della Calabria, Arcavacata di Rende (Cs). I-87036 –Italy

*amc.napoli@unical.it

Abstract. Anthropogenic activities have led to high emissions of toxic metals into the environment. Arsenic is an important environmental toxicant which has both natural and industrial sources. The two environmentally and biologically relevant forms of arsenic in aqueous solution are arsenate [As(V), $HAsO_4^{-2}$] and arsenite [As(III)], $As(OH)_3$]. Glutathione (γ-L-glutamyl-L-cysteinyl-glycine, GSH) and glutathione disulphide (GSSG) molecules are the most important redox pair in organisms responsible for the detoxification of heavy metal ions in an organism. The purpose of our study is not only isolate and characterize As(III) complexes of GSH, GSSG, Cys (cysteine) and Cyst (cystine), but also to investigate their redox features by tandem mass spectrometry. Electrospray mass spectrometry (ESI-MS) has been used for the detection and analysis of metal ion complexes. Matrix assisted laser desorption mass spectrometry (MALDI-TOF/TOF-MS) is more generally used for investigations of the most types of large biomolecules. It is characterized by short analysis time, high sensitivity, tolerance to contaminants and the ability to detect different components in a mixture.The analysis of low molecular weight analytes, such as drugs and metabolites, can be performed by tandem mass spectrometry (MS/MS) that provides the required sensitivity and molecular specificity In this work, MALDI-TOF/TOF-MS is used to investigate the composition, elucidate the structures of complexes of As(III) with the ligands. Under the adopted conditions, ML_2 and ML_3 mononuclear complexes are prevalent, and the formation of polymetallated species are not observed along all experiments. The instrumental data demonstrated that *S* of ligand are involved in the coordination metal spheres.

Keywords: arsenite, MALDI, Mass Spectrometry

Guar Gum Hydrogel Microbial Fuel Cell Using Bacillus Megaterium

Sumin KIM[1*]

[1]Winchester College, College Street, Winchester SO23 9NA, United Kingdom

[*]s_kim2@wincoll.ac.uk

Abstract. The main factors of a microbial fuel cell (MFC) are the anode and the microorganisms around it that produce electrons. This research focuses on increasing the efficiency of a MFC in plant-MFC(PMFC) or aquarium-like conditions by inoculating microorganisms that help produce electrons to the soil. Guar gum was used as a base structure as it can culture microorganisms and create a hydrogel by cross-linking with borax [1,2]. Bacillus megaterium was added to the hydrogel as it can survive under the basic conditions of borax while producing electrons.[3] Glucose was added as well to help culture the bacteria. Then, the change of voltage was observed along with the growth of B.megaterium. A compound consisting of 0.5% glucose, 1% Guar gum, 10% Borax, and B.megaterium culture medium was created with a volume ratio of 1:25:1:1 in each order. This compound will be named GGB-B. GGB-B was able to keep its shape as a hydrogel along with a voltage increase of 250mV compared to control due to the stable growth of B.megaterium. 100g of GGB-B was placed inside a beaker and was covered with aquarium soil. Two goldfishes (Carassius auratus) were added. Voltage, pH, and the health of goldfishes were observed for 9 days. The result was approximately a 150mV increase in voltage compared to control (tap water). pH decrease was about 1.3, showing a pH of 6.12. There was no change in the goldfishes, and the GGB-B under the aquarium soil fused with the soil as it disintegrated. Therefore, when electron-producing microorganisms such as B.megaterium are added to guar gum, the microorganisms would slowly spread over the soil, thereby increasing the efficiency of MFC. This could also apply to PMFC and aquarium-like conditions as well.

Keywords: Guar gum hydrogel, microbial fuel cell, b.megaterium.

Additive Manufacturing of WC-Co by Indirect Selective Laser Sintering (SLS) using High Bulk Density Powders

Rareș Vasile GĂDĂLEAN[1,3*], Ovidiu Darius JUCAN[2], Horea Florin CHICINAȘ[2,3], Nicolae BÂLC[1], Cătălin-Ovidiu Popa[2]

[1]Department of Manufacturing Engineering, Technical University of Cluj-Napoca, 103-105, Muncii Avenue, Cluj-Napoca 400641, Romania
[2]Materials Science and Engineering Department, Technical University of Cluj-Napoca, 103-105, Muncii Avenue, Cluj-Napoca 400641, Romania
[3]Gühring Romania, Constructorilor street 30, Apahida 407035, Romania

[*]gadalean.rares.vasile@gmail.ro

Abstract. Research in additive manufacturing (AM) of WC-Co has been intensified over the last few years due to the increasing need for products designed using methods such as topology optimization and multiscale structures (lattice). These products result in complex shapes and can contain inner structures that are challenging to produce through conventional techniques thus, involving high cost. The present work addresses this problem using a two-step approach to 3D print WC-Co parts with complex shape and internal channels by employing indirect SLS and Sinter-HIP. The paper takes further our research in this field [1] with the aim of improving the part density after the Sinter-HIP process by using high bulk density WC-Co powders. Mechanically mixing WC-Co with the sacrificial binder, PA12, results in a homogenous powder that is successfully used by the SLS process to produce green parts in the shape of cubes, cylinders and an end mill.

Keywords: additive manufacturing, cemented carbide, selective laser sintering, powder metallurgy, polymer powders.

References:

[1] O.D. Jucan, R.V. Gădălean, H.F. Chicinaș, M. Hering, N. Bâlc, C.O. Popa, Study on the indirect selective laser sintering (SLS) of WC-Co/PA12 powders for the manufacturing of cemented carbide parts, *Int. J. Refract. Met. Hard Mater*., (2021), 105498.

A Comparative Study of Nanocrystalline $Fe_{38.5}Co_{38.5}Nb_7P_{15}Cu_1$ Alloys Obtained by Mechanical Alloying and Rapid Quenching

Ana COTAI[1,2], Salvatore MIRAGLIA[2], Bogdan Viorel NEAMŢU[1], Traian Florin MARINCA[1], Horea Florin CHICINAŞ[1,3], Olivier ISNARD[2], Ionel CHICINAŞ[1,*]

[1]Materials Science and Engineering Department, Technical University of Cluj-Napoca, 103-105 Muncii Ave., 400641 Cluj-Napoca, Romania
[2]Institut Néel, CNRS / Université Grenoble Alpes, 25 rue des Martyrs, BP166, 38042 Grenoble, Cédex 9, France
[3]Guhring Romania, Constructurilor street 30, Apahida 407035, Romania

[*]ionel.chicinas@stm.utcluj.ro

Abstract. This paper presents a comparative study of the preparation and characterization of $Fe_{38.5}Co_{38.5}Nb_7P_{15}Cu_1$ alloy produced by mechanical alloying (MA) and rapid quenching (RQ) method. In order to obtain the starting mixture (SS), in the present study we opted for the replacement of elemental Nb and P powders with ferroalloy powders of niobium (FeNb: 58.78 wt.% Nb, 41.22 wt.% Fe) and phosphorus (24.1 wt.% P, 75.9 wt.% Fe). Mechanical alloying experiments were done using the high energy planetary ball mill Pulverizette 6 under Ar atmosphere. The ball to powder mass ratio (BPR) was 16:1. Benzene was used as a control agent of process (PCA) for wet MA. The rapid cooling experiments were performed on a Melt Spinner SC type installation. Tangential wheel speed was 52 m/s and as atmosphere was used hight purity argon. The samples obtained (powders and ribbons) were characterized by X-ray diffraction (XRD), differential scanning calometry (DCS), morphology and chemical homogeneity were studied by scanning electron microscopy (SEM), magnetic measurements M(H) and thermomagnetic measurements M(T). After 40 h of wet MA, the alloy is obtained in nanocrystalline state, and the ribbons obtained by RQ were partially amorphous. Also, the magnetic measurements show the influence of the method used on the magnetic properties.

Keywords: mechanical alloying, melt-spinning, ribbons, X-ray diffraction, magnetisation, ferroalloys.

Mechanical Properties of Some WC-Co / PA12 Samples Made Via Indirect Selective Laser Sintering (SLS) and Sinter-HIP

Ovidiu-Darius Jucan[1,*], Rareş-Vasile Gădălean[1,2], Horea-Florin Chicinaş[1,2], Michael Hering[3], Nicolae Bâlc[4], Cătălin-Ovidiu Popa[1]

[1]Materials Science and Engineering Department, Technical University of Cluj-Napoca, 103-105, Muncii Avenue, 400641, Cluj-Napoca, Romania
[2]Gühring Romania, Constructorilor street 30, 407035, Apahida, Romania
[3]Konrad Friedrichs, Vorwerkstraße 20, 95326, Kulmbach, Germany
[4]Department of Manufacturing Engineering, Technical University of Cluj-Napoca, 103-105, Muncii Avenue, 400641 Cluj-Napoca, Romania

[*]dariusjucan@stm.utcluj.ro

Abstract. A study was carried out to assess the mechanical properties of indirect SLS 3D printed (SLS) WC-Co / PA12. The printed samples were thermally debinded, vacuum sintered, and sinter-HIPed at 1400ºC, using 50 bar Ar, which has led to relative densities up to 66 %. Optical metallography image shows a microstructure consisted of WC average grain size in the range of 1.4 – 2.0 µm with isolated large grains, in a well-distributed Co matrix. The volume shrinkage was 80 %, with no significant shape distortion. The printing direction of the transversal rupture strength (TRS) samples has a great impact on the results, achieving low bending strength up to 612 MPa. The hardness measurements have been performed together with SEM image of the fracture surface of a TRS sample showing the presence of defects in the internal structure which is considered to be the cause behind low bending strength values. The magnetic measurements confirmed 10.9 % free Co, suggesting only a small interaction between Co and C originated from the PA12 decomposition has taken place.

Keywords: additive manufacturing, cemented carbides, selective laser sintering, mechanical properties.

References:

[1] R.K. Enneti, K.C. Prough, T.A. Wolfe, A. Klein, N. Studley, J.L. Trasorras, Sintering of WC-12%Co processed by binder jet 3D printing (BJ3DP) technology, *Int. J. Refract. Met. Hard Mater.*, 71, (2018), 28–35.

Phosphate Coatings for the Protection of Steels Reinforcement for Concrete

Petru LAZAR[1], Costica BEJINARIU[1], Alin Marian CAZAC[1], Andrei Victor SANDU[1], Mihai-Adrian BERNEVIG[1], Diana-Petronela BURDUHOS-NERGIS[1,*]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 41 "D. Mangeron" Street, 700050, Iasi, Romania

[*]burduhosndiana@yahoo.com

Abstract. Concrete and reinforced concrete are the most popular and safest building materials today. The concrete and its steel reinforcements work together to withstand to complex operating stresses. Accordingly, while the steel reinforcement resists very well to tensile forces, the concrete structure will successfully resist to significant compression efforts. According to the concrete manufacturers, under optimal conditions, the durability of this composite material is almost infinite. However, when poor quality concrete, with structural defects, is subjected to certain environmental conditions (rain, ice or air chemicals), its integrity can be severely affected, consequently, its mechanical properties will decrease. Usually, the concrete protects the steel used as reinforcement, but there are specific situations in which its protective and anticorrosive properties are very limited. Thus, the properties of reinforced concrete decrease, endangering the structure of the concrete buildings. This article aims to provide a compressive review regarding the methods used to protect the reinforcement steel against corrosion. Moreover, one of the most widely used methods will be emphasized, namely phosphating, which in addition to improving the corrosion resistance properties, it also supports the adhesion between steel and concrete.

Keywords: phosphate coatings, steel, reinforcement corrosion, reinforced concrete, corrosion protection.

References:

[1] P. Lazar, C. Bejinariu, A.V. Sandu, A. M. Cazac, O. Corbu, I. G. Sandu, M. C. Perju. Corrosion Evaluation of Some Phosphated Thin Layers on Reinforcing Steel. *IOP Conf. Ser.: Mater. Sci. Eng.*, 209, (2017), 012025.

Analysis of the Effect of Doped Metal Ions in the Tricalcium Phosphate Bioceramic

Duarte Félix MACEDO[1,*], Abílio P. SILVA[1]

[1]Centre for Mechanical and Aerospace Science and Technologies (C-MAST), Universidade da Beira Interior, Rua Marquês d'Ávila e Bolama, 6201-001, Covilhã, Portugal

[*]duarte.felix.macedo@ubi.pt

Abstract. Calcium phosphate bioceramics such as hydroxyapatite (HA) and tricalcium phosphate (TCP) were successfully used in medical fields such as dentistry, orthopedics, and facial surgery due to their resorption and bioactivity characteristics. This work aims to obtain an osteoinductive ceramic matrix doped with metal ions. First, TCP doped with 10 mol.% of MgO was selected for the initial matrix due to the increased of HA content, microstructure densification (90%), and mechanical strength (27 MPa). Second, the addition of others metal ions (Zn, Mn, and Fe), at most 5 mol.%, to this initial matrix was evaluated by means of statistical analysis applying design of experiments (DOE). The presence of metal ions was studied by XRD and SEM-EDX analysis. The response surfaces and trace plots were obtained for apparent and relative densities, apparent porosity, and diametral compression resistance, all for a 95% confidence interval and maximum error of $p < 0.05$. The results show a strong dependency between the addition of these metal ions and all studied properties.

Keywords: bioceramics, tricalcium phosphate, metallic ions, design of experiments, response surfaces.

On Bending Creep Behavior of a Powder Metallurgy FeMnSiCrNi Shape Memory Alloy

Lenuța CIURCĂ[1], Bogdan PRICOP[1],
Nicanor CIMPOEȘU[1], Maricel AGOP[1],
Leandru-Gheorghe BUJOREANU[1*]

[1]Faculty of Materials Science and Engineering, „Gheorghe Asachi" Technical University of Iași, Blvd. Dimitrie Mangeron 61A. 700050 Iași, Romania

[*]leandru-gheorghe.bujoreanu@academic.tuiasi.ro

Abstract. Hot rolled lamellar specimens of a powder metallurgy Fe-18Mn-3Si-7Cr-4Ni (mass. %) shape memory alloy (SMA), were tested to creep under four bending forces at five experimental temperatures, by means of a dynamic mechanical analyser (DMA). The device recorded the variation of bending deflection and the data were analysed with the creep-dedicated software the analyser is equipped with. The evolution of total bending deflection, during creep, was analysed as a function of experimental temperature and applied force. Based on total bending deflection, total deformation rate was determined and its variation was illustrated in the total rate-applied force-experimental temperature space. Starting from experimental data and based on the previous results reported by the present authors [1], a multifractal model was developed meant to explain the bending creep behaviour, by considering the applied external constrains, under the form of bending force and testing temperature.

Keywords: shape memory alloy, creep, dynamic mechanical analyser, bending, multifractal model.

References:

[1] L. Ciurca, N-M. Lohan, B. Pricop and L.G. Bujoreanu. Study of tensile behaviour of Fe base shape memory alloys during mechanical cycling. *IOP Conf. Series: Materials Science and Engineering*, (2019), 012009, doi:10.1088/1757-899X/591/1/012009.

Mechanical Characterization of 3D Printed Antibacterial PLA

Dragos ALEXANDRESCU[1*], Robert CIOCOIU[1], Diana TABARAS[1], Robert BOLOLOI[1], Iulian ANTONIAC[1]

[1]Materials Science and Engineering Faculty, University Politehnica of Bucharest, 313 Splaiul Independentei Street, RO-060042, Bucharest, Romania

[*]robertbololoi@yahoo.com

Abstract. The use of 3D printing allows the manufacture of a great variety of personalized medical devices with complex geometries and various applications [1]. Extrusion based systems create the object by liquefaction of a filament that is moved under pressure through a nozzle and plotted on a predefined path. For medical applications polyglicolic acid (PGA) and polylactic acid (PLA) are the most used polymers given their history in sutures, scaffolds, and biodegradable fixation materials [1]. The antibacterial properties of the polymers can be induced by addition graphene, zinc, copper, silver and TiO_2 thus creating a composite. The addition of particles, in theory, should alter the polymer flow in the extrusion chamber and layer cohesion. The aim of this research is to see if the addition of particles with antimicrobial properties would show any influence on the mechanical behavior and properties of the product. The study comprised samples made of conventional PLA and antimicrobial PLA (PLA with embedded silver particles) which were tested in tension, compression and flexure using a universal testing machine. The failed specimens were studied using a stereo-microscope and a scanning electron microscope to observe the fracture surface and based upon those observations an attempt to infer the failure mechanism was performed. The results revealed that the antimicrobial PLA behaved worse than a commercial PLA in all tests, reaching near half values in strength parameters.

Keywords: antibacterial PLA, mechanical behavior, tensile, compression

References:

[1] F. Zhu, J. Skommer, T. Friedrich, J. Kaslin, D. Wlodkowic, 3D Printed Polymers Toxicity Profiling: A Caution for Biodevice Applications; Eggleton, B.J., Palomba, S., Eds.; *International Society for Optics and Photonics:* San Diego, CA, USA, 2015; p. 96680Z.

Corrosion Behaviour of some Biodegradable Composites Based on Magnesium Powders Obtained by SPS

Iulian ANTONIAC[1], Gultekin GOLLER[2], Baris YAVAS[2], Ana BITA[1], Diana TABARAS[1*]

[1]Materials Science and Engineering Faculty, University Politehnica of Bucharest, 313 Splaiul Independentei Street, RO-060042, Bucharest, Romania.
[2]Faculty of Chemical and Metallurgical Engineering, Istanbul Technical University, Maslak, Sarıyer 34469, Istanbul, Turkey

[*]antoniac.iulian@gmail.com

Abstract. Studies regarding biodegradable materials have shown that magnesium alloys without aluminum have a great potential for biodegradable implants. Implant degradation in the same time with tissue healing and regeneration is the main purpose of the biodegradable implants. Current trends in biomaterials show that there is a demand to create magnesium alloys with adjustable corrosion rates and proper mechanical properties [1]. Hydroxyapatite (HA) has similar chemical and crystallographic structures to bone and will reduce the corrosion rate while having excellent mechanical. The objectives of this study were to obtained biodegradable magnesium composites with an addition of hydroxyapatite (HA), using spark plasma sintering and to analyze the corrosion behaviour of them. We used two Mg based alloys (Mg1Ca and ZQ71) in powder form with different ratio of HA (0, 5 and 10 wt.% of HA). Structural and morphological characterizations were made by XRD, SEM and EDS; and corrosion behaviour was evaluated in SBF as simulated physiological environments.

Keywords: composites spark plasma sintering, biodegradable, magnesium

References:

[1] X. Gu, W. Zhou, Y. Zheng, L. Dong, Y. Xi, D. Chai, Microstructure mechanical property, bio-corrosion and cytotoxicity evaluations of Mg/HA composites, *Mater. Sci. Eng, C,* 30, (2010), 827-832.

Acknowledgements: This work was supported by a grant of the Romanian Ministery of Research and Innovation, CCCDI-UEFISCDI, Project number PN-III-P1-1.2-PCCDI-2017-0239 / 60PCCDI/2018, within PNCDI III.

Biodegradation of Anionic and Cationic Surfactants Using Bacterial Strains from Activated Sludge

Iuliana PAUN[1,2], Daniel MITRU[1,3], Gheorghe NECHIFOR[3], Cristina Ileana COVALIU[2], Gigel PARASCHIV[2], Ioana Corina MOGA[4], Alexandru DATCU-MANEA[4], Mihai NITA-LAZAR[1,*]

[1]Research and Development Institute for Industrial Ecology – ECOIND, 71-73 Drumul Podu Dambovitei Street, RO-060652, Bucharest, Romania
[2]University POLITEHNICA of Bucharest, Faculty of Biotechnical Systems Engineering, 313 Splaiul Independentei Blvd., RO-060042, Bucharest, Romania
[3]University POLITEHNICA of Bucharest, Faculty of Applied Chemistry and Materials Science, Department of Analytical, Chemistry and Environmental Engineering, no. 1-7, Polizu Street, RO-011061, Bucharest, Romania
[4]DFR Systems SRL, R&D Department, 46 Drumul Taberei Blvd., RO-061392 Bucharest, Romania

[*]mihai.nita@incdecoind.ro

Abstract. Anionic and cationic surfactants are very common pollutants which could be biodegraded by microorganisms during the biological step of the Wastewater Treatment Plant (WWTP) process. During the biodegradation step, the microorganisms use the surfactant as an energy source or as a source of nutrients breaking down the surfactants into simpler chemical compounds. There have been data showing that certain surfactants can be completely biodegraded, but there also have been data suggesting that some surfactants were an extremely low biodegradable. Their low biodegradability could reside on surfactants negative effects on water's surface, such as reducing air/water oxygen transfer, damaging the water quality via the introduction of foam and sorption on solid particles which generate a toxic effect on microorganisms. For these reasons it is necessary to determine the individual biodegradability of each surfactant or each class of surfactants. In this study, we investigate de biodegradability potential of cationic and anionic surfactants and subsequently their effect on microorganisms. The study of their biodegradation potential was carried out during 28 days and the results showed a partial biodegradation of surfactants induced by the microbiological community from the activated WWTP sludge.

Keywords: surfactants, wastewater treatment, biodegradability

Multi-criteria Optimization of Quasi One-Dimensional Phononic Structures

Sebastian GARUS[1,*]

[1]Department of Mechanics and Fundamentals of Machinery Design, Czestochowa University of Technology, ul. Dąbrowskiego 73, 42-201 Częstochowa, Poland

[*]s.garus@imipkm.pcz.pl

Abstract. Quasi one-dimensional systems, i.e. those where one dimension is significantly smaller than the other two, with an appropriate layer distribution and selection of materials, are characterized by the lack of propagation of certain frequency ranges in the structure. Such a phenomenon is called the presence of phononic band gap and it allows the construction of various devices that allow to control the propagating mechanical wave, such as, for example, acoustic diodes, selective filters, high-directional sound sources and many others. In order to obtain the assumed properties of the structure, optimization algorithms such as the genetic algorithm [1] are used. Knowing the space of solutions of the analyzed problem [2] allows for the appropriate selection of the objective function in optimization. The study investigated two types of optimization algorithms in order to minimize the transmission of the mechanical wave in a given frequency range while minimizing the thickness of the composite. In the first approach, the structure length in the population for a single algorithm run was constant and solutions for a decreasing number of layers in the structure were analyzed. The second solution was based on the variable length of structures in the populations, for which an appropriate objective function and crossover algorithm were developed.

Keywords: Transfer Matrix Method, multilayers, optimization, transmission, genetic algorithm.

References:

[1] S. Garus, W. Sochacki, Structure optimization of quasi one-dimensional acoustic filters with the use of a genetic algorithm, *Wave motion*, 98, (2020), 102645.

[2] S. Garus, Solutions Space State Analysis for Transmission Minimizing of Quasi One-Dimensional Phononic Structures, *Acta Physica Polonica* A, 2(138), (2020), s. 299-301, doi: 10.12693/APhysPolA.138.299.

Modern Supercooled Materials with Amorphous and Nanocrystalline Structure

Marcin NABIAŁEK[1,*], Kinga JEŻ[1]

[1]Department of Physics, Czestochowa University of Technology, ul. Armii Krajowej 19, 42-200 Częstochowa, Poland

[*]nabialek.marcin@wip.pcz.pl

Abstract. Metallic amorphous materials are a group of materials that exhibit a number of interesting properties. Their properties are much better than their crystalline counterparts with the same chemical composition. The reason for these differences is their structure. In addition, the properties of these materials can be improved as a result of the designed processes - leading to their controlled nanocrystallization. It should be noted that the production of these materials is very difficult. Therefore, scientists from all over the world are constantly looking for new production methods, as well as new chemical compositions and nanocrystallization methods. In this paper will be presented and compared research results for a few amorphous and nanocrystalline alloys.

Keywords: nanostructure, nanomaterials, bulk amorphous materials, nanocrystallization methods, grains.

Structure and Magnetic Properties of Amorphous $Fe_{81}(PtRh)_5Zr_7Nb_1Cu_1B_5$ Ribbons

Joanna GONDRO[1,*]

[1]Department Department of Physics, Faculty of Production Engineering and Materials Technology, Czestochowa University of Technology, 19 Armii Krajowej Str., 42-200 Częstochowa, Poland

[*]joanna.gondro@pcz.pl

Abstract. This paper presents the results of investigations into the structure, microstructure and magnetic properties of $Fe_{81}(PtRh)_5Zr_7Nb_1Cu_1B_5$ amorphous alloy. Samples of the as-quenched alloy were created in the form of ribbons with approximate width and thickness of 3mm and 20 μm, respectively. The structure and microstructure of the samples were studied using spectrometry. The magnetic properties, including the low-field magnetic susceptibility and magnetisation as a function of temperature were measured. The magetocaloric effect was observed as the change in the magnetic entropy (ΔS_M), which was determined from recorded isothermal magnetic curves. The Curie temperature (T_C) was estimated, for the alloy in the as-quenched state, over a range of temperatures (360±5K). The obtained transmission Mössbauer spectra were found to be typical of those for ferromagnetic alloys, with an average hyperfine field of $(B_{hf})_{ef}$= 13.12(2) T.

Keywords: amorphous magnetic materials, magnetic entropy, magnetisation processes, Mössbauer spectroscopy.

References:

[1] J. Gondro, J. Świerczek, K. Błoch, J. Zbroszczyk, W. Ciurzyńska, J. Olszewski, Microstructure and some thermomagnetic properties of amorphous and partially crystallized Fe–(Pt)–Zr–Nb–Cu–B alloys, *Physica B*, 445, (2014), 37-41.

[2] J. Gondro, Influence of the microstructure on the magnetic properties of $Fe_{86}Zr_7Nb_1Cu_1B_5$ alloy in the states following solidification and following short-duration annealing below the crystallization temperature*, Journal of Magnetism and Magnetic Materials,* 432, (2017), 501-506.

Geometry Characterization of AISI 430 Stainless Steel Microstructuring using Laser

Edit Roxana MOLDOVAN[1], Carlos CONCHESO DORIA[2], José Luis OCAÑA MORENO[3], Liana Sanda BALTES[1], Catalin CROITORU[1], Alexandru PASCU[1], Mircea Horia TIEREAN[1,*]

[1]Material Science Department, Transilvania University of Brasov, 29 Eroilor Blvd., 500036, Brasov, Romania
[2]BSH Electrodomésticos España, S.A., Avda. de la Industria 49, 50016 Zaragoza, Spain
[3]Universidad Politecnica de Madrid, C/ José Gutiérrez Abascal 2, 28006, Madrid, Spain

[*]mtierean@unitbv.ro

Abstract. Recent advancements in many industry domains have imposed challenging permanent joining setups, both in terms of mechanical strength and the type of materials. Welding with concentrated energy sources such as laser enables higher working distances, low heat application, and thermal distortion of the workpieces. High-quality permanent joints can be obtained by (micro)patterning of the materials' surfaces before welding. The generated patterns (which are usually in the form of periodic asperities with defined geometry, protuberances, or micropores) provide a means for local mechanical interlocking between the joined materials, tunes the wettability of the surfaces that come in contact, and are generally the main factor for bonding strength enhancement, especially between dissimilar materials. This paper presents the influence of different patterning overlays generated with a pulsed Nd-YAG TruMark 5020 laser (maximum average power of 20W and a wavelength 1062 nm) on the surface of AISI 430 stainless steel. For all experiments, an overlapping degree of 90% has been chosen between three patterns, while the engraving speed, pulse frequency and number of passes have been varied. The textured surfaces' morphology was assessed through optical microscopy, and the roughness of the surfaces was correlated with the corresponding experimental parameters. The results have indicated promising insights for joining stainless steel to plastic materials, which is otherwise difficult to assess through usual welding techniques.

Keywords: microstructuring, laser, ferritic stainless steel, surface patterning.

Influence of Flame Retardant and Processing Conditions on Selected Properties of Mouldings Made of ABS

Milena TRZASKALSKA*

[1]Czestochowa University of Technology, Faculty of Mechanical Engineering and Computer Science, 42-201 Czestochowa, Poland

*trzaskalska@ipp.pcz.pl

Abstract. Thanks to the possibility of dyeing polymers, the possibilities of their use are constantly increasing. It is equally important to use additives that will have several functions. A perfect example is titanium dioxide used as an optical brightener and a flame retardant at the same time. Mostly it is used in the form of a powder. However, there are no studies where TiO2 is used as a colourbatch based on the different matrix. The aim of the work was to investigate the effect of titanium white in the form of colourbatch on the flammability and selected properties of mouldings produced in various processing conditions. Colourbatch based on PS matrix, was used in the research. The variable processing parameters were: injection temperature Tw, volumetric flow rate Vw, plasticization delay and the addition of a colourbatch. On the basis of the performed measurements, it was found that the processing conditions and the addition of the colourbatch have little effect on the hardness of the mouldings, which was in the range from 75.59oSh (Shore) to 81.95oSh. It was also noted that the addition of a TiO_2 and increasing injection temperature reduces impact strength even by several dozen percent. Moreover, it was found that use of TiO_2 causes a delay in the ignitability of the samples in selected cases. It is difficult to determine whether the variable processing conditions or the addition of TiO_2 on the PS matrix have a greater impact on the ignitability of the moulded parts.

Keywords: injection moulding, injection moulded parts, ABS, PS, TiO_2, flame retardant, mechanical properties, polymer dyeing.

Characterization of Ni-Cr Alloys used for dental applications

Dragos Cristian ACHITEI[1], Madalina Simona BALTATU[1,*], Stefan Constantin LUPESCU[2], Andrei Victor SANDU[1], Marcelin BENCHEA[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 41 "D. Mangeron" Street, 700050, Iasi, Romania
[2]"Gheorghe Asachi Technical University, Faculty of Mechanical Engineering, Blvd. Mangeron, No. 43, 700050, Iasi, Romania

[*]cercel.msimona@yahoo.com

Abstract. The performance of the field and the condition of success in oral implantology today requires the revision and re-evaluation of the means that essentially contribute to ensuring the stability and durability of the implant, starting from the nature of the biomaterial and continuing with the optimally designed biosurface characteristics. Current research on the modification and control of the biomaterial-tissue interaction to improve the osseointegration process of the implant is aimed at capitalizing on advances in regenerative medicine, using tissue engineering techniques and developing the field of biomimetic materials. The paper proposes a comparative analysis of three commercial alloys VeraBond, Kera N and VeraSoft compared to a modified dental alloy, in order to improve some mechanical properties. They were studied from a structural point of view and mechanical properties.

Keywords: biomaterials, dental implants, XRD, microstructures.

References:

[1] D. Sutiman, A. Cailean, I. Cretescu, et al., Corrosion behaviour of Ni-Cr based biomaterials in rondelli saliva, *Revista de Chimie*, 59(4), (2008), 417-421.

Acknowledgements: This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0239/ Contract no. 60/2018, within PNCDI III.

Study on the Emulsion Stability of Triproplyne Glycol Diarcrylate in Water

Siti Salwa MOHD SHIRAJUDDIN[1,2], Mohd Mustafa Al Bakri ABDULLAH[2,3], Che Mohd Ruzaidi GHAZALI[4], Kamarudin HUSSIN[3], Mohd Faizal Abdul RAHMAN[1]

[1]Radiation Processing Technology, Malaysian Nuclear Agency, Bangi, 43000 Kajang, Selangor, Malaysia
[2]Faculty of Chemical Engineering Technology, Universiti Malaysia Perlis, 01000 Kangar, Perlis
[3]Center of Excellence Geopolymer and Green Technology (CEGeoGTech), Universiti Malaysia Perlis, 01000 Kangar, Perlis
[4]School of Fundamental Science, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu

[1]sitisalwa@nm.gov.my

Abstract. This study addresses the emulsion stability of tripropylene glycol diacrylate (TPGDA) in water. Generally, the oil-in-water (O/W) emulsion is incompatible and tends to separate to an oil and water layer due to the difference in density of both oil and water. This could lead to the occurrence of flocculation and coalescence. However, the emulsion can be controlled with the presence of the right amount of stabilizers such as surfactants (emulsifiers). The emulsion stability of TPGDA emulsion in the presence of Tween 20 (Tw-20) as a surfactant was studied with respect to its concentration effect ranging between 0.1 wt% to 3 wt%. The emulsion was monitored over time by phase separation and creaming index, and later characterized by Fourier Transform Infrared Spectroscopy (FTIR) and optical microscope. The results showed that the 0.4 wt% surfactant concentration of Tw-20 is the optimum parameter with the longest stability of 24 hours and a creaming index of 0%, which is enough for an ideal emulsion. The strong band observed at 1632 cm^{-1} due to the C=C band as well as the absorbance peak at 1723 cm^{-1} indicated the presence of characterized peaks of C=O band from the acrylate group. The FTIR spectra displayed the interaction of TPGDA and Tw-20, proving that the emulsion is fully mixed and stabilized.

Keywords: emulsion, Tripropylene glycol diacrylate, stability, Tween 20

Influence of Na^+ in Modulating Catalytic Activity and Structural properties of Ca_xMo_yO Perovskites Catalyst

Nadhratul Nur Ain ABDUL RAHMAN, Nor Aida ZUBIR[1,*], Rasyidah ALROZI[1], Hawaiah IMAM MAAROF[2]

[1]Faculty of Chemical Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang, 13500 Pulau Pinang, Malaysia.
[2]Faculty of Chemical Engineering, Universiti Teknologi MARA Shah Alam, 40450 Shah Alam, Selangor, Malaysia

[*]noraida709@uitm.edu.my

Abstract. Calcium molybdenum oxide (Ca_xMo_yO) perovskites catalyst were synthesized via EDTA-citric acid complexation method. Two different types of EDTA precursor were used during the complexation synthesis in investigating the influence of sodium ion (Na^+) towards modulating the catalytic activity as well as structural properties of Ca_xMo_yO catalyst. In the presence of Na; the resultant $NaCa_xMo_yO$ had shown relatively 8% increment of catalytic activity by 25% decolorization of orange II solution compared to Ca_xMo_yO (17%) within 60 min of reaction. The resultant catalytic activity of both types of catalyst were enhanced significantly in the presence of oxidant. Interestingly, complete decolorization of orange II (100%) was achieved within 15 min of reaction using $NaCa_xMo_yO$ whilst only 97% by the Ca_xMo_yO catalyst. These findings can be supported by both morphological and structural changes of resultant catalyst due to the incorporation Na within the structure of Ca_xMo_yO. In the presence of Na, suppressions of phase separation of individual components as well as preferential growth of particles on surface of catalysts were observed. Hence, it can be concluded that the incorporation of Na within the structure of Ca_xMo_yO enable to alter the resultant catalyst' structure which subsequently impart on modulation of overall catalytic activity as well as structural properties of resultant perovskite catalyst.

Keywords: Sodium ion, Ca_xMo_yO, perovskites, catalytic activity, structural properties


EURO®
INVENT

SECTION 2

PROCEDURES AND TECHNOLOGIES FOR MATERIALS ENGINEERING

Factors of Influence for Chitosan Functionalised with N-heterocyclic Salt in Aqueaus Medium

Iuliana Florina COSTEA (NOUR)[1], Gabriela MELINTE[1], Silvia NOAPTEȘ[1], Mihaela CUDĂLBEANU[1], Andreea DEDIU[1], Rodica Mihaela DINICĂ[1], Geta CÂRÂC[1,*]

[1]"Dunarea de Jos" University of Galati, Faculty of Science and Environment, Department of Chemistry, Physics and Environment, Domneasca Street 111, 80008 - Galati, Romania

[*]geta.carac@ugal.ro

Abstract. We reported here, synthesis of new N-heterocyclic chitosan derivative including N,N'-diphenacyl-4,4'-dipyridinium dibromide salt to improve the chitosan's characteristics for biological activity. Chemical modifications of chitosan are required to enhance its low solubility in aqueous solutions. The synthesis in mixture of chitosan with salt, in aqueous medium was carried out using temperature range between 20°C-80°C, modified contact time (15-120 min.) as and salt's N-heterocyclic added in reaction. The new chitosan' derivate structure by FT-IR analysis on solid samples, kept at ambient temperature and elemental analysis (C and N) were performed. The results show that the chitosan functionalised structure is due more to the process temperature 'effect and period time between compounds, new compound having promising properties with potential activity for biological applications.

Keywords: chitosan derivative, bipyridinium salt, factors, structure.

References:

[1] A.S. Kritchenkov, A.R. Egorov, A.A. Artemjev, I.S. Kritchenkov, O.V. Volkova, E.I. Kiprushkina, L.A. Zabodalova, E.P. Suchkova, N.Z. Yagafarov, A.G. Tskhovrebov, A.V. Kurliuk, T.V. Shakola, V.N. Khrustalev, Novel heterocyclic chitosan derivatives and their derived nanoparticles: Catalytic and antibacterial properties, *International Journal of Biological Macromolecules,*149, (2020), 682 -692.

Secondary Treatment of High Strength Microalloy Steels

Gigi STRAT[1,*], Maria VLAD[1], Gelu MOVILEANU[2], Elisabeta VASILESCU[1]

[1]Dunărea de Jos University of Galati, Faculty of Engineering, 47 Domnească Street, RO-800008, Galati, Romania.
[2]Valahia University of Targoviste, Romania, 2, Carol I Blvd, Postal code 130024, Targoviste, Romania.

[*]gigistrat1967@gmail.com

Abstract. The paper presents the role of secondary treatment in making process of high-strength micro-alloy steels, type X70, used in the manufacture of oil and gas transmission lines. These steels must have special technical parameters (mechanical characteristics) and must meet economic and environmental protection conditions. To obtain X70 steels, with an advanced degree of purity, the technological process also involves the secondary treatment of steel in heating installation (LF) and vacuum degassing (RH), as well as the treatment of slag during the evacuation of steel from the converter, with synthetic slag. With a view to improve the steel properties, during it evacuation from the converter into the ladle, after the administration of the ferroalloys, a certain amount of synthetic slag (1-2kg / ton of steel) formed by lime (CaO), dolomite (CaOMgO), bauxite, fluorite (CaF_2), cryolite (Na_3AlF_6) and aluminium, have to be added. The administration of easily fusible synthetic slag in the steel increases substantially the contact surface between slag and steel, which leads to fluidization and catalysis of diffusion deoxidation reactions, as well as an advanced desulfurization of steel in the ladle until the start of secondary treatment in the LF installation.

Keywords: hybrid deoxidation, synthetic slag, desulfurization, microalloying, degassing, cryolite.

References:

[1] J.C. Villalobos, A. Del-Pozo, B. Campillo, J. MayenID, S. Serna, Microalloyed Steels through History until 2018: Review of Chemical Composition, Processing and Hydrogen Service, *Metals*, 8(5), (2018), 351. https://doi.org/10.3390/met8050351

Improving the Tungsten Carbide Embedment in the Metal Matrix for the Arc Thermal Spraying of Steels

Radu Armand HARAGA[1], Costica BEJINARIU[1], Daniela Lucia CHICET[1], Petrica VIZUREANU[1], Stefan Lucian TOMA[1*]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 41 "D. Mangeron" Street, 700050, Iasi, Romania

[*]stefan-lucian.toma@academic.tuiasi.ro

Abstract. The arc spraying process of cored wires with insertion of hard metallic particles of WC and TiC allows the obtaining of some armed deposits which offer to stressed surfaces resistance to wear. However, the characteristics of the arc spray process can conduct to unwanted evolutions of the formed phases, which in turn cause the mechanical properties degradation. The process parameters as well as the interactions between the molten pulverized particles affect the process of embedding tungsten carbides in the metal matrix. In this paper, the process parameters: arc voltage and compressed air pressure, varied on three levels to analyze the influence of process parameters on the degree of embedment of the WC in the metal matrix, obtained by spraying the cored wire of 97MXC. Different investigative techniques: optical microscopy, SEM, EDX, X-ray diffraction and nanoindentation were approached to study the reactive layer at the interface WC - metal matrix. The obtained data showed that at the interface level, appears a transition zone whose width and chemical composition depends on the two parameters: air pressure determines the increasing of the transition zone width by up to 32%, arc voltage favors the decomposition of tungsten carbide and the formation of the chemical compound FeW. The porosity of the deposits decreases by 18% as the compressed air pressure increases.

Keywords: ultra-hard alloy, arc spray process, tungsten carbide.

References:

[1] W. Tillmann, M. Abdulgader, Wire Composition: Its Effect on Metal Disintegration and Particle Formation in Twin-Wire Arc-Spraying Process, *Journal of Thermal Spray Technology*, 22, (2013), 352-362.

Some Aspects Concerning Titanium Coverage with Hydroxyapatite

Manuela Cristina PERJU[1,2,3], Carmen NEJNERU[1]*, Petrică VIZUREANU[1,2,3], Andra Adorata AELENEI[1], Andrei Victor SANDU[1,2,3]

[1] "Gheorghe Asachi" Technical University of Iasi, Blvd. Mangeron, No. 51, 700050, Iasi, Romania
[2] Center of Excellence Geopolymer and Green Technology, School of Materials Engineering, Universiti Malaysia Perlis (UniMAP), P.O. Box 77, d/a Pejabat Pos Besar, 01007, Kangar, Perlis, Malaysia
[3] Romanian Inventors Forum, St.Sf. P. Movila 3, Iasi, 700089, Romania

*nejnerucarmen@yahoo.com

Abstract. Two methods to coating titanium implants with hydroxyapatite are described. The first is a two-phase method, where by cathodic polarization is deposed a monetite film followed by an alkaline treatment when the monetite is converted to hydroxyapatite. The second method is a biomimetic deposition on an alkaline activate titanium surface, using a five time more concentrated simulated body fluid (5xSBF). These fims were annealed in air for three hours at 700 ºC. Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD) and optical microscopy were used to analyse the composition, structure and morphology of the deposited films.

Keywords: hydroxyapatite, titanium, electrochemical deposition, biomimetic deposition, FTIR, XRD.

References:

[1] M.S. Baltatu, C.A. Tugui, M.C. Perju, M. Benchea, M.C. Spataru, A.V. Sandu, P. Vizureanu, Biocompatible titanium alloys used in medical applications, *Rev. Chim.*, 70(4), 2019, 1302-1306.
[2] M. Chambard, O. Marsan, C. Charvillat, D. Grossin, P. Fort, Effect of the deposition route on the microstructure of plasma-sprayed hydroxyapatite coatings, *Surface and Coatings Technology*, Elsevier, 371, 2019, 68-77.

Dense Ti-Nb-Xha Composite for Bone Implant: Fabrication and Mechanical Properties

Ahmad FARRAHNOOR[1,2*], Hussain ZUHAILAWATI[2]

[1]Faculty of Mechanical Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang, Kampus Permatang Pauh, 13500 Permatang Pauh, Penang, Malaysia.
[2]Biomaterials Niche Area Group, School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, Malaysia.

[*]farra728@uitm.edu.my

Abstract. The most commonly used metal implant, Ti-6Al-4V have shown toxicity of elements such as V, Al and present low mechanical incompatibilities which can cause “stress shielding” effects. This can lead to the implant loosening. The research work aims at improving the mechanical properties of Ti-Nb-xHA (x = 0, 5, 10 and 15 wt.%) composite prepared by mechanical alloying and powder metallurgy. The powders of Ti, Nb and HA were mixed in a high energy ball mill for 2 hours at 200 rpm and followed by compaction under 500 MPa and sintering in argon atmosphere at 1200°C. With the addition of higher amount of HA, α phase is gradually increased and compound known as α-Ti, β-Ti, titanium oxide (TiO_2) and titanium phosphide (Ti_2P) were detected. The density of 5.28 g/cm^3 to 4.78 g/cm^3 was attained. The incorporation of HA decreased the compressive strength (1001.24 MPa to 160.94 MPa) and microhardness (300.53 HV to 85.47 HV) of composite. Adding HA contribute to the poor bonding with matrix which is more pronounced to reduce the elastic modulus from 65.10 GPa to 29.91 GPa, which being an advantage for bone implant. The decrement in mechanical properties was due to the weak interfacial bonding between Ti matrix and ceramic reinforcement as well as the occurrence of the brittle phases from the HA decomposition.

Keywords: mechanical alloying, titanium-niobium alloy, bone implant, powder metallurgy.

A Rapid NMR-Based Approach for the Direct Determination of Lipid Oxidation Metabolites in Dry Fermented Cured Italian Sausages Containing α-Tocopherol

Carlo SICILIANO*

[1]Dipartimento di Farmacia e Scienze della Salute e della Nutrizione, Univeristà della Calabria, I-87030 Arcavacata di Rende (CS), Italia.

*carlo.siciliano@unical.it

Abstract. Quality of dry fermented sausages is affected by lipid oxidation, which can seriously compromise the molecular composition and nutritional and organoleptic properties of these meat products. The polyunsaturated fatty acid (PUFA) chains in the triacylglycerol structures of sausage lipids, are highly susceptible to degradation by oxidation that produce toxic products, e.g. unsaturated aldehydes, and other unwanted metabolites. Given these circumstances, the need for the use of natural antioxidants has arisen, to circumvent lipid oxidation during storage of sausages. α-Tocopherol has been used as an additive in preparing sausages presenting improved resistance to lipid oxidation. There are several traditional methods (GC-MS, FT-IR, HPLC), and usual chemical tests (TBARS) for the analysis of lipid composition and oxidation in meat products. Proton high-resolution nuclear magnetic resonance (^{1}H HR-NMR) is emerging as one of the most powerful direct tools. The fatty acid acyl chain profile in triacylglycerols can rapidly be determined by ^{1}H HR-NMR, avoiding chemical manipulations and instrumental artifacts. However, there has been little research in this field. In this work, two batches of industrial produced pork sausages, manufactured with and without the addition of α-tocopherol, were stored at 4 °C for prolonged time, and used to assess the powerfulness of the ^{1}H HR-NMR in determining changes of the lipid profile. The results, validated by LC-MS analysis, highlighted the retard in the growth of oxidation metabolites in cured sausages containing α-tocopherol.

Keywords: lipid oxidation, ^{1}H high-resolution NMR, PUFAs, unsaturated aldehydes.

Study on the Effect of In Situ Surface Treatments oOf Medical Microfluidic Systems Obtained through Additive Manufacturing

Alexandra CSAPAI[1*], Dan-Alexandru ȚOC[2], Violeta PAȘCALĂU[1],Victor TOȘA[1] Dan OPRUȚA[3], Cătălin POPA[1]

[1] Materials Science and Engineering Department, Technical University of Cluj-Napoca, 103-105 Muncii Ave., 400641 Cluj-Napoca, Romania
[2]Iuliu Hatieganu University of Medicine and Pharmacy, 8 Victor Babeș Street, 400000 Cluj-Napoca, Romania
[3] Thermal Engineering Department, Technical University of Cluj-Napoca, 103-105 Muncii Ave., 400641 Cluj-Napoca, Romania

[*]alexandra.csapai@stm.utcluj.ro

Abstract. The last decades have witnessed an unfathomable development of the microfluidic field, with MEMS (microelectromechanical systems) being fabricated for chemical, biological, and biomedical applications. Consequently, several additive manufacturing (AM) methods have been used for the fabrication of microfluidic devices. This paper presents a comparative study on the effects of the in-situ surface modifications perfoermed on “H” type microfluidic systems obtained via AM. The microsystem was printed using a polylactic acid (PLA) filament on an Ender- 5 Pro printer. The surface modification of the main channel was done using chloroform by two different methods: vapor smoothing and flushing. The obtained surface roughness was studied using an optical microscope and the ImageJ software, as well as scanning electron microscopy (SEM). The effect of the channel surface treatment upon the characteristics of the fluid flow was assessed. The microfluidic systems were used for the dynamic study of biofilm growth of Candida albicans (ATCC 10231). The influence of the surface roughness of the main channel on the formation and growth of the biofilm was studied using quantitative methods, SEM imaging as well as optical coherence tomography (OCT).

Keywords: additive manufacturing, microfluidic systems, surface roughness, biofilm growth, laminar flow.

A CMOS Solution for Multilayer Electrochemical Probes (Benefits and Constraints)

Vily Marius CIMPOIAŞU[1], Faustin RĂDULESCU[2], Kenneth Henry NEALSON[3], Ioana Corina MOGA[4], Radu POPA[1*]

[1]University of Craiova, Biology and Environmental Protection Department, 13 A.I. Cuza Street, RO-20058 Craiova, Romania.
[2]Portland, OR-97229, United States of America.
[3]University of Southern California, Department of Earth Sciences, University Park, CA-90089, Los Angeles, USA
[4]DFR Systems SRL, R&D Department, 46 Drumul Taberei Blvd., RO-061392 Bucharest, Romania.

[*]radu.o.popa@gmail.com

Abstract. Using actuators to push/pull probes through sediments is technically challenging in submerged conditions. Moreover, as electrodes move up and down they disrupt the texture of the substrate biasing subsequent measurements. This makes analyzing the evolution of real electrochemical gradients very difficult. We discuss an electrode-switching solution based on low resistance Complementary Metal–Oxide–Semiconductors (CMOS). The acronym for this instrument configuration is SPEAR and can be used for cyclic voltammetry profiling of sediments. In this instrument numerous electrodes placed at various depths along a probe, can be monitored independently. We show an example of a probe with 64 working electrodes, one counter and one reference electrode and a software-controlled CMOS-based electrode switchboard. We also discuss solutions for 3D printing layering of multilayer electrodes at mm-scale resolution. Benefits, constraints and applications of CMOS-based SPEARs are discussed.

Keywords: probe, sediments, electrode, complementary metal–oxide–semiconductors, cyclic voltammetry profiling.

Modern Supercooled Materials with Amorphous and Nanocrystalline Structure

Katarzyna BŁOCH*

Department of Physics, Czestochowa University of Technology, ul. Armii Krajowej 19, 42-200 Częstochowa, Poland.

*katarzyna.bloch@pcz.pl

Abstract. Amorphous materials in the form of alloys are one of the most modern groups of materials. The interest in these materials is due to their unique properties, which are much better compared to their crystalline counterparts with the same chemical composition. Initially, such materials were produced in the form of coatings and thin tapes, the so-called classic amorphous materials (seventies). Obtaining the amorphous structure required high cooling rates in the range of 10^5-10^7 K/s. However, it was practically impossible to produce a material thicker than several tens of micrometers at such high cooling rates. The thickness of the produced materials alone was insufficient for their full application. In 1989, three empirical criteria were presented, the application of which makes it possible to systematically produce amorphous materials with a thickness greater than 100 micrometers. This group of materials has been called bulk amorphous materials. Mentioned criteria: the alloy should consist of more than three components whose atomic radii should differ by more than 12% (at least the major components of the alloy) and have a negative heat of mixing. The alloy compositions selected in this way should show good glass transition ability, which means that they can be produced at a much lower cooling rate. Since then, many technical solutions have been developed to enable the production of bulk amorphous alloys. In this paper, four devices for the production of bulk amorphous materials will be discussed, in which the following is used: the suction method, the injection method, a combination of the injection and suction methods, and a method in which the liquid alloy is placed in a copper mold using centrifugal force.

Keywords: bulk amorphous alloys, modern materials, cooling rate, methods production.

Effect of 1 at.% Pt Additive on the Structure and Magnetic Properties of Rapidly Cooled Alloys Based on FeCoWYB in the Form of Ribbon and Flat Bar

Paweł PIETRUSIEWICZ*

Department of Physics, Faculty of Production Engineering and Materials Technology, Czestochowa University of Technology, 19 Armii Krajowej Str., 42-200 Częstochowa, Poland.

* pawel.pietrusiewicz@pcz.pl

Abstract. The paper presents the results of tests of fast-cooled alloys based on FeCoWYB with the addition of 1 at.% Pt. The research material was prepared by two methods: melt-spinnig and injection castig methods. The aim of the work was to investigate the influence of Pt on the structure and magnetic properties of the tested materials in the form of a ribbon with a thickness of 30μm and a flat bar with dimensions of 20mm by 0.5mm by 1mm. The structure was examined using X-ray diffraction (XRD), scanning microscopy (SEM) and Mossbauer spectroscopy. The magnetic properties were investigated using a vibration magnetometer (VSM) and a Faraday magnetic balance. The results of the structural tests showed the existence of crystalline phases containing Pt in the samples produced by injection-casting method, while the samples in the form of ribbon had an amorphous structure. The results of the magnetic tests showed that the tested material in the form of a tape showed properties characteristic of soft magnetic materials (the coercive field is 23 A/m). On the other hand, the sample of the tested alloy in the form of a flat bar, due to the existence of crystalline phases with Pt, showed a higher coercive field of 1100A/m.

Keywords: amorphous and nanocrystalline materials, mossbauer spectroscopy, soft magnetic materials, X-ray diffraction.

Changes in Thermal Properties of Printouts Made of PETG and PLA Doped with Copper after Electrocorrosive Ageing Process

Joanna REDUTKO[1]*, Aleksandra KALWIK[1], Arkadiusz SZAREK[1]

[1]Department of Technology and Automation, Faculty of Mechanical Engineering and Computer Science, Czestochowa University of Technology, POLAND

*jredutko@iop.pcz.pl

Abstract. The article presents the results of research on selected thermal, mechanical properties, as well as the microscopic structure of filaments and details made on a 3D printer in FDM technology. The materials used in the study were PETG (polyethylene terephthalate doped with glycol) and PLA (polylactide) doped with copper. As part of the study, Differential Scanning Calorimetry (DSC) was performed in order to determine the temperatures of phase transformations and changes in melting enthalpy values of filaments before the printing process and also elements made of them. The second part of the research was electrocorrosive ageing process of printouts, carried out in the Simulated Body Fluid solution in a device generating 0.3A direct current, voltage with value 4.3V for the entire duration of the test, which was 720h. After this process DSC test was conducted again. The next stage of the research was Dynamic Mechanical Analysis (DMA) of printouts before and after electrocorrosive ageing process. This test was carried out to characterize the dynamic-mechanical properties as a function of frequency, temperature and time. Additionally, microscopic analyses of the surfaces of the tested printouts were performed in order to assess the changes after electrolysis.

Keywords: Differential Scanning Calorimetry, polylactide, Dynamic Mechanical Analysis, thermal properties.

Assessment of Injection Moulding Process Parameters on the Properties of Mouldings Made of Low-Density Poly(Ethylene) Recyclate LDPE

Aleksandra KALWIK[1]*, Roman HUMIENNY[1], Katarzyna MORDAL[1]

[1]Department of Technology and Automation, Faculty of Mechanical Engineering and Computer Science, Czestochowa University of Technology, POLAND

*jredutko@iop.pcz.pl

Abstract. The parameters of the injection moulding process have a significant influence onthe properties of the moulded parts. Selection of appropriate injection conditions (e. g. the injection temperature, mould temperature, injection and clamping pressure, injection speed) contributes to the productivity and energy consumption of the injection moulding process as well as to the quality of themoulded parts. The aim of this study was to evaluate the influence of injectionmoulding parameters on properties of poly(ethylene) moludings. Regranulate obtained from recycled film, which is a mixture of low-density poly(ethylene) and linear low-density poly(ethylene), was used for testing. Samples in theform of standardised paddles of type A1 were produced by injection moulding. A Krauss-Maffei KM65-160C4 injection moulding machine was used for thispurpose. Variable parameters of this process used in the study were: injection speed, mould temperature and clamping pressure. The results of tensilestrength tests of the obtained samples are presented. The weight and dimensionsof mouldings from four different regranulates were also investigated. The effectof injection moulding conditions on the properties of poly(ethylene) mouldingswas shown in the investigations. The mass of poly(ethylene) mouldings is dependent on the clamping pressure.

Keywords: injection moulding process, injection speed, energy consumption, poly(ethylene).

Speciation Analysis of Arsenic in Copper Electrolyte Baths using Liquid-Liquid Extraction and ICP-OES Method Detection

Eduard STEFANOV*, Stela GEORGIEVA

Department of Analytical Chemistry, University of Chemical Technology and Metallurgy, 1756 Sofia, Bulgaria.

*st.georgieva@uctm.edu

Abstract. The present study describes a method for the determination of As (III) and As (V) in copper electrolytes. The method is based on the separation of As (III) from a copper electrolyte by triple liquid-liquid extraction using a non-polar organic solvent in a medium of 10-12 M HCl. The extract contains As (III) and the raffinate-As (V), respectively. As(III) specie can be re-extracted from the organic solvent through the water. Analyzes of the concentration of As in the re-extract and raffinate were performed by ICP-OES spectroscopic method. The average recovery of arsenic by the proposed method is about 99%. Repeatability was estimated with RSD (n = 6). Selectivity and accuracy were proven by the standard addition method. The relative error for restoring the standard addition of As (III) is about 2%. The method could be applied for determination of the arsenic species in the analytical quality control of refined copper in copper tanks in the production of copper cathodes.

Keywords: arsenic species, copper electrolyte, ICP-OES method, extraction.

Acknowledgments: Financial support from NIS project of the UCTM, Sofia, Bulgaria is gratefully acknowledged.

Impact Behavior of the Ballistic Targets Package Composed of Dyneema Polymer and High Entropy Alloy Structures

Ionelia VOICULESCU[1], Victor GEANTA[1]*,
Tudor CHERECHES[2], Radu STEFANOIU[1],
Adrian ROTARIU[3], Dumitru MITRICA[4]

[1] University Politehnica of Bucharest, Splaiul Independentei, 313, 060042, Bucharest, Romania
[2] UPS Pilot ARM, Bucharest, Romania
[3] Military Technical Academy, Bucharest, Romania
[4]IMNR Bucuresti, Romania

*victorgeanta@yahoo.com

Abstract. Ballistic targets are multi-material assemblies that can be made of various materials, such as metal alloys, ceramics, polymers. Their role is to provide collective or individual ballistic protection against high-speed dynamic penetrators or kinetic fragments. The paper presents the impact behavior with incendiary perforating bullets having 7.62 mm of ballistic packages made of combinations between Dyneema ultra-high-molecular-weight polyethylene and high entropy alloy from alloying system AlCoCrFeNi, by analyzing the dynamic phenomena (deformation, perforation) that take place at high speeds. The geometry evolution of the physical model subjected to numerical simulation allows a very good control over the discretization network and also allows the export for modeling to nonlinear transient phenomena. The results obtained by numerical simulation showed that the analyzed ballistic package does not allow sufficient protection for values of impact velocities over 700m / sec.

Keywords: ballistic target, Dyneema polymer, high entropy alloy, impact, numerical simulation.

References:

[1] V Geantă, T Cherecheș, P Lixandru, I Voiculescu, R Ștefănoiu, D Dragnea, T Zecheru and L Matache, Simulation of Impact Phenomena on the Composite Structures Containing Ceramic Plates and High Entropy Alloys, *IOP Conf. Series: Materials Science and Engineering* 209**, (**2017), 012043 doi:10.1088/1757-899X/209/1/012043.

Comparative Rolling Contact Behavior of Two APS Coatings with Different Matrix

Daniela CHICET[1], Stefan TOMA[1*], Radu HARAGA[1]

[1]Gheorghe Asachi Technical University of Iasi, Department of Materials Science and Engineering, Blvd. Mangeron, No. 41, 700050, Iasi, Romania.

[*]stefan-lucian.toma@academic.tuiasi.ro

Abstract. In this study we analyzed the contact fatigue behavior of two types of coatings made by thermal coating, by the method of atmospheric plasma spraying (APS). Both powders are commercially available, the first of which is a metal powder with a Ni matrix (Ni5Al5Mo), and the second being a ceramic powder based on Al2O3 (Al2O3 - 13 TiO2). To study the contact fatigue behavior, an installation specially designed for this purpose was used, composed of an oil tank in which the test system is mounted: two flat specimens (in the form of axial bearing rings), a spacer, two cages with bearing balls and two conical fixing rings. The specimens obtained by thermal spray were tested for 54 hours (for 1380 rpm), at a load of 944N calculated for the case of the hertzian elastic point contact. After each test, the samples were disassembled, cleaned and analyzed by direct observation (stereomicroscope) but also at the microstructural level (SEM and EDX). In both types of coatings, the appearance of a running channel was observed, which was much more obvious in the case of the Ni matrix layer. The observations regarding the appearance of the running channels were also confirmed by their profilometry. In the case of ceramc coating, the width of the running channel was very small (300 - 450 µm), with very few changes at the surface level of the coating, which recommends this type of material for applications that require wear resistance to rolling.

Keywords: rolling contact fatigue, thermal spray, wear mark microstructure.

References:

[1] V. Paleu, C. Cîrlan Paleu, B. Istrate, S. Bhaumik, C. Munteanu, Friction and wear resistance of Al2O3 40TiO2 (AMDRY 6250) coating of a pump shaft sleeve bearing *IOP Conference Series: Materials Science and Engineering*, 724(1), (2020), 012064.

The influence of Cetyltrimethylammonium Bromide (CTAB) on the Morphology and Dye Degradation Performance of Magnetic Nanoparticles Augmented Microcapsules

Mohamed Syazwan OSMAN[1,2,3,*], Amirul Iqbal Dewa SAFRIL[1], Muhammad Ikhwan NIZAM[1]

[1]School of Chemical Engineering, College of Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang,13500 Permatang Pauh, Penang, Malaysia
[2]EMZI-UiTM Nanoparticles Colloids & Interface (NANO-CORE) Industrial Research Laboratory, Universiti Teknologi MARA, Cawangan Pulau Pinang,13500 Permatang Pauh, Penang, Malaysia
[3]Center of Excellence Geopolymer and Green Technology (CEGeoGTech), Universiti Malaysia Perlis, Perlis 01000, Malaysia

[*]syazwan.osman@uitm.edu.my

Abstract. This study reported on the preparation of magnetic nanoparticles augmented microcapsules by phase inversion technique. The effect of cetyltrimethylammonium bromide (CTAB) as a pore-forming agent on dye degradation and morphological structure was examined. Morphological characterization such as scanning electron microscopy (SEM) and Thermogravimetric analysis (TGA) was performed to understand the structural properties of the microcapsules. With a different concentration of CTAB, the evolution was observed. Using Rhodamine B dye as a model pollutant, the microcapsules performance was evaluated in terms of adsorptive capacity and catalytic degradation percentage. Experimental data revealed that at 1.0 wt. % of CTAB, the dye degradation achieved the optimum performance with 98% degradation while the finger-like structure at the edge of microcapsules.

Keywords: magnetic nanoparticles, microcapsules, pore-forming agent, cetyltrimethylammonium bromide (CTAB), dye degradation.

References:

[1] M.S. Osman, L.P. Kong, N.A. Zamanhuri, J.K. Lim, Role of temperature and pH on the dye degradation using magnetic nanoparticles augmented polymeric microcapsule. In *Advanced Materials Research,* 1113, (2015), 566-570.

Mineralization's Optimization of $Fe_{3-x}Co_xO4$ Catalyst in Oxidative Acid Orange 7 Degradation

Mohammad Khairul Azam SELAMAT[1], Nor Aida ZUBIR[1,*], Rasyidah ALROZI[1], Nadiah Awanis AZMAN[2]

[1]Faculty of Chemical Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang, 13500 Pulau Pinang, Malaysia.
[2]Department of Chemical and Biological Engineering, University of Sheffield, Mappin St, Sheffield S1 4AA, United Kingdom.

[*]noraida709@uitm.edu.my

Abstract. Operational reaction conditions for oxidative degradation of acid orange 7 (AO7) solution using cobalt substitute magnetite catalyst ($Fe_{3-x}Co_xO_4$, x=0.3) in heterogeneous Fenton-like reaction were optimized via response surface methodology (RSM). Central composite design (CCD) with four independent parameters (pH, catalyst dosage, H2O2 concentration and initial dye concentration) and two responses (mineralization and discoloration) were chosen in modelling the design of optimization experiment. Dual quadratic models (p-value < 0.05; r^2 = 0.9982 (mineralization) and 0.9935 (discoloration)) were derived using analysis of variance which providing satisfactory confidence to the optimized results. The optimum operational reaction conditions were found to be at solution pH 2.3, catalyst dosage 0.8 g/L, H_2O_2 concentration 18.7 mM and initial dye concentration 28 ppm with predicted AO7 mineralization percentage of 76.23% and 97.92% AO7 discoloration. Approximately, 74.1% of AO7 were experimentally mineralized and decolorized (95.46%) under these optimum conditions which matched well to the predicted values with absolute deviation of 1.52% and 1.74%, respectively. Such findings suggested that the mineralization kinetics was mostly influenced by pH and catalyst dosage which can an be described by a pseudo-second-order reaction.

Keywords: cobalt substitute magnetite, mineralization, response surface methodology (RSM), discoloration, Fenton-like reaction.

Awards – 2020

BEST POSTERS AWARDS

I.M. Mates, A. Semenescu, S.I. Dumitrescu, R. Vidu – *New Materials developpned for Cranioplasty*

S. Kiseleva, A. Tarasenko, A. Fedotov – *Influence of Primary Power Source on Heat-insulating Material Choice for Autonomous Telecom Unit Container*

V. Soporan, M.M. Vescan, T.R. Lehene, S. Paduretu, T. Gabor – *Consideration regarding the Recalibration of the Manufacture of Castings from the Perspective of Development of the Circular Economy*


EURO®
INVENT

SECTION 3

MATERIALS APPLICATIONS

Improving Indoor Air Quality by Using Sheep Wool Heat Insulation

Andreea HEGYI[1,*], Cezar BULACU[2], Henriette SZILAGYI[1], Adrian-Victor LĂZĂRESCU[1], Vasile MEIȚĂ[3], Petrică VIZUREANU[4], Mihaela SANDU[3]

[1] NIRD URBAN-INCERC CLUJ-NAPOCA Branch, 117 Calea Florești, 400524, Cluj-Napoca, Romania.
[2] MINET SA, 12, Depozitelor, 240426, Râmnicu Vâlcea, Romania.
[3] NIRD URBAN-INCERC BUCHAREST, 266 Șoseaua Pantelimon, 021652, Bucharest, Romania.
[4]Faculty of Material Science and Engineering, Gheorghe Asachi Technical University of Iasi, 41 D. Mangeron St., 700050 Iasi, Romania

[*]andreea.hegyi@incerc-cluj.ro

Abstract. In the current context, the need to ensure an adequate quality of the air inside the living space but also the thermal efficiency of the buildings are pressing. This paper presents the capacity of sheep wool heat-insulating mattresses to simultaneously provide these needs, cumulatively analyzing efficiency indicators for thermal insulation and indicators of increasing air quality. Thus, the values obtained for the coefficient of thermal conductivity, and its resistance to heat transfer; demonstrate the suitability of their use for thermal insulation, the results of the permeability to water vapour characteristics on the sorption / desorption of water, air, demonstrates the ability to control the humidity of the indoor air and the results on the reduction of the concentration of formaldehyde, demonstrating their contribution to the growth of the quality of the air, and to reduce the risk of disease in the population.

Keywords: sheep wool heat-insulating mattresses, air quality, water vapor permeability, formaldehyde concentration reduction.

References:

[1] D. Maskell, C.F. da Silva, K. Mower, C. Rana, A. Dengel, R.J. Ball, M.P. Ansell, P.J. Walker, A. Shea, Properties of bio-based insulation materials and their potential impact on indoor air quality, *First International Conference on Bio-based Building Materials June 22nd - 24th 2015 Clermont-Ferrand, France, AJCE - Special Issue*, 33(2), (2015), 156-163.

Current Density and Time Effect applied during Electro-Codeposition Process on Resulted Cobalt Matrix reinforced with Nano-CeO_2 Particles

Nicoleta SIMIONESCU (BOGATU) [1], Lidia BENEA[1],*

[1]Competences Centre: Interfaces-Tribocorrosion-Electrochemical Systems (CC-ITES), Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.

*lidia.benea@ugal.ro

Abstract. This research paper aims to study the influence of some of the most important electrochemical parameters applied to the electrodeposition process on the nanocomposite layers obtained by strengthening the cobalt matrix with cerium oxide nanoparticles. Thus, the current efficiency (process efficiency) and the degree of inclusion of cerium oxide nanoparticles into cobalt matrix are analyzed according to the current density, the concentration of nanoparticles dispersed in the deposition electrolyte and the time applied to the electro-codeposition process. The obtained results show an increase in the process efficiency of the deposited layers with the increase of time and current density applied. There is also a slight increasing in the current efficiency of the obtained layers with the increase of the concentration of nanoparticles dispersed in the deposition electrolyte. The increase of the current density, the time and the concentration of nanoparticles also have an effect on the degree of embedded CeO_2 nanoparticles into cobalt matrix for the studied nanocomposite layers. The degree of inclusion of nanoparticles decreases for the same studied system with the increasing of the current density.

Keywords: Electrochemical deposition, cobalt matrix, CeO_2 nanoparticles, current density, time.

References:

[1] L. Benea, N. Simionescu, J.P. Celis, Electro-codeposition of CeO_2 nanoparticles into cobalt matrix to improve the tribocorrosion performances of Co/nano CeO_2 composite layers in biological solution for medical applications, *Journal of the Mechanical Behavior of Biomedical Materials*, 101, (2020), 103443. https://doi.org/10.1016/j.jmbbm.2019.103443

Photocatalytic TiO_2 nanostructures developed on the grade 2 Ti material

Claudia Ionela TARCEA[1], Cristian Mircea PANTILIMON[1], George COMAN[1*], Andreea TURCANU[1], Andra Mihaela PREDESCU[1], Ecaterina MATEI[1], Andrei Constantin BERBECARU[1], Cristian PREDESCU[1*]

[1]University Politehnica of Bucharest, Faculty of Materials Science and Engineering, 313 Splaiul Independen.ei, 060042, Bucharest, Romania

*george.coman@upb.ro, cristian.predescu@upb.ro

Abstract. The research focuses on TiO_2 nanostructures environmental applications due to the special characteristics that displayed degradation of the organic compounds into environmentally friendly products through exposure to UV light. The protocol behind obtaining the nanostructures involves the use of a Ti material exposed to alkaline treatment and advanced oxidation using NaOH solution and acetone. These studied nanostructures are analyzed extensively by using methods such as scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS) and X-ray diffraction (XRD) in order to determine the elements, compounds and morphological properties of the material. Different NaOH solution's concentrations lead to in order to obtain different types of 3D nanostructures. The Ti sheets were immersed into NaOH and acetone mixed solutions for 72 hours. The best results were recorded by using 30% NaOH solution. After obtaining the 3D structures, which improve specific surface and contact area with the environment, the samples are tested under UV light in order to degrade methylene blue in order to determine their photocatalytic performance.

Keywords Ti mateial, nanostructures, photocatalytic activity, alkaline treatment, advanced oxidation.

The Applying Software Programs, for Technological Design, and Simulation of the Casting Process, in Optimizing the Technology of Making Parts Castings

Beatrice Daniela TUDOR[1], Marian BORDEI[1]

[1] Faculty of Engineering, Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.

*beatrice.tudor@ugal.ro, *marian.bordei@ugal.ro

Abstract. The optimization of the solidification of the cast parts is based on the exact knowledge of the solidification mode of the part. The only solution for the rapid, and low-cost, optimization of technological problems related to the solidification of castings is the computer simulation of solidification. The solidification of castings from metal alloys is a complex physico - chemical process, which has a great influence on the quality of castings. The optimization of the solidification process of the castings has a direct influence on the consumption of liquid alloy, labor and energy. This is explained by the reduction of the percentage of scrap and specific consumption. In this paper, the steps and the advantages of applying the programs are presented, which lead to the optimization of the realization technology, of a landmark. For a better accuracy of simulating the casting of a part, and to identify possible defects of casting and solidification of the part, the applied programs are MAGMA and Click2Cast.

Keywords: casting, solidification, optimization, computer simulation, scrap.

XRD and STA Characterization of Phosphate Layers Deposited on the Carbon Steel Surface

Diana-Petronela BURDUHOS-NERGIS[1], Costica BEJINARIU[1], Alin Marian CAZAC[1], Andrei Victor SANDU[1] and Petrica VIZUREANU[1,*]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 41 "D. Mangeron" Street, 700050, Iasi, Romania

[*]peviz2002@yahoo.com

Abstract. Carbon steel is one of the most widely used alloy in many industries, however, its use is limited by its low corrosion resistance. Depositing a layer of phosphate on its surface improves the corrosion resistance as well as other properties, such as wear resistance, adhesion etc. Accordingly, preliminary studies demonstrated that carbon steel coated with phosphate layers can be used in the manufacture of carabiners for various fields: civil engineering, oil industry etc. Whereas, in order to demonstrate their capacity to operate in severe conditions related to fire rescue and extinguishing operations, it is necessary to evaluate the thermal behavior of these materials. Thus, the main goal of this paper is to study the behavior at high temperatures of three different types of phosphate layers deposited on carbon steel surface, by STA analysis. Also, the paper aims to study the formation of different phosphate layers by determining the types of compounds formed after the completion of the phosphating process, by XRD analysis.

Keywords: zinc phosphate, manganese phosphate, XRD, STA.

References:

[1] C. Bejinariu, D.P. Burduhos-Nergis, N. Cimpoesu, Electrochemical Immersion Behavior of Carbon Steel, Phosphate Carbon Steel and Phosphate and Painted Carbon Steel in Saltwater, *Materials*, 14(1), (2021), 188.

[2] D.P. Burduhos-Nergis, P. Vizureanu, A.V. Sandu, C. Bejinariu. Evaluation of the Corrosion Resistance of Phosphate Coatings Deposited on the Surface of the Carbon Steel Used for Carabiners Manufacturing, *Applied Sciences*, 10(8), (2020), 2753.

Risk Assessment for Environmental in the Process of Obtaining Compost from Biodegradable Waste

Beatrice Daniela TUDOR

Faculty of Engineering, Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.

beatrice.tudor@ugal.ro

Abstract. The analyzed waste is an inhomogeneous mixture of biodegradable waste, recyclable packaging, recyclable waste, contaminated with organic products, etc. The capacity of the composting plant is 10,000 tons / year, and processes the "green" waste from oilfields, gardens, as well as the organic fraction of waste in the markets. These categories of waste offer a good quality of compost, which allows its recovery. The composting station is built in such a way as to minimize the impact on the environment, but pollution problems can occur due to various other causes, which have been assessed as risk factors for the environment. The level of risk was established for each factor: very low, low, moderate, high and extreme. Following the analysis performed, risk minimization solutions were proposed.

Keywords: biodegradable waste, compost, risk factor

Research on the Degradation Process of Railway Rails Due to Lifespan Exceeding

Andrei Constantin BERBECARU, Cătălin GRĂDINARU, George COMAN, Sorin CIUCĂ, Ioana Arina GHERGHESCU*, Mirela Gabriela SOHACIU, Cristian PREDESCU*

[1]University Politehnica of Bucharest, Faculty of Materials Science and Engineering, 313 Splaiul Independentei, 060042, Bucharest, Romania

*ioana.gherghescu@upb.ro, *cristian.predescu@upb.ro

Abstract. The paper presents the impact of exceeding the railway rails lifespan which usually causes a railway structural failure, thus an accident. The research highlights the rails high degradation, especially on the running area, consisting in 60 – 70% weight loss by advanced wear of the rail, followed by fatigue fracture caused by alternating cyclic stresses that initiates the crack and also by tensile stresses resulting in the crack growth. The chemical composition, structural and mechanical properties were analyzed in order to establish the causes that led to the railway rails rupture.

Keywords: degradation, advanced wear, fatigue fracture, railway rails lifespan.

The Efficiency of Device for Fixation and Cellularization of Small Sized Grafts

Vitalie COBZAC, Mariana JIAN, Viorel NACU

State Medical and Pharmaceutical University "Nicolae Testemitanu", Bd. Stefan Cel Mare 165, MD2004, Chisinau, Republic of Moldova;

*vitalie.cobzac@usmf.md

Abstract. The research work aims to demonstrate effectiveness of Device for fixation and cellularization of small sized grafts (DFCSSG) utilisation in the field of Transplantology and Regenerative medicine. The process of graft cellularization is poorly described in the literature. The whole process is reduced to microplates or Petri dishes utilization, in which the grafts are introduced, with further pouring of cell suspension on the grafts. The obvious problem of the graft cellularization process is that the graft fails to absorb instantly the poured cell suspension, as a result it is spread through the vessel, leading to cell loss, which is especially characteristic for small sized grafts, up to 7 mm in diameter. For transplantation pourpose, were cellularised grafts (n=38) with a volume of 44,31 mm^3 ± 2,72mm^3 with chondrocytes (n=18) and bone marrow mesenchymal stem cells (MSC) (n=20). The cells were resuspended in 45-50µl of cell type specific culture medium. With chondrocytes in a well of 96-well microplate (Mp96) were cellularized 7 grafts with $2.8x10^6$ ±$2.38x10^5$ cells/graft, and in DFCSSG - 11 grafts with $2.87x10^6$ ±$3x10^5$ cells/graft ($p>0.5$). With MSC in Mp96 were cellularized 8 grafts with $1,29x10^6$ ±$2x10^5$ cells/graft, and in DFCSSG - 12 grafts with $1.41x10^6$ ±$3.29x10^5$ cells/graft ($p>0.1$). All grafts were held in a incubator at 37°C, 5% CO_2 for 70 ±12 minutes with further transplantation. After grafts transplantation, the DFCSSGs and wells of the Mp96s were washed from cells with specific cell culture medium.

Keywords: device for fixation and cellularization of small sized grafts, cellularization rate, graft volume, cells number.

References:

[1] V. Cobzac, L. Verestiuc, M. Jian, V. Nacu, Assesment of ionic and anionic surfactants effect on demineralized osteochondral tissue, *IOP Conf. Ser.: Mater. Sci. Eng.*, 572, (2019), 012084.

Carbon Nanotubes and Engelhard Titanium Silicates as Eco-Friendly Adsorbent Materials: A Review

Pierantonio DE LUCA[1],Sebstiano CANDAMANO[1], Janos B.NAGY[1]

[1]Dipartimento di Ingegneria Meccanica, Energetica e Gestionale, University of Calabria, I-87036 Arcavacata di Rende, Italy

pierantonio.deluca@unical.it

Abstract. The present work aims to give a general overview of two important adsorbent materials: Carbon Nanotubes and Engelhard Titanium Silicates. The literature reports important studies on the application and use of these materials in environmental protection. Carbon nanotubes are intended as of rolled-up sheets of single-layer carbon atoms (graphene), while Engelhard titanium silicates (ETS) are titanium silicates. Carbon nanotubes have a diameter of nanoscale while the Engelhard titanium silicates have micrometric pore sizes. Both are advantageously used for water and air purification and also have other peculiar properties. The work reports the synthesis and characteristics of each single adsorbent material. Particular attention is paid to the latest studies reported in the literature regarding their application in the environmental field, trying to grasp their specificities in different fields of environmental application.

Keywords: Enghelhard titanium silicate, carbon nanotubes, adsorbent materials, environmental pollution

References:

[1] A. Aliyu, I. Kariim, S.A. Abdulkareem, Effects of aspect ratio of multi walled carbon nanotubes on coal washery waste water treatment, J*. Environ. Manag,* 202, (2017**)**, 84–93.

[2] A. Policicchio, D. Vuono, T. Rugiero, P. De Luca, J. B.Nagy, Study of MWCNTs adsorption perfomances in gas processes, *J. CO2 Util*, 10, (2015), 30–39.

[3] M.W. Anderson, O. Terasaki, T. Ohsuna, A. Philippou, S.P. Mackay, A. Ferreira, J. Rocha, S. Lidin, Structure of the microporous titanosilicate ETS-10, *Nature*, 367, (1994), 347.

Removal of Hg^{2+} and CH_3Hg^+ by a Polyphosphonate Ligand: a Speciation Study for Application in Natural Waters

Chiara ABATE, Claudia FOTI, Ottavia GIUFFRÈ*

Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche ed Ambientali, Università di Messina, Viale F. Stagno d'Alcontres 31, 98166 Messina, Italy

*ogiuffre@unime.it

Abstract. The potential of employing a polyphosphonate ligand, diethylenetriamine-N,N,N′,N″,N″-pentakis(methylenephosphonic) acid (*DTPMP*), in the removal of Hg^{2+} and $(CH_3)Hg^+$ from water was studied. Metal-ligand systems were investigated by potentiometry in NaCl aqueous solution at t = 25°C, $0.1 \leq I$ / mol $L^{-1} \leq 1$ for Hg^{2+}, I = 0.1 mol L^{-1} for $(CH_3)Hg^+$. By processing the experimental data, the most likely speciation models were obtained. The formation of several complex species was evidenced and stability of Hg^{2+} complex species was significantly higher than that of $(CH_3)Hg^+$. The sequestering capacity determined under the same conditions of temperature and pH, typical of natural waters, showed highest potential towards Hg^{2+}, also respect to those of other polyphosphonate ligand, such as etidronic acid ((1-Hydroxy-1,1-ethanediyl)bis(phosphonic) acid, *HEDPA*). This quantitative study of the interactions between metal cations and ligand is of utmost importance to evaluate the possible use of this ligand in the metal decontamination process of waste effluents, groundwater, and seawater.

Keywords: sequestering ability, heavy metals, poliphosphonate ligands, natural waters

References:

[1] C. Foti, O. Giuffrè, S. Sammartano, Thermodynamics of HEDPA protonation in different media and complex formation with Mg^{2+} and Ca^{2+}, *J. Chem. Thermodynamics*, 66, (2013), 151-160.

[2] P. Cardiano, C. Foti, O. Giuffrè, Removal of di- and tri-alkyltin(IV) compounds by polyphosphonate ligand: A speciation perspective, *J. Mol. Liquids*., 240, (2017), 128-137.

Preliminary Analysis of an Ancient Short Sword

Claudiu Vasile CIUBOTARU[1], Andrei Victor SANDU[1], Alexandru BREZOVAN[2], Petrica VIZUREANU[1]

[1] Faculty of Materials Science and Engineering, "Gheorghe Asachi" Technical University of Iasi, 41 "D. Mangeron" Street, 700050, Iasi, Romania
[2] Institute of Archaeology Iasi, Romanian Academy, Str. Codrescu nr. 6, Iasi, Romania

sav@tuiasi.ro

Abstract. In this research a short sword was studied, being a hybrid weapond between a sword and a Scythian dagger. Attributed to the 5th Century, our focus was to understand the archaeometalurgical context, also to create a scientific replica of the weapond. Made of wrought (bloomery) iron, the artefact was found in Iasi County, in an area with no further discoveries. In the geographical context the artifact could come from several ancient citadels like Poiana Mănăstirii, comuna Țibana, or Cetatea de la Poieni, comuna Dagâța from Iasi county.

Keywords: short sword, archaeometallurgy, 5th Century.

References:

[1] I. Sandu, O. Mircea, I.G. Sandu, V. Vasialche, The Liesegang Effect On Ancient Bronze Items Discovered In Romania, *International Journal of Conservation Science*, 4, SI, (2013), 573-586.
[2] O. Florescu, I.C.A. Sandu, P. Spiridon-Ursu, I. Sandu, integrative participatory conservation of museum Artefacts. Theoretical and practical aspects, *International Journal of Conservation Science*, 11(1), (2020), 109-116
[3] O. Golan, D. Cvikel, Y. Kahanov, Archaeometallurgical analysis of the bow drill from the fifth century BC Ma"agan Mikhael shipwreck, *Archaeological And Anthropological Sciences*, 11(6), (2019), 2581-2595, doi: 10.1007/s12520-018-0683-x.
[4] S.X. Qiao, W. Qian, Replication Experiments and Microstructural Evolution of the Ancient Co-Fusion Steelmaking Process, *Metals*, 10(9), (2020), 1261, doi: 10.3390/met10091261.

Contact Stress Simulation for Mg-0.5Ca-xMn Alloys Used for Medical Application

Roxana Oana NĂSTASĂ[1], Ana TUFESCU[1,*], Corneliu MUNTEANU[1,*], Bogdan ISTRATE[1], Gelu IANUȘ[1]

[1] Gheorghe Asachi Technical University, Faculty of Mechanical Engineering, Blvd. Mangeron, No. 43, 700050, Iasi, Romania

[*]ana.tufescu@yahoo.com , [*]cornelmun@gmail.com

Abstract. In the past decades, Mg alloys have been studied intensively as potential orthopedic applications. The present research work, the finite elemental analysis of the contact stresses resulted in the case of the load applied on Mg-0.5Ca-xMn alloys have been investigated. It has been used as model the NCB Curved Femur Shaft Plate type and it was tried to establish the necessary parameters for modeling, so that it would define as accurately the material studied. The aim of this research was to present the strain values observed at the contact point on the surface of the Mg-0.5Ca-xMn alloys. The results showed that the highest stresses appear near the holes of the plate and in the screws. It means that all loads are supported by the plate and screws, and the patient's femur can be recovered.

Keywords: contact stress simulation, finite element analysis, Mg-Ca-Mn alloys, femur.

Acknowledgment: This work was supported by a grant of the Romanian Ministery of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0239 / 60PCCDI 2018, within PNCDI III.

Hydrogen Energy in Russia - Industrial Waste Gases Utilization Potential

Sophia KISELEVA[1,*], Alexey TARASENKO[2], Vladimir SHAKUN[1], Dmitry AGARKOV[3]

[1]Lomonosov Moscow State University, Faculty of Geography, Leninskie Gory, 1, Moscow, 119999 Russia
Competences Centre: Interfaces-Tribocorrosion-Electrochemical Systems (CC-ITES), Faculty of Engineering, Dunarea de Jos University of Galati, 47 Domneasca Street, RO-800008 Galati, Romania.
[2] Joint Institute for High Temperatures of the Russian Academy of Sciences, 13/2 Izhorskaya str., Moscow, 125412, Russia
[3] Institute of Solid State Physics of the Russian Academy of Sciences, Chernogolovka, Moscow District, 2 Academician Ossipyan str., 142432

[*]k_sophia_v@mail.ru

Abstract. Hydrogen is supposed to be prospective energy carrier and even commercial product for the nearest future. One of the hydrogen energy main problems is hydrogen production problem with high energy consumption in electrolysis case and CO/CO_2 co-production in case of steam hydrocarbon reforming. At the same time several branches of industry are able to produce hydrogen as a by-product with different purity degree. Sodium and chlorine production plants can be a source of high-purity hydrogen. Low-purity hydrogen can be obtained from digester and sewage gas. In both cases there is economic interest to energy production from such hydrogen or its introduction into natural gas pipelines. Technical potential of such hydrogen source in Russia has been briefly estimated in case of fuel cells usage. Resource potential visualization maps have been created.

Keywords: hydrogen energy, hydrogen production, digester and sewage gas, technical potential, fuel cells.

References:

[1] A. Fedotov, D. Karanova, A. Tarasenko, S. Kiseleva, Use of Landfill Gas in Gas Turbine and Gas Piston Installations: Energy and Economic Assessments*, International Scientific Journal for Alternative Energy and Ecology*, 19-21, (2019),12-23.

Experimental Research Using the Finite Element Method on the Influence of the Cutting Tool Geometry on Temperature and Stresses in a Specific Cutting Process

Aurel Mihail ȚÎȚU[1,2,*], Alina Bianca POP[3]

[1]"Lucian Blaga"University of Sibiu, 10 Victoriei Street, Sibiu, România,
[2]The Academy of Romanian Scientists, 54, Splaiul Independenței, Sector 5, Bucharest, Romania, mihail.titu@ulbsibiu.ro
[3]Technical University of Cluj-Napoca, 62A, Victor Babeș Street, Baia Mare, Romania, bianca.bontiu@gmail.com

[*]mihail.titu@ulbsibiu.ro

Abstract. Parts machined by high cutting speeds can often exhibit high fatigue strength, increased micro-hardness in the surface layers and plastic deformations, due to the cutting edge radius of the tool associated with the induced stresses. The changing ofrake and clearance angles has an important influence on the chip formation, cutting forces, residual stresses, temperatures in both the workpiece and the tool. International research on the influence of geometric parameters of the tool on the entire cutting process, are of particular importance to understandthisprocess development. The approach of this study, considers the parametric realization of the cutting tool profile - a coated TiC turning chisel, which will be used in the finite element simulation of the orthogonal turning process. Deform 2D application, which is a powerful simulation engine was chosen and allows the correct simulation of the cutting process in real machining conditions. Deform 2D enables the automatically meshingand remeshinggeneration and also the optimization whenever needed and wherever is required a high accuracy, thereby reducing the overall difficulty of the problem and the computational requirements.

Keywords: rake angle, clearance angle, cutting process, finite element method, Lagrange method, mash.

References:

[1] V.P. Astakhov, Tribology of metal cutting, *Elsevier*, London, (2006).

Air pollution Reducer Using Cluster Corona Electric Field Net

Siseerot KETKAEW*

Ramkhamhaeng University, Ramkhamhaeng Street, 10240, Huamark, Bangkapi, Bangkok, Thailand

* siseerot@hotmail.com

Abstract. This article offers the air pollution reducer using cluster corona electric field net on principle of corona discharge, electric field intensity changing technique and efficiency filter. The experimental results are switching frequency increasing of high voltage at 2 kV equal to 20 kHz, 3 kV equal to 30 kHz, and 4 kV equal to 40 kHz which the testing of ozone gas quantity measuring will observation at electric field intensity equal 5 kV/cm enables generate ozone gas 0.57 ppm, 10 kV/cm enables generate ozone gas 1.28 ppm and 15 kV/cm enables generate ozone gas 2.37 ppm. Therefore this research was funded activities to promote and support research of the Ministry of Higher Education, Science, Research and Innovation from the Department of Ramkhamhaeng University, fiscal year 2021 and can be developed into commercial innovations in the future.

Keywords: corona, air pollution, ozone gas, dust, toxic gases

References:

[1] S. Ketkaew, (2017). Development of Corona Ozonizer Using High Voltage Controlling of Produce Ozone Gas for Cleaning in Cage, *Modern Environmental Science and Engineering,* (ISSN 2333-2581), 3(7), (2017), 505-509, doi: 10.15341/mese (2333-2581)/07.03.2017/011.

[2] S. Ketkaew, Plasma Ozonizer Using Micro-Converter for Ammonia (NH_3) Decreasing in Shrimp Food Production, *Procedia Engineering,* 32, (2012), 148-154.

Experimental Study by the Influence of the Cutting Edge Radius of the Tool in the Cutting Process Simulation Using the Finite Element Method

Alina Bianca POP[1], Aurel Mihail ȚÎȚU[2,3,*]

[1]Technical University of Cluj-Napoca, 62A, Victor Babeș Street, Baia Mare, Romania
[2]"Lucian Blaga"University of Sibiu, 10 Victoriei Street, Sibiu, România,
[3]The Academy of Romanian Scientists, 54, Splaiul Independenței, Sector 5, Bucharest, Romania

[*]mihail.titu@ulbsibiu.ro

Abstract. Machining operation using tools with a cutting edge radius leads to obtain parts with high fatigue strength, with significant microhardness in the surface layers and plastic deformations. The cutting process simulation using the finite element method provides a better understanding on chip formation mechanism, on heat generation in the cutting areas as well as on obtaining the results of stress and temperature fields.This research is emphasizing the real importance of the mathematical model thatunderlyesthe tool geometry in the preprocessingstep of the finite element analysis. The argument in this respect is that by its achieving and definition depends the meshing difficulty.This research purposeis to perform thesimulations series of the orthogonal turning process with different variations of the cutting edge radius and cutting depth.In this way, own conclusions and points of view on the influences caused by these variations on the entire cutting process were drawn.

Keywords: finite element simulatiom, cutting edge radius, specific pressures, Von Misses stresses, cutting forces.

References:

[1] P.J. Arrazola, P.Aristimuno, D.Soler, T. Childs, Metalcutting experiments and modelling for improved determination of chip/toolcontact temperature by infrared thermography, *CIRP Annals*, 64(1), (2015), 57-60.
[2] P.J.Arrazola, T. Özel, D.Umbrello, M.Davies, & I.S. Jawahir. Recent advances in modelling of metal machining processes. *CIRP Annals*, 62(2), (2013), 695-718.

Analysis of Environmental Stress in Sediments Made Possible by Electrochemical Mapping with Novel Multilayer Probes

Radu POPA[1], Ioana Corina MOGA[2],
Vily Marius CIMPOIAŞU[1*]

[1]University of Craiova, Biology and Environmental Protection Department, 13 A.I. Cuza Street, RO-20058 Craiova, Romania.
[2]DFR Systems SRL, R&D Department, 46 Drumul Taberei Blvd., RO-061392 Bucharest, Romania.

[*]radu.o.popa@gmail.com

Abstract. Marine sediments with rapid oxic/anoxic dynamics are difficult to monitor and characterize in real time. Organic overload that may lead to anoxia and buildup of hydrogen sulfide can be caused by a variety of factors including sewage spills, harbor water stagnation, algal blooms and vicinity of aquaculture operations. We have tested a novel multiprobe technology (SPEAR instruments) on marine sediments to evaluate performance in monitoring sediments and the sediment overlaying water. Results show the ability of SPEAR probes to distinguish electrochemical changes in marine sediments at 1-3 mm resolution, in 64 layers and sub-hourly timeline. SPEAR probes have the ability to characterize redox interfaces and electrochemical tansition zones in sediments without the use of manipulators. It is proposed that best target habitats for SPEAR-based monitoring are rapidly evolving muddy deposits and near aquaculture operations where pollution with fish manure is hazardous to the marine ecosystem. We discuss strategies for electrochemical mapping in large marine habitats that are stressed by organic deposits.

Keywords: marine sediments, monitorization, redox transition zones, electrochemical mapping.

References:

[1] P. Chitrakar, M.S. Baawain, A. Sana, A. Al-Mamun, Current Status of Marine Pollution and Mitigation Strategies in Arid Region: a Detailed Review, *Ocean Science Journal*, (2019), 317-348.

Performances of RENE 41 as Hot-Copper Extrusion Die Material

Robert CIOCOIU[1*], Michal SCHWARZ[1], Ion CIUCA[1], Dan GHEORGHE[1], Octavian TRANTE[1]

[1]Materials Science and Engineering Faculty, University Politehnica of Bucharest, 313 Splaiul Independentei Street, RO-060042, Bucharest, Romania

[*]ciocoiurobert@gmail.com

Abstract. Superalloys are the most complex materials created by humans, given their great number of alloying elements present [1]. Specially designed for use at high temperatures, the superalloys are mainly used in aerospace applications where high temperature strength and tight tolerances are required. RENE 41, a nickel based superalloy, is mainly used in gas turbine components [2] and its potential use as extrusion die material is not thoroughly studied. For this research an extrusion die was manufactured and used in service for the hot-extrusion of copper, performed at 850°C. The die was removed from production post extrusion of 14 tons of copper (a quantity that is double when compared to previous tools steel dies [3]) and studied for changes in microstructure. A hardness map was constructed following hardness measurements on the surface of the die, followed by study by light microscopy, scanning electron microscopy and X-ray diffraction. The results showed a good performance of the die: small variation in hardness was noticed near the orifice where also hairline cracks were observed. The microstructure was mostly unaltered, except the regions where high temperatures were reached following direct contact with the hot copper. The Cr23C6 carbide formed on the grain boundary depleting the solid solution of chromium and consequently reducing the reinforcing phase content.
Given the slight structure alteration, it was appreciated that the die was near its half-service life. Its use could be extended for the extrusion of at least 14tons of copper.

Keywords: superalloy, RENE 41, hot copper-extrusion, extrusion die.

References:

[1] M. Donachie, S. Donachie, Superalloys, A Techincal Guide, Second Edition, ASM International, (2002), 30 – 38.
[2] J.R. Davis, Nickel, Cobalt and their Alloys, *ASM Speciality Handbook*, ASM International, (2000), ISBN 0-87170-6857.

Antimicrobial Behavior of Some Polymeric Recipes Loaded with Essential Oils to Be Used in Wound Healing Applications

Aurora ANTONIAC[1*], Iulian ANTONIAC[1], Elena GROSU[1], Lia Mara DITU[2], Anca Daniela RAICIU[3]

[1]Faculty of Materials Science and Engineering, University Politehnica of Bucharest, 313 Splaiul Independentei, 060042, Bucharest, Romania.
[2]Faculty of Biology, University of Bucharest, 4-12 Blv. Regina Elisabeta, 030018, Bucharest, Romania
[3]S.C. HOFIGAL EXPORT-IMPORT S.A., 2-4 Int. Serelor, 042124, Bucharest, Romania

[*]antoniac.aurora@gmail.com

Abstract. The research work proposes to analyse the antimicrobial behavior of some intelligent biopatches as concrete and convenient solution for the topical treatment of bedsores, avoiding in this way the affected area debridement or surgical interventions on larger areas. The wound dressing, object of this research contain drug and essential oils encapsulated within dendritic polymers like β-cyclodextrins, to be released in a controlled manner directly at cutaneous wound level in order to maintain all time a constant concentration on wound. The biopatches due to the biopolymer support for essential oils encapsulated, exhibit optimal release characteristics in relation with the application site and therapeutical indication. The antimicrobial efficacy is been reported against *Trichoderma viride, Aspergillus niger, Penicillium niger* grown on PDA (potato dextrose agar) media.

Keywords: antimicrobial biopatches, wound dressing, bedsores healing, essential oils, biopolymers, controlled release of active substances.

Acknowledgements: This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-5236, within PNCDI III.

References:

[1] R.F.S. Barbosa, E.D.C. Yudice, S.K. Mitra, D.S. Rosa, Characterization of Rosewood and Cinnamon Cassia essential oil polymeric capsules: Stability, loading efficiency, release rate and antimicrobial properties, *Food control,* 121*,* (2021), 1-8.

Protection Against Mechanical Risks Provided by Gloves Used by Firefighters in Intervention Actions

Constantin ARVINTE[1], Liliana HRISTIAN[1], Diana-Petronela BURDUHOS-NERGIS[1], Mihai Adrian BERNEVIG[1], Stefan-Lucian TOMA[1], Ioan Gabriel SANDU[1] and Costica BEJINARIU[1,*]

[1]"Gheorghe Asachi" Technical University of Iasi, 67 "D. Mangeron" Street, 700050, Iasi, Romania

[*]costica.bejinariu@tuiasi.ro

Abstract. The safety of firefighters during the intervention is determined by the performance of the personal protective equipment used. The behavior of the materials used in the manufacture of protective gloves under the action of risk factors has a significant influence on the degree of safety it provides to the user. This paper presents the conditions that must be met by materials used in the manufacture of protective gloves for firefighters and describes the results of tensile and abrasion resistance tests obtained in the case of a material on which a treatment has been applied, in order to increase protective capabilities.

Keywords: firefighter gloves, safety, mechanical testing, protective capabilities.

References:

[1] M. Araujo, Natural and manmade fibers: Physical and mechanical properties, in „Fibrous and composite materials for civil engineering applications", *Woodhead Publishing Ltd.,* Cambridge, UK, (2011).
[2] V. Blascu, Fibre textile cu destinații speciale și înalt performante, *Ed. Performantica*, Bucuresti, (2007).
[3] Standard EN 659+A1:2009.

Introduction of Residual Chlorine Sensor using Constant Voltage Method and its Measurement Principles

Juhyeong KIL

Lotus Prosuming Management,
3F, 3 Hangeulbiseok-ro 46na-gil, Nowon-gu, Seoul, Korea

kjh@lotuselectrode.com

Abstract. In the past, we could never imagine buying drinkable water. Who would buy to drink water? But now, bottled water are sold just about anywhere in the world, but there are still many countries with water supply shortages. When drinking water is contaminated with microorganisms, it can be exposed to various diseases such as hepatitis, cholera, diarrhea, and typhoid fever. We are not only interested in drinking water, but also the water used in bathrooms, gardens, and laundry of each household. We mention “water quality” because all of these kinds of water are enough to give us a direct stimulus such as odors and greens. When we use tap water in each household, the most direct irritation is the “smell”. In this case, we know that chlorine comes to mind first, and that chlorine is very useful in disinfection. Then, why are we sensitive to toxic odors in drinking water or swimming pools? The answer is simple. The effect of disinfecting with chlorine is only exerted in clear water, and we need to focus on the analysis of residual chlorine that is important for instrumental analysis. Therefore, what is introduced in this study is a “residual chlorine sensor” of a new constant voltage method that can be more accurate in measuring the amount of residual chlorine in water which is the most important factor when it comes to effectively disinfecting our drinking water.

Keywords: water quality, residual chlorine sensor, constant voltage method, water disinfection, drinking water, clean water.

Analysis of the Influence of the Mold Temperature in the Weld Line Areas on Strength of the Injection Moldings

RomanHUMIENNY[1], Przemysław POSTAWA[1], Aleksandra KALWIK[1,*]

[1]Department of Technology and Automation, Faculty of Mechanical Engineering and Computer Science, Czestochowa University of Technology, POLAND

[*]kalwik@itm.pcz.pl

Abstract. The weld lines that occur in injection moldings are critical areas on which depends on the strength of the moldings. The flow of the material in the injection mold takes place through the gate and then gradually in the mold cavity. Depending on the shape of the formed object, the weld line may or may not occur. In the case of spreading of plastic streams or bypassing obstacles in the form of cores in the mold, the joining lines run down. Most often, the strength of the molded part is the lowest in these areas and the resulting lines can cause cracking. The aim of the research presented in the publication was to evaluate the properties of particulat parts of moldings obtained from an experimental injection mold equipped with 4 wel line areas. The tests were performed using the method of thermal analysis by Dynamic Mechanical Analysis DMA. Tensile tests were performed on the parts with weld areas and the maximum crack force was determined. The morphology of the obtained fractures was observed using an optical microscope.

Keywords: strenght, injection molding, mold temperature, Dynamic Mechanical Analysis.

Biosynthesized of Silver and Copper's Nanoparticles using Beijing Grass (*Murdannia loriformis)* as Reducing Agent and their Antibacterial Potential

Norain ISA[1], Wan Zuraida WAN KAMIS[1], Mohamad Sufian So'aib[1], Mohd Azahar MOHD ARIFF[1] Noor Fitrah ABU BAKAR[4], Nurul Hazira ZIZIEMURIKAN[1], Mohamed Syazwan OSMAN[1,2,3,*]

[1]School of Chemical Engineering, College of Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang,13500 Permatang Pauh, Penang, Malaysia
[2]EMZI-UiTM Nanoparticles Colloids & Interface (NANO-CORE) Industrial Research Laboratory, Universiti Teknologi MARA, Cawangan Pulau Pinang,13500 Permatang Pauh, Penang, Malaysia
[3]Center of Excellence Geopolymer and Green Technology (CEGeoGTech), Universiti Malaysia Perlis, Perlis 01000, Malaysia
[4]School of Chemical Engineering, College of Engineering, Universiti Teknologi MARA,40450 Shah Alam, Selangor, Malaysia

[*]syazwan.osman@uitm.edu.my

Abstract. In recent decades, the increasing occurrence of infectious diseases has posed a significant threat to public health in the 21st century. Silver nanoparticles (AgNPs) and copper nanoparticles (CuNPs) incorporated in in fabrics layer have been proven to help kill bacteria and viruses that contact them. In this study, Beijing grass capped silver nanoparticles (BgAgNPs) and copper nanoparticles (BgCuNPs) were prepared via salt reduction method using Beijing grass (*Murdannia loriformis*) as a naturally derived reducing agent and stabilizing agent. Antimicrobial activity on the as-made nanoparticles indicated nanoparticles positive efficacy towards tested bacteria.

Keywords: Antibacterial, Beijing grass, biosynthesized, copper

References:

[1] N. Isa, N.A. Bakhari, S.H. Sarijo, A. Aziz, Z. Lockman, Kyllinga brevifolia mediated greener silver nanoparticles. In *AIP Conference Proceedings*, 1901(1), (2017), 020012.

Effect of Fibre Contents toward Manufacturing Defects and Interfacial Adhesion of *Arenga Pinnata* Fibre Reinforced Fibreglass/Kevlar Hybrid Composite in Boat Construction

Suriani MAT JUSOH[1,2], Che Mohd Ruzaidi GHAZALI[1,2*], Wan Norani WAN NIK[1,2], Fakhratul Ridzwan ZULKIFLI[1,2], Sapuan SALIT[3], Ilyas RUSHDAN[4], RohaniMUSTAPHA[1,2], Nurul Naziera ZULKIFLI[1,2], Nur Dayana Syazwani MOHD ASRI[1,2].

[1]Faculty of Ocean Engineering Technology and Informatics, UniversitiMalaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.
[2]Marine MaterialsResearch Group,Faculty of Ocean Engineering Technology and Informatics, UniversitiMalaysia Terengganu, 21030 Kuala Nerus, Terengganu
[3]Department of Mechanical and Manufacturing Engineering, Faculty of Engineering,Universiti Putra Malaysia, 43400 Serdang, Serdang, Selangor.
[4]Department of Chemical Engineering, Faculty of Engineering,Universiti Teknologi Malaysia, 81310 Skudai, Johor Bharu, Johor.

[*]ruzaidi@umt.edu.my

Abstract. In recent years, *Arenga Pinnata* fibre has been found with great potential to be used as fibre reinforcement in material matrix composites. This study investigates the effect of fibre contents toward manufacturing defects and interfacial adhesion of *Arenga Pinnata* fibre reinforced Fiberglass/Kevlar hybrid composite material in boat constrruction. The composite testing coupons were prepared based on the volume fraction of *Arenga Pinnata* fibre which are 30%, 45%, 60%, and 75%. The long Arenga Pinnata fibre was placed and arranged into the mould by hand lay-up technique. The testing coupon have been arranged with a thickness of 5mm. Manufacturing defects and interfacial adhesion had determined by Scanning Electron Microscopy (SEM) techniques. As a conclusion, 60% of *Arenga Pinnata* fibre contents showed less manufacturing defects and exhibited good interfacial adhesion.

Keywords: Hybrid composites, adhesion, fibre reinforced composites


EURO®
INVENT

SECTION 4

MATERIALS & LIFE SCIENCE

Education through Innovation in the field of Metallic Materials Science

Adrian IOANA[1,*], Daniela TUFEANU[1], Dragos Florin MARCU[1], Bogdan FLOREA[1], Daniela Alice LUTA[1], Bianca Cezarina ENE[1], Daniela Ionela JUGANARU[1]

[1]University Politehnica of Bucharest, Faculty Science and Engineering Materials, Bucharest, Spl. Independentei 313, 060442, Romania.
[2]Department of Engineering and Management ok Metalic Materials Obtaining

[*]adyioana@gmail.com

Abstract. The importance of the innovation process lies in its main function, that of generating and leading to the conception and development of new processes and products, based on creativity. Hence the need of education for innovation. In this article we present, for a start, the main stages of an innovation process. Then, elements of innovation management, innovation strategies, innovation activities. We also present aspects regarding the financing of the innovation process and of the technology transfer. As results of the efficient application of these theoretical elements specific to an innovation process, we present the main elements of a patent (Invention Patent no. 107025/1993) of one of the authors. This patent, entitled "Burner" has gone through all stages, from conception to implementation in industry. This implementation took place in the former Special Steels Plant ok Targoviste (COST), in Electric Steel Mill no. 1 (OE1), with a good technological and economic efficiency.

Keywords: education, innovation, metallic materials science, innovation strategies

References:

[1] I. Adrian, Noi Descoperiri, Noi Materiale, Noi Tehnologii, *Editura Printech*, , Bucureşti, (2013), ISBN 978-606-23-0069-2.
[2] I. Adrian, A. Gaba, L. Pãunescu, Burner, *Invention Patent no. 107025/1993*, OSIM, Bucharest, (1993).

Methods of Conservation the Residential and Public Architecture of the 19th – Early 20th Centuries (on the Examples of Kyiv and Cracow)

Mykola ORLENKO[1], Yulia IVASHKO[2]*, Dominika KUŚNIERZ-KRUPA[3], Justyna KOBYLARCZYK[3], Oleksandr IVASHKO[2]

[1] Ukrrestavratsiia Corporation, 6 Boryspilska Street, Kyiv, 02099, Ukraine
[2]Kyiv National University of Construction and Architecture, 31 Povitroflotskyi Avenue, Kyiv, 03037, Ukraine
[3]Cracow University of Technology, 24 Warszawska Street, 31-155, Cracow, Poland

* yulia-ivashko@ukr.net

Abstract. The article examines the phenomenon of "pseudo-Gothic" and "neo-Gothic" in the architecture in Kyiv and Cracow in the 19th – early 20th century. There are three essential features of historicism with elements of Gothic: free interpretation by architects of the "token" elements of medieval Gothic which were often combined with the elements of Renaissance and Baroque architecture and some details of Art Nouveau; "Kyiv neo-Gothic" was a purely "facade style", which did not affect the changes in the characteristic plans of residential buildings; the limited use of stylized and simplified Gothic motives. But in Cracow it was an attempt to revive the national style – the embodiment of national identity.The difference between the Cracow neo-Gothic style and the Kyiv one was primarily in the fact that such buildings were only public or sacred objects.

Keywords: Gothic motifs, stylization, facade style, Kyiv, Cracow, residential and public buildings, churches, features of restoration.

References:

[1] M. Orlenko, The system approach as ameans of restoration activity effectiveness, *Wiadomości Konserwatorskie – Journal of Heritage Conservation,* 57, (2019), 96 -105.

Automated Supplier Risk Evaluation System

Eduard-Paul SCHELEGIA[1*], Traian FLEŞER[1]

[1]Mechanic machines, utility vechicules and transportation, Politehnica University Timişoara, Timişoara, Romania.

[*]eduard.schelegia@student.upt.ro

Abstract. One key aspect in the manufacturing process is the monitoring of the third-party suppliers, a potential disruption in this component would have impact in the whole chain of manufacturing and potentially have risks in monetary aspects and in reputation loss. Even tough stated by contract delivery dates and the quality of the delivery content might vary in between shipments even with well-established providers due to technological changes of changes in the quality process. To minimize this risk and to partially take out the subjective human factor, the current paper proposes the implementation of an impartial observer system that based upon a set of key performance indicators will assign a trust rating to each third party. With the option of both human and a machine input the system can be used as an indicator to how reliable the business with a certain entity is and if the risks would be acceptable for a better price offer.

Keywords: manufacturing, key performance indincator, risk, supplier management.

Finishing Materials for Facades and Interiors of Art Nouveau Buildings (on the Examples of Ukraine and Poland)

Yulia IVASHKO[1,*], Ann KOROVKINA[2], Iryna YERMOLENKO[3], Valerii TOVBYCH[1], Dominika KUŚNIERZ-KRUPA[4], Justyna KOBYLARCZYK[4]

[1]Kyiv National University of Construction and Architecture, Povitroflotskyi Avenue, 31, Kyiv, 03037, Ukraine.
[2]O.M. Beketov National University of Urban Economy in Kharkiv,17 Marshal Bazhanov Street, Kharkiv, 61002, Ukraine.
[3]National Technical University "Kharkiv Polytechnic Institute", 2 Kyrpychova Street, Kharkiv, 61002, Ukraine.
[4] Cracow University of Technology, Warszawska 24, Cracow 31-155, Poland.

[*] yulia-ivashko@ukr.net

Abstract. The article is devoted to the study of Art Nouveau buildings in the cities of Ukraine and Poland. Considering the vastness of Art Nouveau heritage in Ukraine and Poland, the authors limited themselves to only one narrow aspect – finishing materials and four cities – Kyiv, Kharkiv, Krakow and Lodz. The buildings of the northern national romanticism, in which natural raw stone was widely used, were distinguished by the specifics of the decoration. The Polish Art Nouveau version formed in the mainstream of European trends and under the direct influence of the Vienna Secession. By the example of objects in Krakow and Lodz, different methods of finishing the facades of buildings with various functional purposes shown. The scientific novelty of the article is the analysis of the chemical compositions of paints and plasters of the Secession period and modern methods of restoration.

Keywords: Art Nouveau, facades and interiors, finishing materials

References:

[1] Y. Ivashko, T. Kuzmenko, S. Li, P. Chang, The influence of the natural environment on the transformation of architectural style, *Landscape architecture. Scientific Journal of Latvia University of Agriculture*, 15(15), (2020), 101-108.

Historical and Educational Aspects of Discoveries and Inventions that Revolutionized Mankind

Adrian IOANA[1,*], Daniela TUFEANU[1], Dragos Florin MARCU[1], Bogdan FLOREA[1], Daniela Alice LUTA[1], Bianca Cezarina ENE[1], Daniela Ionela JUGANARU[1], Roxana Marina SOLEA[1]

[1]University Politehnica of Bucharest, Faculty Science and Engineering Materials, Bucharest, Spl. Independentei 313, 060442, Romania.

[*]adyioana@gmail.com

Abstract. This article presents discoveries and inventions from different periods of mankind, which played an important role in social and technological evolution. Thus, from the period of the Ancient World (prehistory - 400 AD), we present: the appearance of stone tools (which occurred in East Africa and belongs to the first hominids); pottery (appeared in 10500 BC); the development of metallurgy (began in the Middle East, around 6500 BC); the invention of the ox-drawn plow (which occurred around 4000 BC); the construction of the first pyramid in Egypt (2600 BC); the development of iron processing (as part of the development of metallurgy, it occurred around 1400 BC); modernization of papermaking technology (attributed to Tsai Lun, China, around 105 AD); Another historical period that we analyzed in terms of discoveries and innovations that revolutionized humanity was the Middle Ages (400 - 1500). Thus, from this period we presented the following discoveries and inventions: the discovery of the number zero (occurred in 520 and belongs to Indian mathematicians); woodcut printing (appeared in sixth century China); the first printed newspaper (year 700); the development of algebra (it belongs to the Greek mathematician Diophantos, 3rd century AD); gunpowder (it was discovered around 850); the establishment of the University of Bologna (made in 1088);

Keywords: discoveries, inventions, historical periods, human revolution.

References:

[1] I. Adrian, Noi Descoperiri, Noi Materiale, Noi Tehnologii, *Printech*, Bucureşti, (2013), 15-47, ISBN 978-606-23-0069-2.

The Specificity of the Restoration and Monument Protective Measures for the Preservation of Historical Chinese Gardens

Mykola ORLENKO[1], Yulia IVASHKO[2,*],Peng CHANG[2], Yang DING[2], Michał KRUPA[3], Kazimierz KUŚNIERZ[3]

[1] Ukrrestavratsiia Corporation, 6 Boryspilska Street, Kyiv, 02099, Ukraine.
[2]Kyiv National University of Construction and Architecture, 31 Povitroflotskyi Avenue, Kyiv, 03037, Ukraine.
[3]Cracow University of Technology, 24 Warszawska Street, 31-155, Cracow, Poland.

[*] yulia-ivashko@ukr.net

Abstract. The relevance of research and preservation of Chinese historical gardens with small forms is due to several factors. The unique heritage of Chinese landscape design, represented by the gardens of Suzhou, is today listed as a UNESCO World Heritage Site and is an international tourist attraction. It is a source of research on traditional Chinese landscape design techniques based on the principles of Feng Shui, Taoism, Buddhism and Confucian doctrines. All Chinese gardens had been developed with the use of established rules and techniques, among which the authors have described eight main ones that are present in the gardens of Suzhou. The methods of figurative expressiveness of pavilions in different regions of China are systematized. Comparison of historical and modern Chinese pavilions demonstrated the narrowing of figurative means, the use of a narrow range of historical prototypes (mainly in the east and southeast), in which the national features of the small-scale architecture are vividly pronounced.

Keywords: historical Chinese gardens, landscape techniques, conservation

References:

[1] Yu. Ivashko, D. Kuśnierz-Krupa, P. Chang, History of origin and development, compositional and morphological features of park pavilions in Ancient China. *Landscape architecture, Scientific Journal of Latvia University of Agriculture 15(15)*, (2020), 78-85.

Innovative Miniaturized Approach by MicroNIR and Chemometrics for the Monitoring of the Occupational Exposure of Workers

Giuseppina GULLIFA[1], Roberta RISOLUTI[1]

[1] Department of Chemistry "Sapienza" University of Rome

[*]roberta.risoluti@uniroma1.it

Abstract. In this work, an innovative screening platform is developed and validated for the on-site detection of cladribine during pharmaceutical productions, for the monitoring of the worker's exposure to drugs. The novelty of this completely automated tool, consists of a miniaturized NIR spectrometer operating in a wireless mode that permits to process samples in a rapid and accurate way and to obtain the early detection of the residual amount of cladribine on a filter membrane. Simulated samples were realized to instruct the platform and prediction models were developed by chemometric analysis of the NIR spectra using Partial Least Square regression algorithms. Validation of the system was achieved by comparing results with those obtained from the GC-MS analyses and a good correlation was observed.

Keywords: life sciences, new method, MicroNIR, chemometrics, occupational exposure.

References:

[1] A. Saven, L. Piro, *Annals of Internal Medicine*,120, (1994), 784-791.
[2] R. Risoluti, S. Materazzi, MicroNIR/chemometrics assessement of occupational exposure to hydroxyurea, *Frontiers in Chemistry,* 6, (2018), 248.

Ways of Performance and Preservation of Monumental Art Works on the Facades of Architectural Monuments of the 19th – Early 20th Century

Yulia IVASHKO[1,*], Michał KRUPA[2], Kazimierz KUŚNIERZ[2], Piotr GRYGLEWSKI[3], Andrii DMYTRENKO[4]

[1]Kyiv National University of Construction and Architecture, 31 Povitroflotskyi Avenue, Kyiv, 03037, Ukraine.
[2]Cracow University of Technology, 24 Warszawska Street, 31-155, Cracow, Poland.
[3]Institute of Art History, University of Lodz, 65 Narutowicza Street, 90-131, Lodz, Poland.
[4]National University "Yuri Kondratyuk Poltava Polytechnic", 24 Pershotravnevyi Avenue, Poltava, 36011, Ukraine.

[*] yulia-ivashko@ukr.net

Abstract. One of the restoration important tasks is to preserve the original monumental art works on the historic buildings facades. The stylistics of buildings in the Central Ukraine cities in the second half of the 19th – early 20th centuries was analyzed and it was proved that ceramic decor was used to a rather limited extent, mainly in the form of decorative inserts and cornice strips of one colour. Polychrome majolica panels also did not become widespread. The exception is the direction of Ukrainian national romanticism, which can be called "ceramic Art Nouveau" and most vividly embodied in the Poltava Provincial Zemstvo building and the memorial chapel in Poltava. Original examples of Secession period monumental art have been preserved on the buildings' facades in Cracow and Lodz. A common technique is the combination of typical Art Nouveau forms with rich sculptural and ornamental decorations.

Keywords: monumental art, restoration, facades, architectural monuments

References:

[1] M. Orlenko, I. Buzin, Stylistic peculiarities, features of the use of building materials and structures in buildings of the latter half of the nineteenth century and the early twentieth century, and methods for their restoration (evidence from Ukraine), *Wiadomości Konserwatorskie – Journal of Heritage Conservation, 59***,** (2019), 97-105.

Degradation Ability of Indigenous Bacteria from Pesticide-Contaminated Water and Soil in Brebes Regency, Indonesia

Dina ISTIQOMAH[1,*], IRWANDHI[1], Haris Raditya SUBANDRIO[2], Hilmy Ihza RAKHMAN[1], Ilham Filsa Satria NUGROHO[1], HENDRA[1], Annisa ISLAMIATI[1]

[1]Agrotechnology, Faculty of Agriculture, Jenderal Soedirman University, Indonesia.
[2]International Biology, Faculty of Biology, Jenderal Soedirman University, Indonesia.

[*]dinaistiqomah@unsoed.ac.id

Abstract. Brebes regency is the center of shallot cultivation in Indonesia. Chemical pesticides are very frequent and widely used to control pest and disease of shallot. The use of chemical pesticides adversely affects human health and the environment. Bioremediation of pesticide-contaminated environments using microbes that come directly from the polluted environment is a promising, effective, and harmless for the environment. Indigenous-bacteria could be the eminent agent because they are able to remediate pesticides with a high level of effectiveness compared to agents from outside the environment. This is needed to solve the problem of pesticide pollutants that have no solution in Brebes Regency and other agricultural areas. The aim of this research was to obtain bacterial isolates that can degrade pesticide contamination by exploring bacteria in a polluted environment. This research was conducted by isolating bacteria and characterizing the existing bacteria in the shallot cultivation from Brebes Regency. Bacteria were taken from soil and water in the shallot cultivation and irrigation channels. The research methods include biochemical tests, pesticide degradation abilty test and analysis of pesticides and metabolites using HPLC. Four isolates were promising to be potential pesticide-degrading agent. The prospect of this research is could produce a product in the formula of bacteria which can be a pesticide-bioremediation agent.

Keywords: bacteria, pesticide, environment, bioremediation.

Uncomprehensive Requirements for Drinking Water Hardness: Conservation Indicators

Mihai LESNIC[1], Daniela Simina STEFAN[1*], Ioana Corina MOGA[2], Mircea STEFAN[3]

[1]University POLITEHNICA of Bucharest, Faculty of Applied Chemistry and Materials Science, Department of Analytical Chemistry and Environmental Engineering, 1-7 Gheorghe Polizu Street, RO-011061 Bucharest, Romania.
[2]DFR Systems SRL, R&D Department, 46 Drumul Taberei Blvd., RO-061392 Bucharest, Romania.
[3]University Titu Maiorescu, Pharmacy Faculty, 22 Dâmbovnicului Street, RO-040441 Bucharest, Romania.

[*]simina_stefan_ro@yahoo.com

Abstract. Although drinking water hardness and alkalinity have little sanitary significance, economic disadvantages make them important characteristics to be considered in taking decision in obtaining suitable conditions for a proper quality of water intended for human consumption. Soap-consumption and corrosive aspects are the most challenging to the engineers. Disparities in water quality parameters related to hardness have been observed with the Romanian and European legal acts. Romanian Laws 458 / 2002 and 311 / 2004 do not contain any provisions for calcium and magnesium maximum admissible concentrations and for minimum admissible residual hardness of water after the appliance of softening process. The minimum hardness value of 5 German Degree fixed by the Law 458 / 2002 was not compatible with the values indicated in the repealed 80 / 778 / EEC and replaced by CD 98 / 83 /EC.

Keywords: total hardness, temporary hardness, permanent hardness, soften water.

References:

[1] F. Kozisek, Regulations for Calcium, Magnesium or Hardness in Drinking Water in the European Union Member States, *Regulatory Toxicology and Pharmacology*, (2020), 104589.

A Study on the Surface Alteration of Mouth Guards Used in Sports

Alexandru STREZA[1*], Florin MICULESCU[1], Robert CIOCOIU[1], Aurora ANTONIAC[1], Iulian ANTONIAC[1]

[1]Materials Science and Engineering Faculty, University Politehnica of Bucharest, 313 Splaiul Independentei Street, RO-060042, Bucharest, Romania.

alexandru_streza@yahoo.com

Abstract. Serious injuries can occur in sports following head impacts, teeth clenching or blows to the mouth [1,2]. The use of mouth guards alleviates the impact or blow than can cause serious damage to the teeth, jaw, and tongue or even face injuries by the expense of its damage [2,3]. Usually made of poly (vinyl acetate-ethylene), polyurethane or laminated thermoplastics [2,3] the durability of the mouth guard needs to be evaluated in order to improve either the materials they are made of or the design.
The aim of the research was to study the surface of a used mouth guard to determine the regions of highest wear/damage and to improve the performance. A mouth guard used in a contact sport was obtained for this study and first observed by means of a stereomicroscope to find visible damaged regions where further tests are to be performed. Using FTIR the chemical composition on several regions was determined to see if saliva or sports drinks altered the composition. Using SEM surface damage was inspected and further profilometric tests were performed. Surface wetting was studied by means of contact angle measurements to see if damage/roughness alters in a significant manner the behavior. Preliminary results show that no severe surface damage could be identified using the stereomicroscope and following FTIR no significant composition change occurs.

Keywords: mouth guard, surface, alteration.

References:

[1] J.J. Knapik, S.W. Marshall, R.B. Lee, S.S. Darakjy, S.B. Jones, T.A. Mitchener, B.H. Jones, Mouth guards in Sport Activities, *J Sports Medicine*, 37, (2007), 120.

Possibilities for the Recovery of Sludge from Municipal Wastewater Treatment Plants through the Design and Production of Concrete

Ofelia CORBU[1,2,3,*], Irina SMICAL[4,*],
Valer MICLE[5], Ioan Gabriel SANDU[6]

[1]Faculty of Civil Engineering, Technical University of Cluj-Napoca, Memorandumului Street, 400114 Cluj-Napoca, Romania
[2]Research Institute for Construction Equipment and Technology, Bucuresti
[3]Center of Excellence Geopolymer& Green Technology (CEGeoGTech), School of Materials Engineering, Universiti Malaysia Perlis, 01000 Kangar, Perlis, Malaysia
[4]Faculty of Engineering, Technical University of Cluj-Napoca, North University Centre of Baia Mare, 62A Victor Babes Street, 430083 Baia Mare, Romania
[5]Faculty of Materials and Environmental Engineering, Technical University of Cluj-Napoca, 28, Memorandumului Street, 400114 Cluj-Napoca, Romania
[6]Faculty of Materials Science and Engineering, Gheorghe Asachi Technical University of Iasi, D. Mangeron 41, Iasi, Romania

*ofelia.corbu@staff.utcluj.ro; *irina.smical@cunbm.utcluj.ro

Abstract. The main objective of the present research was the design and realization of a concrete recipe of resistance class C16/20, based on the incorporation in the form of addition of sludge from the treatment plant of Baia-Mare City, Maramureș County, Romania. Until now, this type of sludge has been used on agricultural land as fertilizer both in the country and abroad. What makes it reshaping its use in construction materials is that this sludge contains in addition organic elements and hazardous heavy metals that can be retained in the matrix of the concrete mixture. The paper will present methods and results obtained in the research, which support the use of sludge from sewage treatment plants in dry granular form for strength concrete class C16/20 obtaining but with limited applicability.

Keywords: treatment plant sludge, waste, recycling, heavy metals, concrete mix design/ concrete class

References:

[1] S. Andrei, J. Stefan, DaCS Report 06: Requirements and recommendations for frost durable concrete. Test methods. Overview of national and international standards, codes, committees, representative projects. (2019). http://hdl.handle.net/11250/2598133.

Numerical Analysis of Blood Flow in Vessels

Katarzyna MORDAL[1,*], Arkadiusz SZAREK[1]

[1]Department of Technology and Automation, Faculty of Mechanical Engineering and Computer Science, Czestochowa University of Technology, 42-201 Czestochowa, Poland

[*]kmordal@iop.pcz.pl

Abstract. Nowadays, an increasing percentage of the society is facing cardiovascular diseases, which are favored by factors such as stress, low physical activity, nicotine addiction and bad diet. Bioengineers are increasingly involved in pre-operative planning and diagnostics of many diseases, including these connected with cardiovascular system, using computer aided design and engineering systems (CAD/ CAE) to facilitate the simulation, modelling of blood flow under different conditions. Therefore, the article is devoted to numerical analysis of the flow of blood-like substance in healthy and pathologically altered blood vessels in order to determine the influence of the degree of vessel stenosis on blood flow velocity and pressure distribution. Simulations are carried out on basis of Finite Element Method (FEM) using Autodesk Inventor Professional 2019 and ADINA 9.4 software at different stages of disease changes. The obtained results allowed to confirm the assumption of differences in blood flow in physiologically normal and pathologically altered vessels, which negatively affect the human body, leading to closure of the active cross-section of the blood vessel.

Keywords: blood flow, ADINA, vessel, disease changes, numerical modelling

The Traditional Wood House from Maramureș between Old and New

Veronica LUCA[1], Ofelia CORBU[1,2,3*], Ildikó BUCUR[1]

[1] Faculty of Civil Engineering, Technical University of Cluj-Napoca, 28, Memorandumului Street, 400114 Cluj-Napoca, Romania
[2] Research Institute for Construction Equipment and Technology, ICECON S.A. Bucharest, 266, Pantelimon Road, 2nd District, postal code 021652, CP 3-33, icecon@icecon.ro
[3] Center of Excellence Geopolymer & Green Technology (CEGeoGTech), School of Materials Engineering, Universiti Malaysia Perlis, 01000 Kangar, Perlis, Malaysia

[*]ofelia.corbu@gmail.com

Abstract. „The Romanian traditional architecture contains a series of proportions, ratios and results of some geometric routes, dominated by the golden number: Ø= $\frac{1+\sqrt{5}}{2}$ =1.618, number that expresses the closest connection between the whole volume and it's parts (the detail, the ornaments, completing only the volume, without suffocating it) ".
The old house from Maramureș within the traditional household fully represents the answer to the needs of the people sheltered in it, sedimented over time. From the sustainable point of view, we can say in this case that the use of this term in practice appeared even before the theoretical appearance of the concept itself. In this paper I propose two directions of analysis - the functionality and aesthetic framing of a house with Maramures features. Therefore I've chosen an old house from 1950 located on the original site that it will be repartitioned to accommodate a family with two children and a new house with traditional elements that meets the current requirements in terms of space and appearance.

Keywords: traditional architecture, sustainability, old and new

References:

[1] S. Păun, România – Valoarea arhitecturii autohtone, *Ed. Per omnes Artes*, București, (2003).

Water Quality Analysis of the Rivers Topolnitsa and Luda Yana, Bulgaria Using Different Indices

Kristina GARTSIYANOVA[1], Marian VARBANOV[1], Atanas KITEV[1], Stefan GENCHEV[1]

[1]National Institute of Geophysics, Geodesy and Geography, Department of Geography, Bulgarian Academy of Sciences (NIGGG-BAS), Sofia, Bulgaria, Acad. G. Bonchev Str., bl. 3, Sofia 1113, Bulgaria.

*krisimar1979@gmail.com

Abstract. This study focuses on the analysis of some of the worldwide use of surface water index estimates. The catchment areas of the two model basins of bulgarian rivers(Topolnitsa and Luda Yana) are subject to active anthropogenic load. There are numerous metallurgical plants, combines for non-ferrous metals, mines and tailing ponds have been operating in the area for many years, with heavy metals (copper, lead, zinc, silver, gold) being the final result of their production activity. In the same time the waters of the rivers have a varied application. To obtain an assessment of the water quality status of the Topolnitsa and Luda Yana rivers in Bulgaria, two different indices are used - Water Pollution Index (WPI) and the Bavarian Surface Quality Index (CJ). The first presents a summary of water quality in a given sample according to a set of physicochemical indices and is expressed as a non-dimensional quantity from 0 to 100 (0 is the worst and 100 is the best water quality) the set of reference values are defined. In the second one the researcher fully respects the pre-set indicators and reference values.

Keywords: water quality indexes, Topolnitsa, Luda Yana

Acknowledgments: Financial support from Bulgarian National Scientific Fund project КП-06-ОПР 03/3/ 14.12.2018 (Profiles of spatial differentiation of the quality of river waters is basins with various anthropogenic impact) of the Ministry of Education and Science, Bulgaria is gratefully acknowledged.

Analysis of the Quality of River Water in Sofia City District

Marian VARBANOV*, Kristina GARTSIYANOVA, Emilia TCHERKEZOVA, Atanas KITEV, Stefan GENCHEV

National Institute of Geophysics, Geodesy and Geography, Department of Geography, Bulgarian Academy of Sciences (NIGGG-BAS), Sofia, Bulgaria, Acad. G. Bonchev Str., bl. 3, Sofia 1113, Bulgaria.

* marian.varbanov@gmail.com

Abstract. The article analyzes the current status of the river waters in Sofia city district. The object of this study are the waters of the river Iskar and its tributaries in the selected area. The main hydrochemical indicators are analyzed in accordance with the national legislation for the period 2015-2019. Key points and areas of anthropogenic impact are determined. A complex assessment of quality of the river water is made using several indices: Water Quality Index (CCME) - Canada; Water Pollution Index (WPI) - Russia; Chemical Index for River Water Quality (CJ) - Germany.

Keywords: water quality indexes, Sofia city district

Acknowledgements: This work has been carried out in the framework of the National Science Program "Environmental Protection and Reduction of Risks of Adverse Events and Natural Disasters", approved by the Resolution of the Council of Ministers No 577/17.08.2018 and supported by the Ministry of Education and Science (MES) of Bulgaria (Agreement No Д01-363/17.12.2020).

Metal Removal from Surface and Wastewaters Using an Eco-Friendly and Sustainable Material

Ana MOLDOVAN[1,2*], Anamaria TOROK[1], Eniko KOVACS[1], Marius ROMAN[1], Erika LEVEI[1], Oana CADAR[1], Vanda BABALAU-FUSS[1], Marin SENILA[1], Valer MICLE[2]

[a]INCDO-INOE 2000, Research Institute for Analytical Instrumentation, 67 Donath Street, 400293 Cluj-Napoca, Romania.
[b]Technical University, Faculty of Materials and Environmental Engineering, 103-105 Muncii Boulevard, 400641 Cluj-Napoca, Romania.

[*]ana.moldovan@icia.ro

Abstract. In this study, the potential adsorption properties of a natural and modified (by chemical, thermal and thermo-chemical activation) Romanian zeolite was tested in order to obtain the maximum metal removal efficiency. The structural changes of zeolite achieved through activation were studied by X-ray diffraction (XRD), Fourier-transform infrared spectrometry (FT-IR) and cation exchange capacity analysis (CEC). Adsorption experiments were carried out for 72 h at room temperature, using a zeolite/liquid ratio of 1 g/50 mL. For the adsorbtion tests, highly contaminated surface and wastewaters were used. The metal concetrations (Mn, Fe, Ni, Cu) were determinated before and after the adsorbtion experiments using inductively coupled plasma mass spectrometry (ICP-MS). Although, the chemical and thermo-chemical activation methods had a positive effect on the CEC values, the FT-IR and XRD analyses did not indicated any notable changes in the structure of activated zeolites. The obtained results showed that the highest metal removal efficiency was achieved for the thermally and thermo-chemically activated zeolite. After 72 h, the metal removal efficiency ranged between 12.8 and 100% in the case of surface waters and between 1.55 and 59.2% in the case of wastewaters.

Keywords: natural zeolite, activation, adsorbtion, metal removal, surface water.

Eggshell Powder (ESP) as Low-cost Adsorbent for Wastewater Treatment

Warid Wazien AhmadZAILANI[1,*], Mohd Fadzil ARSHAD[1], Nurliyana ISMAIL[1], Mohd Remy Rozainy Mohd Arif ZAINOL[2], Mohd Mustafa Al Bakri ABDULLAH[3], Muhammad Faheem Mohd TAHIR[3]

[1]School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.
[2]School of Civil Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Pulau Pinang, Malaysia.
[3]Center of Excellence Geopolymer and Green Technology (CEGeoGTech), Universiti Malaysia Perlis (UniMAP), 01000Perlis, Malaysia.
[4]Faculty of Chemical Engineering and Technology, Universiti Malaysia Perlis (UniMAP), 01000 Perlis, Malaysia.

*waridwazien@uitm.edu.my

Abstract. Filtration is the process which is majorly used in treating wastewater. Usually, the filter is located at the tertiary and as an advanced treatment process in wastewater treatment system. Filtration is the process where the solid particles are separated from the solution by passing it through porous pores. This process always comes together with the adsorption method and it depends on the type of filter media being used. Currently, activated carbon, zeolite and sand are widely used in treating wastewater influent. However, the increasing demands and materials cost had encouraged various approaches in finding solutions to replace the current filter media. Therefore, eggshell waste is introduced in this study as a replacement material for zeolite to treat wastewater impurities. The usage of eggshell waste as a new filter media is more beneficial which represents a low cost, renewable, available and sustainable approaches. The objectives of this study is to determine the optimum proportion of Eggshell Powder (ESP) as a filter media for wastewater treatment. As a conclusion, this study hopes that by utilizing an industrial waste as a low-cost adsorbent, the environmental ecosystem can be protected for the sake of next generations.

Keywords: eggsheel powder, adsorbent, wastewater treatment.

References:

[1] T. Jirawan, D. Phihusut, Phosphorus Removal from Wastewater using Eggshell Ash, *Environmental Science and Pollution Research,* (2018), 1-9.

Evaluation Of The Effect Of Rock Joints On The Stability Of Underground Tunnels

Rahimn AFIKAH[1,*], Taslim MOHD NASAE[2], Zabidi HAREYANI[2]

[1]Department of Geotechnics & Transportation, School of Civil Engineering, Faculty of Engineering,Universiti Teknologi Malaysia, Malaysia
[2] School of Material and Mineral Resources, Universiti Sains Malaysia, Penang, Malaysia

[*]afikahrahim@utm.my

Abstract. Generally it is pre mind setup that granitic terrain is always suitable for tunneling media and requirement of detail feasibility studies are minimize accordingly. To facilitated water supply and other utility en-route of water shortage states of main cities in Malaysia such as Kuala Lumpur, Putrajaya adn Cyberjaya , Pahang Selamngor Raw Water Stransfer Tunnel project is constructed. Facility tunnel of44.6 km length with 5.2 m finished dia are being constructed to transfer water from Karak to Hulu Langat. Granitic rock with dominant intrusive zones in various range of i untl V were observed in the studied tunnel length. Problematic zones categorized into fair, poor and very poor rock classes with occasional bands of good rock class based on rock tunneling grade point which has been classified by the Japanese Highway system (JHS) for the 1.927km of NATM-1. This zone observed created difficulties for tunneling. Heavy steel ribs were erected for rock mass supports in poor and very poor tunnel reaches as per design drawing. These complex zones are responsible for delaying the construction progress and created vulnerable situation for the tunneling work. Modifications /changes in excavations plan was done, which was very much essential as per the site condition to achieve the targeted quantity of excavation within the time frame. Intelligently changes in excavations were planned based on the anticipated poor rock masses at ahead of tunnels reaches. Modification was based on the subsurface exploration data. In this paper emphasis are made on the requirement of detailed feasibility study along the tunnel alignment even the tunneling media is made up of granite.

Keywords: meta sedimenatryrock terrain; Pahang Selangor Raw Water Transfer tunnels; Karak; Hulu Langat; New Austrian Tunnelling Method, Drill and Blast

PV panels application for water boilers

Sophia KISELEVA[1], Musy SOULEIMANOV[2], Alexey TARASENKO[2,*]

[1]Lomonosov Moscow State University, Faculty of Geography, Leninskie Gory, 1, Moscow, 119999 Russia
[2] Joint Institute for High Temperatures of the Russian Academy of Sciences, 13/2 Izhorskaya str., Moscow, 125412, Russia

a.b.tarasenko@gmail.com

Abstract. PV panels price decrease with average efficiency growth is a stable trend for modern solar energy technologies. In these conditions several companies proposed control systems for solar water heating, substituting solar collectors by PV panels. Advantages and disadvantages for such scheme application in Russian conditions are discussed in this paper. Results of PV water heater experimental testing in Moscow climate conditions and numerical simulation of collector versus PV panels in several Russian regions are also given, as the development of earlier economic estimations [1]. Both maximum power point tracking (MPPT) PV array control scheme and array with constant load discharge have been tested. MPPT revealed better efficiency, but special controller without battery application is needed.

Keywords: Water boilers, PV panels, Solar collectors, PV automation.

References:

[1] S.E. Frid, N.V. Lisitskaya, A.B. Tarasenko, N.D. Frolova, Suleimanov M.Zh. Photoelectric Water Heaters Use in Hot Climate Conditions. *Problemele Energeticii Regionale,* 3(47), (2020), 92-100.

Effect of P/Al ratio on the microstructure of phosphate based-geopolymers

Dumitru Doru BURDUHOS NERGIS[1], Petrica VIZUREANU[1,*], Dragos Cristian ACHIȚEI[1], Manuela Cristina PERJU[1], Andrei Victor SANDU[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Blvd. Mangeron, No. 51, 700050, Iasi, Romania

[*]peviz2002@yahoo.com
*

Abstract. An alternative for Ordinary Portland cement (OPC) consumption is the production and integration of green cement. In other words, the clinker consumption has to be replaced with new low-carbon binders. A possible solution was introduced by the geopolymerisation technology. However, the alkaline activation of geopolymers offers the possibility of obtaining greener materials with high properties, superior to OPC, but due to the high price of sodium silicate, their industrial use is limited. In the past few years, a new activator has been discovered, namely phosphoric acid. This study investigates the influence of H_3PO_4/Al_2O_3 ratio on the microstructure of phosphate acid based geopolymers. Accordingly, phosphoric acid, 85% by mass, was diluted in distilled water to obtain corresponding activation solution for H_3PO_4/Al_2O_3 ratio of 0.5, 1.0 and 1.5. Moreover, to evaluate the influence of the raw materials characteristics, three different types of aluminosilicates have been used as precursors or in blended systems.

Keywords: phosphate based geopolymers, SEM, mine tailings, acid activation, coal ash.

References:

[1] H. Majdoubi, Y. Haddaji, S. Mansouri, D. Alaoui, Y. Tamraoui, N. Semlal, M. Oumam, B. Manoun, H. Hannache, Thermal, mechanical and microstructural properties of acidic geopolymer based on moroccan kaolinitic clay, *J. Build. Eng.* (2021), *35*, doi:10.1016/j.jobe.2020.102078.

Fluorine-doped SnO_2 thin films in solar cell applications. Morphological, optical and electrical proprieties

Petru LISNIC[1,*], Laura HROSTEA[2], Liviu LEONTIE[1], Mihaela GIRTAN[3]

[1]Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Bulevardul Carol I, nr. 11, 700506, Iasi, Romania
[2]Research Center on Advanced Materials and Technologies, Science Department, Institute of Interdisciplinary Research, Alexandru Ioan Cuza University of Iasi, Blvd. Carol I, no. 11, 700506 Iasi, Romania
[3]Photonics Laboratory, (LPhiA) E.A. 4464, SFR Matrix, Angers University, Faculty of Sciences, 2 Bd. Lavoisier, 49000 Angers, France

[*]lisnic.petru@yahoo.com

Abstract. This study examines the optimal parameters for obtaining fluorine-doped SnO_2 (FTO) films with promising potential in photovoltaic applications. Due to its properties, tin oxide is utilized in a wide range of technologies, and the technology of solar cells is one of the most important fields of its application. Being doped with fluorine, tin dioxide becomes a good transparent and conductive electrode, suitable for solar cell applications. The chemical stability and low cost of the fluorine-doped SnO_2 makes it an advantageous replacement for the tin-doped indium oxide (ITO). Among the most important characteristics of FTO thin films are high photoconductivity under sunlight irradiation and strong UV absorption. The SnO_2 doped with fluorine has a considerable chemical and physical stability, good conductivity and high transmission (over 85%) in the visible range. The spray pyrolysis is the most preferable and efficient deposition method of FTO thin films. This work aims to identify the optimal parameters for spray pyrolysis of SnO_2:F films and to analyze their morphology, transparency and strength, in relation to the amount of dopant in the precursor solution, spraying distance and film thickness.

Keywords: fluorine tin oxide (FTO), thin films, spray pyrolysis, solar cells.

Observations on the sliding wear of bronze coatings produced by electric arc spray

Cristian STESCU[1], Daniela CHICET[2,*], Anisoara DASCALU[1,*], Cornelia PALEU[1], Corneliu MUNTEANU[1,4], Ioan VIDA-SIMITI[3,4]

[1]Gheorghe Asachi Technical University of Iasi, Department of Mechanical Engineering, Blvd. Mangeron, No. 61, 700050, Iasi, Romania.
[2]Gheorghe Asachi Technical University of Iasi, Department of Materials Science and Engineering, Blvd. Mangeron, No. 41, 700050, Iasi, Romania.
[3]Technical University of Cluj-Napoca, 103-105 Muncii Ave., Cluj-Napoca, 400641, Romania.
[4]Technical Sciences Academy of Romania, 26 Dacia Blvd, Bucharest, 030167, Romania

[*]dchicet@tuiasi.ro, dascaluanisoara1@gmail.com.

Abstract. In this paper we studied the possibility of using bronze coatings, made by thermal spraying, to extend the life of some components subject to abrasive slip wear. For this purpose, a set composed of three types of samples was made: S1 (samples covered by electric arc deposition with a Cu-Al 90-10 coating), S2 (cast CuAl9 sample) and S3 (bearing steel sample). The sliding wear tests were performed on an Amsler type test machine in a greased environment (clean oil), at constant values of the loads, being recorded both the coefficient of friction specific to each type of material, and the loss of material for each sample. A satisfactory resistance of the bronze coating was registered, its wear behaviour being superior to the two materials.

Keywords: electric arc spray, wear, bronze coatings.

References:

[1] Gaurav Prashara, Hitesh Vasudeva, Lalit Thakurb, *Performance of different coating materials against slurry erosion failure in hydrodynamic turbines: A review*, Engineering Failure Analysis 115 (2020) 104622.

CONTENTS

Section 1: Synthesis and Characterization of Materials

Section 2: Procedures and Technologies for Materials Engineering

Section 3: Materials Application

Section 4: Materials & Life Science