Coalesce Research Group

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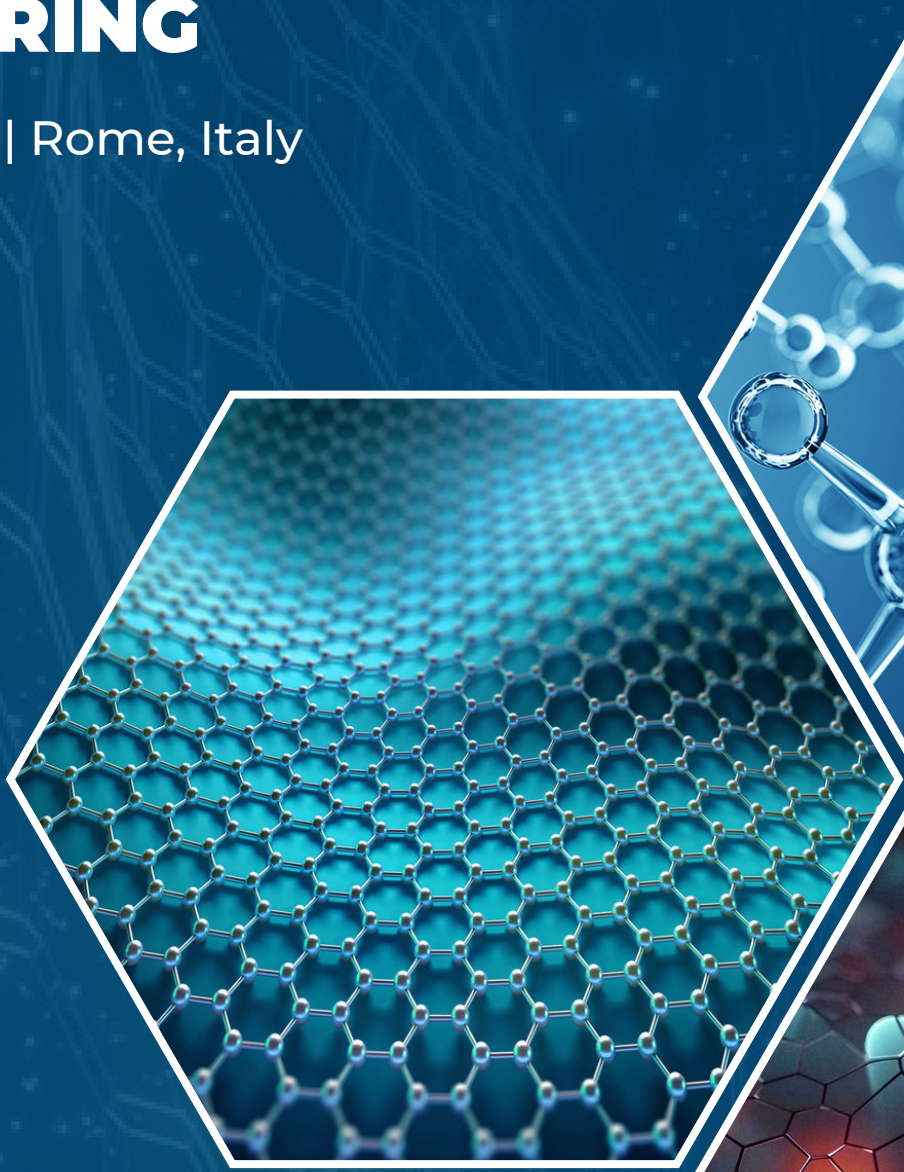
9th International Conference on

MATERIAL SCIENCE AND ENGINEERING

April 11-12, 2024 | Rome, Italy



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Scientific Program

Scientific Program

Thursday
April 11, 2024

9th International Conference on
Material Science and Engineering

Day-1 : April 11, 2024	
Metting Hall: Parioli 1	
08:00 - 08:45	Registrations
08:45 - 09:00	Introduction
Keynote Presentations	
09:00 - 09:40	Materials Developed for High Energy Physics Research and their new Life as Medical Physics Instruments
	Benedetto Di Ruzza, University of Foggia, Italy
9:40 - 10:20	When does Gravity actually Influence the Macroscopic Contact Angle in Partial Wetting Problems
	Marc Medale, Aix-Marseille University, France
10:20 - 11:00	Evolution of the Ballistic Protection Systems
	Marcin H. Struszczyk, Institute of Security Technologies "MORATEX", Poland
Network & Refreshments @ Bar 11:00 - 11:30	
Oral Presentations	
Session Chair	**Marcin H. Struszczyk,** Institute of Security Technologies "MORATEX", Poland
Session Chair	**Benedetto Di Ruzza,** University of Foggia, Italy
Sessions:	Material Science and Engineering|Nano Technology and Bio-Nano Technology|Energy Materials and Sustainable|Environmental and Green Materials|Nano Materials|Mechanical, Civil and Architectural Engineering|Plastics and Recycling Materials|Surface Science and Engineering
11:30 - 11:55	The Influence of The use of ABS Plastic and Basalt Powder in Standard Mortars
	Ryszard Dachowski, Kielce University of Technology, Poland
11:55 - 12:20	Development of Innovative Materials Based on Natural Polysaccharides and Nanocellulose for the Packaging Sector
	Ylenia Ruberto, University of Parma, Italy
12:20 - 12:45	Lathyrus Brachypterus-Mediated Facile Green Synthesis of Magnetic Nanoparticles / Nanocomposite and Investigation of their Adsorption Capacity for Anion Removal from Aqueous Solution
	Muradiye Şahin, Kırşehir Ahi Evran University, Turkey
Group Photo@ 12:45 - 13:00	
Lunch @ Seguimi 13:00 - 14:00	
14:00 - 14:25	Application of a Geochemical Modeling Code to Analyze the Phase Composition of Silicate Bricks Modified with Glass Sand
	Anna Stepien, Kielce University of Technology, Poland
14:25 - 14:50	On the Fatigue of Ship-Strucures Under Wave Loads
	Federico Frisone, University of Messina, Italy
14:50 - 15:15	Structural Stress of Titanium Welded Joints
	Pasqualino Corigliano, University of Messina, Italy

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15:15 - 15:40	Synthesis of Magnetic Nanoparticles/Nanocomposite from *Lathyrus Brachypterus* Extract and Photocatalytic Hydrogen Production from Water
	Muradiye Şahin, Kirşehir Ahi Evran University, Turkey
15:40 - 16:05	Analytical Expressions of Non-Markovian Qualities of Biomaterials
	Orchidea Maria Lecian, Sapienza University, Italy
	Network & Refreshments @ Bar 16:05 - 16:30
	Keynote Presentation
16:30 - 17:10	Disposal of Rejected brine Utilizing Innovative Technologies such as Plunging Liquid Jet Reactor
	Bader Shafaqa Al-Anzi, Kuwait University, Kuwait
	Day 1 Concludes followed by Award Ceremony

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Day-2 : April 12, 2024	
Metting Hall: Parioli 1	
Keynote Presentations	
10:00 - 10:40	Fabrication of Ultrafine-Grained Bulk Ti-Alloy Sheets and Rods and its Industrial Application
	Chong Soo Lee, Pohang University of Science and Technology, Republic of Korea
10:40 - 11:20	Tribology: Conceptualization and Applications
	Ronaldo Cámara Cozza, CEETEPS – State Center of Technological Education "Paula Souza" Faculty of Technology – Department of Mechanical Manufacturing – Campus, Brazil
Network & Refreshments @ Bar11:20 - 11:55	
11:55 - 12:35	Simultaneous Heavy Metal Wastewater Treatment and Nanoparticle Synthesis using Dead Biomass of Microalgae
	Tau Chuan Ling, University Malaya, Malaysia
Oral Presentations	
Session Chair	**Marcin H. Struszczyk,** Institute of Security Technologies "MORATEX", Poland
Session Chair	**Ronaldo Cámara Cozza,** CEETEPS, Brazil
Sessions:	Material Science and Engineering | Tribology and Surface Engineering | Environmental and Green Materials | Plastics and Recycling Materials | Mechanical, Civil and Architectural Engineering | Environmental and Green Materials | Biomaterials and Tissues Engineering | Nano Materials | Biopolymers and Bioplastics
12:35 - 13:00	Recycling of Multi-Component, Multi-Layer Waste by the use of 'Green' Solvents
	George Theodosopoulos, TWI Ltd, United Kingdom
Lunch @ Seguimi 13:00 - 14:00	
14:00 - 14:25	Synergistic Electronic and Facets Engineering in Novel Double Perovskite Oxide -Based Photocatalysts for Spatial Charge Separation for Overall Water Splitting and CO_2 Reduction
	Khakemin Khan, Trento University, Italy
14:25 - 14:50	Surface Science and Engineering
	Sabrina Zuccalà, 4ward360, Italy
14:50 - 15:15	Physiochemical Characterization of Glycyrrhiza Mediated Bioengineered Palladium Nanoparticles (PdNPs), their Antiproliferative and other Biomedical Applications
	Ahmed H. Ragab, King Khalid University, Saudi Arabia
15:15 - 15:40	The Importance of Color-Dye Injection and Cord Insertions' Sites Studies in Monochorionic Twin Placentas
	Elisa Bevilacqua, Fondazione Policlinico Agostino Gemelli IRCCS, Italy
Video Presentation	
15:40 - 16:05	Conjugated Coupling for Two Penrose Tiles Pair and Their Elementary Unit Cell, for Translation Tiles
	Kung Chung Yuan, National Chung Hsing University, Taiwan

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Network & Refreshments @ Bar 16:05 - 16:30	
Poster Presentations	
MSPP-01	Polyesters of Azelaic Acid and Selected Short-Chain Dihydroxy Alcohols for the Preparation of Cell Scaffolds
	Aleksandra Bandzerewicz, Warsaw University of Technology, Poland
MSPP-02	DNA and G4 PAMAM Dendrimers as a Basis for Reduction of Silver Ions
	Irine Khutsishvili, Ivane Javakhishvili Tbilisi State University, Georgia
MSPP-03	Synthesis and Characterization of Platinum Nanoparticles on Reducible Metal Oxide Supports for Catalytic Applications and Hydrogen Sensing
	Marijan Gotic, Laboratory for Molecular Physics and Synthesis of New Materials, Division of Materials Physics, Ruđer Bošković Institute, Croatia
MSPP-04	Preliminary Research of Michael Addition of Cysteine as a Solution for Osteoporosis Patients
	Magdalena Mietus, Warsaw University of Technology, Poland
MSPP-05	Optically Active Nanostructured Thin Films of Cellulose Nanocrystals
	Rachel Yerushalmi - Rozen, Ben-Gurion University of the Negev, Israel
MSPP-06	Photoconductive Response of a Field-Effect Transistor Through the Traps Effect
	Bilal Bouzidi, Hight School d'Agriculture Saharien Adrar(ESASA), Algeria
Keynote Presentations	
17.15 - 17.55	Physico Chemical and Mechanical Characterization of PVC Waste and Sand Composite for its Valorization for Roofing
	C Diange Collins Misodi, Paul Herbert Higher Institute of Professional Studies Kumba
17.55 - 18.35	Physico Chemical and Mechanical Characterization of PVC Waste and Sand Composite for its Valorization for Roofing
	Mbelle Samuel Bisong, University of Buea, Cameroon
Day 2 Concludes followed by Vote of Thanks & Awards Ceremony	

Scientific Program

Thursday
April 11, 2024

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Virtual Presentations	
April 11-12, 2024 | Virtul Program (BST)	
10:45 - 11:00	Introduction
Keynote Presentation	
11:00 - 11:30	Development of Energy Efficient Alkali-Activated Bricks using Waste Foundry Sand
	Rahul Ralegaonkar, VNIT, India
Oral Presentations	
11:30 - 11:50	Underwater Swimming Robot based on Piezoelectric Ceramics
	Qingping Wang, Hubei Unversity of Education, China
11:50 - 12:10	Burning Tobacco Cigarettes with Ca Polymer Filters Harms Smokers and the Environment - Toxic Deposits and Respirable Microfibers
	Peter Eyerer, HomeFraunhofer Institute for Chemical Technology (ICT), Germany
12:10 - 12:30	Use of Nanoscale Materials in Sensor Devices
	Ruslan, Yuriy Fedkovych Chernivtsi National University, Ukraine
12:30 - 12:50	Role of Polymer-BSA Interactions on the Formation Biofilms on Biomaterials
	Suparna, University of Exeter, United Kingdom
Lunch (12:50 - 13:15)	
13:15 - 13:35	Strength and Stiffness Properties of Softwood after Long-Term Use in Variable Service Conditions
	Lilita Ozola, Latvia University of Life Sciences and Technologies, Latvia
13:35 - 13:55	Comparative Study Tire Recycling Products Obtained by Different Technologies
	Arkady Cherepanov, Russian Technological University - MIREA, Russia
13:55 - 14:15	Post-COVID-19 Functional Status: Relation to Age, Smoking, Hospitalization, and Previous Comorbidities
	Abdelrahman Ezzat, Aswan University, Egypt
14:15 - 14:35	Acarbose-Encapsulated Guar Gum Nanoformulation: A Promising Strategy for Type 2 Diabetes Management
	Sourbh Suren Garg, Lovely Professional University, India
14:35 - 14:55	Sound Energy Harvester using Polyvinylidene Fluoride
	Kailash Chandra Shivaji Paturi, University of North Texas, USA
14:55 - 15:15	Analysis of Physical and Mechanical Properties in Lime-Sand Materials Modified with Glass Sand with an Amorphous Structure
	Magdalena Balonis, University of California, USA
15:15 - 15:35	Chemical Composition-Based Machine Learning Model to Predict Defect Formation in Additive Manufacturing
	Ankit Roy, Pacific Northwest National Lab, USA
Day-1 Conludes	

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Day-2: April 12, 2024	
Keynote Presentation	
10:00 - 10:30	Evaluation of Developed Alkali- Activated Concrete for Energy-Efficient Building Material
	Rahul Ralegaonkar, VNIT, India
Oral Presentations	
10:30 - 10:50	Vibration of Arches Elastically Restrained at Both Ends and Reinforced by Elastic Support Points
	Ahmed Babahammou, Hassan II university of Casablaca, Morocco
10:50 - 11:10	The Uncertainty of Reusable Building Components/Materials
	Christian Jonathan, Politecnico di Milano, Italy
11:10 - 11:30	First Report on Pichia Kudriavzevii Lactic Acid Production from Orange Peel Waste (OPW)
	Neha Thakur, Lovely Professional University, India
11:30 - 11:50	Comparison of Mechanical Properties of Additively Manufactured Chopped Carbon Fiber Reinforced Nylon Specimens with Variation In Process Parameters
	Niranjan S. Deshmukh, Defence Institute of Advanced Technology, India
11:50 - 12:10	Compare Study of Ag and K Nanoparticles with Sea Weed Extract (Sagarika) in Seed Priming
	Indira Rathore, IFFCO, India
12:10 - 12:30	Fabrication and Characterization of Hydroxyapatite and Chitosan from Bio-Resources
	Aasma, NED University of Engineering and Technology, Pakistan
12:30 - 12:50	Formulation and Evaluation of Novel Additive-Free Spray-Dried Triamcinolone Acetonide Microspheres for Pulmonary Delivery: A Pharmacokinetic Study
	Sawsan A Zaitone, Suez Canal University, Egypt
12:50 - 13:10	Energy Harvesting Through Diverse Nanowires
	Bestley Joe S, Kings Engineering College, India
13:10 - 13:30	Improving The Fatigue Design of Mechanical Systems such as Refrigerator
	Seongwoo Woo, Ethiopian Technical Uniersity, Ethiopia
13:30 - 13:50	The use of Laser in Fixed Prosthodontics.
	Yosra Gassara, University of Monastir,Tunisia
Day-2 Conludes followed by Vote of Thanks	

Day-1
Keynote Presentations

MATERIALS DEVELOPED FOR HIGH ENERGY PHYSICS RESEARCH AND THEIR NEW LIFE AS MEDICAL PHYSICS INSTRUMENTS

Benedetto Di Ruzza

University of Foggia, Italy

Abstract

Since long time there is a strong connection between the development of materials sensitive to particles, particle accelerators used in high energy physics laboratories and tools used in medical physics. This link is particular relevant nowadays in medical instruments for hadrontherapy and will be even more relevant in the rapidly diffusing flash irradiation oncological hadrontherapy technique.

In his talk an overview will be given of sensors and materials designed for particle detection in high energy physics and then used also in oncological hadrontherapy. Finally a description will be done of the materials and performance requirements for instruments used in flash irradiation oncological hadrontherapy treatments.

Biography

Benedetto Di Ruzza is a Tenure Track Assistant Professor in Experimental Physics at the University of Foggia, Italy, presently working in the CERN ALICE experiment and in application of silicon detectors in medical physics for the FOOT experiment. The fundamental motivation of his research activities is a deep passion for experimental research in particle physics. Pushed by this passion he had the privilege to work for long time in experiments located at the most relevant hadron colliders: Tevatron at FNAL, RHIC at BNL and now LHC at CERN. In these laboratories he acquired a relevant experience in managing, operating, installing, commissioning, and testing silicon detectors (mainly MAPS pixels and strips detectors) for particle physics. This knowledge in silicon detectors and in managing general experimental apparatus has been of pivotal importance for the research activities in medical physics he undertook from 2018 at the Trento TIFPA-INFN Center, where he started to made research in application to hadron therapy of silicon trackers and in radiation hardness characterization of silicon devices for space and medical applications.

WHEN DOES GRAVITY ACTUALLY INFLUENCE THE MACROSCOPIC CONTACT ANGLE IN PARTIAL WETTING PROBLEMS?

Marc Medale

Aix-Marseille University, France

Abstract

Background: We are interested in characterizing the wetting properties of a flat surface by a liquid, surrounded by a non-miscible fluid. We consider the configuration of a sessile droplet in contact with a solid assumed to be ideal (undeformable, horizontal, chemically homogeneous, with low roughness) and subjected to gravity.

Objective: The aim is to understand whether gravity can influence this partial wetting configuration. Indeed, in a gravity field when the drop volume is such that its size becomes greater than its capillary length, then its liquid-fluid interface deviates from a spherical cap. So, what happens to the macroscopic wetting angle? Does it depend on the volume of the drop (the Bond number), or does it remain independent of it?

Methods: We have implemented two complementary approaches: one experimental and the other from modeling. The creation of a sessile drop on a horizontal substrate is achieved by injecting distilled water via a motorized syringe through a 1 mm hole drilled in the PMMA substrate, in an ambient air environment. In parallel, an axisymmetric macroscopic model has been developed, whose equations model the shape of the drop in static equilibrium, accounting for the thermodynamic equilibrium and the Viral theorem in projection along the vertical direction. This model leads to an algebraic-differential system comprising four first-order differential equations in space, and two algebraic constraint equations. As this system is highly non-linear, it is solved numerically using the numerical asymptotic method.

Results: The results from experiments in “adavancing contact line” mode show that the macroscopic contact angle decreases rapidly even for drop volumes smaller than 100 µl, then reaches a minimum value at around V=250 µl, and then no longer varies for larger volumes. The macroscopic wetting angle reaches its minimum value when the drop height reaches its asymptotic value. This leads us to conjecture that the macroscopic wetting angle decreases as the hydrostatic pressure in the drop increases, then stabilizes with the latter, when the drop reaches its limiting height. The wetting radius increases monotonically with drop volume. There is therefore no stick-slipping during this “advancing contact line” phase. The model results are in very good agreement with experimental results on all observable quantities (wetting angle, wetting radius and drop height).

Conclusion: This set-up emphasizes the gravity influence om macroscopic wetting angle and the developed model enables us to understand how, as well as the role of triple zone energy in its evolution, both in advancing and in receding contact lines.

Biography

Marc Medale has her expertise in numerical modeling of coupled heat and fluid flows, with particular emphasis on natural and mixed convection fluid flows with or without phase change along with partial wetting problems. The developed models address both Newtonian and visco-plastic rheologies and they aim at computing branches of steady state solutions, detect bifurcation points if any, by means of continuation algorithms based on the Asymptotic Numerical Method and finally perform linear stability analyses when relevant.

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EVOLUTION OF THE BALLISTIC PROTECTION SYSTEMS

Marcin H Struszczyk

Institute of Security Technologies "MORATEX", Poland

Abstract

Background: The research presents the design and evolution of the wide range of the ballistic material systems based on the textiles made of various type of the polymers: p-aramid or/and UHMWPE fibres as well as hybrid systems for the improvement of the performance, safety of the designed ballistic solutions. Designs of various variants of soft and composite ballistic protectors will be discussed, as well as their modifications related to the change in material properties.

Objective: The aim of the performed researches was to develop new material solutions in the production of ballistic body shields used to reduce weight, energy demand in technology and increase performance and safety.

Methods: As part of the project works, the developed solutions were verified on the basis of the current normative methodology used in Poland (PN-V Standards) and the USA (NIJ documents), as well as on the basis of our own, proprietary research procedures, also developed in the conditions of computer simulations.

Results: The project activities allowed for the development of new solutions in the field of ballistic soft shields (functionalized systems using Plasma Assisted Chemical Vapour Deposition - PACVD) and composite protections (hybrid ballistic composite plates, multifunctional ballistic vests dedicated for women, ballistic hybrid helmets, EOD systems), which took into account weight reduction while at least maintaining the required ballistic resistance, the reduction of energy demand in the technological process and the aspect of gender equality.

Conclusion: The designed ballistic solutions have been validated in real conditions, confirming tactical and operational assumptions, including comfort of use, safety and key performance parameters responsible for ballistic protection.

Biography

Marcin H. Struszczyk (M), PhD. Eng., graduate in Biotechnology, 1995, at Technological University in Lodz, Poland; PhD degree in Organic Chemistry in 2001 at University Potsdam, Germany; habilitation at Technological University in Lodz, Poland, 2008. Research interest: 20 years' experience in chitin, chitosan and medical devices design; leader of several research and developmental projects supported by national (Polish) and EU sources, since 2008 project leader of 6, coordinator and project manager of 5 projects supported by European Regional Development Fund and partner coordinator of 3 project supported by UE Commission. Between 2001 – 2008 - member of board of TRICOMED SA (manufacturer of textile, implantable medical devices) responsible for research and development. Director for science of "MORATEX"; 2008 – 2017. Since 2017 Director of "MORATEX". 4 medical devices implemented for the commercialization (wound dressing, applicator for implant introduction, two implants of the IIb class – hernia meshes), 2 medical devices during the clinical studies, 7 medical devices during the pre-clinical studies. Additionally, the 5 technologies of ballistic protectors were commercialized and two textile solutions for the fireguard's protection. Co-author of the design and the implementation of the mobile isolation and decontamination cabin with the equipment of the filtering and ventilation unit for biomedical applications for patients with suspected COVID-19 infection. More than 100 science publications, more than 35 intellectual property rights, 8 EUIPO Community industrial designs, 3 trademarks.

DISPOSAL OF REJECTED BRINE UTILIZING INNOVATIVE TECHNOLOGIES SUCH AS PLUNGING LIQUID JET REACTOR

Bader Shafaqa Al-Anzi
Kuwait University, Kuwait

Abstract

Plunging Liquid Jet Reactors (PLJRs) were investigated as potential outfalls to discharge the rejected-brine efficiently and optimally. Plunging Liquid Jet Reactor (PLJR) technology is one of the promising unconventional technologies that could potentially be used in various applications that help protecting the environment, such as outfalls for the disposal of rejected brine from desalination plants in an optimal way to dilute the rejected brine and at the same time a means of aeration of the ambient seawater to increase the concentration of dissolved oxygen in the water.

Biography

Prof. Bader Al-Anzi, Acting Vice Dean of the Academic Affairs, Research and Graduate Studies and a former Head of the Department of Environmental Sciences (2016-2021) at Kuwait University. He was appointed as a full-time visiting professor in the Department of Life and Environmental Sciences at the University of Alberta, Canada (2021-2022). He joined the Department of Mechanical Engineering at MIT, Cambridge, USA as a full-time Visiting Scientist from 2013 to 2014 and continued in the same department as a research affiliate from 2014 – 2020. Having completed graduate studies in chemical engineering from renowned universities, his research experience includes water and wastewater treatment, desalination, two phase flow/aeration, corrosion, bioengineering, air pollution control and solid waste management. He has authored many papers, book chapters, one book, 24 US granted patents, two European granted patents and five nonprovisional US patent applications some of which were filed at MIT. He served as a judge, an invited speaker, a committee member and a chair/convener for many international awards juries and conferences. He has also worked in several governmental organizations that focus on water desalination and wastewater treatment projects. He is the principal investigator (PI) of several national and international research projects, including two Kuwait-MIT desalination projects worth USD 5.5 million and 615K, respectively. He, individually and jointly, with MIT and other organizations, supervised local and international PhD & MSc students from engineering departments exploring unconventional technologies, such as, producing water from oil fields, wastewater treatment and desalination processes. He was an MIT committee member (Co-supervisor) for one of the PhD candidates at MIT. He received several national and international prizes/awards as recognition of his work, and one of his inventions "Al-Anzi Coarse Aerator" has been manufactured and certified by American Aerators Company in USA to be used globally for water and wastewater treatment applications.

Day-1
Oral Presentations

Coalesce Research Group

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THE INFLUENCE OF THE USE OF ABS PLASTIC AND BASALT POWDER IN STANDARD MORTARS.

Ryszard Dachowski[1], Anna Stepien[1], Dale P Prentice[2] and Magdalena Balonis[3]

[1]Kielce University of Technology, Poland
[2]UCLA Samueli School of Engineering Institute for Carbon Management Los Angeles, CA
[3]Materials Science And Engineering University of California Los Angeles (UCLA) Los Angeles, CA

Abstract

The article concerns the characteristics of screeds and the reduction of the use of quartz sand by using recycled material and an addition in the form of basalt powder with cryptocrystalline properties. The basic purpose of using a screed is to level the subfloor for the floor or the ceiling for the finishing material, which allows the top layer of the floor to bear loads freely. The screed can be used both in new buildings (residential buildings, service buildings, production halls) as well as during the renovation of an existing building. There are two types of screeds: liquid screed and dry screed.

The research part of the article includes tests on standard mortars in which the content of quartz sand was reduced with a modifier in the form of ABS plastic (poly(acrylonitrile-co-butadiene-co-styrene)) and basalt flour was used. The tests were performed according to the following standards: mortar density (PN-EN 12350-5), consistency test (PN-EN 12350-5), strength tests such as compression and bending (PN-EN 196-1:2006) and water absorption coefficient test (PN-EN 1015-18). Basalt powder is a fine-grained mineral waste produced in the production of dedusting crushed aggregate. This type of mineral can also be obtained as waste from mechanical processing of aggregate during the production of, for example, mineral-asphalt masses (MMA). In both cases, it is not reused, so its further disposal and storage is a common problem, e.g. by the previously mentioned mineral-asphalt mass production plants, even though it has good properties and is a component with a very fine fraction, similar to dust. Used in concrete, thanks to its natural properties, it has a positive effect on the so-called sealing the material through the "filler effect" of the cement matrix structure and improving the mechanical parameters of modified concretes. The disadvantage of using additives in the form of flour and rock dust as a substitute for fine aggregate is a larger specific surface than sand, which results in increased water demand and deteriorated workability. To neutralize this effect, add more water and flour or dust, which may result in increased shrinkage.

The following strength tests were carried out after 28 days from the production date, i.e. compressive strength, bending strength (PN-EN 196-1:2006), and water absorption coefficient tests **[Figure 1-3]**.

Figure 1. Sample with ABS.

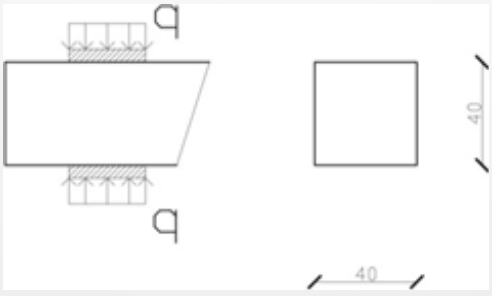

Figure 2. Scheme of standard compressive strength testing.

Figure 3. Bending strength test - sample with 15x20 content.

The water absorption coefficient, i.e. capillary rise of the hardened mortar, was tested according to the PN-EN 1015-18 standard. The test consisted of drying the test sample to a constant mass (mentioned in point 1.10) and weighing it accurately to 1 g. The height of 7.5 mm from the bottom edge was marked on the sample and placed so that the level of distilled water corresponded to the level of the sketched line. According to the standard, this level should be within the range of 5-10 mm.

After that, a stopwatch was turned on and a time of 10 minutes was measured, after which the samples were removed from the water, the immersed bottom was wiped with a damp cloth and the mass was weighed (M1), after which the sample was quickly placed back into the container with water. The operation was repeated for 90 minutes, the mass (M2) was weighed and substituted into the formula:

Raw material ingredients:

- Quartz Sand: The tested sample was made of quartz sand with a density of 2.65 g/cm^3 and a fraction of 0-2[mm]. It comes from Przemysłowe Silicate Production Company (Ludynia, Poland): H+H Silikaty Sp. z o. o. the plant extracts sand locally
- Cement: CEM II/C-M (V-LL) 32.5 R multi-component Portland cement with a density of 3.0 g/cm3 was used for the tested sample. The composition of cement production is in accordance with the PN-EN 197-5:2021-07 standard and this type of cement is the so-called cement from the ECOPlanet green cement series, the use of which allows for the reduction of the emission of constructed structures.
- Water: According to the PN-EN 1008:2004 standard, it is possible to use drinking water, it is not subject to additional quality tests.

Basalt powder

Basalt powder with a density of 3.0 g/cm^3, fraction 0-2[mm] was used as a mineral additive. Basalt flour is a mineral waste that is produced in the production of dedusting crushed aggregate, and its chemical and phase composition does not differ from the rock from which it comes. The material used was used in the production of mineral-asphalt masses (MMA). Initially, the entire material (basalt rock) was dried at a temperature of about 200°C. It was later removed through the fabric filter of the coating machine and then collected in a special tank. The basalt flour used in the research came from crushing basalt rocks.

ABS plastic

ABS plastic, i.e. acrylonitrile-butadiene-styrene copolymer with a density of 1.05 g/cm^3, was added as the second additive. It was added to the tested samples in order to increase compressive strength, scratch strength and impact strength, according to the available literature.

The calculated values were assumed as the correct composition for the proportions of 5% ABS and 10% basalt flour. The calculations are presented in tables taking into account correction factors [**Table 1**].

ABS [%]	Basalt powder[%]	ABS [g]	Basalt powder[g]	SiO2 - ABS +Basalt powder[g]
5	10	78.75	157.5	1338.75
5	20	78.75	315.0	1181.25
5	30	78.75	472.5	1023.75
10	10	157.5	157.5	1260.0
10	20	157.5	315.0	1102.5
10	30	157.5	472.5	945.0
15	10	236.25	157.5	1181.25
15	20	236.25	315.0	1023.75
15	30	236.25	472.5	866.25

Table 1: Calculated composition of ABS plastic and basalt flour.

The results of the tests carried out are presented graphically in the figures below. Samples containing 10% ABS also maintain a similar decreasing trend as in the case of bending strength tests. Assuming 100% for the standard mortar, it was compared that the samples obtained the value for the percentage of additive content 10 x 10 - 80.7%, 10 x 20 - 82.3% and 10 x 30 - 71.7%. All samples are below the ±10% limit and cannot be used from a practical point of view. In the case of modification of cement mortar

with basalt flour, the predominant phases are C-S-H (in the form of needles) and portlandite, which is the result of hydration of C_3S (tricalcium silicate) and C_2S (dicalcium silicate). Portlandite forms columnar aggregates that have hexagonal crystals. SEM tests show that the addition of basalt dust tightens the microstructure, making it possible to achieve higher bending and compressive strength [**Table 2**].

		Proper composition of concrete mixtures [1dm^3]				
		ABS [g]	Bazalt [g]	Piasek [g]	Cement [g]	Woda[g]
Zaprawa normowa		0	0	1575.0	470.0	250.0
5	10	75.6	151.2	1285.2	451.2	240.0
5	20	76.4	305.6	1145.8	455.9	242.5
5	30	77.2	463.1	1003.3	460.6	245.0
10	10	144.9	144.9	1159.2	432.4	230.0
10	20	146.5	293.0	1025.3	437.1	232.5
10	30	148.1	444.2	888.3	441.8	235.0
15	10	210.3	140.2	1051.3	418.3	222.5
15	20	210.3	280.4	911.1	418.3	222.5
15	30	212.6	425.3	779.6	423.0	225.0

Table 2: Proper composition of concrete mixtures [1dm^3]

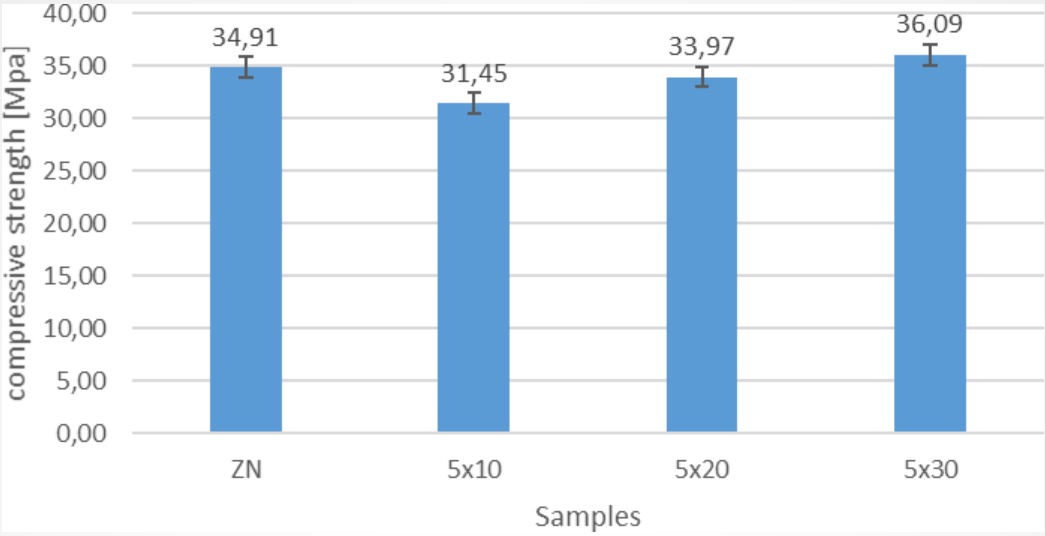

Figure 4: Graph showing compressive strength for 5% ABS.

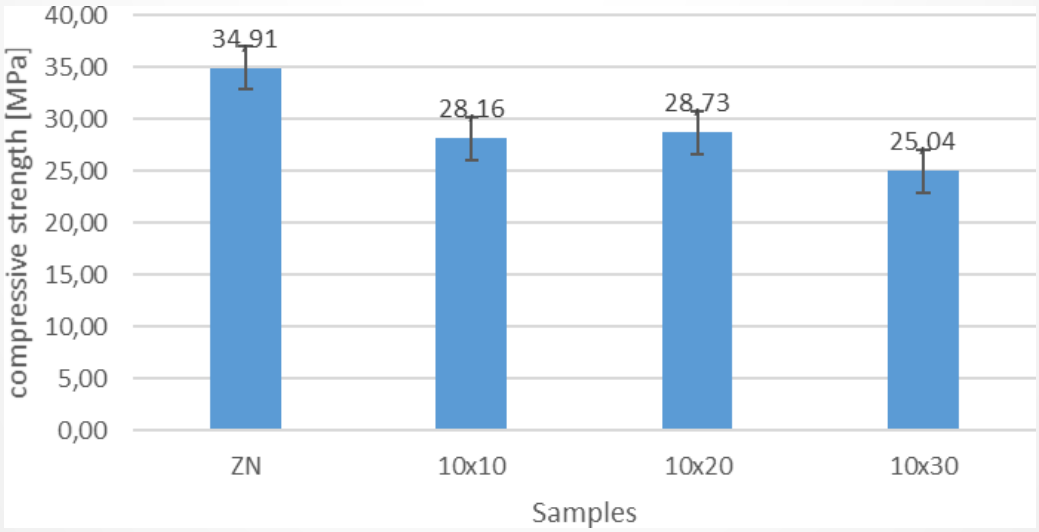

Figure 5: Graph showing compressive strength for 10% ABS.

DEVELOPMENT OF INNOVATIVE MATERIALS BASED ON NATURAL POLYSACCHARIDES AND NANOCELLULOSE FOR THE PACKAGING SECTOR

Ylenia Ruberto
University of Parma, Italy

Abstract

Background: The uncontrolled production and consumption of plastics are among the biggest causes of environmental pollution. The European Community has issued several directives limiting the use of plastics and especially promoting the adoption of alternative environmentally sustainable materials (biodegradable and/or compostable), to steer the system towards a circular economy model.

Objective: Formulation of innovative, biodegradable materials based on natural polysaccharides in the form of films/films for use in the packaging sector as plastic substitutes.

Methods: In this work, three different polysaccharides were analysed: chitosan, glucomannan and galactomannan. Films characterised chemically by FTIR - ATR were formulated, while hydrophobicity was assessed by contact angle analysis and calculation of the degree of swelling. The chitosan-only film was found to be the most hydrophobic, so it was chosen as the basis for the blend formulation, to which two different types of cellulose, nanocrystalline cellulose (CNC) and micro- fibrillated cellulose (CMF), were added in order to increase the mechanical properties of the final material. Two films were formulated with chitosan/CNC and one film with chitosan/CNC/CMF, using glycerol as a plasticiser.

Results: The films obtained were characterised by FTIR-ATR analysis; the results show that chitosan and cellulose form interactions. Indeed, when comparing the spectra of the chitosan-only films and the blend, new CNC-related bands appeared, shifted with respect to the solo component. Hydrophobicity analyses showed that the presence of CNC maintains the hydrophobic character of the chitosan and increases the mechanical strength; whereas, the use of CMF makes the film hydrophilic. TGA and DSC analyses of the chitosan/CNC blends show that the presence of crystalline nanocellulose improves the thermal stability of the blend compared to the film with only chitosan.

Conclusion: The results show that the combination of different reagents can be exploited to modulate the properties of films to make them suitable for contact with different products to be packaged.

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LATHYRUS BRACHYPTERUS-MEDIATED FACILE GREEN SYNTHESIS OF MAGNETIC NANOPARTICLES /NANOCOMPOSITE AND INVESTIGATION OF THEIR ADSORPTION CAPACITY FOR ANION REMOVAL FROM AQUEOUS SOLUTION

Muradiye Şahin

Kırşehir Ahi Evran University, Turkey

Abstract

Background: In recent years, nanoparticles exhibiting magnetic properties have gained an important place among the nanostructured materials on which research on their use in biotechnological and biomedical applications has focused. An important application of magnetic nanoparticles is the removal of pollutants such as heavy metals, anions and dyes in aqueous media by adsorption method. Adsorption, which is one of the techniques used in wastewater treatment, is a widely used method because it can be applied to different types of pollutants, is less costly and easy.

Objective: Magnetic nanoparticle/nanocomposite will be synthesised from Lathyrus brachypterus extract, an endemic plant species and removal of F^-, Cl^-, NO_3- and PO_4^{-3} anions from aqueous media by adsorption was investigated.

Methods: Anion adsorption experiments with nanoparticle/nanocomposites (Fe_3O_4 NPs, Fe/Cu NPs, Fe_3O_4-CS, Fe/Cu-CS, Fe_3O_4-AT and Fe/Cu-AT) were carried out using 25 ppm 25 mL F^-, Cl^-, NO_3- and PO_4^{-3} aqueous solutions and 25 mg adsorbent. The amount of anion remaining in the solution was determined by ion chromatography.

Results: The order of anion removal was found to be Cl- > PO_4^{-3} > NO_3- > F-. Fe_3O_4-CS with the highest adsorption capacity for chlorine and nitrate, Fe/Cu-AT with the highest adsorption capacity for phosphate and Fe_3O_4-AT with the highest adsorption capacity for fluorine were found to be nanoadsorbents.

Conclusion: Anion removal from water is important in terms of water quality and health and our studies on competitive adsorption and adsorption from real wastewater samples are continuing.

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APPLICATION OF A GEOCHEMICAL MODELING CODE TO ANALYZE THE PHASE COMPOSITION OF SILICATE BRICKS MODIFIED WITH GLASS SAND

Anna Stepien[1], Dale P Prentice[2] and Magdalena Balonis[3]

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[2]ENGINEERING INSTITUTE FOR CARBON MANAGEMENT, Los Angeles,CA
[3]MATERIALS SCIENCE AND ENGINEERING University of California Los Angeles (UCLA) Los Angeles,CA

Abstract

In the civilization of the 21st century, several particularly important problems can be identified:

- rapid and progressive construction progres.
- production of concrete, bricks and other building materials;
- industrial pollution (construction furnaces, autoclaves);
- Overproduction and exploitation of natural resourcesthe need for increased recycling;
- climate change, global warmingfloods/droughtspoor quality of soil, food and watershortages of drinking water caused by climate change – mainly drought.

One of the solutions to the problem with glass recycling and excessive use of quartz sand is to modify the composition of the silicate brick with recycled glass sand. Because of that, the article focuses on the characteristics of hydrothermal processes during which silicate materials (autoclaved bricks) are created and the possibilities of these bricks with recycled components. Traditional silicate bricks produced in industrial conditions are structural building materials that are formed in hydrothermal conditions (temperature of about 200°C under a pressure of 16 bar (1.6 MPa)) during an autoclaving period of 8 hours (usually). The production of this type of bricks are completely natural and the bricks made of natural components: sand (SiO_2: 87–90%), lime (CaO: 3–7%) and water (H_2O: 3–5%). The class of bricks depends on the length of the autoclaving process and the cooling rate of the autoclave (bricks left in autoclaves to cool naturally are more durable and are exposed to sudden temperature changes, which constitute the difference between the interior of the autoclave and the external environment. Extended autoclaving time increases the class and durability bricks, but also increases production costs. As part of sustainable construction and a sustainable economy, considerations are being sought for the disposal of waste materials in construction production. In addition, an important aspect is the excessive use of quartz sand in the construction process. The preprepared substrate mixture (sand, lime, water) is placed in steel reactors, where it remains for about 4 h. There, the lime slaking process takes place, accompanied by an increase in temperature to about 60–80 °C. The sand-lime mass is directed to the press, where it is compressed under a pressure of 15–20 MPa, and then formed under pressure into blocks of the appropriate size and shape. Hydraulic presses are used to produce these bricks. In the final phase, the pressed bricks are placed in devices called autoclaves and subjected to the hardening process. Within 6–12 h (average 8 h) of autoclaving, CaO enters into a chemical reaction with SiO2 and the mixture is recrystallized. After the autoclaving process, the bricks are packed and stored on pallets. According to information from Science Journal and the European Union (UN) report from June 2021, it is estimated that the World uses: approximately 50 billion tons of sand and gravel for the production of concrete, road construction and infrastructure, which is 18 kg of sand per person per day. In 2001, approximately 850,000 tons of glass packaging were recycled, only 140 thousand tone. The remaining glass (approx. 700 thousand tons) was not utilized and probably remains in landfills along with with other waste.

Figure 1: Sand-lime bricks-lab.production.

Figure 2: Autoclaves in Ludynia H+H Silicaty, (near Kielce).

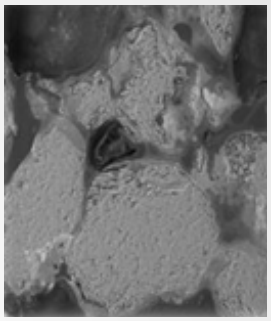

Figure 3: Microstructure (SEM) of sand-lime mix.

The conducted tests were aimed at the complete elimination of quartz sand in favor of glass sand (due to the high consumption of quartz sand and attempts to slow down this proces). The study of the microstructure was important because the hydration temperature between the binder and water in the presence of glass sand was 50% lower (39-42°C) than the hydration temperature of the binder and water in the presence of crystalline sand (about 86-90°C). As shown by five-year analyzes, autoclaved products modified by glass sand undergo crystallization (due to the metastability of glass sand).

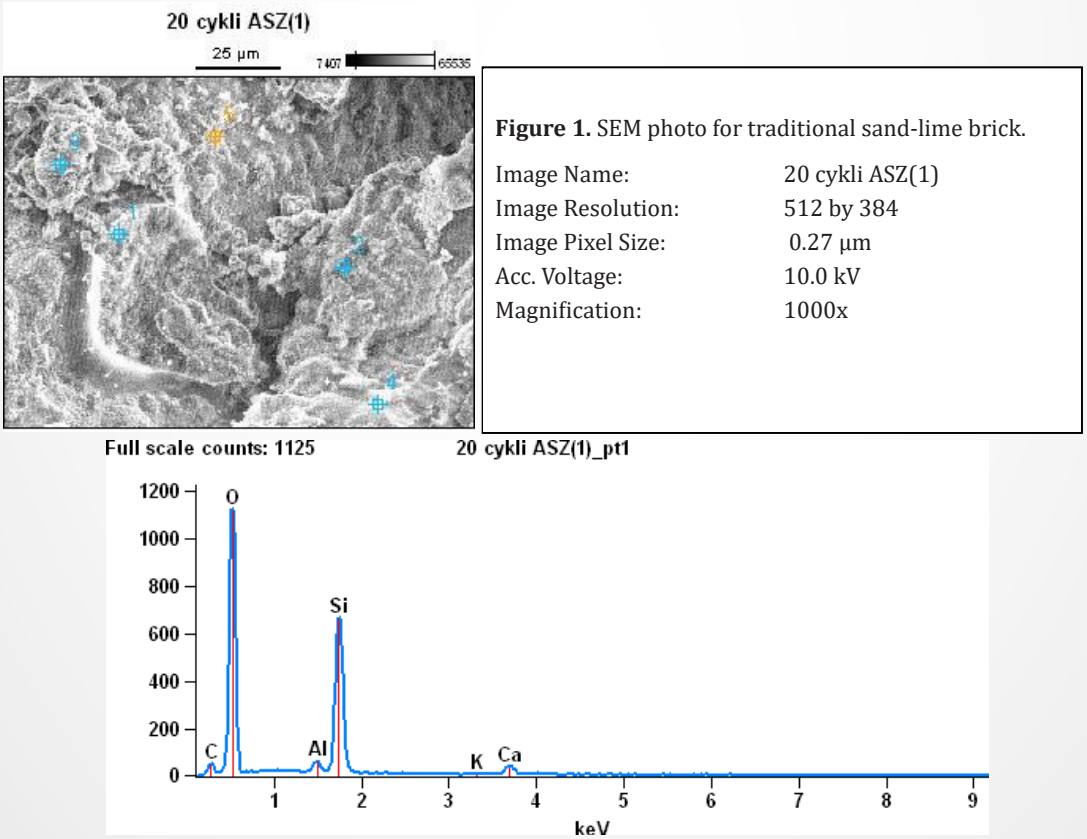

Figure 1. SEM photo for traditional sand-lime brick.

Image Name:	20 cykli ASZ(1)
Image Resolution:	512 by 384
Image Pixel Size:	0.27 µm
Acc. Voltage:	10.0 kV
Magnification:	1000x

Figure 2. EDS spectrum for traditional sand-lime brick.

The durability and direction of crystallization as well as the quality and volume of the resulting phases were tested using the GEMS-PSI program. This program takes into account the base of minerals and phases present in building materials. The concretes are mainly made of the C-S-H phase, which corresponds to their durability and strength. In autoclaved bricks, the C-S-H phase is a deficit phase, in favor

of the crystalline phases (tobermorite in traditional bricks and nartolite/gyrolite in bricks modified by GS). The following tests were performed: compressive strength, XRF, XRD, SEM. Another aspect is the use of a geochemical modeling code based on elemental composition analysis to simulate and analyze the direction of crystallization of amorphous phases present in the material structure. Geochemical modeling is also a factor reducing the number of ineffective laboratory and industrial tests.

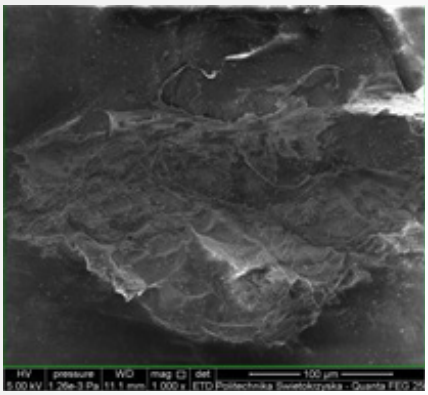

Figure 3: Glass - image from an SEM microscope.

Figure 4: Estimated amount of glass introduced to the market in 2009 2014 in thousands. tons and potential glass recovery rate.

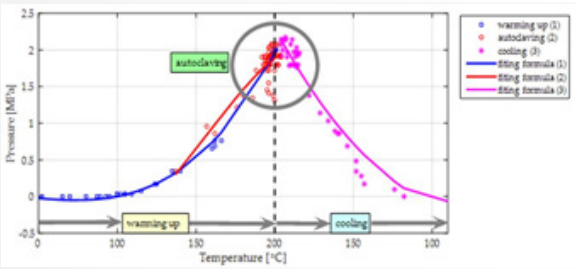

Figure 5: Autoclaving process in laboratory conditions

Figure 6: Samples with 90% Glass Sand.

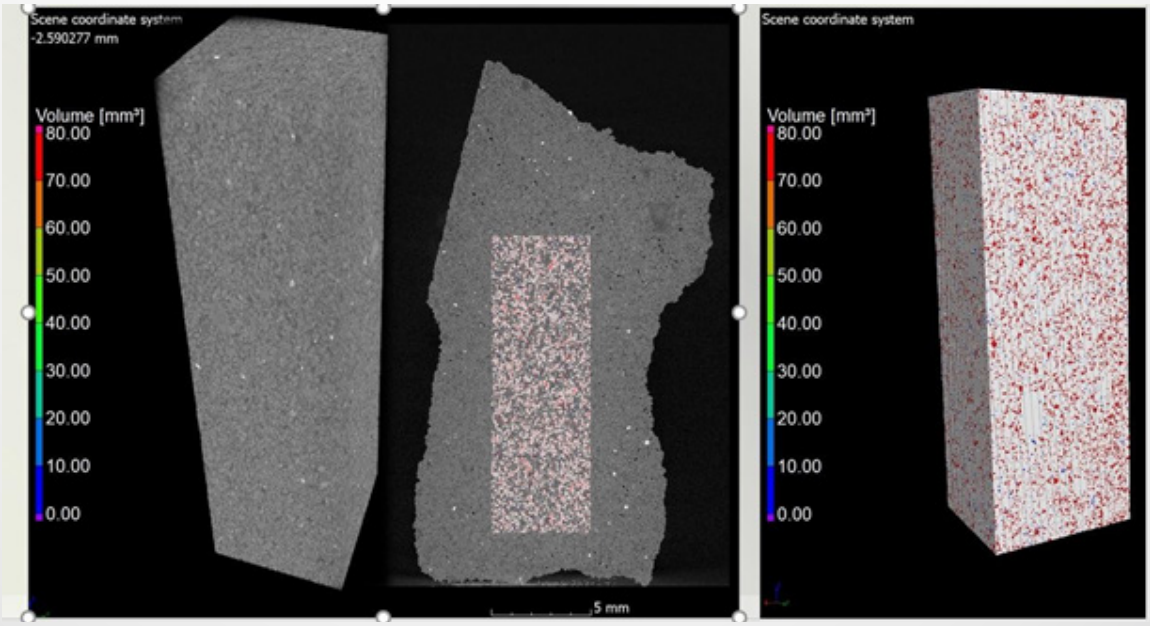

Figure 7: Characteristics of the pore skeleton of bricks modified with glass sand.

ON THE FATIGUE OF SHIP-STRUCTURES UNDER WAVE LOADS

Federico Frisone

Department of Engineering, University of Messina, Messina, Italy

Abstract

Background: Fatigue damage is one of the main failure modes in ship structures. This type of damage usually starts from weak point of the structure as welded joints, sites of stress concentrations and cracks, whose propagation can lead to the failure of the ship structures. Cyclic loadings that ships encounter during their service life are one of the main causes that can produce fatigue damage, especially loads due to wave, mainly analyzed in this work. Once the crack is started, also lower stress cycles, which would have negligible effects on intact components, can propagate the crack.

Objective: This paper wants to resume the most used fatigue strength assessment approaches, in order to analyze drawbacks and advantages and to provide the necessary background knowledge for the development of a future and reliable theoretical/numerical models for predicting the fatigue life of ship structures subjected to collision events and different sea states.

Methods: This scientific work will thus consider the main theoretical approaches in time and frequency domain by using energy spectral methods. Collision rules are also assessed to check the hull girder ultimate bending capacity in the damaged state.

Results: Cyclic stresses determination in specific structural details of the hull girder and welded joints is discussed, in order to evaluate the relevant maximum stress range useful for the subsequent fatigue studies, performed by finite element analysis. In a collision scenario, also in minor damages, fatigue cracks may appear and propagate, reducing structural strength and structures fatigue life.

Conclusion: Structural loads determination can be categorized in different methods, but the frequency-domain method is the most extensively used methods in fatigue analysis procedure, because it requires significantly less computational efforts than the time-domain method. Once determined the stress distribution, in most cases fatigue damage is calculated using the Palmgren–Miner cumulative damage rule in combination with the S–N curves of materials, structural details and welded joints. In a scenario where a damaged ship encounters large wave amplitudes, the damage accumulation could lead to low-cycle fatigue.

Acknowledgements: This study has been supported by the project PRIN_2022TXST8X_002 “EMPATHY, CUP J53D23002430001. Project funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component C2 Investment 1.1 by the European Union – NextGenerationEU.

Biography

Federico Frisone, marine engineer and naval architect.
Graduated at the University of Messina (bachelor’s degree) and Trieste (master’s degree), then I worked as Project Manager in major companies leader in the marine industry, as Ferretti Group and The Italian Sea Group. Right now he is carrying out research activity at the University of Messina, concerning ship structural response under different types of loads, supervised by professor Pasqualino Corigliano.

STRUCTURAL STRESS ANALYSIS OF TITANIUM WELDED JOINTS

Pasqualino Corigliano

Department of Engineering, University of Messina, Italy

Abstract

Background: Experimental tests are essential for the S-N curve evaluation in terms of maximum load versus the number of cycles to failure. However, when dealing with complex geometries, experimental tests cannot provide stress-strain information that are suitable for that specific material and welded joints.

Objective: To examine the fatigue properties of titanium welded joints, produced using an innovative laser source, were analyzed by means of numerical analyses with the aim of assessing the S-N curve in terms of hot-spot stresses versus the number of cycles to failure. The latter were taken for experimental tests.

Methods: Finite element (FE) analysis is indispensable for assessing the fatigue behavior of complex geometries and discontinuities induced by welding processes. In this particular case, solid elements were used to model the test specimen with hexagonal elements as regularly as possible. Specifically, 20-node parametric solid elements were employed, offering six degrees of freedom. The boundary and loading conditions were applied in order to represent the real conditions of the experimental tests.

Results: The structural hot-spot stress approach was applied to T-specimens fabricated from Ti_6Al_4V sheets and welded without the use of filler materials. The structural stress- number of cycles to failure curve was provided.

Conclusion: The structural hot-spot stress - number of cycles to failure curve exhibited a similar slope to the load - number of cycles curve. In addition, when dealing with welded joints made of steel and aluminum, specific FAT classes, provided by the International Institute of Welding, are available to assess their fatigue resistance. Yet, there are no such class assignments for titanium alloys. Further studies should assess proper FAT curve for titanium welded joints.

Acknowledgements: This study has been supported by the project PRIN_2022TXST8X_002 "EMPATHY, CUP J53D23002430001. Project funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component C2 Investment 1.1 by the European Union – NextGenerationEU.

Biography

Pasqualino Corigliano is Assistant Professor – RTD-B – Italian Scientific field (SSD): ING/IND-02 "Ship structures and marine engineering" at the Department of Engineering of the University of Messina, starting from 1/10/2021 up to present. He obtained his PhD (XXVIII Cycle), with mention DOCTOR EUROPAEUS, at the University of Messina. He was Awarded of the national scientific qualification as full professor for the Academic area 09/A1 Aeronautical and aerospace engineering and naval architecture in 2023. He is Principal Investigator of two research projects (PRIN 2022 and PRIN 2022 PNRR) Projects funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component C2 Investment 1.1 by the European Union – NextGenerationEU. The main research topics are: Static and fatigue behaviour of metallic and composite marine structures, Adhesive and welded joints used in marine structures, Fatigue analysis of welded joints used in shipbuilding, Full-field experimental techniques and nonlinear finite element analysis of welded joints for naval application, Dissimilar welding.

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SYNTHESIS OF MAGNETIC NANOPARTICLES/NANOCOMPOSITE FROM LATHYRUS BRACHYPTERUS EXTRACT AND PHOTOCATALYTIC HYDROGEN PRODUCTION FROM WATER

Muradiye Şahin

Kırşehir Ahi Evran University, Turkey

Abstract

Background: One of the 21st century's greatest scientific and technological endeavours is undoubtedly to develop new ways of producing and storing renewable energies. Hydrogen, which is not found free in nature but in the form of compounds, is not a natural energy source. It can be produced from various raw materials and is seen as an alternative energy carrier of the future. Hydrogen, which is seen as the energy carrier of the future, has a very important place among renewable energy sources due to its advantages such as being a sustainable energy source, not containing carbon in its structure and having high energy density. In particular, photocatalytic and electrocatalytic hydrogen production from water is accepted as cheap and efficient methods.

Objective: Magnetic nanoparticle/nanocomposite will be synthesised from Lathyrus brachypterus extract, an endemic plant species and photocatalytic H_2 production from aqueous media will be investigated.

Methods: Nanoparticles and nanocomposites were synthesised economically and environmentally friendly by green synthesis method. In photocatalytic hydrogen production experiments, 10 mg each of the synthesised nanoparticles and nanocomposites were used as catalysts and 3.25×10^{-4} M Eosin Y (EY) solution mixture was used as light absorber. Aqueous solution of 5% triethanolamine (TEOA) was used as electron donor (pH=9). Photocatalytic hydrogen production was initiated by continuous light from the light source and stirring. The amount of hydrogen produced was calculated from the calibration graph drawn on gas chromatography.

Results: From the results obtained, it was observed that the best catalytic activity in terms of hydrogen production amount belongs to Fe/Cu NPs. This is thought to be due to the fact that both metals in the bimetallic nanoparticle have band gaps due to the appearance of double metal peaks and the crystal defects are less. Nanocomposites produced higher hydrogen in a short time but lost their catalytic activity in a short time since they could not maintain their stability.

Conclusion: Trimetallic nanoparticles can be synthesised and modified with materials such as cellulose or chitosan and their catalyst effects can be investigated in the production of hydrogen from water *via* photocatalytic and/or hydrolysis.

ANALYTICAL EXPRESSIONS OF NON-MARKOVIAN QUALITIES OF BIOMATERIALS

Orchidea Maria Lecian
Sapienza University, Italy

Abstract

Some of the methodologies study of the long-time-scale dynamics of biological macromolecules is introduced.The stochastic apporach of biochemical systems is recalled; the qualities which can be ascribed to a markov-chain modellisation are summoned. The Markovian perturbations of Markov chains and the non-Markovian perturbation of Markov chains are compared. In the first instance, the perturbation of ergodic Markov chains are studied as far as the criteria to obtain Markovian perturbed chains are concerned.In the second instance, the chains originating after the perturbations of geometrically-ergodic Markov chains are envisaged. The mecroscopic matter is defined as the collpse of the wavefuction after the opportune clustering methods. The stochastic Markov model is framed with the statistical reconstruction and within the qualitiies of the unknow of the involved equations. The 'memory' qualities of the Langevin scheme is compared with the coarse-geining method as far as the description of soft matter is concerned.

Day-2
Keynote Presentations

FABRICATION OF ULTRAFINE-GRAINED BULK TI-ALLOY SHEETS AND RODS AND ITS INDUSTRIAL APPLICATION

Chong Soo Lee

Pohang University of Science and Technology, Republic of Korea

Abstract

This research aims to establish economical methods to obtain ultra-fine grained Ti alloys, in the form of sheets and rods, respectively. Ultrafine-grained (UFG) titanium alloys have attracted attentions for industrial uses due to their enhanced properties not only in mechanical properties but also in bio-compatibility. In general, these UFG materials are manufactured by a severe plastic deformation (SPD) process, such as equal-channel angular pressing, accumulative roll bonding, and high-pressure torsion. However, the UFG samples fabricated by the SPD processes are generally small in size, difficult to be used in the industry. We have produced bulk sheet of Ti-6Al-4V via controlled rolling, which is an economical way as compared to SPD processes. The produced UFG sheet recorded 600 mm in length and 300 mm in width whose average grain size was about 1 μm. Also, the UFG rod with 1200 mm in length was produced via multi-pass caliber-rolling process and exhibited a mean grain size of 0.2 μm. The UFG Ti-6Al-4V rod revealed excellent performances in both the mechanical properties and the biocompatible properties. The effective grain refinement in such bulk materials was discussed in light of dynamic globularization and strain accumulation.

Biography

Prof. Chong Soo Lee received the B.S. and M.S. degrees from Seoul National University, Seoul, Korea, in 1979 and 1981, respectively, and the Ph.D. degree from the Polytechnic Institute of New York University in 1985, all in metallurgical engineering. He became an assistant professor in the department of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH) Korea in 1987 and promoted to be a full professor in 1998. He is currently a Professor in the Graduate Institute of Ferrous Technology, POSTECH. He has published more than 300 SCI journals, and has worked as an Editorial board member of International Journal of Fatigue (2004-present). Several keywords of research are hydrogen embrittlement, fatigue, formability of metals and bio-materials. Owing to his active academic contribution, he has been elected as a member of the European Academy of Science (2009), the National Academy of Engineering of Korea (NAEK) (2012) and the Korean Academy of Science and Technology (KAST) (2014).

TRIBOLOGY: CONCEPTUALIZATION AND APPLICATIONS

Ronaldo Câmara Cozza

Ronaldo Cámara Cozza, CEETEPS – State Center of Technological Education "Paula Souza" Faculty of Technology – Department of Mechanical Manufacturing – Campus, Brazil

Abstract

The loss of energy in automobiles due to friction causes, annually, a loss of around US$500 billion. In the industrial sector, this waste is in the order of 5% GDP – Gross Domestic Product and in general terms, the impact of the wear in a country's economy is between 1 – 10% GDP. Additionally, in industrial sectors, where wear causes stoppage, or decreased production, or involves high maintenance costs, it is not enough to acquire knowledge only in metallurgical and/or mechanical manufacturing materials and processes – just as important is to research, study and understand not only the wear processes that act under specific conditions, but also the concepts involved. Among the various types of wear classified by the Standard ASTM G40 – 96, is the "abrasive wear", which in general terms, is responsible for, approximately, 50% of the industrial problems involving wear – however, on the other hand, it is part of the principle of several industrial processes, such as, for example, waterjet cutting, grinding, and polishing of molds for injection of thermoplastics. In view of the above scenario, scientific research involving tribology becomes important, not only in scientific terms, but also in industrial, economic, and social terms. With this, the objective of this lecture is to conceptualize the science "*Tribology*" along with certain mechanical-metallurgical applications.

Biography

Ronaldo Câmara Cozza received the titles of Mechanical Engineering by University Center FEI – Educational Foundation of Ignatius "Padre Sabóia de Medeiros" in 2002 and Mathematical by Methodist University of São Paulo, in 2005. He conducted his Programs of Master Degree and Doctor Degree in the Department of Mechanical Engineering of the Polytechnic School of the University of São Paulo – 2006 e 2011, respectively; in 2015, he finished the Post-Doctorate in Metallurgical and Materials Engineering, also in the Polytechnic School of the University of São Paulo. Nowadays, Ronaldo Câmara Cozza works as Titular Professor in two Universities: University Center FEI – Educational Foundation of Ignatius "Padre Sabóia de Medeiros" – Departments of Mechanical and Materials – and CEETEPS – State Center of Technological Education "Paula Souza" – Department of Mechanical Manufacturing – both in São Paulo, Brazil, teaching "Technical Drawing", "Mechanical Processes of Manufacturing", "Machine Kinematics and Dynamics" and "Tribology". Since 2003, Prof. R.C. Cozza studies fundamentals and tribological behavior of materials under conditions of micro-abrasive wear.

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SIMULTANEOUS HEAVY METAL WASTEWATER TREATMENT AND NANOPARTICLE SYNTHESIS USING DEAD BIOMASS OF MICROALGAE

Tau Chuan Ling

Universiti Malaya, Malaysia

Abstract

Background: Heavy metal pollution in wastewater from mining sites, drinking water, or pipelines proposed critical health concerns and environmental challenges. At the same time, there has been a growing interest in biosynthesis for desired metal nanoparticles from designed metal precursors. Dead biomass from microalgae, a promising biosorbent for heavy metals, can act both for heavy metal wastewater remediation and as a bio-factory to synthesize nanoparticles.

Objective: To demonstrate the efficiency of microalgae dead biomass as a bio-factory for the biogenic synthesis of metal nanoparticles by using the heavy metals adsorbed from wastewater as a precursor.

Methods: Different types of microalgae were cultivated and harvested. Microalgae extract was prepared and utilized in batch adsorption experiments to sequester iron (Fe) and manganese (Mn) ions selectively from synthetic wastewater under controlled conditions. The adsorbed metal ions were then reduced by the phycochemical component in the microalgae extract, resulting in metal nanoparticle synthesis. The nanoparticle was characterized using Field Emission Scanning Electron Microscopy (FE-SEM), High-Resolution Transmission Electron Microscopy (HRTEM), X-ray Diffraction (XRD), and additional spectroscopic methods.

Results: Both cyanobacteria and green microalgae exhibited remarkably high tolerance and adsorption capacities for Fe and Mn ions, which served as a precursor for the subsequent biogenic synthesis of metal nanoparticles. The nanoparticles generated displayed unique morphological and crystalline properties, which could be extracted for various industrial applications.

Conclusion: The study provides an innovative and green method for the metal nanoparticle synthesis pathway by utilizing microalgae biomass as a bio-factory. The study offers a more sustainable method for nanoparticle production while providing the collateral benefit of heavy metal wastewater bioremediation. As such, it introduces a new paradigm in sustainable material science, using waste to generate high-value nanoparticles.

Biography

Professor Dr. Ling Tau Chuan received his doctorate in Chemical Engineering from the University of Birmingham, United Kingdom, in 2002. He has been a Professor at the Institute of Biological Sciences, Faculty of Science, University of Malaya since 2011. He is one of the executive committee members of the International Bioprocessing Society and is positioned as the Vice Chair in the Malaysia Chapter of the Biochemical Engineering Special Interest Group (BESIG) from the Institution of Chemical Engineers (IChemE). He has more than 15 years of research experience in downstream processing and bioprocess engineering. He is interested in bioseparation, especially protein recovery from enzymes, microalgae, and food. His current research mainly focuses on clean energy, green chemistry, the cultivation of algae in wastewater for biodiesel production, and bioprospecting microalgae for valuable proteins. He has published over 300 international peer-reviewed journals and presented over 80 conference papers.

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PHYSICO CHEMICAL AND MECHANICAL CHARACTERIZATION OF PVC WASTE AND SAND COMPOSITE FOR ITS VALORIZATION FOR ROOFING

Diange Collins Misodi

Paul Herbert Higher Institute of Professional Studies Kumba, Cameroon

Abstract

This article deals with the valorization of PVC waste and river sand for the production roof tiles. This work is based on experimental study of roof tiles produced with recycled PVC and river sand in varying proportion of 10%, 20%, 30%, 50%, 60% ..... 100% of PVC combined with the corresponding fine aggregate percentage of river sand. The PVC waste used was subjected to heat of 170°C to ensure that it does not lose its properties. The tests which were performed to evaluate the physical and mechanical performances of this material were water absorption, density, moisture content and flexural strength. The following results were obtained: Absorption rate of the composite varies between 1.267% and 2.726%, which gives us a mean value of 1.913% and a standard deviation of 0.551%. The density of the composite varies between 1.0004 g/cm^3 and 1.1111 g/cm, with a mean value of 1.041 g/cm^3 and a standard deviation of 0.041 g/cm^3.The applied force at the ultimate stress point varies between 32.3 N for a displacement of 0.395mm in sample 9 and 205.3 N for a displacement of 0.9245 mm in sample 4 recycled PVC/sand composite tile have both good water absorptive property and strength.

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PHYSICO CHEMICAL AND MECHANICAL CHARACTERIZATION OF PVC WASTE AND SAND COMPOSITE FOR ITS VALORIZATION FOR ROOFING

Mbelle Samuel Bisong

University of Buea, Cameroon

Abstract

This article deals with the valorization of PVC waste and river sand for the production roof tiles. This work is based on experimental study of roof tiles produced with recycled PVC and river sand in varying proportion of 10%, 20%, 30%, 50%, 60% ..... 100% of PVC combined with the corresponding fine aggregate percentage of river sand. The PVC waste used was subjected to heat of 170°C to ensure that it does not lose its properties. The tests which were performed to evaluate the physical and mechanical performances of this material were water absorption, density, moisture content and flexural strength. The following results were obtained: Absorption rate of the composite varies between 1.267% and 2.726%, which gives us a mean value of 1.913% and a standard deviation of 0.551%. The density of the composite varies between 1.0004 g/cm^3 and 1.1111 g/cm, with a mean value of 1.041 g/cm^3 and a standard deviation of 0.041 g/cm^3.The applied force at the ultimate stress point varies between 32.3 N for a displacement of 0.395mm in sample 9 and 205.3 N for a displacement of 0.9245 mm in sample 4 recycled PVC/sand composite tile have both good water absorptive property and strength.

Day-2
Oral Presentations

RECYCLING OF MULTI-COMPONENT, MULTI-LAYER WASTE BY THE USE OF 'GREEN' SOLVENTS

George Theodosopoulos
TWI Ltd, United Kingdom

Abstract

Background: Less than a fifth of plastic packaging is currently collected for recycling globally, with the remainder ending up in landfills and oceans, causing alarming environmental consequences. These figures show the need for a new approach to packaging waste, and focus on recycling flexible, multi-material packaging systems. The advantages of recycling of these systems would lower greenhouse gas emissions, save resources, provide new job possibilities, and promote a circular economy. SolRec^2 project funded by the EU is looking at developing 'green' solvents for such multi-material recycling.

Objective: The separation of polymer-aluminium laminates by usage of 'green solvents', such as Deep Eutectic Solvents (DESs) and Ionic Liquids (ILs) for recycling and reduction of the plastic waste in the environment.

Methods: By the usage of non-toxic, stable, DESs and ILs the separation of polymer-aluminium laminates was tested, determining the efficacy of these 'green' solvents in delaminating the multi-material systems. Moreover, some of the experimental methods that were tested for the delamination by solvents and recovery of films from packaging are triboelectric sorting and density methods.

Results: Some of the tested systems were successful in dissolving certain polymers with separation of the aluminium layer. However, the initial approach required additional steps for the recovery of the polymer. Further study of the systems that accelerated delamination was performed and the findings revealed that these systems resulted in excellent aluminium recovery. Though, the corrosion or dissolution of aluminium in the DESs and ILs studies were limited, at least in the short-term tests.

Conclusion: This work illustrates the possible application of DESs and ILs for polymer-aluminium laminate separation, resulting in effective separation and excellent recovery of the laminate constituents. Finally, for a scaled-up procedure and for the assessment of the long-term impact of these solvents on aluminium corrosion performance more research is critical to be conducted.

SURFACE SCIENCE AND ENGINEERING

Sabrina Zuccalà
4ward360, Italy

Abstract

Surface science and engineering represent a multidisciplinary research field that focuses on the study and manipulation of the surface properties of materials. This branch of engineering analyzes the interactions between surfaces and the surrounding environment, and develops new technologies and methodologies to control and modify surface characteristics. The main goal of surface science and engineering is to improve the performance of materials in various sectors, such as industry, energy, electronics, and medicine. This abstract provides an overview of the main research areas and techniques used in surface science and engineering, highlighting the importance of this field for technological innovation and sustainable development.

Scientists and engineers at our 4wardResearch Laboratory are working to improve various characteristics of material surfaces. Some of the key features that are being considered include:

Adhesion: The ability of a surface to adhere to other materials is an important feature in many sectors, such as the automotive industry, electronics, and aerospace. Scientists and engineers are working to improve surface adhesion through chemical treatments, structural modifications, or the use of special coatings.

Corrosion resistance: Corrosion is a process that can damage material surfaces, reducing their lifespan and performance. Scientists and engineers are striving to improve the corrosion resistance of surfaces by using corrosionresistant materials, protective coatings, or passivation techniques.

Durability: Surface durability is important in applications that require long-lasting performance, such as construction structures, electronic devices, and medical devices. Scientists and engineers aim to enhance surface durability by using wear-resistant materials, reducing wear through the addition of protective coatings, or employing surface engineering techniques.

Optical properties: Optical properties of surfaces are crucial in sectors such as optics, solar energy, and electronics. Scientists and engineers seek to improve the optical properties of surfaces through the manipulation of surface structure, the addition of optical coatings, or the use of materials with desired optical properties.

Friction properties: Friction properties of surfaces impact resistance to movement and surface wear. Scientists and engineers are working to enhance friction properties by modifying surface texture, adding lubricating coatings, or utilizing materials with desired friction characteristics.

These are just a few of the surface characteristics that are considered in surface science and engineering. Our goal is to optimize materials for various applications in manufacturing, energy, electronics, and medicine, leading to technological advancements and sustainable development.

SYNERGISTIC ELECTRONIC AND FACETS ENGINEERING IN NOVEL DOUBLE PEROVSKITE OXIDE -BASED PHOTOCATALYSTS FOR SPATIAL CHARGE SEPARATION FOR OVERALL WATER SPLITTING AND CO_2 REDUCTION

Khakemin Khan
University of Trento, Italy

Abstract

The excessive use of fossil fuels in recent times has led to substantial carbon dioxide (CO_2) emissions, which have caused global warming and presented ecological and sustainability difficulties. It is crucial to decrease CO_2 emissions and find environmentally friendly and renewable alternatives to fossil fuels is becoming increasingly important, particularly considering the ambitious global climate regulations aimed at reducing coal consumption. Hydrogen (H_2) is a versatile energy carrier that is highly regarded as a promising solution to various energy challenges. Its remarkably high gravimetric energy density, little greenhouse gas emissions, and compatibility with existing manufacturing processes and fossil fuel-powered facilities have attracted substantial global interest;

Photocatalysis plays a key role in reducing waste and energy consumption and is consequently used in ca. 90% of industrial chemical products. Nevertheless, there is significant opportunity to develop new materials and utilize solar energy. Efficient charge separation and utilization are critical factors in photocatalysis. The aim of the project is to synthesize novel, advanced functional materials-based double perovskite photocatalysts. Perovskite semiconductor materials have attracted tremendous interest in heterogeneous photocatalysis. Despite this, most inorganic perovskite oxide semiconductors have limited charge mobility, poor charge separation, and severe charge recombination. Electronic and facets engineering of semiconductor photocatalysts play a key role in overcoming the above-mentioned shortcoming of double perovskites photocatalysts. This unique strategy will prove to be a potential pathway to a new class of intriguing materials with wide-ranging applications, for example, photocatalytic overall water splitting and CO_2 reduction to various value-added chemicals. These short-term goals will help prominently develop the applicant's research career, and in the long term, they will create many fascinating opportunities and knowledge for emerging advanced and functional materials for the production of renewable energy in order to overcome the energy shortage and environmental problems.

Biography

Elisa Bevilacqua is a woman very enthusiastic about her work. She has been concentrating her research on fetal medicine, prenatal diagnosis, and fetal therapy. She is in charge of the Multiple Pregnancy Clinic at Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy.

Coalesce Research Group

9th International Conference on

Material Science and Engineering

April 11-12, 2024 | Belstay Roma Aurelia, Rome, Italy

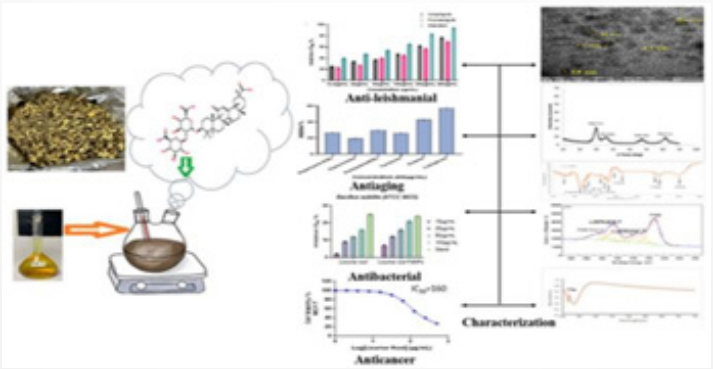
PHYSIOCHEMICAL CHARACTERIZATION OF *GLYCYRRHIZA* MEDIATED BIOENGINEERED PALLADIUM NANOPARTICLES (PDNPS), THEIR ANTI-PROLIFERATIVE AND OTHER BIOMEDICAL APPLICATIONS

Najlaa S. Al-Radadi

Taibah University, Saudi Arabia

Abstract

Synthesis of metallic nanoparticles using an environmentally safe and green synthetic technique has gained prominence in recent years. In the current study, licorice root leaf extract was used to create palladium nanoparticles in an environmentally benign and plant-mediated synthetic technique. Licorice root extract offered long-term stability, lower toxicity, and more penetration into specific target cells when used as a reagent in the biosynthesis of nanoparticles. Optimal conditions (temperature, pH, and time) were maintained to synthesize tiny, regular, spherical, and homogenous nanoparticles. The PdNPs have been characterized by UV–Visible spectroscopy, Energy dispersive X-ray spectroscopy, X-ray diffraction, High resolution Transmission electron microscope, Fourier Transform Infrared Spectroscopy, Particle-Size Distribution, Zeta potential and X-ray photoelectron spectroscopy analysis. By using ABTS and DPPH, two widely used antioxidant techniques, both synthetic and biosynthetic Palladium nanoparticles demonstrated strong antioxidant potential and maximal inhibition rates. Palladium nanoparticles successfully inhibited the growth of Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Bacillus subtilis with mean inhibition zones of 20-25±0.22 mm. PdNPs shown anti- Alzheimer activity by suppression of acetylcholinesterase and butyryl cholinesterase enzymes. The biosynthesized Palladium nanoparticles anti-proliferative activity was assessed against MCF-7 and HCT-116 cancer cells line, the Palladium nanoparticles minimum anti-proliferative concentration values were 44.4 and 6.58 µg/mL against MCF-7 and HCT-116. Based on the potency that showe by Palladium nanoparticles in biological assays we can conclude that Palladium nanoparticles are good therapeutic agents to be used in pharmaceutical industries for drug delivery and other biomedical applications.



Biography

Najlaa Saad Oudah Al-Radadi

She later worked at Taibah University as an Associate Professor of Nanotechnology and Inorganic Chemistry in 2019 until 2022. In 2022 she was appointed a full Professor in Nanotechnology and Inorganic Chemistry until present at Taibah University. Prof. Najlaa is a member of several editorial boards and professional societies. She is the recipient of several awards and honors such as:

Prof. Najlaa has been honored by the Saudi Embassy in Washington, D.C, where it launched the Ambassador of the Kingdom of Saudi Arabia to the United States of America Her Royal Highness Rima bint Bandar bin Sultan bin Abdulaziz is an initiative to shed highlig hting Saudi

women pioneers. The project is entitled as "Saudi Women in the Spotlight", and the Saudi Embassy publishes videos that tell a unique story of women who contribute to the development of their country in various ways. She was one of the Saudi pioneers for whom a video was published highlighting her role as a Saudi inventor and holder of many patents and many international awards and honors in the field of green synthesis of nanoparticles and their therapeutic applications

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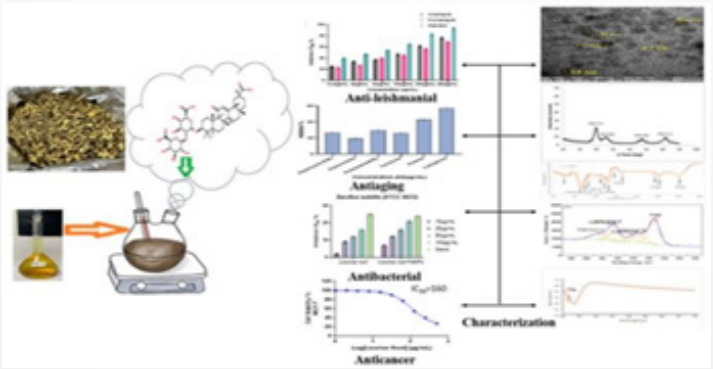
Ahmed H. Ragab

King Khalid University, Saudi Arabia

Abstract

Synthesis of metallic nanoparticles using an environmentally safe and green synthetic technique has gained prominence in recent years. In the current study, licorice root leaf extract was used to create palladium nanoparticles in an environmentally benign and plant-mediated synthetic technique. Licorice root extract offered long-term stability, lower toxicity, and more penetration into specific target cells when used as a reagent in the biosynthesis of nanoparticles. Optimal conditions (temperature, pH, and time) were maintained to synthesize tiny, regular, spherical, and homogenous nanoparticles. The PdNPs have been characterized by UV–Visible spectroscopy, Energy dispersive X-ray spectroscopy, X-ray diffraction, High resolution Transmission electron microscope, Fourier Transform Infrared Spectroscopy, Particle-Size Distribution, Zeta potential and X-ray photoelectron spectroscopy analysis. By using ABTS and DPPH, two widely used antioxidant techniques, both synthetic and biosynthetic Palladium nanoparticles demonstrated strong antioxidant potential and maximal inhibition rates. Palladium nanoparticles successfully inhibited the growth of Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Bacillus subtilis with mean inhibition zones of 20-25 ± 0.22 mm. PdNPs shown anti- Alzheimer activity by suppression of acetylcholinesterase and butyryl cholinesterase enzymes. The biosynthesized Palladium nanoparticles anti-proliferative activity was assessed against MCF-7 and HCT-116 cancer cells line, the Palladium nanoparticles minimum anti-proliferative concentration values were 44.4 and 6.58 µg/mL against MCF-7 and HCT-116. Based on the potency that showe by Palladium nanoparticles in biological assays we can conclude that Palladium nanoparticles are good therapeutic agents to be used in pharmaceutical industries for drug delivery and other biomedical applications.



THE IMPORTANCE OF COLOR-DYE INJECTION AND CORD INSERTIONS' SITES STUDIES IN MONOCHORIONIC TWIN PLACENTAS

Bevilacqua Elisa

Policlinico Universitario Agostino Gemelli IRCCS, Italy

Abstract

Introduction: Monochorionic (MC) pregnancies represent a challenge in obstetric practice. Not only are all twin pregnancies associated with a higher risk of all maternal-fetal complications of pregnancy, but the peculiar angioarchitecture of MC twins' placentas is also responsible for unique complications that cause higher odds of perinatal morbidity and mortality. Our knowledge of MC pregnancies complications is largely based on the extensive ongoing research on MC placental structure. This study aimed to evaluate placental anastomoses and cord insertions as independent risk factors for neonatal adverse outcomes.

Methods: This was a prospective study conducted at Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy from April 2021 to December 2022. After delivery, the placentas were stored at 4°C until color-dye injection and examined within 7 days. Chorionicity was confirmed by gross examination of the dividing membrane and/or histopathological examination of the placenta and the dividing membrane. Data on umbilical cords' insertions, and presence, number, and type of anastomoses, was collected.

The primary outcomes were a Composite Monochorionic Pregnancy Outcome (CMPO) and a Composite Neonatal Adverse Outcome (CNAO). The secondary outcome was the birth weight discordance between the neonates.

Results: The CMPO occurred in 15.8% pregnancies, and the CNAO occurred in 67.1% pregnancies. The analysis confirmed a significant association between velamentous cord insertions and neonatal adverse events (p=0.003). Also, a significant positive association (p=0.0326) between twin birth weight discordance and discordance in twins umbilical cord insertions' sites was found. No significant association between the number and type of the anastomoses and both the CMPO or CNAO was detected.

Discussion: Our data suggest that the routine sonographic assessment of umbilical cords' insertion sites could be helpful in predicting fetal and neonatal adverse events. We believe it is important to implement the evaluation of this ultrasound parameter to optimize risk stratification and resource allocation, thus improving the management of monochorionic twin pregnancies. Moreover, color-dye injection study of placentas after birth should be promoted in all referral center for MC pregnancies. This is a feasible procedure that can help fetal therapy operators to gain valuable knowledge about the etiopathogenesis of twin complications.

Biography

Elisa Bevilacqua is a woman very enthusiastic about her work. She has been concentrating her research on fetal medicine, prenatal diagnosis, and fetal therapy. She is in charge of the Multiple Pregnancy Clinic at Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy.

Day-2
Video Presentation

Coalesce Research Group

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CONJUGATED COUPLING FOR TWO PENROSE TILES PAIR AND THEIR ELEMENTARY UNIT CELL FOR TRANSLATION TILES AND THEIR UNIT CELL

Chung Yuan Kung

National Chung Hsing University, Taiwan

Abstract

Background:. According to the traditional method to produce a large size Penrose tiling is very time consuming.Commonly making mistakes in the connection direction, resulting in no way to complete it later. . It is impossible to predict in advance whether an error has occurred until tiling reaching to a large enough size. Most people have no way to draw the Penrose tiling picture orderly(systematically) to large enough and repeat it. It seems that no one has ever made the picture large enough to make people believe that the picture can be correctly continued.

Objective: To make a systematical method extend the Penrose tiles to infinity in size.

Methods: Develop the coupling and tessellation schemes to extend the tiles.

Results: I have made the largest Penrose tiling up to 60000 rhombuses together.

Conclusion: Two different types of pentagonal Penrose tiles are constructed in this study in order to create translational periodic Penrose tiles (crystals). It is found that these two Pentagonal-shaped Penrose tiles can be coupled successfully without any defect and on different direction and at different depths. Some unit cell can be intercepted from the coupled result, these unit cells can be (combinated) self-tessellated respectively, to become different periodic tiling. These periodic tiling (with atoms inside the tiles) can be simulated the recently discovered hundreds quasi crystals.

Therefore, a model of Penrose multiple concentric nanotube is established to facility a further 3-DPenrose-tiling studies.

Biography

Kung graduated from National Tsing Hua University 1969 and 1972 with BS and MS degree in physics, university of Alabama in Huntsville 1974 in physics and Northwestern university 1979 in material science. Post doctor at Georgia Tech and research science at Lawrence laboratory. With about 6 years experiences in US industries Fairchild and National Semiconductor and work for ITRI (Taiwan) since 1987 to1991 and worked for National Chung-Hsing University electric engineering department (four years for Chairman)and Institute of optoelectronic Engineering (Three years for director) , since 1991 to 2016 (retired).

Day-2
Poster Presentations

POLYESTERS OF AZELAIC ACID AND SELECTED SHORT-CHAIN DIHYDROXY ALCOHOLS FOR THE PREPARATION OF CELL SCAFFOLDS

Aleksandra Bandzerewicz
Warsaw University of Technology, Poland

Abstract

Azelaic acid is a dicarboxylic acid of plant origin with numerous applications in dermatology. Pharmacological applications of azelaic acid have been studied since the 1980s. Its anti-inflammatory and antioxidant properties are believed to determine its efficacy in the treatment of rosacea and acne vulgaris, among others. Both dihydroxy alcohols, 1,3-propanediol and 1,5-pentanediol, have cosmetic applications. 1,3-propanediol shows moisturising properties and can be used as a humectant in skin and hair products. Studies on selected dihydroxy alcohols have shown that their antifungal activity increases with carbon chain length, with the use of 1,5-pentanediol allowing up to a 10-fold increase in efficacy compared to shorter diols.

The work focuses on synthesising polyesters of azelaic acid and chosen dihydroxy alcohols: 1,3-propanediol and 1,5-pentanediol. The intended use of the materials obtained is the production of biodegradable and bioresorbable scaffolds for skin cell culture.

Polymer syntheses were carried out, varying in temperature and reaction time. The products were characterised by their molecular weight, degree of acid group conversion and thermal properties. The chosen materials were used to produce cell culture scaffolds by electrospinning. The fibre-forming potential of poly(azelate diols) were assessed. The applicability of the obtained fibres was determined based on mechanical and surface properties and their internal morphology. Resistance to radiation sterilisation was determined. An essential part of the project were cytotoxicity tests on extracts.

The research was funded by the Warsaw University of Technology within the Excellence Initiative: Research University (IDUB) programme, a project called *Polyesters of azelaic acid and selected short-chain dihydroxy alcohols for the preparation of cell scaffolds*

Biography

Aleksandra Bandzerewicz is a PhD student at the Faculty of Chemistry, Warsaw University of Technology. Her research work focuses on polymers for biomedical applications, the manufacture of implants and scaffolds for cell culture, and testing the biocompatibility of such products. She has won several national awards for her scientific activities and led her own project on cell culture on porous materials.

DNA AND G4 PAMAM DENDRIMERS AS A BASIS FOR REDUCTION OF SILVER IONS

Irine Khutsishvili

Ivane Javakhishvili Tbilisi State University, Georgia

Abstract

Using different organic materials, it is possible to obtain various types of clusters during the reduction of metal ions. For example, the unique structural features and powerful recognition capabilities of DNA can be of interest for assembling artificial structures for a variety of applications in Nano-photonics. A DNA helix is, itself, a nano-object that can be manipulated in various ways, but it can also be treated as a versatile molecular scaffold for building nanoscale devices from the bottom up. The unique properties of DNA's are being intensively studied from different points of view: as a molecular wire, as a drug delivery system, as a ladder for ordered arrangements of various nanostructures, as a spacer to control distances between nano-objects, etc.

Organic nanoparticles G4 PAMAM (polyamidoamine) dendrimers have important characteristics, such as: chemical content, huge surface, spherical form, "pockets" full of water between the branches, therefore in modern research, dendrimers are used for synthesis of various metal nanoparticles. This means that the metal ions enter the existing hollow space in the structure of the dendrimer, and when the reductant is added, they reduce to atoms and form a nanoparticle. In this case, the distribution of nanoparticle sizes is narrow.

The main goal of the research was to study the reduction process of silver ions on calf thymus DNA, to create one dimentional structure of silver atoms, also G4 PAMAM dendrimers to create new, stable nanosized (~5 nm) metalorganic nanocomplexes.

The investigation of the catalytic properties of the DNA and G4 PAMAM in the reactions of reduction of silver ions, and photo-induced processes was performed using spectroscopic and thermodynamic methods.

Biography

Irine Khutsishvili, works at Ivane Javakhishvili Tbilisi State University, (TSU) Andronikashvili Institute of Physics as the Senior Research Scientist. The areas of her interests are: the structure and functions of DNA molecule, DNA interaction with metal ions, water molecules, lipids, and various drugs, structure and stability of DNA complexes, nonstandard DNA structures (hairpin, triplex, G-quadruplex, i-motiv) physical-chemical properties, and bio-nanophysics. Irene Khutsishvili in recent years has been interested in studying catalytic properties of DNA using spectroscopic and thermodynamic methods: in redox reactions, photoinduced processes, nanoscale resonance radiationless electron excitation energy transfer and in the formation of inter-strand crosilink in DNA double helix. She is actively involved in international conferences around these fields.

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SYNTHESIS AND CHARACTERIZATION OF PLATINUM NANOPARTICLES ON REDUCIBLE METAL OXIDE SUPPORTS FOR CATALYTIC APPLICATIONS AND HYDROGEN SENSING

Marijan Gotić

Laboratory for Molecular Physics and Synthesis of New Materials, Division of Materials Physics, Ruđer Bošković Institute, Croatia

Abstract

Background: The effectiveness of platinum in catalysis and gas sensing depends to a large extent on its dispersion. Achieving optimal dispersion is critical and often requires the synthesis and dispersion of platinum nanoparticles (PtNPs) or atomic platinum on supports. While the stabilization of subnanometric PtNPs in liquid media is difficult due to coalescence, smaller PtNPs or atomic platinum can be effectively dispersed on supports, which improves the catalytic properties. Furthermore, dispersion of platinum on metal oxide supports such as reducible α-Fe_2O_3, SnO_2 and MnO_2 increases the catalytic potential, emphasizing the importance of understanding the interactions between platinum and supports for improved efficiency.

Objective: This study aims to synthesize and dispersed platinum (Pt) nanoparticles on reducible metal oxide supports such as α-Fe_2O_3, SnO_2 and MnO_2. Specifically, we focus on optimizing the dispersion of Pt nanoparticles on these supports to enhance catalytic activity in the reduction of 4-nitrophenol (4-NP) to 4-aminophenol (4-AP). Additionally, we investigate the hydrogen (H_2) sensing ability of both pure α-Fe_2O_3 and Pt/α-Fe_2O_3 samples.

Methods: Various characterization techniques, including STEM, XRD, SEM, XPS, NEXAFS, and Mössbauer spectroscopy, are employed to analyse the synthesized catalysts. Additionally, the catalytic performance is evaluated, focusing on the influence of Pt loading and support morphology on catalytic efficiency and reusability.

Results: In this study, platinum (Pt) nanoparticles on SnO_2 and α-Fe_2O_3 and MnO_2/Mn_5O_8 nanorods were synthesized and characterized for catalytic applications. The mechanochemically synthesized Pt/SnO_2 and Pt/α-Fe_2O_3 catalysts exhibited ultrasmall Pt nanoparticles, which were well dispersed on SnO_2 and α-Fe_2O_3 supports and showed high catalytic activity in the reduction of 4-nitrophenol (4-NP) to 4-aminophenol (4-AP). Pt/MnO_2 nanorods synthesized by wet impregnation showed Pt loading-dependent effects on nanorod morphology and catalytic performance, with the relatively highest catalytic efficiency observed at a lower Pt loading (1 mol%). These results emphasize the importance of Pt dispersion and support morphology for catalytic applications. The hydrogen (H_2) sensing ability of pure α-Fe_2O_3 and Pt/α-Fe_2O_3 samples was also investigated.

Conclusion: Mechanochemical synthesis yielded Pt/SnO_2 and Pt/α-Fe_2O_3 catalysts with well-dispersed ultrasmall Pt nanoparticles (PtNPs), confirmed by STEM analysis. XPS revealed Pt in all oxidation states, varying with Pt loading and support type. Catalytic activity in 4-NP reduction was attributed to highly dispersed PtNPs, promising for environmental applications. Besides, it was found that dispersed platinum nanoparticles exhibit increased sensitivity to H_2 regardless of concentration, as well as increased sensitivity at higher temperatures and a reversible response to H_2 in ambient air, suggesting avenues for future research on optimal platinum concentrations and support morphologies.

Microwave-assisted synthesis produced Pt/SnO_2 catalysts with controlled Pt particle formation on mesoporous SnO_2 supports. XRD and SEM confirmed tailored structural properties. Catalytic activity peaked at 5 mol% Pt loading, with exceptional reusability observed over cycles.

MnO_2/Mn_5O_8 nanorods supported Pt nanoparticles, showcasing varying crystalline phases and PtNP dispersions. XPS and NEXAFS indicated changes in Pt oxidation states with loading, alongside the presence of Mn(II). Low Pt loading samples exhibited superior catalytic performance in 4-NP reduction, emphasizing the importance of Pt loading and support interaction.

Biography

Marijan Gotić, a renowned Croatian scientist in the field of materials chemistry, has made groundbreaking contributions to science. With 77 papers cited in the "Web of Science Core Collection"," with more than 2708 citations and an h-index of 28, Gotić's impact is great. He currently works as a senior scientist at the Ruđer Bošković Institute and specializes in materials science and the synthesis of novel materials. His research focuses on the synthesis, dispersion and catalytic and gas sensing properties of noble metal nanoparticles on metal oxide substrates as well as microstructural characterization. His leading role in projects such as the HRZZ project "Platinum decorated iron-tin oxide solid solutions for hydrogen gas sensing" should be emphasized. Beyond research, Gotić contributes to scientific bodies, reflecting his commitment to advancing knowledge and promoting international collaboration.

PRELIMINARY RESEARCH OF MICHAEL ADDITION OF CYSTEINE AS A SOLUTION FOR OSTEOPOROSIS PATIENTS

Magdalena Miętus

Warsaw University of Technology, Poland

Abstract

Bone is one of the most commonly transplanted tissues in the body - ranked as the second after blood. Current statistics (as of the year 2021) indicate around 2.22 million bone transplants. This value is expected to increase by around 13% each year. While bone can self-heal from injuries such as cracks or fractures with a diameter of 2 centimeters, it is not possible for diseases such as osteoporosis. Currently, the treatment of osteoporosis is mainly based on pharmacotherapy, which inhibits bone resorption. However, it does not lead to the restoration of already lost bone mass. A potential solution to this problem could be the use of biodegradable cellular scaffolds, which would be formed directly in the bone tissue.

An aliphatic polyester, poly(glycerol itaconate) (PGItc), was chosen as the first of two components of a cellular scaffold that would be formed in situ. It was obtained by the polycondensation reaction of itaconic acid and glycerol. Both itaconic acid and glycerol exhibit antimicrobial properties. Itaconic acid is a biocompatible chemical compound, obtained industrially by conversion of sugars. A multiple bond is present in the side chain of itaconic acid, which allows for a Michael addition reaction. It makes it possible to obtain an *in-situ* scaffold. In the present study, PGItc acted as an electrophile in the Michael reaction. Endogenous amino acid L-cysteine acted as a nucleophile. In its structure, there are two groups reactive in the Michael reaction - an -NH_2 and -SH groups. L-cysteine is a non-toxic substance - it is found in many drugs, in the food and cosmetic industries.

In the present study, PGItc was synthesized and a series of additions of L-cysteine to PGItc were performed. PGItc and the products of the addition reaction were mainly investigated by FTIR, NMR, DSC, TG, and wetting angle analyses.

Biography

Magdalena Miętus is a Ph.D. student in the Department of Polymer Chemistry And Technology at Warsaw University of Technology in Poland. Her main scientific interests are tissue engineering and polymer biomaterials. Currently, Magdalena is dedicating her research time to 3D bioprinting. In addition to her work in the laboratory, Magdalena devotes her time to developing her skills by attending courses on clinical research.

Until now, Magdalena has taken part in three scientific projects. She is the author of several scientific articles, which are focused on the synthesis and application of biocompatible polyesters. Magdalena has participated
in several scientific conferences – both national and international, at which she presented the results of her lab work.

OPTICALLY ACTIVE NANOSTRUCTURED THIN FILMS OF CELLULOSE NANOCRYSTALS

Rachel Yerushalmi - Rozen

Ben-Gurion University, Israel

Abstract

Background: Nanocellulose is a bio-based, non-toxic, degradable source for nano-structured functional coatings. Cellulose nanocrystals (CNCs) can be derived from agricultural and industrial waste via mild-acid-hydrolysis. When dispersed in aqueous solutions CNCs self-assemble into a liquid crystalline phase and can be further used for preparation of large area, micron-thick chiral nematic films that selectively reflect circularly polarized light at a wavelength that is determined by organization of the nanoparticles. These films show bright interference colours and can be used as components in active nano-devices.

Objective: The timescale for the assembly of low-defect orientationally ordered photonic films is of the order of weeks, forming an obstacle for their processing via most industrial-scale process. In the study presented here report we the utilization of a new approach, borrowed from polymer technology, for a two-step processing of solvent deposition followed by solvent vapor annealing (SVA).

Methods: In this approach, CNCs suspensions are deposited on a solid substrate, to form a micrometric film, and quenched within minutes. In a second step SVA is applied, allowing for surface-induced self-organization of the CNCs.

Results: We report methodical investigation of CNCs re-organization (on glass, quartz and mica substrates) under SVA using Atomic Force Microscopy, Polarized Optical Microscopy and Cryo-TEM. Our study shows significant re-organization within the CNCs films, leading to the formation of chiral - nematic assemblies. The results indicate the CNCs suspensions can serve as colloidal ink for printing of optically functional films on a variety of substrates, offering an alternative to synthetic nanocrystals in a variety of applications.

Conclusion: SVA can be used to improve the self-assembly of optically active thin films comprising CNCs.

Biography

Rachel Yerushalmi – Rozen is a professor of Chemical Engineering at the Ben-Gurion University of the Negev, Beer-Sheva Israel. She is investigating self-assembly in soft matter, polymers and colloids using a variety of experimental methods.

PHOTOCONDUCTIVE RESPONSE OF A FIELD-EFFECT TRANSISTOR THROUGH THE TRAPS EFFECT

Bellal Bouzidi

Hight School d'Agriculture Saharien Adrar(ESASA), Algeria

Abstract

The choice of an energy system must obey and comply with certain rules. The selected energy system must show as a preliminary its competitiveness with respect to other systems for the same rendered service. Its credibility must rest on economic and technical bases. In this paper, the photoconductive parameters of Field-Effect Transistors (FETs) excited by high-frequency optical source is studied. The FETs plasma oscillations dominated in the Terahertz (THz) range demonstrates their important effect related to THz emission and detection at room temperature. The study taking into account the plasma modes of FETs which can be coupled with photoexcitation optical pulse. Particularly, the model using the excess carriers flow through the traps density and the small-signal response of Field-Effect Transistors to describe the photoconductivity and the drain current in external circuit. The effect of the carriers relaxation time, the excited wavelength and the channel plasma modes on photoexcited FETs behavior is investigated. This leads to the possibilities of increasing the photoconductive contribution in total current by coupling both the microwave and optical FET proprieties an analytical calculations, based on both evolutionof excess carriers through the traps effect, proposed to describe a high frequency photoconductive HEMT behavior. The time evolution of carriers density, obtained by absorption in the channel, and the traps density are used to calculate the HEMT photoconductivity. Moreover, the drain current in external circuit is determined by the small-signal elements of HEMT obtained . The influences of the material parameters (relaxation rate, channel length), excited wavelength and carrier velocity are investigated.

Biography

Aleksandra Bandzerewicz is a PhD student at the Faculty of Chemistry, Warsaw University of Technology. Her research work focuses on polymers for biomedical applications, the manufacture of implants and scaffolds for cell culture, and testing the biocompatibility of such products. She has won several national awards for her scientific activities and led her own project on cell culture on porous materials.

Virtual - Day 1
Keynote Presentation

Coalesce Research Group

9th International Conference on

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DEVELOPMENT OF ENERGY EFFICIENT ALKALI-ACTIVATED BRICKS USING WASTE FOUNDRY SAND

Rahul Ralegaonkar

Visvesvaraya National Institute of Technology, India

Abstract

Waste foundry sand (WFS) is the by-product of the foundry industry, which is produced about 0.6 tons per 1 ton of foundry industry production and normally is disposed in landfills. Also, the conventional method of clay-brick manufacturing is energy intensive process. In order to provide a sustainable solid waste management solution and also to reduce the embodied energy of the manufactured bricks, the present study elaborates development of alkali-activated bricks using waste foundry sand. The anhydrous sodium metasilicate (SMS) as the activator, ground granulated blast furnace slag (GGBS) and fly ash (FA) as aluminosilicate precursor, and waste foundry sand (WFS) as a fine aggregate were identified as locally available materials for experimental trials. Alkali activated waste foundry sand bricks (AFSB) were developed using FA and GGBS in different proportions with SMS (8% and 10% of the binder). The water-to-binder ratio was kept same at 0.35, and the binder-to-WFS ratios were 1:1 and 1:2 by proportion. After evaluating various physico-mechanical properties as per the standards (IS 3495 (Part1-3), 1992), AFSB were classified into three classes based on its compressive strength (ranging from 4 to 18 MPa). The developed bricks were found to have a density of 1900-2000 kg/m^3 with water absorption of 4-6%. The thermal conductivity of AFSB ranged from 0.32-0.40 W/(m.K). The embodied energy required in the production of AFSB was found to be around 8% and 5% less compared to the energy required to produce burnt clay bricks and fly ash bricks respectively. The experimental analysis demonstrated the significance of utilizing industrial byproducts such as FA, GGBS, and WFS to produce energy-efficient alkali-activated bricks.

Biography

Rahul V. Ralegaonkar has completed B.E. (Civil), M.E. (Civil) & Ph.D. (Energy Efficient Buildings). His keen interest is in broad areas of Sustainable Construction Engineering and Disaster Management. He is presently working as Professor in Department of Civil Engineering, at Visvesvaraya National Institute of Technology, Nagpur, India. He has been actively involved in R & D sponsored projects.

Apart from academics he is also the member of several professional bodies of International and National repute. He has over 20 years of professional experience of which around 2 years has been in the industry at the Managerial post in GIS industry and Civil Construction industry. He was awarded prestigious Building Energy Efficiency Higher & Advanced Network (BHAVAN) fellowship by Indo-US science & technology forum, DST, New Delhi from from July 2016-December 2016 and also bagged 1 international, 1 national and 3 state level awards. He has been awarded Visiting Professor Post at Liverpool John Moores University, UK for the track February 2019-January 2022. 10 Ph.D.s and more than 55 M.Tech. Projects were completed under his guidance. Till date, seven Indian patents were granted and was awarded 2 copyrights for the developed software tools focusing on sustainable construction engineering. He has published more than 170 publications at international and national level Journals and Conferences. As an organizing committee member including principal coordinator, convener and secretary for workshops, training program and national conferences, he participated in more than 40 events. He is also actively involved with technical forums as an editorial board member and the reviewer for several journals and conferences at national and inrnational lev

Virtual - Day 1
Oral Presentations

UNDERWATER SWIMMING ROBOT BASED ON PIEZOELECTRIC CERAMICS

Qingping Wang
Hubei University of Education, China

Abstract

Underwater swimming robots that utilize piezoelectric materials encounter various challenges, including swift movement and potential application in water purification. In this study, we thoroughly investigate an acoustic system composed of a 3D-printed housing with a piezoelectric actuator and nanocellulose. Initially, we provide a brief introduction to the 3D-printed housing. Next, we examine the preparation process and the hydrophobic and oleophilic properties of the cellulose. Subsequently, we evaluate the acoustic impedance properties of the piezoelectric materials operating in thick-vibration mode. We then measure the velocity of the underwater swimming robot and make a corresponding comparison between dense and porous piezoelectric materials. Finally, we successfully demonstrate the application of water purification using the underwater robot with cellulose. This research renders the robot highly suitable for tasks such as water cleaning in various environments.

Biography

Relevant experience in Architectural design, Interior & Exhibition design, Urban planning, and building construction, across Nigeria and in Europe (Italy, France, and Iceland) with proficiency in the use of Building Information Modelling BIM. Currently doing doctorate research with Politecnico di Milano, on Circular Economy in the African Constructionsector

BURNING TOBACCO CIGARETTES WITH CA POLYMER FILTERS HARMS SMOKERS AND THE ENVIRONMENT - TOXIC DEPOSITS AND RESPIRABLE MICROFIBERS

Peter Eyerer
Fraunhofer ICT, Pfinztal, Germany

Abstract

Well over 90% of the 6.5 trillion cigarette butts smoked worldwide each year contain a cellulose acetate filter. 4.5 trillion of these filters loaded with chemical pollutants, each of which consists of approx. 15,000 individual fibers with a large surface area, are disposed of illegally and carelessly in the environment. Around 70% of them end up in the world's oceans, 30% on the ground and as airborne emitters.

Most of the approximately 1 billion smokers on earth believe that the CA polymer filter benefits their lungs and health. However, many studies and investigations have proven the opposite. The filter is a marketing tool of the tobacco industry. During smoking, cigarette butts emit around 100 micro- and nanofibers loaded with harmful substances into the respiratory tract per filter. With an average of 16 cigarettes a day, a smoker ingests approx. 1600 microfibers, with unexplained consequences. The filter effect against combustion chemicals from the exhaust smoke, i.e. the protection of the smoker, is negligible because the smoker recovers the reduced nicotine (deposits on the fibers) through a higher draw. This compensates for the filtered, lower quantities of chemicals.

What remains is enormous annual global environmental damage, including cleaning costs running into billions.

Despite extensive scientific research over the past 50 years, there are still important questions without answers.

1. we do not know the half-life of the toxicity of nicotine in water, even though we dispose of around 180,000 tons of nicotine globally every year via butts (nicotine is a pesticide banned in the EU) in surface waters (everything except drinking water).

2. are the respirable parts (micro- to nanofibers) of the trillions of cellulose acetate fibers in the environment (water, soil, air) carcinogenic to humans? What effects do they have in the food chain?

3. how can the discarded butts on earth be collected, processed and recycled in the smoking products cycle in a cost-saving and effective way?

4. how should the more recent developments in cigarettes over the past decade be assessed?

- Tobacco cigarettes (conventional cigarette smoke by burning at 600 to 800°C, with enormous pollutants)

- Tobacco heaters (tobacco sticks are vaporized at < 350°C, with significantly fewer harmful substances)

- E-cigarettes (propylene glycol and glycerine liquid with nicotine, flavorings, etc. are vaporized at < 315°C, with significantly fewer pollutants)

Solutions to the 4 sets of questions are

- Mix cellulose acetate with cigarette butt pyrolyzate (tobacco charcoal). This has the following advan-

tages: Circulation capability, CO_2 sink, approx. 30% better filter effect

- Treat cellulose acetate filter paper so that the fibers remain locked in a more stable fiber coating.

- Alternative: development of a filter without fibers, based on cigarette butt charcoal or tobacco charcoal

- Introduce air bubbles in the filter tangentially and along the length under the paper so that the 70% butts float on the water and can be fished out

- Quantitatively evaluate tobacco cigarettes, tobacco heaters and E-cigarettes through comparative holistic balancing and research long-term effects

A 10-point program serves to concretize and implement the above solution ideas, which should be worked on globally together with science, industry and politics/environmental authorities.

USE OF NANOSCALE MATERIALS IN SENSOR DEVICES

Ruslan Politanskyi
Yuriy Fedkovych Chernivtsi National University, Ukraine

Abstract

Background: Sensory properties of metamaterials can be an important aspect of their application. Metamaterials can be specially designed to interact with different types of waves, allowing them to function as sensors in a variety of areas. Each of these applications opens up new possibilities in various fields, from remote sensing and medical research to the development of new technologies for vision and communication.

Objective: To investigate the possibility of remote sensing of microwaves by generation of spin waves in metamaterials.

Methods: Used quantum models of a two-level system excited by an external microwave field, in which spontaneous transitions from one state with a higher energy to another with a lower energy occur, which are known as Rabi oscillations. The investigated metamaterial is a ferromagnet, in which spin waves corresponding to quanta known as magnons can occur.

Results: A quantum model of spin pumping, which is caused by an external microwave field, was constructed. The properties of generated spin waves and the influence on them of the parameters and geometric shape of metamaterials, which have the form of nanorods placed perpendicular to the ferromagnetic plane, on which external electromagnetic radiation falls, were studied.

Conclusion: The possibility of using the developed model as a microwave radiation detector is considered.

Biography

Ruslan POLITANSKYI received a Ph.D. in solid state physics from Yuriy Fedkovych Chernivtsi National University. Received a Dr. of Eng. Science in Telecommunication from National University «Lviv Polytechnic». He is currently a professor at Yuriy Fedkovych Chernivtsi National University. His research interests include signal processing, coding theory, pseudorandom sequence systems with chaotic dynamics, physical principles of processes for information coding, distribution and transferring

ROLE OF POLYMER-BSA INTERACTIONS ON THE FORMATION BIOFILMS ON BIOMATERIALS

Suparna
University of Exeter, United Kingdom

Abstract

A defining feature of biofilms is the extracellular (Exopolysaccharide or EPS) matrix , a complex mixture of biomacromolecules, which contribute to reduced antimicrobial susceptibility. EPS targeting is a promising, but underexploited, approach to biofilm control allowing disruption of the matrix and thereby increasing the susceptibility to antimicrobials. We present here the results of studies on the growth of biofilms of two different strains each, of the Gram-negative bacteria Escherichia coli and Klebsiella pneumoniae, on four polymers used commonly in indwelling medical devices. The polymer substrates are studied before and after immersing in BSA for 9 and 24 h, using contact angle measurement (CAM) and field emission scanning electron microscopy (FE-SEM) to extract the "philicity" φ (defined as −cos θ), where θ is the contact angle of the liquid on the solid at a particular temperature and ambient pressure. The substrates are found to transform from large hydrophobicity to near amphiphilicity with the formation of a BSA conditioning surface layer. Biofilms of E. coli did not grow on bare PTFE and HDPE substrates. Biofilms grown on BSA-covered surfaces are studied with CAM, FE-SEM, Fourier transform infrared (FTIR), and surface-enhanced Raman spectroscopy (SERS). Both spectra and φ-values were independent of bacterial species but dependent on the polymer Thus, EPS composition and wetting properties of the corresponding bacterial biofilms seem to be decided by the interaction of the conditioning BSA layer with the specific polymer substrate.

STRENGTH AND STIFFNESS PROPERTIES OF SOFTWOOD AFTER LONG-TERM USE IN VARIABLE SERVICE CONDITIONS

Lilita Ozola

Latvia University of Life Sciences and Technologies, Latvia

Abstract

Background: Determining the mechanical strength characteristics and stiffness modulus values of wood is often problematic in timber building reconstruction projects. In this study specimens cut from intermediate floor beams were tested that have been in service for more than 120 years.

Objective: To determine the strength characteristics and stiffness modulus of old wood and examine relationships between different properties.

Methods: Experimental tests of the mechanical properties such as modulus of elasticity (MOE), bending strength (MOR), shear strength and compression strength perpendicular to the grain direction of softwood (*Pinus sylvestris*) specimens were tested in short-term static loading conditions according to EN 408. Large sample data processing was performed according to EN 14358 and EN 384.

Results: By correcting the experimentally determined value of the modulus of elasticity of wood with the deformation factor of long-term load and moisture influence *kdef* (EN 1995-1-1), it is predicted that the original strength class was in accordance with the class C14 defined today according to EN 338.

Conclusion: The modulus of elasticity of wood under long-term loading decreases faster than the strength. When evaluating the relationship between wood strength and stiffness, a weak correlation was found between wood bending strength and modulus of elasticity. Moreover, the correlation between wood mechanical properties and density turned out to be even weaker. In the experiments, it was established that the strength of old wood in shear in the longitudinal direction of the fibers and perpendicular to their direction is significantly different, moreover, the correspondence to the empirical relationships according to EN 384 between the strength values in different stress states is not confirmed.

Biography

LILITA OZOLA, Dr.Sc.ing., Professor of Latvia University of Life Sciences and Technologies. She has 47 years of academic work experience at the university, teaching courses related to structural engineering. The research topics are devoted to the assessment of the conformity of the calculation models of building structures and their elements and to increasing the safety level of structures and ensuring plastic behaviour in overload situations, as well as the behaviour of wooden element connections under long-term loading. Separate studies are devoted to steel structures and foundations. She has participated in many international scientific conferences with reports on structural engineering problems (IABSE- International Association for Bridge and Structural Engineering, ISEC- International Structural Engineering and Construction Conference, WCTE World Conference on Timber Engineering chain conferences, etc.). Author or co- author of more than 130 publications including methodologies for implementation of Eurocode 5 (in Latvian).

COMPARATIVE STUDY TIRE RECYCLING PRODUCTS OBTAINED BY DIFFERENT TECHNOLOGIES

Arkady Cherepanov

Russian Technological University - MIREA, Russia

Abstract

Background: There are several types of tire recycling. We will focus on one thing - the mechanical processing of tires into crumb rubber. This processing method is the most promising, as it does not cause any harm to the environment. And it ensures the most complete recycling of tires, that is, there is practically no waste. The mechanical method of processing tires involves grinding tire rubber into crumbs or rubber powder.

Objective: To compare samples from three crumb rubber manufacturers. The first two manufacturers use traditional technology for grinding old tires; the third one produces crumb rubber using a technology in which the tool (mill) that crushes the crumb moves at a speed higher than the speed of sound in the rubber and this gives new properties to the crumb.

Methods: Crumb samples were tested for their ability to vulcanize on an MDR-300 rheometer in its pure form and with various additives. Vulcanized samples were tested for tensile strength and tensile elongation. Analysis of samples by infrared attenuated total internal reflection (ATR) spectroscopy in the Fourier transform (FTIR) to determine the presence of chemically active groups on its surface.

Results: The vulcanization ability of crumb rubber obtained by grinding with a rotating tool at a speed exceeding the speed of sound in rubber is significantly better than crumbs obtained by the traditional method. Also, better results were obtained for tensile strength and elongation of vulcanized rubber samples using the above-mentioned technology compared to traditional ones. An explanation for these data may be a significantly larger number of reactive groups, such as SO, R-SO-OR, C=S.

Conclusion: Rubber powder obtained by grinding with a rotating tool at a speed exceeding the speed of sound in rubber is capable of vulcanization without the addition of vulcanizing agents, accelerators and vulcanization activators to form a rubber-like material. The greater chemical activity this type of rubber powder is a promising ingredient for creating formulations for the production of rubber products.

Biography

Arkady Cherepanov
Was born in 1960.
Education
1977-83 – Moscow Institute of Fine Chemical Technology / Chemical Engineering / Engineer Diploma (honors degree). 1985-87 – Research Institute of Rubber Industry (Moscow) Post Graduate Program in Chemical Engineering / Ph.D. Diploma. More than 30 years experience in Rubber, Chemical and other processing industry. From 2019 Associate Professor Department of Elastomers Processing in Institute of Fine Chemical Technologies (Russian Technological University -MIREA)

POST-COVID-19 FUNCTIONAL STATUS: RELATION TO AGE, SMOKING, HOSPITALIZATION, AND PREVIOUS COMORBIDITIES

Abdelrahman Ezzat
Aswan University, Egypt

Abstract

Rational: Recently, a new "Post-COVID-19 Functional Status (PCFS) scale" is recommended in the current COVID-19 pandemic. It is proposed that it could be used to display direct retrieval and the functional sequelae of COVID-19.

Aim of The Study: The aim of the study was to assess the PCFS and to evaluate if age, gender, smoking, hospitalization, and comorbidities have any effect on functional limitations in recovered COVID-19 patients.

Methods: A total of 444 registered confirmed COVID-19 patients were included. They were interviewed in our follow-up clinics and filled an Arabic translated PCFS scale as well as their demographic and clinical data.

Results: Eighty percent of COVID-19 recovered cases have diverse degrees of functional restrictions ranging from negligible (63.1%), slight (14.4%), moderate (2%), to severe (0.5%) based on PCFS. Furthermore, there was a substantial variance between the score of PCFS with age ($P = 0.003$), gender ($P = 0.014$), the duration since the onset of the symptoms of COVID-19 ($P < 0.001$), need for oxygen supplementation ($P < 0.001$), need for intensive care unit (ICU) admittance ($P = 0.003$), previous periodic influenza vaccination ($P < 0.001$), smoking status ($P < 0.001$), and finally, the presence of any comorbid disorder ($P < 0.001$).

Conclusions: Most of the COVID-19 recovered cases have diverse degrees of functional restrictions ranging from negligible to severe based on PCFS. These restrictions were affected by age, gender, periodic influenza vaccination, smoking, duration since symptoms onset, need for oxygen or ICU admittance, and finally the presence of coexisting comorbidity.

ACARBOSE-ENCAPSULATED GUAR GUM NANOFORMULATION: A PROMISING STRATEGY FOR TYPE 2 DIABETES MANAGEMENT

Sourbh Suren Garg
Lovely Professional University, India

Abstract

Background: Diabetes is an emerging epidemic disease with an estimated 425 million people already affected worldwide. Acarbose is a competitive inhibitor of α-Glucosidase, which exerts hypoglycemic effects by delaying carbohydrate digestion. However, the clinical application of acarbose is hampered due to its short half-life in systemic circulation, so the drug requires repetitive administration (3-4 times per day), with doses of 25-100 mg, which further leads to several gastrointestinal side effects like abdominal pain, flatulence, and diarrhea. To address these issues, herein, we developed acarbose-encapsulated guar gum nanoformulation.

Method: The formulation was developed using spray-dryer, and characterized using SEM, FTIR, XRD, and HPLC. The developed spray-dried nanoformulation was also evaluated in vitro to observe its antioxidant and anti-diabetic potential.

Result: The developed nanoformulations exhibit spherical shape under SEM and the peak reduction was observed under XRD examination. The drug loading capacity and encapsulation efficiency of nanoformulations were found to be 72.016%, 80.59%, 89.52%, and 64.68%, 78%, 80.94% respectively. Furthermore, these nanoformulations were capable maintain a sustain release of acarbose and also found to inhibit the free radical generation, and activities of carbohydrate-digesting enzymes: α-glucosidase and α-amylase. The developed formulation was found to be non-cytotoxic and capable of normalizing hyperglycemic conditions mimicked in L6 and BHK-21 cells. Furthermore, the developed formulation was able to prevent the cascade of hyperglycemia-induced oxidative stress in L6 cells by restoring the levels of antioxidant enzymes such as catalase, glutathione-S-transferase, superoxide dismutase, and reducing lipid peroxidation.

Conclusion: These findings collectively indicated that developed nanoformulations may serve as a promising nanocarrier for improved therapeutic efficacy of acarbose in diabetes.

Biography

Sourbh Suren Garg received his Master's degree from Lovely Professional University (LPU), India, in the Department of Biochemistry. He worked in the Quality Assurance Department of Abryl Laboratories, a pharmaceutical company in India before rejoining LPU. He is currently working as a Ph.D. student in the Department of Biochemistry at LPU. His doctoral research focuses on developing an innovative formulation to assess treatment approaches for type 2 diabetes through in vitro and in vivo methods. His research interests encompass the utilization of natural phytochemicals or synthetic compounds for assessing treatment strategies across various diseases, including diabetes and inflammatory disorders, employing nanoformulation and targeted drug delivery techniques.

SOUND ENERGY HARVESTER USING POLYVINYLIDENE FLUORIDE

Kailash Chandra Shivaji Paturi
University of North Texas , USA

Abstract

The objective of the project is to perform analyses on the piezoelectric materials by subjecting it to maximum vibration and thereby recording the output voltage achieved by them. Experiments use polyvinylidene fluoride (PVDF) polymer which is a piezoelectric material and is fabricated in the form of thin film, which in turn is sandwiched between polyethylene terephthalate (PET) film. PVDF compared to other polymers has high purity, lightweight, flexibility, resistance to solvents, and stability under high electric fields. It has been studied that PVDF nanofibers have been mainly used for the application in the energy harvesting and battery separators.

PVDF pallets with DMF and acetone are added in the ratio of 4:6 to the vile along with a magnet for stirring. The vile is then sealed of using a parafilm, which is then placed on a magnetic stirrer at the temperature of 108°C and 1200 rpm for 3 hours. The syringe was loaded with 2 ml solution and angle was adjusted to 15 degrees, the drum collector was adjusted to 1000rpm and drum collector- syringe distance is at 15 cm and 23 gauge. The flow rate was set to 350 µL/hr.

Device Fabrication: The PET film was sputter coated with electrode (nickel) of desired thickness 100 nm and the PVDF nanofiber film obtained from electrospinning was cut to specific dimensions 3 x 4 cm2 and sandwiched between the PET electrodes. The sample was connected to a digital multimeter (Agilent 34401A multimeter) and subjected to loading through sound load by setting a frequency range from 20 Hz to 20 kHz.

Conclusion: Responses to mechanical vibration were measured to be the maximum of 225 mV ac and 43 mV dc, which were about 50 and 100 times higher than the background noise. The parameter selection of the electrospinning plays a crucial role in the output and fibers alignment. In previous studies PVDF fibers were not focused on the alignment of the fibers, where the fibers alignment has a good relation to the vibrations. The electrode selected was nickel compared to copper (highly conductive), and the device was able to produce a significant voltage output.

Biography

I am a motivated young professional with an aptitude for innovation, creative problem-solving, and analytical thinking with proficiency in SolidWorks, GD&T, AutoCAD, Creo parametric, ANSYS APDL &Work Bench and MATLAB, from the early days of my academic journey to my current position as a Research Assistant. I honed my skills in mechanical engineering, electrical systems, and sustainable design with a keen intellect and a heart ablaze with ambition, I immersed myself in research projects that sought to revolutionize the way we perceive and utilize energy.

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ANALYSIS OF PHYSICAL AND MECHANICAL PROPERTIES IN LIME-SAND MATERIALS MODIFIED WITH GLASS SAND WITH AN AMORPHOUS STRUCTURE

Magdalena Balonis[1], Anna Stepien[2], Magdalena Balonis[3], Ryszard Dachowski[2] and Medard Makrenek[2]

[1]*University of California, USA*
[2]*Kielce University of Technology, Poland*
[3]*MATERIALS SCIENCE AND ENGINEERING University of California Los Angeles (UCLA),Los Angeles, CA*

Abstract

The main point of the presented article is the analysis of the microstructural and physical-mechanical properties of autoclaved bricks produced in hydrothermal conditions and the characterization of changes occurring in the structure of the material as a result of the modification of the raw material mass with recycled glass sand (as partial elimination of quartz sand).

Silicate brick is an imitation of naturally occurring sandstone.

The following materials are used to produce this type of brick: quartz sand (approx. 90–92% by weight), consisting almost entirely of SiO_2, quicklime (approx. 5–8% by weight) and water.

The raw material mass is prepared from the above-mentioned raw materials and matures in silos (reactors) for 2-4 hours. During this time, the lime slaking process takes place, during which the chemical reaction of calcium oxide with water takes place and calcium hydroxide is formed:

$CaO + H_2O \rightarrow Ca(OH)_2$.

Then, the resulting raw material mass is delivered to hydraulic presses, which form the products into appropriate blocks and bricks. The final stage of the production of silicate bricks is their autoclaving,

i.e. treating the silicates with saturated steam at high pressure, i.e. 1.2–1.6 MPa, at a temperature of approx. 200°C. This process takes from 6 to 12 hours. In the chemical reaction that occurs, calcium hydroxide combines with silicon dioxide in the reaction:

$2Ca(OH)_2 + SiO_2 \rightarrow 2CaO \cdot SiO_2 \cdot 2H_2O$.

Fig.1. Sand-lime mass.

Fig.2. Autoclaves in Ludynia H+H Silicaty, PL

Fig.3. samples to test the hardness of the material

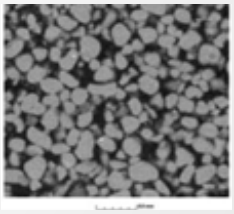

Fig.4. Microstructure of sand-lime brick (porosity).

The conducted tests were aimed at the elimination of quartz sand in favor of glass sand (due to the high consumption of quartz sand and attempts to slow down this proces). The oxide chemical composition of the material modified with glass sand is presented below:

TEST 1 => 90% GS, 0%QS 7%, CaO, 3 (+4)% H2O (1050g mass)

CaO: 166,303g	Al_2O_3: 15,505g	Fe_2O_3: 0,134g
H_2O: 31,5 (3%) + 42g = 73,5g	MgO: 10,61g	Mn_3O_4: 0,0176g
SiO_2: 644,179g	K_2O: 5,418g	

The tests were carried out on the basis of traditional samples made on the basis of quartz sand and brick samples made as part of the modification of the raw material mass with glass sand in the following amounts: 0, 10, 50 and 90% GS. The dimensions of the laboratory items were: 5 x 5 x 5 cm.

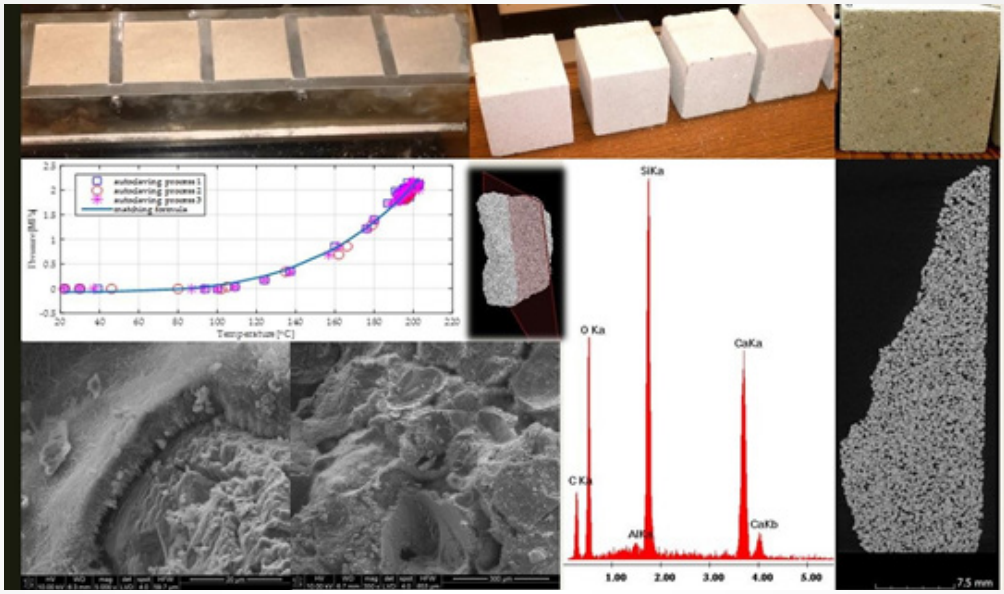

Fig.5. The process of creating silicate blocks and the characteristics of the substrates and the elemental composition of the raw material

In order to verify the microstructural and physical-mechanical properties of traditional sand-lime bricks and those modified with glass sand, the following tests were carried out:
-compressive strength [MPa];
-bulk density;
-material hardness tests;
-water absorption;
-porosity;
-microstructure (SEM).
The results of the analysis indicate that the modification of the raw material mass in the case of silicate bricks with glass sand has a positive effect on the physical and mechanical properties of the new product (the strength of the brick modified with glass sand reaches up to 20 MPa).

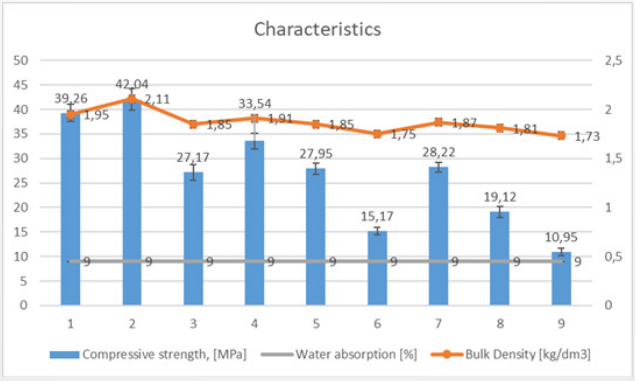

Fig.6. Analysis of the physical and mechanical properties of silicate bricks modified with recycled glass sand.

CHEMICAL COMPOSITION BASED MACHINE LEARNING MODEL TO PREDICT DEFECT FORMATION IN ADDITIVE MANUFACTURING

Ankit Roy
Pacific Northwest National Laboratory, USA

Abstract

With a goal of exploiting additive manufacturing to improve the manufacturing of existing reactor materials, we developed a chemical composition-based machine learning model to predict the printability of any given alloy in laser powder bed fusion (L-PBF) using experimental data from peer-reviewed literature. We defined printability as the ability to avoid defects like cracking, balling, porosity, and lack of fusion, that are caused by thermal stresses (during solidification or liquation), molten pool disintegration into disconnected small beads or lack of heat input respectively. Our models predict the tendency of balling defect formation and porosity percentage for a given composition, under a given set of processing conditions. To predict the likelihood of balling defect, three models: a random forest classifier, a gradient boost regressor and a neural network were trained on a dataset containing both single and multi principal element alloys. The neural network model showed the highest accuracy of 92.3% in predicting the balling defect formation. A random forest regressor, gradient boost regressor and neural network were trained and tested on a dataset of various alloys to predict porosity. The random forest regressor showed the best predictions with an R^2 score of 0.97. The models also revealed the relative importance of the input descriptors on defect-formation tendency of particular significance was the identification of carbon as an important element in determining the occurrence of balling and percent porosity in alloys like steel, as well as being moderately important to the percentage porosity in other alloys as well as steel. Manganese was also identified as a key descriptor for the percentage of porosity in steel and other alloys. Manganese's low thermal conductivity and consistent presence in the dataset is the likely cause for its contribution. Carbon's role is attributable to its relatively high specific heat and high melting temperature. Our model serves as a swift, chemistry-based tool to design experiments and find modified compositions better suited for additive manufacturing.

Virtual - Day 2
Keynote Presentation

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EVALUATION OF DEVELOPED ALKALI-ACTIVATED CONCRETE FOR ENERGY-EFFICIENT BUILDING MATERIAL

Rahul Ralegaonkar

Visvesvaraya National Institute of Technology, India

Abstract

Anticipated urbanisation and population growth, particularly in developing countries, are expected to boost demand for concrete, resulting in higher emissions and raw material consumption. In response to growing global sustainability awareness, various industries and countries have implemented diverse initiatives aimed at significantly reducing their greenhouse gas emissions. Alkali Activated Concrete (AAC), often known as zero cement concrete, is a viable substitute for conventional concrete. This study developed self-compacting alkali-activated concrete (SCAAC) using agro-industrial wastes and curing at ambient temperatures. The precursors were ground granulated blast furnace slag (GGBS) and fly ash (FA), which were activated with sodium hydroxide flakes and liquid sodium silicate. Co-fired bio-blended ash (BA), an agro-industrial waste, was used to partially replace river sand. The physical, chemical, mineral, and morphological properties of BA were thoroughly investigated. The BA was found to have suitable characteristics for use as a partial replacement for river sand in self-compacting alkali-activated concrete. The curing at ambient temperature was effective in producing a high-strength and durable concrete material. The thermal conductivity of the developed concrete was determined. The reduction in embodied energy for the developed material was calculated. The reduction in peak cooling load was found using the BIM software Revit for conventional concrete and SCAAC. The developed concrete successfully met the specified compressive strength requirement for M30 grade concrete, achieving a value of 38.12 MPa. Results show that the peak cooling load can be reduced by 35% compared to conventional concrete (1.9 W/ (m.K)) due to the lower thermal conductivity of the developed material (1.247 W/ (m.K)). The use of agro-industrial wastes in the concrete mixture not only reduced the environmental impact but also utilized waste materials that would otherwise be disposed of in landfills. Overall, this study demonstrates the potential for sustainable and environmentally friendly construction materials using agro-industrial wastes.

Biography

Rahul V. Ralegaonkar has completed B.E. (Civil), M.E. (Civil) & Ph.D. (Energy Efficient Buildings). His keen interest is in broad areas of Sustainable Construction Engineering and Disaster Management. He is presently working as Professor in Department of Civil Engineering, at Visvesvaraya National Institute of Technology, Nagpur, India. He has been actively involved in R & D sponsored projects.

Apart from academics he is also the member of several professional bodies of International and National repute. He has over 20 years of professional experience of which around 2 years has been in the industry at the Managerial post in GIS industry and Civil Construction industry. He was awarded prestigious Building Energy Efficiency Higher & Advanced Network (BHAVAN) fellowship by Indo-US science & technology forum, DST, New Delhi from from July 2016-December 2016 and also bagged 1 international, 1 national and 3 state level awards. He has been awarded Visiting Professor post at Liverpool John Moores University, UK for the track February 2019-January 2022. 10 Ph.D.s and more than 55 M.Tech. projects were completed under his guidance. Till date, seven Indian patents were granted and was awarded 2 copyrights for the developed software tools focusing on sustainable construction engineering.

He has published more than 170 publications at international and national level Journals and Conferences. As an organizing committee member including principal coordinator, convener and secretary for workshops, training program and national conferences, he participated in more than 40 events. He is also actively involved with technical forums as an editorial board member and the reviewer for several journals and conferences at national and international level.

Virtual - Day 2
Oral Presentations

VIBRATION OF ARCHES ELASTICALLY RESTRAINED AT BOTH ENDS AND REINFORCED BY ELASTIC SUPPORT POINTS.

Ahmed Babahammou
Hassan II university of Casablaca, Morocco

Abstract

To make structures more flexible and better resistant to earthquakes, their ends can be elastically re-strained. Additionally, elastic support points appro- priately located along the structure can alter inten-tionally and adequately its natural frequencies and modes of vibration to avoid undesirable reso- nances. In this article, the Rayleigh-Ritz method was utilized to investigate the in-plane vibration characteristics of arch-es with variable radius, elasti- cally restrained at both ends and reinforced by internal support points. The mass matrix is derived from the kinetic energy of the arch, while the stiffness matrix is de-termined by considering the strain energy of the arch and the elastic energy stored at its end supports, presented by springs with a finite stiffness. This allows the calculation of the total potential energy and de- rives the stiffness matrix. Then, Hamilton's principle is applied to find the Rayleigh-Ritz eigenvalue formulation. This study concerns circular arches with one or two support points located at well-chosen positions to make the structure symmetrical or non-symmetrical. The impact of the rigidity of the sup-port ends, the location of the internal point supports and their rigidity on the arch vibration frequencies and shape modes is investigated in a con- sistent parametric study, illustrated through plots, and leading to interesting qualitative and quantitative results, in a good agreement with the available previously published findings.

THE UNCERTAINTY OF REUSABLE BUILDING COMPONENTS/MATERIALS. A SUBSIDIARY OF CIRCULAR ECONOMY IN THE AFRICA CONSTRUCTION SECTOR: THE ISSUE OF AFFORDABLE HOUSING IN KENYA.

Christina Jonathan
Politecnico di Milano, Italy

Abstract

Background: There is growing interest in the adaptation of circular economy approaches in the construction sector, especially in developing African countries like Kenya, with an increase in construction activities leading to more generation of construction/demolition wastes. The approach of circularity presents an alternative to reuse these construction wastes thereby lowering environmental risks (including the extraction of raw materials) and providing for lower price building components/materials required for affordable building projects. However, there is little, or no information on these reusable building components/materials, which often lowers the confidence of stakeholders in using them. No information on its possible new life longevity (durability), its possible maintenance budget, and no means of enabling a design team to plan for its acquisition (accessibility) in a design project.

Objective: To review existing literature and provide a possible information catalogue that can enable the insertion and provision of needed information on reusable building materials.

Methods: The paper adopted a review of previous literature on these topics to search for possible solutions to the above research problems, of which some literature provided only a list of requirements needed to give a level of information to reusable building elements.

Results: The paper further provides proposals for an information catalogue that would enable the insertion of reusable building elements' Indicators of service (availability, reliability, and maintainability) obtainable from experience with the elements. Also, a format for a maintenance budget plan would be required during the new service life of the reused element. And an overview of simulation using the Monte Carlo simulation tool which can enable obtaining a reliable viability of access to reusable building elements in a building design stage.

Conclusion: The given proposals would have to be put into practice to ascertain their effectiveness, meanwhile, other areas of further studies are provided in the paper.

Biography

Relevant experience in Architectural design, Interior & Exhibition design, Urban planning, and building construction, across Nigeria and in Europe (Italy, France, and Iceland) with proficiency in the use of Building Information Modelling BIM. Currently doing doctorate research with Politecnico di Milano, on Circular Economy in the African Constructionsector

FIRST REPORT ON PICHIA KUDRIAVZEVII LACTIC ACID PRODUCTION FROM ORANGE PEEL WASTE (OPW)

Neha Thakur
Lovely professional University, India

Abstract

The production of oranges has increased worldwide during the last 10 years as per FAO. Therefore, the waste associated to the orange processing industry has also increased. Managing the massive amount of orange peel waste (OPW) is a complex issue, although it has a very high potential in biorefining. Currently, most of the produced OPW is dumped near production sites or in landfills, causing severe impacts on air, soil and water. Valorization of OPW is a sustainable solution to manage pollution while generation revenue. In the current study, enhanced green production of lactic acid has been achieved by using hydrolyzed OPW as carbon source, fermented by using indigenous yeast pichia kudriavzevii. HPLC confirmed the presence and the quantity of lactic acid in the end product. The maximum production of lactic acid from orange peel wastes (OPW) was observed under the optimized condition (pH 5, time 72h), which is significantly high compared to the recent studies.

COMPARISON OF MECHANICAL PROPERTIES OF ADDITIVELY MANUFACTURED CHOPPED CARBON FIBER REINFORCED NYLON SPECIMENS WITH VARIATION IN PROCESS PARAMETERS

Niranjan S. Deshmukh
Defence Institute of Advanced Technology , India

Abstract

Additive manufacturing, also known as 3D printing has established its mark in the manufacturing industry with advancements such as 3D printing of fiber reinforced polymer materials. Such components are being used as end use products. Reinforcing fibers into the polymer increase the mechanical properties of the material also improving its strength to weight ratio. Although, the properties of the material are also influenced by 3D printing process parameters. The current study focuses on determining the effect of 3D printing process parameters on the mechanical properties of the specimens. Fused Deposition Modelling (FDM) technique was used to fabricate the specimens from two different manufacturers of chopped Carbon fiber filled Nylon material. Tensile, compressive and Izod impact tests were performed as per ASTM D638- Type 1, ASTM D695 and ASTM D256 standards, respectively. The influence of layer thickness and infill alignment was observed for both the materials and comparison of strength values for the materials was also performed. It was observed that the infill alignment prominently influenced the strength of the component as compared to layer thickness. Maximum strength values were observed when the infill was aligned in the direction of loading. Moreover, tensile, and compressive strength decreased with increase in layer thickness, while impact strength increased with increase in layer thickness. Furthermore, a considerable deviation in mechanical strength values was observed for different makes of the same material.

COMPARE STUDY OF AG AND K NANOPARTICLES WITH SEA WEED EXTRACT (SAGARIKA) IN SEED PRIMING.

Indira Rathore
IFFCO, India

Abstract

Recent studies have shown that nanoparticles have effects on seeds and plant. Nano priming can be applied to seed in order to provide protection for seed during storage, improve germination synchronization and plant growth as well as to increase the resistance of crops to abiotic and biotic stress condition, which can help to reduce the required quantities of pesticides and fertilizers.

New studies showed that seed nano priming is able to activate different gene during the germination. In seed nano priming the media used are suspensions or Nano formulations.

The rapid development of seedlings ensures fast expansion of the leaves and elongation of the roots, which favor the uptake of nutrients, their translocation through the transpiration flow, and biomass production. Slow germination can expose the young seedling, which is one of the most vulnerable stages of plant life cycle, to many environmental stress conditions or pathogen, resulting in decrease in vigor and crop productivity, leading to economic losses for farmers.

Seed priming uses treatments to improve seed germination and thus potentially increase growth and yield. Low-cost, environmentally friendly, effective seed treatment remain to be optimized and tested for high-value crop like wheat, rice, gram and mustard.

In the present study Silver (Ag NPs) and Potassium (K NPs) nanoparticles synthesized from agro-industrial byproducts were used as nano priming agents. Seedlings grown in the vermiculites under greenhouse condition in plant growth chamber.

Silver nitrate (AgNO3) and Potassium Nitrate (KNO3) treated with biotic protein are required for preparing Ag NPs and were procured from Sigma-Aldrich (Sigma-Aldrich Chemical Co, St. Louis, MO, USA).

The prepared nanomaterial was characterized by using a dynamic light scattering (DLS) technique (Malvern Zeta sizer Nano-ZS model, Malvern, UK), according to our published protocol was used for optical absorption measurements of prepared Ag NPs and K NPs.

For further advance characterization Transmission Electron Microscope (TEM- delong instruments LVEM 5) and FTIR (Model No. Interspec 200-X) was used.

FABRICATION AND CHARACTERIZATION OF HYDROXYAPATITE AND CHITOSAN FROM BIO-RESOURCES

Aasma

NED University of engineering and Technology, Pakistan

Abstract

Background: In this work bio-waste, in the form of chicken eggshells and crustacean shells is used to fabricate two different biomaterials which are hydroxyapatite and Chitosan. Hydroxyapatite is prepared by using the conventional chemical precipitation method. It is the major component of human hard tissues such as bones and teeth, is one of the key materials for developing bone grafts with bioactive nature, the first step in the synthesis of HAp is annealing of eggshells at 900°C to get calcium oxide from $CaCO_3$, Afterwards, CaO is hydrated to synthesize $Ca(OH)_2$. The titration of $Ca(OH)_2$ with Phosphoric acid yielded Hydroxyapatite. FTIR confirmed HAp as the main phase of the obtained powdered Sample and the highest peak on the XRD graph shows high periodicity and indicates that the synthesized HA is highly crystalline. While PSA ofHA shows our material is Well Graded Sand. For Chitosan production, after the usual demineralization and deproteinization stages, the process includes two 10 minute bleaching steps with ethanol. Before the process of deacetylation, the chitin was then immersed in 12.5M NaOH afterwards it was cooled and kept frozen for 24 hours.

Objective: 1) Producing HA (Hydroxyapatite) and Chitosan samples using bio resources; egg shells and crustacean shells respectively, acquired as a bio waste from natural waste hence recycling a natural resource rich in Calcium resulting in a sustainable, cost-efficient and mainly utilizing as little as possible to provide economic advantage.

2) Characterization and comparison of synthesized HA with existing literature.

Methods: Hydroxyapatite is prepared by using the conventional chemical precipitation method. The first step in the synthesis of HAp is the annealing of eggshells at 900°C to get calcium oxide from $CaCO_3$; afterward, CaO is hydrated to synthesize $Ca(OH)_2$. The titration of $Ca(OH)_2$ with Phosphoric acid yielded Hydroxyapatite. For Chitosan production, after the usual demineralization and deproteinization stages, the process includes two 10-minute bleaching steps with ethanol. Before the deacetylation process, the chitin was immersed in 12.5M NaOH; afterward, it was cooled and kept frozen for 24 hours.

Results: FTIR analysis reveals Hydroxyapatite (HA) spectrum characteristics, indicating chemical group presence and substitutions. XRD analysis identifies crystalline phases in HA, determining its crystallinity and chemical composition. Particle size analysis confirms HA sample as uniformly graded sand with consistent particle size distribution

Conclusion: The study aimed to utilize bio-waste from chicken eggshells and crustacean shells to produce Hydroxyapatite (HA) and Chitosan, respectively. HA synthesis involved chemical precipitation with annealed eggshells, yielding highly crystalline HA confirmed by FTIR and XRD analysis. Chitosan production underwent demineralization and deproteinization stages, resulting in a sustainable, cost-efficient process with economic advantages.

Biography

I am Aasma, a graduate in Biomedical Engineering from NED University of Engineering and Technology (2017-2021). I am a passionate researcher with a focus on Biomaterials and Bio-resources. It first gained my interest in my 3rd year, 5th semester when Dr. Engr. Eraj Humayun Mirza taught us Biomaterials who later became my Final Year Project supervisor. I, along with my four mates, worked on the fabrication and characterization of Hydroxyapatite and Chitosan from natural Bio-resources. We utilized eggshells to convert them into raw Hydroxyapatite through precipitation method and crustacean shells which were the source for Chitin and with it's extensive deacetylation, we obtained Chitosan. I have presented my work in an International conference held at my own university and am enthusiastic to present in this conference as well. I want to indulge more in the field of Biomaterials and Bio-resources to grow my research and find methods with which we can utilize waste and convert them into material that can assist humanity and save lives.

FORMULATION AND EVALUATION OF NOVEL ADDITIVE-FREE SPRAY-DRIED TRIAMCINOLONE ACETONIDE MICROSPHERES FOR PULMONARY DELIVERY: A PHARMACOKINETIC STUDY

Sawsan A Zaitone

Suez Canal University, Egypt

Abstract

Objective: This work aimed to establish a simple method to produce additive-free triamcinolone acetonide (TAA) microspheres suitable for pulmonary delivery, and therefore more simple manufacturing steps will be warranted.

Methods: The spray-drying process involved the optimization of the TAA feed ratio in a concentration range of 1–3% w/v from different ethanol/water compositions with/without adding ammonium bicarbonate as a blowing agent. Characterization of the formulas was performed via scanning electron microscopy, Fourier-transform infrared spectroscopy, differential scanning calorimetry, and powder X-ray diffraction.

Results: Our results indicated that the size and morphology of spray-dried TAA particles were dependent on the feed and solvent concentrations in the spray-dried formulations. Furthermore, adding the blowing agent, ammonium bicarbonate, did not produce a significant enhancement in particle characteristics. We prepared additive-free TAA microspheres and found that TAA formulation #1 had optimal physical properties in terms of diameter (2.24 ± 0.27 µm), bulk density (0.95 ± 0.05), tapped density (1.18 ± 0.07), and flowability for deposition during the pulmonary tract, from a centric airway to the alveoli as indicated by Carr's index = 19 ± 0.01. Hence, formulation #1 was selected to be tested for pharmacokinetic characters. Rats received pulmonary doses of TAA formula #1 and then the TTA concentration in plasma, fluid broncho-alveolar lavage, and lung tissues was determined by HPLC. The TAA concentration at 15 min was 0.55 ± 0.02 µg/mL in plasma, 16.74 ± 2 µg/mL in bronchoalveolar lavage, and 8.96 ± 0.65 µg/mL in lung homogenates, while at the 24 h time point, the TAA concentration was 0.03 ± 0.02 µg/mL in plasma, 1.48 ± 0.27 µg/mL in bronchoalveolar lavage, and 3.79 ± 0.33 µg/mL in lung homogenates. We found that TAA remained in curative concentrations in the rat lung tissues for at least 24 h after pulmonary administration.

Conclusion: Therefore, we can conclude that additive-free spray-dried TAA microspheres were promising for treating lung diseases. The current novel preparation technology has applications in the design of preparations for TAA or other therapeutic agents designed for pulmonary delivery.

Biography

Sawsan Zaitone is a Professor of Pharmacology & Toxicology at Suez Canal University and she is interested in research projects about in neurologic disorders and diabetes complications and creation of new treatment modalities for solving these critical problems.

ENERGY HARVESTING THROUGH DIVERSE NANOWIRES

BESTLEY JOE S
Kings Engineering College, India

Abstract

Energy harvesting is indispensable in today's life. As many of the non-renewable energy resources are depleting, many researchers have turned their attention towards developing more renewable resources to sustain life in this earth. One such way to develop alternate energy resource is MEMS energy harvesting. Due to rapid advancement in fabrication techniques, it is easier to develop MEMS and NEMS based energy harvesters.

Many wireless sensor networks are remote and are difficult to power up. Energy that is harnessed using semiconducting nanowires have gained importance as they are able to provide power output when subjected to low frequency mechanical vibrations that are abundantly available in the environment.

Research work based on 3D semiconductor germanium nanowire resulted in good voltage, power and power density values when subjected to low frequency vibrations. This is greatly contributed by the greater charge carrier transport capability due to high mass of electrons and holes. Moreover the harnessed output is larger due to greater mobility and smaller bandgap for germanium semiconductor.

The trade off existing between area and harnessed power output can be minimized using the germanium based semiconductor nanowire energy harvester. Performance analysis have shown significant improvement in the electrical characteristics with respect to area.

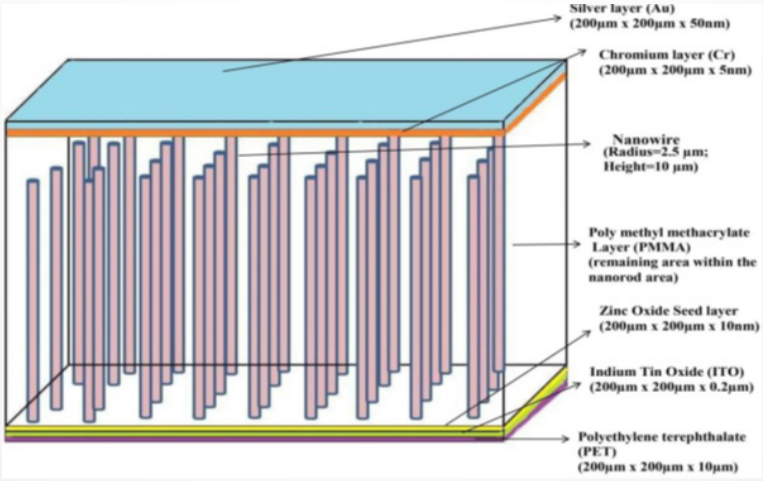

Figure 1: Overall schematic view of the Semiconductorenergy harvester

Biography

Bestley Joe Sgraduated from Anna University, Chennai in 2010 with Bachelor's degree in Electronics and Instrumentation Engineering. He received his M.E degree in Applied Electronics from Anna University, Chennai in 2012 and Ph.D degree from Sathyabama Institute of Science & technology in 2022. He has more than ten years of teaching and research experience. He is currently working as Assistant Professor in the department of Electronics and Communication Engineering at Kings Engineering College, Chennai. His research interests are piezoelectric MEMS and NEMS based energy harvesters.

IMPROVING THE FATIGUE DESIGN OF MECHANICAL SYSTEMS SUCH AS REFRIGERATOR

Seongwoo Woo
Ethiopian Technical University, Ethiopia

Abstract

Background & Objective: To enhance the lifetime of mechanical system such as automobile, new reliability methodology – parametric Accelerated Life Testing (ALT) – suggests to produce the reliability quantitative (RQ) specifications—mission cycle—for identifying the design defects and modifying them.

Methods: It incorporates: (1) a parametric ALT plan formed on system BX lifetime that will be X percent of the cumulated failure, (2) a load examination for ALT, (3) a customized parametric ALTs with the design alternatives, and (4) an assessment if the system design(s) fulfil the objective BX lifetime. So we suggest a BX life concept, life-stress (LS) model with a new effort idea, accelerated factor, and sample size equation. This new parametric ALT should help an engineer to discover the missing design parameters of the mechanical system influencing reliability in the design process.

Results: As the improper designs are experimentally identified, the mechanical system can recognize the reliability as computed by the growth in lifetime, LB, and the decrease in failure rate. Consequently, companies can escape recalls due to the product failures from the marketplace. As an experiment instance, two cases were investigated: 1) problematic reciprocating compressors in the French-door refrigerators returned from the marketplace and 2) the redesign of hinge kit system (HKS) in a domestic refrigerator.

Conclusion: After a customized parametric ALT, the mechanical systems such as compressor and HKS with design alternatives were anticipated to fulfil the lifetime – B1 life 10 year.

Biography

Woo has a BS and MS in Mechanical Engineering, and he has obtained PhD in Mechanical Engineering from Texas A&M. He majors in energy system such as HVAC and its heat transfer, optimal design and control of refrigerator, reliability design of thermal components, and failure Analysis of thermal components in marketplace using the Non-destructive such as SEM & XRAY. In 1992.03–1997 he worked in Agency for Defense Development, Chinhae, South Korea, where he has researcher in charge of Development of Naval weapon System. He was working as a Senior Reliability Engineer in Refrigerator Division, Digital Appliance, SAMSUNG Electronics. Now he is working as associate professor in mechanical department, Ethiopian Technical University.

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