PEERS ALLEY MEDIA

Theme: Materials Science Revolution; we'll unpack the most important materials advancements, future innovations and cutting-edge technologies happening now

NOVEMBER 08-09 2022

Virtual Event on

4TH GLOBAL SUMMIT ON

FUTURE OF MATERIALS SCIENCE & RESEARCH

FUTURE MATERIALS 2022

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1126 59 Ave East, V5X 1Y9
Vancouver BC, Canada
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PROGRAM-AT-A-GLANCE

FUTURE MATERIALS 2022

DAY 1

NOVEMBER 08, 2022

Scientific Program

GMT-Greenwich Mean Time

Introduction @ 08:45-09:00

Keynote Session

09:00-09:25	**Title: Nanobugs as drugs: Bacterial derived nanomagnets enhance tumor targeting and oncolytic activity of HSV-1 virus** **Munitta Muthana,** *University of Sheffield, United Kingdom*
09:25-09:50	**Title: Geophysical-hydrochemical study of saline paleo-water contamination in alluvial aquifers** **Patrizio Torrese,** *The University of Pavia, Italy*

Distinguished Speaker Talks

09:50-10:10	**Title: Effects of alloy compositions on the interfacial microstructure and mechanical properties of explosively welded Mg/Al alloy plates** **Mami Mihara-Narita,** *Nagoya Institute of Technology, Japan*
10:10-10:30	**Title: How brain morphology reveals the severity of excessive internet use** **Li Wan,** *Anhui Medical University, China*
10:30-10:50	**Title: Engineered microoganisms with the synthetic chromosome or ribosomes** **Guanghou Zhao,** *Northwestern Polytechnical University, China*
10:50-11:05	**Title: The progression of 3D-printed tissue engineering strategies for heterogeneous meniscus reconstruction** **Mingze Du,** *Peking University Third Hospital, China*

Refreshment Break 11:05-11:20

11:20-11:40	**Title: Diamond for antifouling applications** **Zejun Deng,** *Central South University, China*

11:40-11:55	**Title: Biodegradable and injectable poly (vinyl alcohol) microspheres in silk sericin-based hydrogel for the controlled-release of antimicrobials: Application to deep full-thickness burn wound healing** **Bakadia Bianza Moise,** *Huazhong University of Science and Technology, China*
11:55-12:15	**Title: Exploring thermal transport properties of solids by machine learning** **Ruiqiang Guo,** *Shandong Institute of Advanced Technology, China*
12:15-12:35	**Title: Retroviral vectorization for modern gene therapy** **Xiaomo Wu ,** *Dermatology Institute of Fuzhou, China*
12:35-12:55	**Title: Hollow fiber contactors with improved membrane materials –Unique devives for efficient metal separation** **Anil Kumar K. Pabby,** *Bhabha Atomic Research Centre, India*
12:55-13:15	**Title: A review: Photocatalytic activity of Zinc Oxide nanoparticles synthesized via chemical and green synthesis methods** **Gurjinder Singh,** *Sri Guru Granth Sahib World University, India*
Lunch Break 13:15-14:00	
14:00-14:20	**Title: Rare earth doped magnetite nanoparticles: An overview** **Richa Jain,** *Motilal Nehru College, India*
14:20-14:40	**Title: Development of scheduling methodology in a multi-machine flexible manufacturing system without tool delay employing flower pollination algorithm** **Sivarami Reddy N,** *Annamacharya Institute of Technology and Sciences, India*
14:40-15:00	**Title: Comparative study of ZnO/Polypyrole and SnO_2/ Polypyrole nanocomposites for ammonia gas sensing application** **Ajay Pratap Singh Gahlot,** *University of Delhi, India*
15:00-15:15	**Title: Effect of the crystalline phase on the electrocatalytic performance of $Sm_{2-x}Sr_xNiO_{4-\delta}$ (x = 0.4 to 1.0) Ruddlesden Popper based system: A comparison of bulk and thin electrocatalysts** **Manisha Chauhan,** *Indian Institute of Technology (BHU), India*
15:15-15:30	**Title: Study on effect of nano-hydroxyapatite in microwave heating of magnesium/hydroxyapatite biodegradable composites and their properties** **Shivani Gupta,** *Indian Institute of Technology Roorkee, India*

15:30-15:45	**Title: Ag decorated iron Titanate nanohybrids as visible light active photo-catalyst in micropropagation applications** **Nethupa Arachchi,** *Bellaire High School, USA*
15:45-16:05	**Title: Combined machine learning and multiscale modeling of DNA-templated dye aggregates for excitonic applications** **Lan Li,** *Boise State University, USA*

Refreshment Break 16:05-16:20

16:20-16:40	**Title: Protective clothing cleaning practices in the United States** **Meredith McQuerry,** *Florida State University, USA*
16:40-17:00	**Title: Enhancing spike resistance of flexible body armor using silane coupling agent and a fixative cross-linker** **Hassan Mahfuz,** *Florida Atlantic University, USA*
17:00-17:20	**Title: Effect of Ag and Si on the microstructures in Al-Cu-Ni-Mn-Ag/Si ternary high entropy alloy** **S.K. Varma,** *The University of Texas at El Paso, USA*
17:20-17:40	**Title: Immunomodulation with FasL presenting PEG microgel achieves long-term survival of allogeneic islets in the absence of immunosuppression in a non-human primate model chronic** **Ji Lei,** *Harvard Medical School, USA*
17:40-18:00	**Title: Role of relaxations in material's mechanical toughness** **Madhusudan Tyagi,** *National Institute of Standards and Technology, USA*

Panel Discussion

End of Day 1

DAY 2

NOVEMBER 09, 2022

Scientific Program

GMT-Greenwich Mean Time

Introduction @ 08:55-09:00

Distinguished Speaker Talks

Keynote Talk 09:00-09:25	**Title: Surface characteristics of the materials with use the complementary measuring instruments** **Magdalena Niemczewska-Wójcik,** *Cracow University of Technology, Poland*
09:25-09:45	**Title: Waste paper cellulose based-MoS_2 hybrid composites: Towards sustainable green shielding** **Rabia khatoon,** *Zhejiang University, China*
09:45-10:05	**Title: Imputation method based on collaborative filtering and clustering for the missing data of the squeeze casting process parameters** **Jianxin Deng,** *Guangxi University, China*
10:05-10:25	**Title: Effect of mineral phases on the leaching efficiency of titanium slag** **Xiaoping Wu,** *Ansteel Group, China*
10:25-10:45	**Title: Inhibition of S-adenosylhomocysteine hydrolase induces endothelial senescence via hTERT downregulation** **Wenhua Ling,** *Sun Yat-Sen University, China*
10:45-11:05	**Title: Photonic crystals decorated aptasensor for SARS-COV-2** **Ghulam Murtaza,** *Beijing Institute of Technology, China*

Refreshment Break 11:05-11:20

11:20-11:40	**Title: Application of the static structure factor for efficient characterization of finite-size particle-films** **Paweł Weroński,** *Polish Academy of Sciences, Poland*
11:40-12:00	**Title: The effect of particle content and sintering time on the properties of Al-Al_9Co_2-$Al_{13}Co_4$ composites, made by powder metallurgy** **Iman Bahaj,** *Université Hassan I – Settat, Morocco*

12:00-12:20	**Title: Integrative and functional analysis of scientific production aspects by simplex simulation approach** **Semmar Nabil,** *Pasteur Institute of Tunis, Tunisia*
12:20-12:40	**Title: The versatility of Fe_2TiO_5 as a water splitting photocatalyst** **Mauricio A. Melo,** *Fluminense Federal University, Brazil*
12:40-13:00	**Title: Material futures past: Digital materiality of the internet of things** **Gerard Briscoe,** *Royal College of Art, United Kingdom*
13:00-13:15	**Title: 3D printing in biotechnology: Supply chain independent single-use plasticware for cell culture** **Lena Achleitner,** *Austrian Centre of Industrial Biotechnology, Austria*
Panel Discussion	
Closing Remarks	

KEYNOTE PRESENTATIONS

DAY 1

PEERS ALLEY MEDIA

Virtual Event

4th Global Summit on

Future of Materials Science and Research

November 08-09, 2022

FUTURE MATERIALS 2022

BIOGRAPHY

Munitta Muthana is a Senior Lecturer in the department of Oncology & Metabolism. Her research focuses on innate and adaptive immunity and reprogramming the tumour microenvironment with oncolytic viruses. She has a long-standing track record of working with viruses and she devised a way to deliver large quantities of cancer-killing virus to tumours using a cell delivery approach. Together with her team (Nanobug Oncology Sheffield @ Nanobug_Shef) they have developed a number of new nanodrug delivery platforms for targeting these viruses to tumours via the bloodstream using nanomaterials including liposomes, magnetic nanoparticles, nanohydrogels and silk fibroins. These exciting technologies could change the way we deliver immunotherapies to cancer patients.

M. Muthana

University of Sheffield, United Kingdom

Nanobugs as drugs: Bacterial derived nanomagnets enhance tumor targeting and oncolytic activity of HSV-1 virus

The survival strategies of infectious organisms have inspired many therapeutics over the years. Indeed, the advent of oncolytic viruses (OVs) exploits the uncontrolled replication of cancer cells for production of their progeny resulting in a cancer-targeting treatment that leaves healthy cells unharmed. Their success against inaccessible tumours, however, is highly variable due to inadequate tumour targeting following systemic administration. Nanotechnology is paving the way for new carrier systems designed to overcome this challenge. Until recently, a biologically derived alternative to metallic particles, namely bacterial-derived magnetosomes, has been relatively overlooked presumably due to the challenges associated with their biomanufacturer. They possess many advantages including a narrow size and shape distribution and a biologically compatible surface chemistry, which prevents aggregation and provides an anchor for functional groups for biotechnology applications. Here we demonstrated their nanocarrier capabilities by co-assembly with herpes simplex virus-1 for the treatment of mammary carcinoma. This provides a magnetic coat of armour for the virus shielding the virus from immune attack in the blood stream. Magnetosomes thus enabled tumour targeting from the circulation with magnetic guidance and enhanced viral replication within tumours. This approach was associated with a significant increase in the recruitment/activation of cytotoxic T cells and reprograming of the tumour microenvironment towards a pro-inflammatory phenotype resulting in significant tumour shrinkage and increased survival in a syngeneic mouse model of breast cancer by 50%. Exploiting the properties of such a versatile nanocarrier offers an exciting, novel approach for active tumour targeting to disseminated neoplasms.

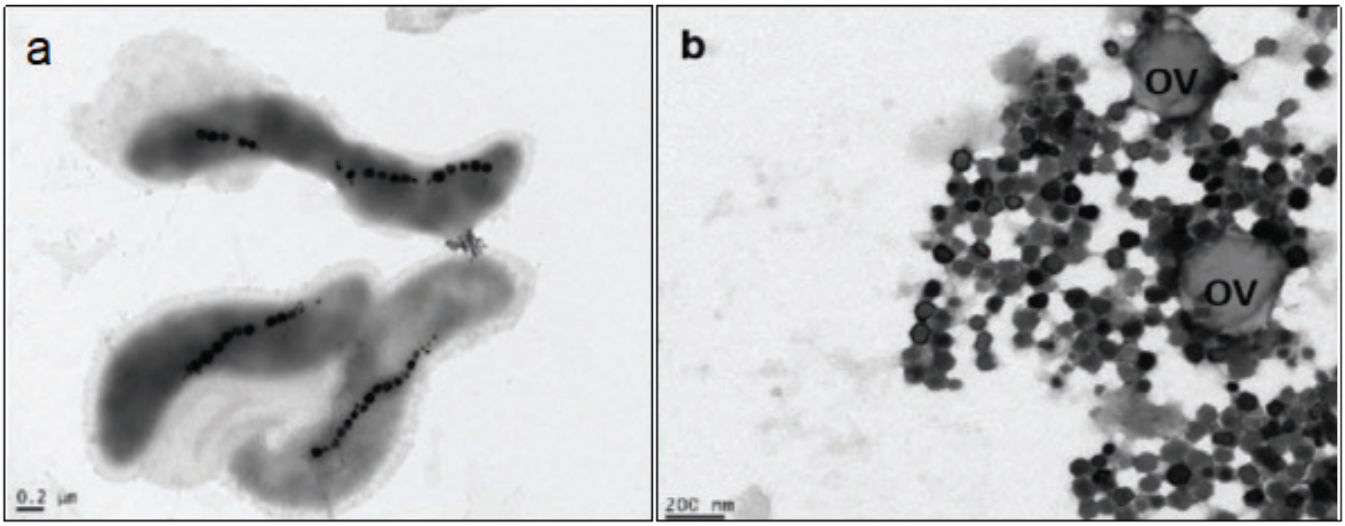

Figure: Representative transmission electron microscope (TEM) image of AMB-1 magnetotactic bacteria (tiny black dots are the magnetic nanoparticles). Bacteria use these to align against the earth magnetic field. The particles are purified from bacterial and in b) representative TEM images of MAG-OV complexes in PBS suspension reveal co-assembly with OV based on electrostatic interactions.

PEERS ALLEY MEDIA

Virtual Event

4th Global Summit on
Future of Materials Science and Research

BIOGRAPHY

Patrizio Torrese is Assistant Professor in Applied Geophysics at University of Pavia, Italy, where he carries out research and teaching activity.

His current research focuses on near surface geophysics, especially hydrogeophysics, archaeo-geophysics, planetary analogue study, and improvement and development of shallow geophysical methods.

He participated in research projects related to groundwater contamination, circular economy for water and energy, sustainable agriculture, drought resilience improvement in vineyard ecosystems, precision viticulture, as well as, soil seismic characterisation, seismic hazard, unstable slope characterization.

He was training and test campaign investigator and experiment/instrument safety responsible for PANGAEA-X European Space Agency (ESA) astronaut training campaigns.

He also carried out consulting activity in civil engineering and water research projects. He is author of more than 50 peer-reviewed articles and conference papers.

P. Torrese

The University of Pavia, Italy

Geophysical-hydrochemical study of saline paleo-water contamination in alluvial aquifers

An integrated geophysical and hydrochemical study of the saline paleo-water uprising into the alluvial aquifer of the Oltrepò Pavese plain sector (Po Plain, northern Italy) is presented.

This study involved one-, two- and three-dimensional electrical geophysical surveys, hydrochemical analysis of groundwater and assessment of well logs. Geophysical surveys specifically involved both electromagnetic surveys undertaken over vast areas for a speedy assessment of sub-vertical conductive bodies connected to the uprising of high salinity waters through structural discontinuities and more detailed 1D to 3D electric resistivity surveys for the accurate investigation of the sectors where the uprising phenomenon of deep saline waters occurs.

The studied area was selected for its characteristic hydrogeological setting (Pilla et al., 2010; Torrese and Pilla, 2021). The alluvial aquifer is strongly conditioned by the presence of a buried tectonic discontinuity along which the saline waters are mainly distributed. These waters rise along the discontinuities in the bedrock and flow into the overlying alluvial aquifer. This particular setting conditions the distribution of saline waters into the alluvial aquifer.

Contamination from saline waters is not spatially and vertically homogeneous within the aquifer. The spatial distribution of Na–Cl waters suggests the existence of plumes of highly mineralized waters that locally reach the aquifer, diffuse and mix with fresh waters. Detailed 3D imaging revealed irregular-shaped shallow saline water contaminations within the alluvial aquifer.

Deep saline paleo-waters show a dilution during upward migration. This is due to the mixing with shallow fresh groundwater. Highly mineralized groundwater is identified even at

very shallow depth in correspondence of each plume, which is located above a structural discontinuity. On the other hand, there is a lower degree of contamination in those sectors of the aquifer that are further away from the structural discontinuities and generally only involves the deeper parts of the aquifer.

The results from our study are applicable in similar hydrogeological contexts where the aquifer's contamination by saline water is caused by mixing of freshwaters with brines or where the fossil saltwater, located different kilometers far from the coastline, are remainder of ancient marine ingressions.

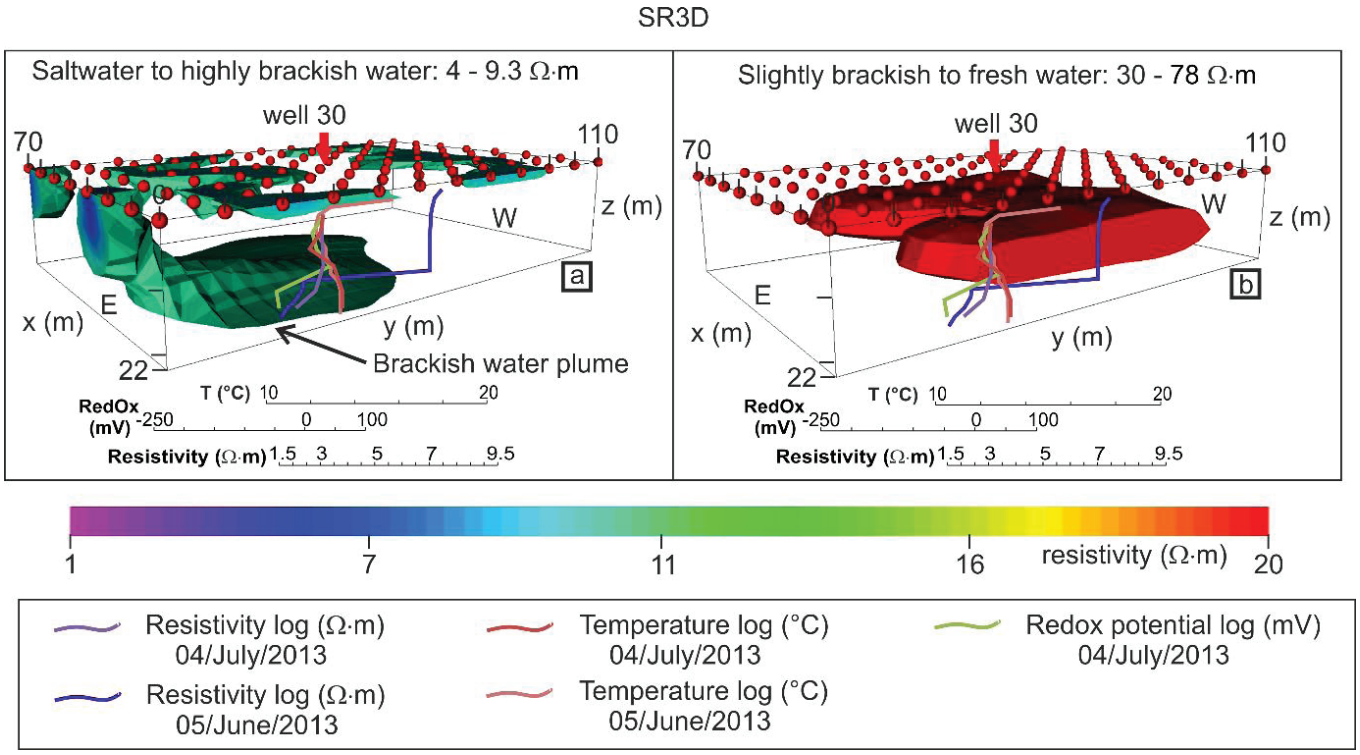

Figure: 3D ERT model (SR) cross-validated with well logs which shows a saltwater to highly brackish water plume contaminating the alluvial aquifer: (a) saltwater to highly brackish water plume contaminating a sandy body within the alluvial aquifer and shallow low resistivity anomalies within the upper clayey deposits; (b) slightly brackish to fresh water contaminating clayey sandy deposits. The resistivity model shows good correlation with respect to well 30 logs which found at 11 m of depth a drop in resistivity, along with an increase of temperature and a decrease of redox potential of groundwater suggesting a well transition zone between slightly brackish to moderate brackish water.

SCIENTIFIC ABSTRACTS

DAY 1

PEERS ALLEY MEDIA

Virtual Event

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PEERS ALLEY MEDIA

Virtual Event

4th Global Summit on
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Effects of alloy compositions on the interfacial microstructure and mechanical properties of explosively welded Mg/Al alloy plates

M. Mihara-Narita

Nagoya Institute of Technology, Japan

Magnesium alloys are the lightest of all practical alloys and have a great weight-reduction effect, thus they are expected to be applied to vehicle bodies. Recently, the development of a composite material (cladding plate) between magnesium alloys and aluminum alloys is drawing attention to achieve. Magnesium alloys and aluminum alloys are difficult-to-weld materials since the bonding strength is reduced by forming a brittle intermetallic compound layer at the bonding interface due to heat input during joining. In the present study, the explosive welding method, which is a type of solid-phase welding, is applied to the dissimilar joining of Mg/Al alloys. This method utilizes the instantaneous high energy generated by the explosion of explosives for metal bonding and has almost no thermal effect except for local heat generation near the bonding interface. Previously, it was revealed that a thin interlayer was formed at the interface in cladding plates produced by explosive welding between magnesium alloys having different aluminum concentrations and A6005C aluminum alloy. The thickness of the interlayer increased with an increase in aluminum concentration in the magnesium alloy, while the thickness was 1μm or less. Scope of this study is to clarify the effects of aluminum alloy compositions on the interfacial microstructure and mechanical properties of the cladding plates. In the AZ31/A6005C and AZ31/A5052 cladding plates, when the magnesium concentration in the aluminum alloy was high, the thickness of the interlayer increased, and the shear strength increased. Although the thickness of the interlayer is not uniform, the weldability might be improved as the thickness of the interlayer increases. In the AZ80/A6005C and AZ80/A5052 cladding plates, when the magnesium concentration in the aluminum alloy was high, the thickness of the interlayer became very large (5μm or more), and the shear strength decreased.

Biography

Mami Mihara-Narita received her PhD in engineering from Tokyo Institute of Technology, Japan, in 2017. From 2017, she was a researcher at UACJ corporation. In 2019, she joined the Department of Physical Science and Engineering at Nagoya Institute of Technology, as an Assistant Professor. She has received several academic awards as the first author including the Light Meatal Promising Graduate Award (JILM, 2014), the Best Poster Award (JIMM, 2014, and 2017), the Best Poster Award in ICAA-15 (2016), Light Metal Outstanding Female Award (JILM, 2019), the Encouragement Prize for Young Researcher (Nagoya Institute of technology, 2007). Her research focus is on improvement of the properties of light metals by microstructure controlling, dissimilar metal joining of light metals, and severe plastic deformation of aluminum alloys.

Virtual Event

4th Global Summit on
Future of Materials Science and Research

How brain morphology reveals the severity of excessive internet use

Li Wan[1,3], Rujing Zha[2], Jiecheng Ren[2], Ying Li[2], Qian Zhao[2], Huilin Zuo[2] and Xiaochu Zhang[2,4]

[1]Anhui Medical University, China
[2]University of Science & Technology of China, China
[3]Anhui University of Traditional Chinese Medicine Neurology Institute Affiliated Hospital, China
[4]Hefei National Laboratory for Physical Sciences at the Microscale (HFNL), China

As previous studies have mainly focused on the reward system and the corresponding brain regions, the relationship between brain morphology and excessive internet use (EIU) was not clear, and the purpose of the study was to investigate whether brain regions other than the reward system were associated with EIU.

Data were acquired from 131 excessive internet users. Psychological measures included internet use, life quality, personality, mental illness symptoms, impulsivity, and thought suppression. The brain was scanned with 3T magnetic resonance imaging (MRI), and 6 types of brain morphological indexes were calculated. Lasso regression methods were used to select the predictors. Stepwise linear regression methods were used to build the models and verify the model. The variables remaining in the model were left precentral (curve), left superior temporal (surface area), right cuneus (folding index), right rostral anterior cingulate (folding index) and harm avoidance. The independent variable was the EIU score of the worst week in the past year.

The study found that brain morphological indexes other than the reward system, including the left precentral (curve), the left superior temporal (surface area), the right cuneus (folding index) and the right rostral anterior cingulate (folding index), can predict the severity of EIU, suggesting extensive changes in the brain. The study conducted a whole-brain data analysis and concluded that the changes in certain brain regions were more predictive than the reward system and psychological measures or more important for EIU.

Biography

Li Wan graduated from Virginia Tech, USA, currently working at the Affiliated Psychological Hospital of Anhui Medical University, China. She has been engaged in research on cognitive psychology, mental disorders and neuromodulation. The current main research direction is the regulation of cognitive impairment and the treatment of mental illness by nondrug and nontraumatic interventions and probes its neuropsychological mechanisms in various ways. The Brain Diseases and Neuromodulation Research Center was established in 2021, and a series of basic and clinical studies related to EEG, near-infrared imaging, neuroimaging, transcranial electrical stimulation and magnetic stimulation were carried out with her team members.

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4th Global Summit on
Future of Materials Science and Research

Engineered microoganisms with the synthetic chromosome or ribosomes

Guanghou Zhao
Northwestern Polytechnical University, China

Design, build and test ('DBT') of artificial organisms represented a fascinating approach to deepen our understanding of natural biosystems and to facilitate engineering life for applications. The speaker is engaged in understanding life by engineering and functional analysis of the biological components that store or express the genetic information, and in recent years have made some significant achievements as below: 1) synthesis and functional analysis of the longest linear designer eukaryotic chromosome, namely yeast chromosome 12, which "was a significant milestone towards creation of the first fully synthetic eukaryotic genome"; 2) engineering and functional analysis of a series of artificial ribosomes, which uncovered the functions and mechanistic insights of ribosomal RNA and proteins in ribosome assembly, translation and evolution. In this talk, the speaker will present the design principles, approaches, and what could be learnt from the 'DBT' cycle of these artificial microorganisms.

Biography

Guanghou Zhao is an associated professor at Northwestern Polytechnical University. His research focuses on design, build and test of artificial microorganisms to further the understanding of life and to facilitate engineered life for applications. He has published these experimental results in top-rated journals, including Science, PNAS, Nucleic Acids Research, which were highlighted in special article or previews by Nature, Science, Nature Biotechnology et al, and selected as one of the "Ten Breakthrough in Chinese Science 2017".

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Virtual Event

4th Global Summit on
Future of Materials Science and Research

The progression of 3D-printed tissue engineering strategies for heterogeneous meniscus reconstruction

Mingze Du

Peking University Third Hospital, China

The meniscus is the fibrocartilage tissue of the knee joint, which plays an important role in transmitting loads, shock absorption, maintaining joint stability and reducing contact stress. Meniscal injuries can be commonly treated with simple sutures, while meniscectomy is inevitably required for severe injuries. However, meniscectomy could disrupt the mechanical microenvironment of the knee joint, leading to articular cartilage degeneration and osteoarthritis (OA). Tissue engineering technology, as a strategy with diverse origins, customizable and tunable mechanical and biological properties, has emerged as a promising approach for the treatment of meniscal injuries represented by 3D printing. Notably, the heterogeneity of the meniscus, including anatomical structure, cellular phenotype, extracellular matrix (ECM), and biomechanical properties, is critical for the reconstruction of natural bio-function. Therefore, the construction of heterogeneous tissue-engineered meniscus has become a promising approach for meniscus substitution and regeneration. Hereby, we systematically summarized the heterogeneity of the meniscus and 3D printing strategies for tissue engineering anisotropic meniscus. Manufacturing techniques, biomaterial combinations, surface functionalization, growth factors, and bioreactors related to 3D printing strategies are highlighted, and future research directions are proposed.

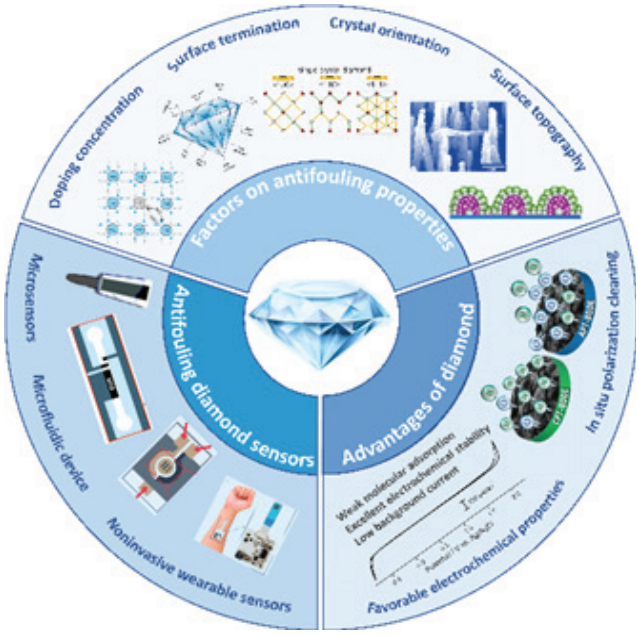
Biography

Mingze Du is a doctor student from the Institute of Sports Medicine in Peking University. The objectives of his research are: 1. Heterogeneous tissue engineering meniscus construction; 2. Study on the function and preparation method of biological collagen membrane.

Diamond for antifouling applications

Zejun Deng
Central South University, China

Diamond has emerged as an attractive electrode material over the past decades owing to its exceptional electrochemical properties, including the wide potential window for water stability, low background current, excellent electrochemical stability and antifouling properties. In the case of conductive diamond electrode materials, particularly for boron-doped diamond (BDD), the fouling process can be significantly suppressed because of many factors, such as the weak adsorption of fouling molecules on the respective electrode surface or the potential generation of strong oxidants (e.g., hydroxyl radicals) to suppress the formation of biofilm via self-cleaning. The factors of surface chemistry (e.g., the concentration of boron dopants and surface termination), crystal orientation and surface topography play critical roles in the electrochemically-relevant properties of BDD. Recent progress and achievements regarding diamond sensors and biosensors for biologically-related sensing applications, particularly on determining fouling agents, will be summarized, including diamond microelectrodes, BDD-based microfluidic devices, and noninvasive wearable sensors. The challenges and future of diamonds for antifouling applications will be discussed. This work will also include environmental applications with respect to wastewater treatment.



Biography

Zejun Deng received his PhD (2020) from Institut Polytechnique de Paris under the supervision of Profs. Christophe Renault and Fouad and Maroun. After a one-year postdoc (Research Fellow) with Prof. Huilin Shao at the University of Singapore, he joined as a Lecturer in the Department of Materials Science & Engineering at Central South University. His current research interests include diamond electrochemistry and diamond-related applications in the field of electrochemical sensors and wastewater treatment. He has published over twenty peer-reviewed articles in international journals and featured as a young editorial board member in Functional Diamond.

PEERS ALLEY MEDIA

Virtual Event

4th Global Summit on
Future of Materials Science and Research

Biodegradable and injectable poly (vinyl alcohol) microspheres in silk sericin-based hydrogel for the controlled-release of antimicrobials: Application to deep full-thickness burn wound healing

Bianza Moise Bakadia[1,2], Aimei Zhong[1], Xiahong Li[3], Biaou Oscar Ode Boni[1], Abeer Ahmed Qaed Ahmed[4], Tiatou Souho[5], Ruizhu Zheng[1], Zhijun Shi[1], Dingwen Shi[1], Lallepak Lamboni[1,6] and **Guang Yang[1]**

[1,3,6]Huazhong University of Science and Technology, China
[2]Democratic Republic of the Congo, Republic of the Congo
[3]Chinese Academy of Sciences, China.
[4]University of South Africa, South Africa
[5]Université de Kara, Togo
[6]Institut Nationale d'Hygiène (INH), Togo

Deep full-thickness burn wounds are prone to multi-drug resistant (MDR) infections following injury, which extends the healing time. Thus, providing a bioactive hydrogel dressing with prolonged antimicrobial activity and reduced dressing changes is quite desirable for accelerating burn wound healing and preventing scarring. To achieve this, we developed an injectable hydrogel based on silk sericin (SS), poly (vinyl alcohol) (PVA), and PVA microspheres (MSs) containing vancomycin (VA), gentamicin (GEN), or their association (VG) for the healing of infected burn wounds. The microspheres were prepared by inverse emulsion crosslinking, while the hydrogels were prepared by freeze-thawing cycles. Antibacterial studies showed that gentamicin acts synergistically with vancomycin by increasing the bacterial killing rate and enhancing the biofilm inhibition and eradication effects on methicillin-resistant Staphylococcus aureus more than on Pseudomonas aeruginosa and Escherichia coli. Findings from SEM images showed that the microspheres were sphere-shaped with a smooth surface and their average diameter ranging from 26.22 to 32.42 µm suitable for parenteral drug delivery. The prepared hydrogel containing 10% of microspheres was more elastic than viscous, with lower tan delta values (<1) suited for deeper injection with homogeneous tissue integration. The incorporation of VG-PVAMS in the PVA/SS hydrogel led to zero-order release kinetics and efficient antimicrobial effects. Moreover, the in vivo study using a rat full-thickness burn model showed that the VG-PVAMS@PVA/SS hydrogel displays a better therapeutic effect than drug-free PVAMS@PVA/SS hydrogel and TegadermTM film dressing by inducing early vascularization and collagen deposition, leading to early re-epithelialization and burn wound closure.

Biography

Bakadia Bianza Moise is currently a Ph.D. student at Huazhong University of Science and Technology and a research fellow at the Higher Institute of Medical Techniques of Lubumbashi, DR. Congo. He received a Bachelor of Science degree from the Higher Institute of Medical Techniques of Lubumbashi, DR. Congo, and a Master's degree from Huazhong University of Science and Technology, China. His research interests include biomedical analysis of biological fluids, the immune response to microorganisms, and the development of biomaterials for tissue engineering. He has published more than 19 SCI papers.

Exploring thermal transport properties of solids by machine learning

Ruiqiang Guo, Jialin Tang, Guotai Li and **Xiaohan Song**

Shandong Institute of Advanced Technology, China

Micro/nanoscale heat conduction is crucial for a broad range of applications such as thermal management of electronic devices, thermal insulation, and thermoelectrics. Understanding and designing of thermal transport properties in solid materials largely depends on atomistic simulations based on density functional theory (DFT) or empirical potentials, which however suffer either low computational efficiency or accuracy. In recent years, machine learning is emerging as a powerful tool to bridge the gap between DFT and empirical simulations. The applications of machine learning in exploring thermal transport properties of solids mainly include constructing interatomic potentials and predicting thermophysical properties of materials. In this talk, we will introduce our recent progess in building machine learning interatomic potentials and predicting interfacial thermal resistance using machine learning. On one hand, we have developed machine learning interatomic potentials that can accurately describe phonon transport in materials containing point defect, grain boundary structures, and layered materials. The machine learning interatomic potentials achieve DFT-level accuracy and 3 to 5 orders of magnitude higher efficiency than DFT. On the other hand, we have developed machine learning models to accurately predict the thermal resistance of non-metallic/non-metallic and metal/non-metallic interfaces.

Biography

Ruiqiang Guo is a professor at Shandong Institute of Advanced Technology. He received his B.S. in from Jilin University in Materials Science and Engineering in 2008, his M.S. in Materials Science from Huazhong University of Science and Technology in 2011 and his Ph.D. in Mechanical Engineering at the Hong Kong University of Science and Technology in 2015. After that, he worked as a postdoc at the Hong Kong University of Science and Technology, California Institute of Technology, and University of Pittsburgh. His main research interest is in nanoscale heat transfer and energy conversion, with special focus on the fundamental understanding of transport and interaction processes of principle energy carriers, as well as the design and engineering of materials for thermal management, electronics and clean energy.

PEERS ALLEY MEDIA

Virtual Event

4th Global Summit on
Future of Materials Science and Research

Retroviral vectorization for modern gene therapy

Xiaomo Wu
Dermatology Institute of Fuzhou, China

Vectorization of viruses provides the approach of the exploitation of the remarkable viral capabilities of delivering genetic material to host cells. Recently, gene therapy (GT) based on viral vector has emerged as a promising therapeutic modality for multiple inherited and acquired human diseases. Following just a single application, GT is capable of achieving curative treatment or mediating long-lasting therapeutic benefits, which fundamentally distinguishes itself from traditional medicine. For the last four decades, retrovirus mediated gene therapy has been the major player in the field of GT, and multiple lentiviral/ γ-retroviral vector-mediated GT products have been approved for treating various pathological conditions, including immunodeficiency, blood disorders and neurometabolic disorders. However, the early development of GT had been turbulent, with unexpected devastating effects exposed linked to the genotoxicities associated with retroviral semi-random genomic insertion. Here we talk about how the iterative vectorization processes taming the retroviruses, enabling them to become the foundation of modern gene therapy. And we will also take an evolutionary perspective to understand and perceive how retroviruses shaped us in the distant past.

Biography

Xiaomo Wu is the head of Regenerative Medicine LAB and the deputy Director of the Dermatology Institute of Fuzhou, China. She received a B.A. in Medicine in 2002 from the University of Wuhan, followed by a M.S. in Genetics in 2006 from the University of Fudan, Shanghai. In 2008, she came to Biozentrum, the University of Basel, Switzerland and received a PhD in Genetics in 2012 under Prof. Walter J. Gehring. She conducted her postdoctoral research in Bettler's LAB, Biomedicine Department, also from the University of Basel, Switzerland. In 2017, she was recruited as a lad head and the deputy director of a newly founded institute in the Dermatology Hospital of Fuzhou, Fujian, China. In recent years, her Lab has been dedicated to developing therapeutic interventions based on genetic modification and alteration, namely gene therapy, for the treatment of inherited skin diseases as well as hemophilia A.

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Future of Materials Science and Research

Hollow fiber contactors with improved membrane materials – Unique devives for efficient metal separation

Anil Kumar K. Pabby
Bhabha Atomic Research Centre, India

In chemical industry, the chemical engineering community is already paying significant attention to the quest for technologies that would lead us to the goal of technological sustainability. In this context, improved membrane material has come a long way over the past three decades from a simple laboratory curiosity to full-fledged commercial environmentally friendly technology to answer the multifarious demands of chemical industry. Also, newly developed HF membrane contactors with super hydrophobic membrane have proved to be efficient contacting devices, due to their improved hydrophobicity and high area per unit volume that results in high mass transfer rates. Membrane contactor processes, in which phase contacting is performed or facilitated by the structure and shape of the porous membrane, provide a new dimension to the growth of membrane science and technology and also satisfy the requirements for process intensification. Some of the specific examples of HF technology are as follows: gas-liquid applications including oxygen desorption for industrial scale boilers, from ultrapure water, for absorption applications and at smaller scale, for blood oxygenation in open heart surgery.

Recent progresses include selection of better contactor membrane materials and/or modification of existing membranes via coating/surface modification or development of an altogether new material or membrane structure. High free volume polymer-based dense coatings with high gas permeabilities can eliminate membrane pore wetting caused by various absorbents. A number of examples of ILMs for gas separation show extended stability. Membranes with greater solvent resistance have appeared for membrane contactors for L-L processes. Prevention of loss of organic solvent-extractant acting as a SLM continues to be challenging. Introduction of fiber sorbents has facilitated applications of gas-solid membrane contactors. Porous hollow fiber membranes facilitate high efficiency mixing of anti-solvent with a crystallizing solution to enable continuous processes for crystallization as well as forming a polymer coating on suspended crystals and nanoparticles.

This invited talk presents the overview of HF technology and their commercial applications in chemical industries including current scenario of these techniques applied worldwide. Attempts are made to focus future progresses in membrane engineering.

Biography

Anil Kumar Pabby was serving Bhabha Atomic Research Centre (BARC), Tarapur, Mumbai, Maharashtra, as Senior Scientist (Scientific Officer, G). Now, he is retired on superannuation in July 2021. He did his Ph.D. from University of Mumbai, India and subsequently carried out his postdoctoral work at Technical university of Catalunya, Barcelona, Spain. He has more than 190 publications to his credit including 20 chapters and two patent on non-dispersive membrane technology. He has taken a leading role in publishing "Handbook of membrane separation: Chemical, pharmaceutical, food and biotechnological applications' in July 2008 and second edition published in April 2015. Also, he has been awarded with prestigious Tarun Datta Memorial award (instituted by Indian Association Nuclear Chemist and Allied Scientist) in 2005 for his excellent contribution in Nuclear and Radiochemistry. He is serving as Editor/editorial/advisory board member of some international peer reviewed journals (Separation and Purification Reviews, Desalination (2010-2014), Desalination and Water Treatment, Membrane Technology, Applied Membrane Science and Technology, Journal of Radioanalytical & Nuclear Chemistry (Editor 2001-2005).

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A review: Photocatalytic activity of Zinc Oxide nanoparticles synthesized via chemical and green synthesis methods

Gurjinder Singh
Sri Guru Granth Sahib World University, India

Nanoparticles draw larger attention in the latest years due to their versatile chemical, optical, electrical and magnetic properties. The metal oxide nanoparticles i.e zinc oxide, copper oxide, and titanium dioxide showed potential applications as photocatalyst, sensors and luminescent material for optoelectronic devices. The properties of such metal oxide nanoparticles are size and shape dependent. The synthesis route i.e chemical or green, selection of precursor, stabilizing material and operating temperature conditions affects the morphology of synthesized nanoparticles. To remove pollutants i.e dyes from industrial water, the different semiconductor metal oxide nanoparticles having particular size and shape tested for their photocatalytic behaviour. The chemical synthesis route i.e co-precipitation method using the Zinc acetate dihydrate, Sodium hydroxide, and Cetyltrimethylammonium bromide as precursor, reducing and stabilizing agent respectively produced elongated triangular bipyramidal shaped zinc oxide nanostructures and the fructose capped zinc oxide nanoparticles synthesized via co-precipitation method elaborates the formation of quasi-spherical shaped nanoparticles. The synthesized zinc oxide nanoparticles showed good photocatalytic activity for removal of methylene blue and congo red dyes. The green synthesis route preparing extract from the plant leaves i.e syzygium cumini gives formation to spherical shaped zinc oxide nanoparticles. The synthesized nanoparticles used for removal of reactive orange-4 dye in photocatalytic process. The green synthesis is preferred process due to its environment friendly nature and cost effectiveness. This review elaborates the synthesis of zinc oxide nanoparticles through chemical and green synthesis routes and use of synthesized nanoparticles for removal of pollutants i.e methylene blue, congo red and reactive orange-4 dyes from water for environment remediation.

Biography

Gurjinder Singh has research area in the field of synthesis, characterization and electronic properties of metal oxide semiconductor nanoparticles. His research work highlights the synthesis of copper oxide, zinc oxide and titanium dioxide semiconductor nanoparticles through chemical and green synthesis methods. He has published research articles having Photocatalytic applications of nanoparticles. His current research work relates to the properties of metal oxide semiconductor nanoparticles i.e. Light absorption, photocatalytic, photoluminescence, anti-reflective and electrical resistivity for optoelectronic devices.

Rare earth doped magnetite nanoparticles: An overview

Richa Jain
Motilal Nehru College, India

Dynamic and intense research is being carried out on magnetite nanoparticles because of the vast potential of their usage in various fields such as biomedicine, drug delivery, resonance imaging, making transformers cores, microwave devices, recording material, etc. Various properties of magnetite can be easily optimized by doping with various metal ions. The rare-earth ions have unpaired 4f electrons and strong spin-orbit coupling of angular momentum due to which they have higher magnetic moments. In this study, an overview is presented to investigate the effect of rare earth doping in magnetite. The effect of doping on the structural, morphological, magnetic, optical, and electrical behavior of magnetite has been discussed for various applications.

Biography

Richa Jain has completed her Ph.D. in Nano Science in the year 2021 from IGNOU. Her area of research interest is synthesis and characterization of ferrites nanomaterials. She has a teaching experience of more than 12 years and is currently employed as an assistant professor in a college under the central University of India (University of Delhi) India.

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Development of scheduling methodology in a multi-machine flexible manufacturing system without tool delay employing flower pollination algorithm

Sivarami Reddy N[1], Padma Lalitha M[1], Venkata Ramamurthy D[2] and Prahlada Rao K[3]

[1]Annamacharya Institute of Technology and Sciences, India
[2]Satya Institute of Technology and Management, India
[3]JNTUACollege of Engineering Anatapur, India

This paper addresses machines, automated guided vehicles (AGVs), tool transporter (TT), and tools concurrent scheduling in a multi-machine flexible manufacturing system (FMS) for makespan minimization. The fewest copies of each tool type are employed to prevent tool delays, and job and tool shift times between machines are taken into account. The tools are placed in a central tool magazine (CTM), which shares and serves them to many machines to cut down the price of duplicating the tools in each machine. This simultaneous scheduling problem is challenging to solve because it entails determining the fewest tool copies of each tool kind without tool delay, assigning AGVs and tool copies to job-operations (jb-ons), ordering jb-ons on machines, and related trip operations such as deadheading and loaded flight times for both TT and AGVs. This paper uses a mixed-integer nonlinear programming (MINLP) framework to present the problem, and a flower pollination algorithm (FPA) is employed to solve it. For verification, a manufacturing company's industrial problem is employed. The results show that employing two copies each for two tool types and one copy each for the remaining tool types causes no tool delay, reduction in makespan and cost, and the FPA outperforms the Jaya algorithm.

Biography

N Sivarami Reddy completed his Ph.D. at JNTUA, India, in 2019. Currently, he is working as a Professor of Mechanical Engineering. He has 30 papers to his credit. His research areas include the Scheduling of FMS and Soft Computing Techniques.

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Comparative study of ZnO/ Polypyrole and SnO_2/ Polypyrole nanocomposites for ammonia gas sensing application

Ajay Pratap Singh Gahlot, Ayushi Paliwal and **Avinashi Kapoor**

University of Delhi, India

A gas sensing system for the detection of harmful and hazardous ammonia gas is made using a Surface Plasmon Resonance (SPR) laboratory setup. In this manuscript, various methods for producing developed ZnO, SnO_2 and traditional WO_3 and In_2O_3 nanowires on a large scale and with great reproducibility have been discussed. The NH_3 gas-sensing system that was proposed for our developed ZnO and SnO_2 performed better than expected. The ZnO/PPy and SnO_2/PPy interface is used to successfully demonstrate the SPR system for the detection of NH_3 gas. But for NO_2 gas applications, the traditional WO_3 and In_2O_3 nanowires technologies are primarily utilized. In order to successfully detect NH_3 gas, thin films of 100 nm ZnO and 150 nm PPy were formed, which provide the sharpest SPR reflectance curve. SnO_2 performed better when compared to other approaches. The SPR gas sensor exhibits a rapid response (1 s) and good sensitivity ($3.15x10^{-3}$ o/ppm) for ZnO and ($4.5x10^{-3}$°/ppm) for SnO_2 towards NH_3 gas over a wide concentration range (1 to 10 ppm). Additionally, the dynamic response was seen, and from the calibration curve, the sensitivity was calculated to be 0.202 /ppm for SnO_2 and 0.121 /ppm for ZnO, respectively. Because of improved response characteristics, the research demonstrates that efficient SPR gas sensors are accomplished in the current SnO_2 with PPy work.

Biography

Ajay Pratap Singh Gahlot received his B.Sc. Physics (Hons) from Dyal Singh College, University of Delhi and M.Sc. degree in physics from the University of Delhi, New Delhi, India. Currently, he is working as Associate Professor, Department of Physics, Deshbandhu College, University of Delhi. His research interests are in the area of Condensed Matter physics, High temperature Superconductivity, Perovskite Solar Cell and the Study of Nanostructures based design of devices for gas sensing application. Presently, working on SnO_2/ZnO /Polypyrrole Composite Nanomaterials and its various properties and applications. He has vast experience of teaching at different colleges. He is the life member of Math Tech Thinking Foundation: Fazilka, Punjab, India, Also, an affiliate member of Royal Society of Chemistry and American Chemical Society. Have experience of organizing several national & international conferences and seminars.

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Effect of the crystalline phase on the electrocatalytic performance of $Sm_{2-x}Sr_xNiO_{4-\delta}$ (x = 0.4 to 1.0) Ruddlesden Popper based system: A comparison of bulk and thin electrocatalysts

Manisha Chauhan and **Prabhakar Singh**
Indian Institute of Technology (BHU), India

Here, we are investigating the effect of composition on the Oxygen Evolution Reaction (OER) mechanism of $Sm_{2-x}Sr_xNiO_{4-\delta}$ (x = 0.4 to 1.0 with a step of 0.2) synthesized through the standard solid-state technique. With the change in oxygen non-stoichiometry, Rietveld refinement of X-ray diffractograms and EDX indicate the compositional phase change from orthorhombic to tetragonal. x = 0.6 and 1.0 thin films were also produced using the Pulsed laser deposition technology (PLD) for comparative electrocatalytic behaviour understanding, and cyclic voltammograms were compared to bulk ones to estimate the transient response and electrochemical reversibility. The cyclic voltammetric curves in bulk samples indicate a change in the number of electron transfers with x, as well as a change in electrochemical reversibility. Our findings show that electrochemical reversibility in thin films is driven by adsorption rather than diffusion, as it is in bulk samples. In both bulk and thin films, we found that the tetragonal phase (x= 1.0) has a larger Tafel slope than the orthorhombic phase (x = 0.6).

Biography

Manisha Chauhan is a senior research fellow at the Indian Institute of Technology (BHU), working under Prof. Prabhakar Singh's supervision in the department of physics. Functional materials for energy application, fuel cells, and electrochemical energy devices are my areas of interest. She is currently working on Investigation of Nickelate-based Ruddlesden popper perovskites for fuel cell applications. She has published a couple of papers in prominent journals that look into the catalytic characteristics of the RP system and double perovskite system. And a few papers are in the process of being communicated.

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Study on effect of nano-hydroxyapatite in microwave heating of magnesium/ hydroxyapatite biodegradable composites and their properties

Shivani Gupta[1], Apurbba Kumar Sharma[1] and Dinesh Kumar Agrawal[2]

[1]Indian Institute of Technology Roorkee, India
[2]The Pennsylvania State University, USA

Magnesium is an alkaline earth light metal with good biocompatibility and osteoconductivity. It is one of the essential minerals for the human body. However, pure magnesium is not suitable for artificial biomaterials since its low mechanical properties and corrosion resistance. Composites of magnesium and its alloys with bioceramics have been developed to enhance desired properties. In this work, magnesium alloy (AZ31) and hydroxyapatite (HA) composites were fabricated using microwave energy of 2.45 GHz at 1.4 kW microwave power for 15 min exposure time in argon atmosphere. Biodegradable metal matrix composites (BMMCs) of three compositions; AZ31 with 10, 15 and 20 wt% hydroxyapatite, were explored. The role of nano-hydroxyapatite in microwave heating of BMMCs was analyzed and observed that heating rate increased as HA content increased in the BMMCs. It happened due to the higher dielectric loss of HA than AZ31. The high dielectric loss enhanced the microwave absorption in the green compact of BMMCs and raised the temperature at the same exposure time and microwave power. Microwave heating mechanism of BMMCs was also tried to understand. Moreover, these three BMMCs were characterized for their microstructural, mechanical properties and corrosion behaviour. The XRD and SEM results revealed that the major phases are Mg and HA, while in AZ31/20HA, one minor phase of the β-$Ca_3(PO_4)_2$ is observed. AZ31/20HA showed the highest density and microhardness among the three compositions. In contrast, AZ31/15HA exhibited the highest compressive strength, Young's modulus and corrosion resistance. The reason for reducing AZ31/20HA compressive strength is the formation of the β-$Ca_3(PO_4)_2$ phase since it shows lesser compressive strength than HA phase, which reduces the compressive strength of BMMC. Similarly, β-TCP degrades faster than HA due to its high solubility in simulated body fluid, which reduces the corrosion resistance of AZ31/20HA. However, the noble achievement of this study is the porosity gradient developed in the microwave processed BMMCs. The porosity gradient was obtained due to specific microwave heating characteristics; material gets heated from core to surface. Porosity gradient could be the desirable attribute of BMMCs for orthopedic applications. It enhances the osteogenesis reactions, increases surface area for more ion exchange from artificial material to host tissue and helps in tissue in growth.

Biography

Shivani Gupta is a Senior Research Fellow at Indian Institute of Technology Roorkee, India and she is going to finish her Doctor of Philosophy. She has done her B.Tech with honor and was awarded Gold Medal in her Master's. She visited The Pennsylvania State University, USA, as an Exchange Visiting Scholar under SPARC scheme. Her research areas are manufacturing processes, process optimization, powder metallurgy, microwave materials processing, biomaterials, characterization, modeling and simulation.

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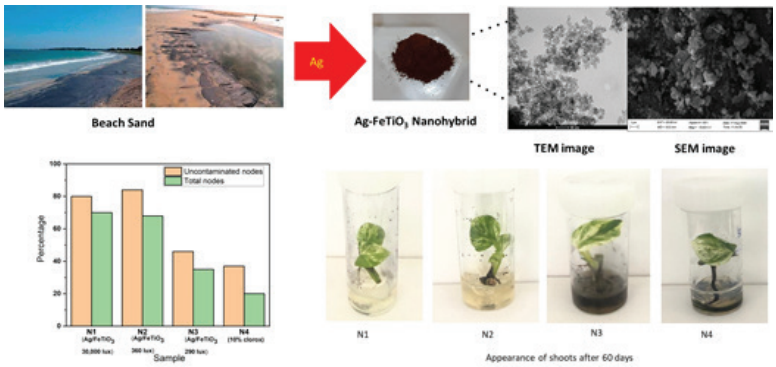
Ag decorated iron Titanate nanohybrids as visible light active photo-catalyst in micropropagation applications

Nethupa Arachchi[1,2], Kasun Seneviratne[3], Sanadie Gamage[3] and Sriyani E Pieris[3]

[1]Bellaire High School, USA
[2]Gateway College, Sri Lanka
[3]Sri Lanka Institute of Information Technology, Sri Lanka

Micropropagation techniques are commonly used to produce large quantities of healthy plants in commercial agriculture. In this technique, all plant parts used in vitro experiments should be free of microorganisms. Therefore, vigorous surface sterilization is carried out. Chemical sterilization based on $HgCl_2$, NaOCl, alcohol, benzalkonium chloride and peroxide (H_2O_2) are commonly used at commercial scale and some of these compounds are known to be highly carcinogenic and toxic. Therefore, these practices, impose threats to both humans and the environment. Photocatalytic sterilization is identified as a safer and sustainable alternative method. In this study, an efficient photocatalytic nanohybrid material based on Ag decorated iron titanate (Ag-$FeTiO_3$) derived from natural beach sand has been developed. $FeTiO_3$ nanoparticles are isolated from beach sand using an acid dissolution method followed by treatment with $AgNO_3$. Electron microscopy studies confirmed the successful anchoring of Ag nanoparticles onto the iron titanate nanoparticles separated from beach sand. The band gap of 2.80 eV calculated using UV-Vis studies confirmed its activity under visible light. The efficacy of the nanohybrid has been tested using Scindapsus aureus as the model plant. Plant nodes (40 for each experiment) were sterilized using commercial sterilizing agent 10% Clorox at 360 Lux (N1) and Ag-$FeTiO_3$ dispersion and kept the plants under various light intensities of 290 Lux (N_2), 360 Lux (N_3) and 30,000 Lux



Biography

Nethupa is a high school student in Bellaire high school Houston Texas, USA. The research was conducted in Sri Lanka while studying in Gateway College Colombo, Sri Lanka.

(N_4). Rate of contamination and propagation of the plants were monitored for a period of 90 days. It was observed that 63%, 54%, 16% and 20% contaminations were observed for Ni, N_2, N_3 and N_4, respectively. Interestingly, high rate of node propagation (84%) was observed in the plants sterilized using nanohybrid under 360 Lux value (visible light) compared to N_1 (37%). The observations confirm significantly improved sterilization efficacy in removal of microorganisms thus leading to improved rate of propagation.

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Combined machine learning and multiscale modeling of DNA-templated dye aggregates for excitonic applications

Lan Li

Boise State University, USA

Organic molecules, known as dyes, which can absorb and emit light, have various potential applications, such as biomedical imaging, organic photovoltaics, non-linear optics, and quantum information systems. These applications are controlled by dye orientation and properties such as extinction coefficient, transition dipole moment, and aggregation ability. Dye aggregate networks via deoxyribonucleic acid (DNA) templating exhibit exciton delocalization, energy transport, and fluorescence emission. DNA nanotechnology provides scaffolding upon which dyes attach in an aqueous environment. To control the process and optimize the properties, a combination of machine learning, density functional theory (DFT), and time-dependent (TD) DFT was performed to screen more than 26,000 dyes, select ideal dye candidates, and determine dye structure-property relationships. The machine learning models were developed with an accuracy of above 90%. Top 15 dyes were identified due to their properties comparable to those of a reference dye - pentamethine indocyanine dye Cy5. Molecular dynamic (MD) simulations were then performed to reveal dye aggregate-DNA interactions and dye orientations. Simulation results agreed well with experimental observations. The developed data-driven and computational workflow for identifying dyes with large extinction coefficients and transition dipole moments and good aggregation ability is effective and can be used as a tool to develop new dyes for excitonic applications.

Biography

Lan Li is an Associate Professor at the Micron School of Materials Science and Engineering, Boise State University in Boise, Idaho, USA. She leads the Materials Theory and Modeling Group, focusing on the development of multiscale modeling and data-driven approaches to design materials for electronic and energy applications. She has received research grants from Department of Energy, National Science Foundation, Office of Naval Research, Idaho National Laboratory, and National Institute of Standards and Technology. She has also been awarded the CAES (Center for Advanced Energy Studies) Follow, Boise State University's Top Ten Scholar Honored Faculty, TMS (The Minerals, Metal and Materials Society) Young Leader Professional Development Award, and NIST (National Institute of Standards and Technology) – ARRA (American Recovery and Reinvestment Act) Fellowship. She has been a former Chair of TMS Education Committee, and presently serves as a Programming Chair for TMS ICME (Integrated Computational Materials Engineering) Committee.

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Protective clothing cleaning practices in the United States

M. McQuerry[1] and **E. Easter**[2]

[1]*Florida State University, USA*

[2]*University of Kentucky, USA*

The cleaning practices of U.S. wildland firefighters' personal protective clothing (PPC) are widely unregulated and unknown. As documented in the structural fire service, failure to regularly and effectively clean soiled and contaminated PPC may lead to severe health impacts, especially in the long term. This study aimed to investigate the current cleaning practices of wildland firefighting gear and to determine the laundering resources wildland firefighters have access to while deployed in the field. This study is the first of its kind to collect end-user feedback on wildland firefighter PPC cleaning. Findings indicate most wildland firefighters do not isolate their contaminated gear, wash their PPC at home, and frequently transport their gear in personal vehicles. These practices are significant departures from the recommendations of the National Fire Protection Association 1877 Standard on Selection, Care, and Maintenance of Wildland Firefighting Protective Clothing and Equipment. Considerations of practicality and feasibility specific to the wildland fire service should be adopted by the standard.

Biography

Meredith McQuerry is an Associate Professor of Textile Science in the Jim Moran College of Entrepreneurship at Florida State University. She oversees the operations of two labs; the Textile Testing Laboratory and the ThermaNOLE Comfort Lab® home to the only dynamic sweating thermal manikin at a public institution in the western hemisphere. As a clothing comfort physiologist, her research focuses primarily on the physiological comfort and performance of protective clothing for first responders, athletes, and industrial workers.

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Enhancing spike resistance of flexible body armor using silane coupling agent and a fixative cross-linker

Hassan Mahfuz[1], Vincent Lambert[2] and **Floria Clements[3]**
[1]Florida Atlantic University, USA
[2]TechnipFMC plc, USA
[3]NextEra Energy, Inc, USA

The idea of flexible body armor is not new, and it has been around for the last few decades. What is, however, new is how it has evolved to its current state. Initial development included shear thickening fluid (STF) as a backbone polymer to impregnate ballistic fibers. STF was made from a mixture of silica particles and polyethylene glycol (PEG) at 55 to 45% weight ratio. At the core of the spike and ballistic resistance was the instantaneous rise in viscosity of STF at the event of an impact. Viscosity rise was due to hydroclustering of fumed silica particles embedded within the PEG. When the armor system was dry, hydroclustering was not possible in absence of any fluidity in the polymer. Still, coating of silica particles around the fiber offered reasonable amount of resistance to spike and ballistic penetration. In the next step, when silica nanoparticles were functionalized with a silane coupling agent (Gelest), siloxane (Si-O-Si) bonds were formed and it improved bonding of particles to the fiber. Subsequently, PEG was replaced by silane as the base polymer to develop N-H (amide) receptors on the surface of silica particles. To promote further bonding, a fixative cross-linker, Glutaraldehyde (Gluta) was added in the particle-polymer mixture. Gluta created strong bridges between distant pair of amide groups present in silated silica particles and kevlar. The particle-polymer mix was then used to impregnate multiple layers of woven kevlar fabrics to construct the armor. After fabrication, armor composites were tested using a drop tower following the NIJ (National Institute of Justice) Standard 0115.0.NIJ tests were performed with spikes having a drop weight of 1790g and drop heights ranging from 0.05m to 1.0m. that produced impact energies from 1 to 18J. Impact energy is normalized with aerial density of the armor to account for any variation in layer thickness during impregnation. It is observed that spike resistance for no penetration (i.e., 0 witness layer) increased from 12 J-cm^2/g for STF to 200 J-cm^2/g for the new silane-silica-gluta system. The improvement is almost 16 times. Silica nanoparticles bonded strongly with kevlar in uniform dispersion and offered unprecedented resistance to penetration.

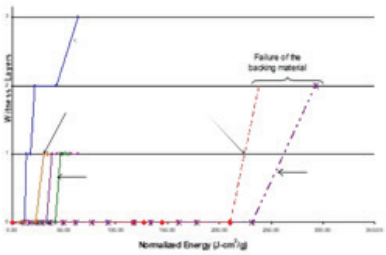

Figure. 1: Spike Tests for Various Armor Composites

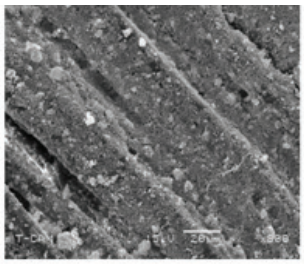

Figure 2: Silica particles bonded to Kevlar

Biography

Hassan Mahfuz is a Professor in the Ocean and Mechanical Engineering Department at Florida Atlantic University (FAU). He is also the Director of Nanocomposites Laboratory at FAU. He has published 11 book chapters, 111 journal, and 146 conference papers in composites and nanostructured materials. He has 1 US patent. He has presented 48 keynote and invited lectures in 13 countries. He has served as PI and Co-PI in materials research funding totaling $30 million in 56 projects since 1990. He has graduated 12 Ph.D. and 48 M.S. students. He is currently supervising 2 Ph.D. and 2 M.S. students. He became a ASME Fellow in 2010. He is serving as an Editorial Board Member for Oceans Journal since 2020.

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Effect of Ag and Si on the microstructures in Al-Cu-Ni-Mn-Ag/Si ternary high entropy alloy

S.K. Varma, Gina Zavala Alvarado and **Mckenna Mae Lin Hitter**

The University of Texas at El Paso, USA

The microstructures developed by the addition of (a) Ag and (b) Si in Al-Cu-Ni-Mn HEA alloy have been compared. The alloys were prepared by melting pure metals of at least 3 nines purity in electric arc furnace followed by casting. The alloys were repeatedly melted and cast several times to ensure a homogeneous distribution of the metals in the castings. The as cast microstructures in the monolithic form and as modified by Si and Ag were examined by the SEM in the back scattered electron mode. EDS was used to identify the compositions of the phases and x-ray color mapping was used to determine the locations of different elements in the microstructures. Phases developed, as identified by the compositions in atomic percent, were compared to ascertain the role of additives in the monolithic form. Monolith microstructure consists of three phases rich in (a) Al-Cu-Ni with gray contrast, (b) Ni with white contrast, and (c) Mn with black contrasts. Ag and Si alloys show similar three phases but variations in contrast. Phases in Ag alloy are rich in (a) Al-Cu-Mn, gray, (b) Ni, black, and (c) Ag, white, while the phases present in Si alloy are rich in the following elements: (a) Al-Cu-Mn, gray, (b) Ni, white, and (c) Mn, black contrasts. The compositions of the phases in the alloys may also be related to the atomic radii of the elements in the phases. The ratio of the two richest elements in the phases show that if their atomic radii are within ±15% of each other then they attract other elements also in that phase. On the other hand, for ratios of the atomic radii for the two richest elements that are not within ±15%, other elements are not attracted towards this phase.

Biography

S.K. Varma is a professor in the department of Metallurgical, Materials, and Biomedical Engineering at the University of Texas at El Paso since 1984. He teaches Nanofunctional Physical Metallurgy, Mechanical Behavior of Materials at this time. He has taught many courses both at graduate and undergraduate levels. He is the recipient of many awards including Best Teaching and Distinguished Achievement in Research. He has been conducting research in many physical and mechanical metallurgy areas: large strain plastic deformations, static annealing, composite materials, corrosive wear, refractory metals, and high entropy alloys. The research has yielded nearly 100 peer reviewed journal publications, numerous proceedings papers and supervision of 35 graduate students for their master's theses and Ph.D. dissertations. Organizers of the conferences, chairing many sessions in MS&T and TMS conferences, reviewing manuscripts for many peer reviewed journals are few of the other professional activities with which he is involved with.

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Immunomodulation with FasL presenting PEG microgel achieves long-term survival of allogeneic islets in the absence of immunosuppression in a non-human primate model chronic

J. Lei, H. Deng, Z. yang, T. Chen, K. M. Lee, C. Peters, I. A. Rosales, Z. Wang, M. M. Coronel, E. S. Yolcu, H. Shirwan, A. J. García and **J. F. Markmann**
Harvard Medical School, USA

Introduction: The full potential of islet transplantation will only be realized by development of tolerogenic strategies that obviate the need for maintenance immunosuppressants. We are reporting a clinically relevant strategy that co-transplantation of unmodified islets and SA-FasL-presenting immunomodulatory biomaterials achieved long term islets acceptance and glycemic control in the absence of chronic immunosuppression in an allogeneic diabetic non-human primate (NHP) model.

Methods: Poly (ethylene glycol) [PEG]-based microgels presenting controlled densities of SA-FasL are engineered. For experimental group, allogeneic unmodified islets from single donor were co-transplanted with SA-FasL-presenting microgels to the omentum of STZ-induced diabetic cynomolgus monkeys with Rapamycin as the only maintenance therapy for the first three months posttransplant. Recipients co-transplanted islets with PEG microgels without SA-FasL served as controls. Animals were followed for six months to demonstrate that reproducible long-term grafts survival and tolerance can be achieved.

Results: 4 experimental diabetic NHPs were co-transplanted with average 17K islet equivalents (IEQ)/Kg and SA-FasL-presenting microgel. Posttransplant each recipient promptly achieved excellent glycemic control with normal fasting BG during the 180-day designed study endpoint except one animal was electively terminated on day 147 posttransplant due to earlier grafts removal. IVGTTs performed at 3-month and 6-month post-transplant showed normal provocative glucose homeostasis, especially at the 6-month time point where blood glucose dynamics were as robust as the normal healthy animal. Insulin and C-peptide were greater than 1.5mU/L and 50pmol/L respectively for all animals. After removal of the islets containing omentum, all the experimental animals returned to diabetic immediately. All 4 recipients demonstrated evidence of Treg expansion and reduction of effector memory T cells by flow cytometry; and donor hypo-responsiveness by in vitro ELISPOT and MLR.

3 Control group diabetic NHPs that co-transplanted islets with non-FasL presenting microgel in the omentum and Rapamycin as the maintenance therapy achieved glycemic control less than 3 weeks, which is consistent with similar IS regimens in the literature and our previous studies. Recipient demonstrated no evidence of Treg expansion and donor hypo-responsiveness during study period.

Conclusions: Immunomodulation with SA-FasL-presenting microgels results in long term allogeneic islet graft survival in a NHP model in the absence of chronic immunosuppression. SA-FasL-presenting microgels as an off-the-shelf product presents a novel immunomodulatory approach with considerable translational potential for the treatment of type 1 diabetes.

Biography

Ji Lei is an Associate Immunologist and the Director of the Human Islet/Cell Isolation and Transplantation Special Service cGMP Facility at Massachusetts General Hospital. He also holds an Assistant Professor of Surgery position at Harvard Medical School. As a surgeon, he was formally educated and trained in medicine, medical research, and business administration at 4 universities. He has over 30 years of clinic practice and research experiences with more than 70 research papers contributions. His research focuses are on immuno-tolerance induction, immune-modulation, immune-isolation, and innovations of technologies in the fields of pancreatic islet transplantation to treat diabetes and hepatocyte transplantation to treat liver function failure. His core research expertise is in field of nonhuman primate translational studies for biomaterials such as encapsulation, immunomodulation, and novel cells derived from stem cells for the treatment of diabetes.

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Role of relaxations in material's mechanical toughness

Madhusudan Tyagi[1,2] and **Christopher Soles**[1]

[1]*National Institute of Standards and Technology, USA*

[2]*University of Maryland, USA*

The mechanical toughness in materials is defined as the amount of energy that a material can absorb per unit volume without experiencing a catastrophic failure. Despite the societal importance of tough engineering thermoplastics, it is currently not possible to predict why one material might display a tough mechanical response while another material might be brittle and breaks. In this work, we look at the origin behind mechanical toughness in a variety of polycarbonate-based systems in detail by Inelastic and Quasi-elastic Neutron Scattering (QENS) and were able to develop a framework that quickly correlates macroscopic mechanical toughness to the nanosecond dynamics. We find striking correlations between the fast relaxations in the quiescent glass and essential trends in mechanical toughness. The onset of macroscopic ductility (accompanied by a substantial increase in toughness), demarcated by the brittle-to-ductile transition (BDT), correlates with the onset of anharmonic motions in the mean-squared atomic displacement, (u2), on time scales faster than 1 ns. This finding1 emphasizes the role of anharmonic motions in dissipating energy in the glassy state. Poisson's ratio, characterized by Brillouin light scattering, shows an upturn in the same temperature region. Further investigation2 into the full inelastic neutron scattering spectra reveals two nanoscopic processes: (1) collective vibrational modes (the so-called Boson peak) with a characteristic time scale $\tau \approx 0.5–0.8$ ps and (2) collective relaxations with $\tau \approx 3$ ps. We show that the macroscopic phenomenon of the BDT corresponds to a change in the dominant nanoscale process from vibration-dominated to relaxation-dominated dynamics. This work clearly shows relaxation processes are how tough materials dissipate the energy and shows a way forward to tune the mechanical toughness in polymer glasses.

Biography

Madhusudan Tyagi works at the National Institute of Standards and Technology (NIST) and the Department of Materials Science and Engineering at the University of Maryland. He has also been working as an instrument scientist for the High Flux Backscattering spectrometer (HFBS) for the last 15 years. His research interests include the dynamics and structure of liquids, polymers, and biomolecules.

SCIENTIFIC ABSTRACTS

DAY 2

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BIOGRAPHY

Magdalena Niemczewska-Wójcik has experience on Faculty of Mechanical Engineering at the Cracow University of Technology: February 2006 – a research and teaching assistant, October 2007 – a research and teaching assistant professor, from April 2019 – a research and teaching associate professor.

Her achievements include the functions, such as - vice dean of Faculty of Mechanical Engineering at Cracow University of Technology, deputy director of the institute, member of the University Senate, member of the scientific council of Mechanical Engineering, member of the Polish Academy of Sciences (Machine Building Committee), and the research internships, i.e. V. Bakul Institute for Superhard Materials NASU in Kiev (Ukraine), Tribology Department of Łukasiewicz Research Network–The Institute for Sustainable Technologies in Radom (Poland) and NTB Interstate University of Technology Buchs in Switzerland. She is the project

Continued ..next page

Magdalena Niemczewska-Wójcik

Cracow University of Technology, Poland

Surface characteristics of the materials with use the complementary measuring instruments

Surface characteristics play an important role in identifying surface features and in describing stereometrics and functional properties. Characterization of the surface is possible on the basis of test results obtained from measuring instruments. There are many devices that use contact or/and non-contact measurement method. Each device can be used to characterize the surfaces. However, not every device is suitable for all materials, type of surfaces or object shapes. The use of various measuring instruments provides a comprehensive approach to characterizing the surface, especially if the devices used allow to measure in various scales, from macro to nano.

The work presents advantages and disadvantages of using contact and non-contact measurement method. The various measuring instruments from the macro to the nano scale have been presented (i.e. coordinate measuring machine, optical microscope, focus variation optical system, scanning electron microscope, confocal microscope, interference microscope, contact profilometer, atomic force microscope) used to the surface characterizing including identifying surface features, describing stereometrics and functional properties.

On the example of selected materials (metals, ceramics, composites, polymers), it has been shown that an important step in the methodology of surface study (surface characteristics) is the selection of measuring instruments, which should allow the comprehensive surface analysis and evaluation. The quantitative (parametric) and qualitative (non-parametric) analysis of the research results was presented. General rules for surface characterizing of materials with the use of various measuring instruments have been defined.

BIOGRAPHY

manager of Regional Group of Accredited Research and Calibration Laboratories of the Cracow University of Technology.

Due to the complexity of scientific problems, her research interest includes: materials and biomaterials, materials properties, manufacturing process, machining process, surface engineering, surface metrology, surface topography, methods of surface topography measurements (including multi-sensors instruments), tribology/biotribology, investigations of surface topography (from macro to nano scale), tribology studies (friction and wear tests), surface topography analysis (including multi-scale analysis), surface characterization.

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Waste paper cellulose based-MoS_2 hybrid composites: Towards sustainable green shielding

Rabia khatoon and **Azim uddin**
Zhejiang University, China

Biodegradable materials with green shielding characteristics, where "green" represents large effective absorption and less secondary reflection are in great demand but up to date no attention has been given to fulfill both requirements. This requires meticulous microstructural design for independently controlling absorptionassociated polarization loss and reflection-associated conduction loss. Herein, 2D-layered MoS_2 with low conductivity was integrated by simple soaking and carbonization into waste cellulose paper to promote both absorption through optimizing dielectric loss and green shielding through minimizing reflection. The 2D large surface area guaranteed efficient contact with the host and therefore only 10 wt% MoS_2 resulted in higher but moderate conductivity than cellulose paper ensuring low reflection-shielding effectiveness. Moreover, the cellulose fibers were bridged by MoS_2 establishing a conductive network. Efficient conductive pathway and improvement of dielectric losses from interfacial polarization resulted in simultaneous EM absorption (~− 15 dB) and green shielding (28 dB, green shielding index gs ≈1). Therefore, the developed composites not only demonstrated environmental sustainability but also effectively suppressed secondary electromagnetic pollution.

Biography

Rabia Khatoon has recently completed her PhD in materials Physics and chemistry from Zhejiang university, China. She is working on the synthesis of heterostructure, waste-derived carbon based composites and their applications in energy devices, i.e. Li-ion, Li-S batteries, gas sensors and microwave absorbence with shielding effect. She has publish more than twenty articles.

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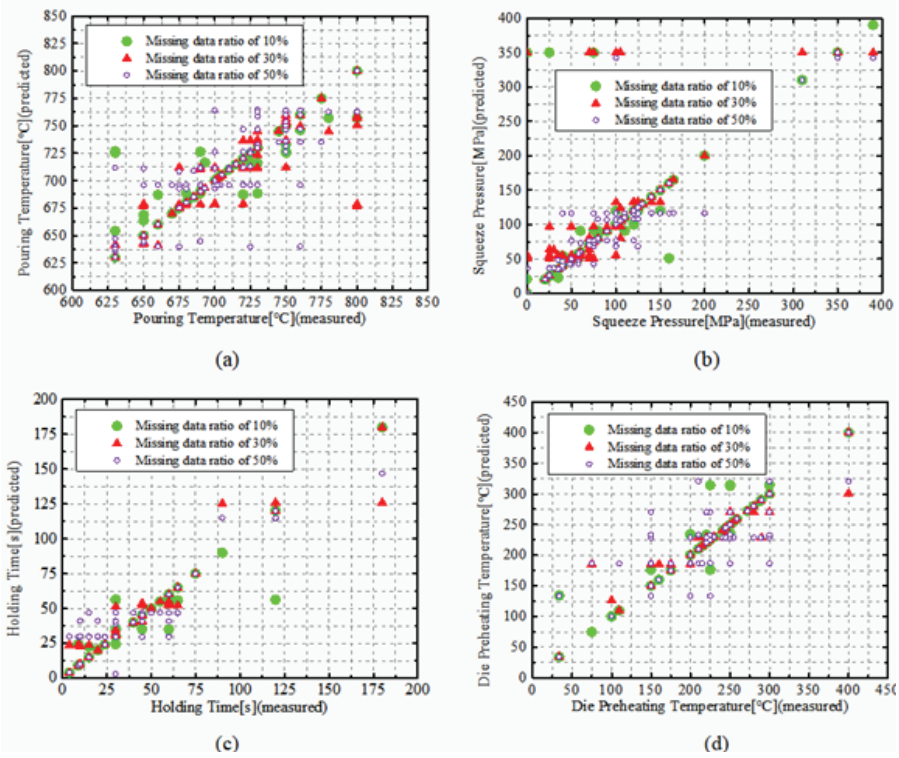
Imputation method based on collaborative filtering and clustering for the missing data of the squeeze casting process parameters

Jianxin Deng[1], Zhixing Ye[1], Lubao Shan[1], Dongdong You[2] and Guangming Liu[1]

[1]Guangxi University, China
[2]South China University of Technology, China

The development of a highly efficient methodology for establishing squeeze casting process parameters from past data is essential. However, designing squeeze casting process parameters based on past data is difficult when there are many missing values. Conventional missing data approaches are fraught with additional computational challenges when applied to highdimensional multivariable missing data, especially material process data with correlation. As the relationship between material composition and process parameters has similar characteristics with that between users and information of interest, we proposed a method for missing data imputation based on a clustering-based collaborative filtering (ClubCF) algorithm to address this challenge. Data samples with and without missing values were divided into two groups. K-means clustering based on a canopy algorithm was applied to the data samples without missing values to obtain k subclass data, whose values were then selected



to fill data samples with missing values via a collaborative filtering theory based on Pearson similarity user filling. The missing squeeze casting process parameters data of aluminum alloys were used to evaluate the method, and more comparative experiments were carried out to understand their performance and features. Two different indicators, including the mean absolute error and the standard deviation, were utilized to quantify the imputation performance, which was compared with those of three conventional methods (mean interpolation, regression interpolation, and the expectation maximization algorithm). The results indicate that the proposed approach is effective and outperforms conventional methods in processing high-dimensional correlated data.

Biography

Jianxin Deng is currently working as a professor and a master supervisor of Mechanical Engineering at Guangxi University and the vice director of Guangxi Key Lab of Manufacturing System and Advanced Manufacturing Technology. He received his master degree in industrial engineering from Chongqing University (China) in 2004 and his Ph.D. degree in mechanical engineering from South China University of Technology (China) in 2010. His research interests include manufacturing systems and informatics, squeeze casting technology, E-manufacturing, product axiomatic design, manufacturing service technology.

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Effect of mineral phases on the leaching efficiency of titanium slag

X. Wu, H. Wang, K. Sun, B. Wang and **R. Lu**
Ansteel Group, China

Titanium slag obtained from electric-furnace smelting using ilmenite from Panzhihua contains predominately two phases: anosovite and augite. The mineral phase compositions in titanium slag can have severe effects on the leaching process and leaching efficiency. However, the precise role of the effect of mineral phases on the leaching efficiency is unclear. In this work, the leaching behaviour of titanium from slag originated from Panzhihua region was investigated by using kinetic analysis and the characterizations of mineral phases and morphologies of particles involved in the fluid-solid leaching reactions. It was found that the leaching rates of titanium slag particles became more rapid with the increase of the concentration of sulphuric acid, temperature and surface area of titanium slag particles. Kinetic analysis using the data from the leaching kinetic study showed that the leaching process of titanium slag conformed to the shrinking core model controlled by surface chemical reaction and internal diffusion, and the apparent activation energy of leaching reaction was determined to be 69.87 kJ/mol. From the characterizations of mineral phases and morphologies of particles involved in the fluid-solid leaching reactions, it was shown that the formation of boundaries between mineral phases in titanium slag acted as resistance to slow down the leaching rate of titanium from titanium slag in sulphuric acid. Because the dissolution rate of augite phase was much slower than anosovite phase, the surface area available for the titanium leaching from titania-rich anosovite phase was reduced due to the coexistence of augite and anosovite phases in titanium slag particles. Our results demonstrate that the formation of boundary structures of anosovite and augite phases is an important factor affecting the leaching efficiency of titanium slag.

Biography

Xiaoping Wu has been working in Ansteel Research Institute of Vanadium & Titanium (Iron & Steele), Pangang Group, as a research director and a senior research fellow in the area of titanium fine chemicals, titanium extraction, and titanium oxide materials. Previously, he had worked as the senior research scientist and senior research engineer in chemical industries and universities in UK. He obtained a BSc and MSc in China, and a PhD in chemistry from University of London.

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Inhibition of S-adenosylhomocysteine hydrolase induces endothelial senescence via hTERT downregulation

Wenhua Ling and **Yiran You**
Sun Yat-Sen University, China

Background and aims: It has been established that endothelial senescence plays a critical role in the development of atherosclerosis. Elevated S-adenosylhomocysteine (SAH) level induced by inhibition of S-adenosylhomocysteine hydrolase (SAHH) is one of the risk factors of atherosclerosis; however, the interplay between endothelial senescence and inhibition of SAHH is largely unknown.

Methods: Human umbilical vein endothelial cells (HUVECs) after serial passage were used. SAHH-specific inhibitor adenosine dialdehyde (ADA) and SAHH siRNA treated HUVECs and SAHH+/-mice were used to investigate the effect of SAHH inhibition on endothelial senescence.

Results: HUVECs exhibited distinct senescence morphology as HUVECs were passaged, together with a decrease in intracellular SAHH expression and an increase of intracellular SAH levels. SAHH inhibition by ADA or SAHH siRNA elevated SA β-gal activity, arrested proliferation, and increased the expression of p16, p21 and p53 in HUVECs and the aortas of mice. In addition, decreased expression of hTERT and reduced occupancy of H3K4me3 over the hTERT promoter region were observed following SAHH inhibition treatment. To further verify the role of hTERT in the endothelial senescence induced by SAHH inhibition, overexpression of hTERT plasmid vector under CMV promoter was constructed. The hTERT overexpression rescued the senescence phenotypes in endothelial cells induced by the SAHH inhibition.

Conclusions: SAHH inhibition induces endothelial senescence via the downregulation of hTERT expression, which is associated with attenuated histone methylation over the hTERT promoter region.

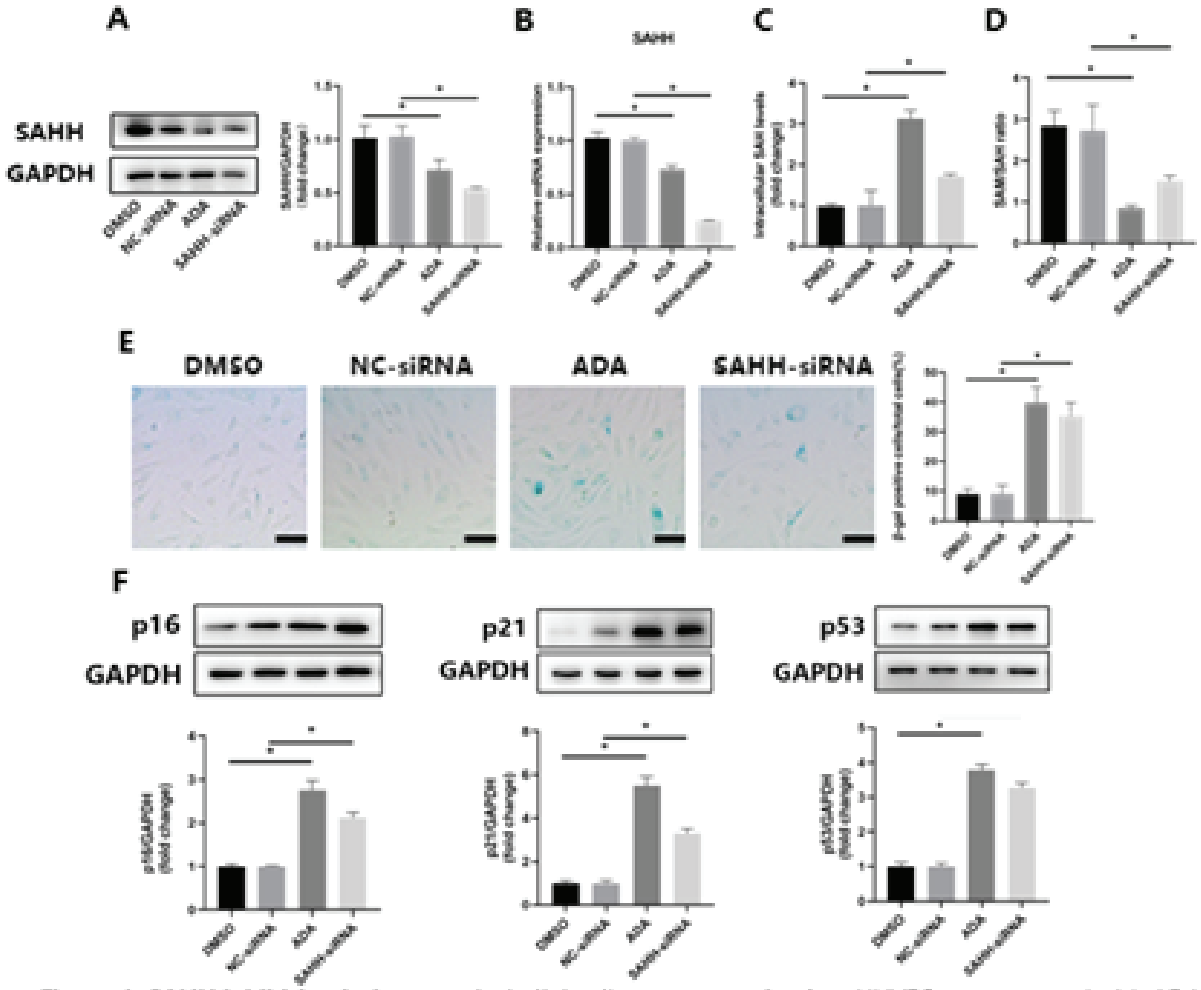

Figure 1. SAHH inhibition induces endothelial cell senescence *in vitro*. HUVECs were treated with ADA (15 μmol/L) or transfected with SAHH siRNA for 48 h. **A-B** Western blot analysis and Real-time reverse transcription-polymerase chain reaction analysis of SAHH in HUVECs among the 4 groups (n=3). **C-D** Intracellular levels of SAH and the SAM/SAH ratio in HUVECs among the 4 groups (n=3). Intracellular levels of SAH and SAM were measured by stable-isotope dilution liquid chromatography–electrospray tandem mass spectrometry. **E** SA β-gal staining in HUVECs among the 4 groups measured by a SA-β-gal staining kit (n=4). Scale bar =200 μm. **F** Western blot analysis of p16, p21, and p53 in HUVECs among the 4 groups (n=3). For all bar graphs, data are the mean ± SEM, * p <0.05, ** p <0.01 (determined by 1-way ANOVA).

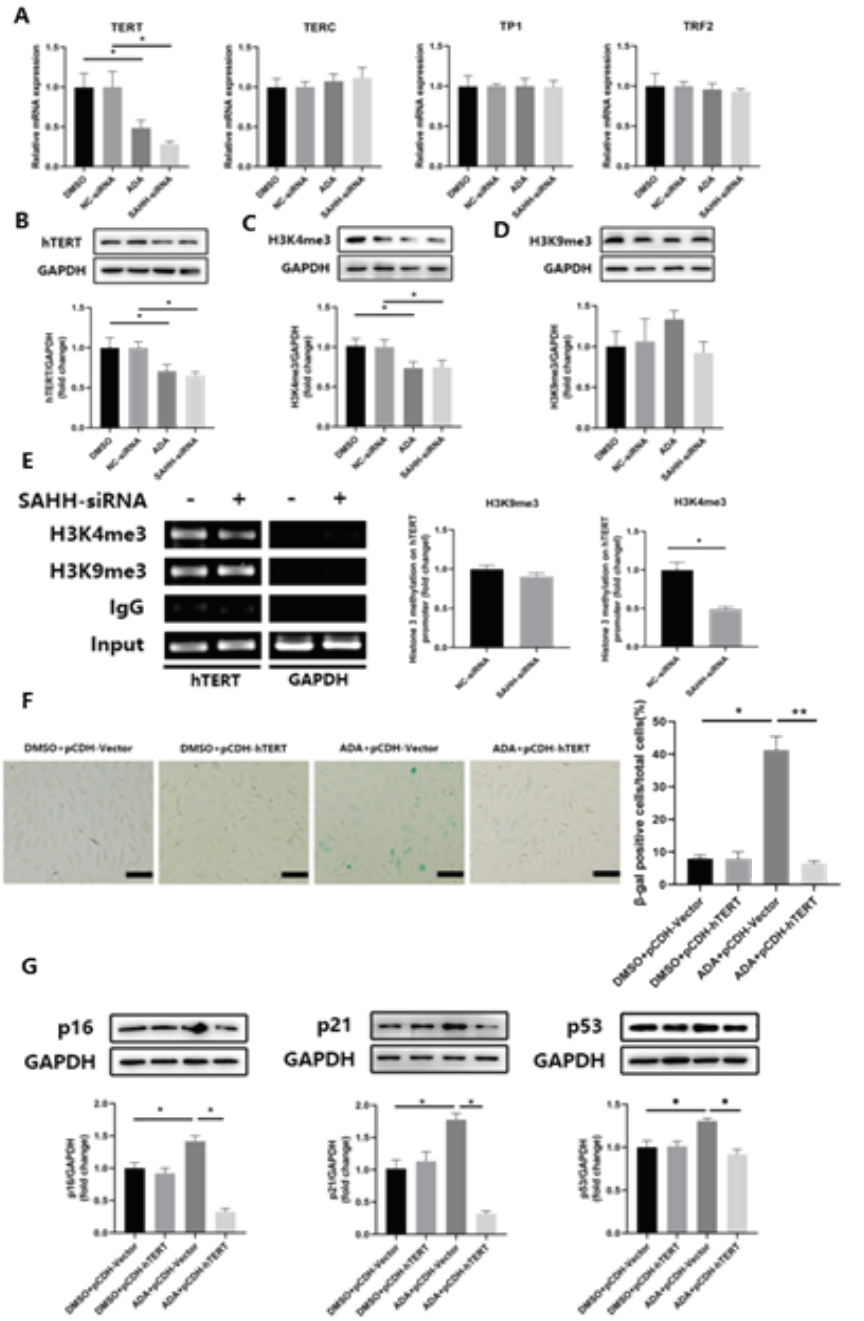

Figure 2. SAHH inhibition induces endothelial cell senescence via hTERT downregulation . A Real-time reverse transcription-polymerase chain reaction analysis of mRNA levels of telomerase subunits and accessory proteins in HUVECs among the 4 groups (n=3). **B** Western blot analysis of hTERT protein expression in HUVECs among the 4 groups (n=3). **C-D** Western blot analysis of H3K4me3 and H3K9me3 protein expression in HUVECs among the 4 groups (n=3). **E** Methylation of histone 3 lysine 9 (H3K9) and histone 3 lysine 4 (H3K4) on the hTERT promoter in HUVECs treated with SAHH siRNA and the control (n=3). Chromatin immunoprecipitation of HUVECs chromatin was performed with H3K4me3, H3K9me3, IgG antibodies. PCR was performed with specific primers for the hTERT gene promoter and primers for control region. Input and products immunoprecipitated by IgG were used as positive and negative controls, respectively. Quantification was normalized to input. **F** SA β-gal staining in HUVECs overexpressing hTERT with or without ADA treatment and the corresponding control groups by a SA-β-gal staining kit (n=4). Scale bar =400 μm. **G** Western blot analysis of p16, p21, and p53 in HUVECs among the 4 groups (n=3). For all bar graphs, data are the mean ± SEM, * p <0.05, ** p <0.01 (determined by 1-way ANOVA).

Biography

Wenhua Ling is a professor of School of Public Health, Sun Yat-sen University, a doctoral supervisor, director of the Institute of Preventive Medicine, School of Public Health, Sun Yat-sen University, the director, key Laboratory of Nutrition, Diet and Health, Guangdong Province, a member of the 6th and 7th Disciplinary Review Group of the degrees Committee of the State Council, "National Distinguished Young Scholar" winner, the instructor of 100 excellent doctoral theses in China, and he is also an excellent teacher in China. He also published research papers as newsletter or the first author in international authoritative academic journals such as Circulation, Circ Res, Hepatology, JCI, Diabetes Care, Am J Clin Nutr, Heart,Clin Chem, ATVB, Cardiovasc Res, J Lipid Res, J Biol Chem, J Nutr., etc.

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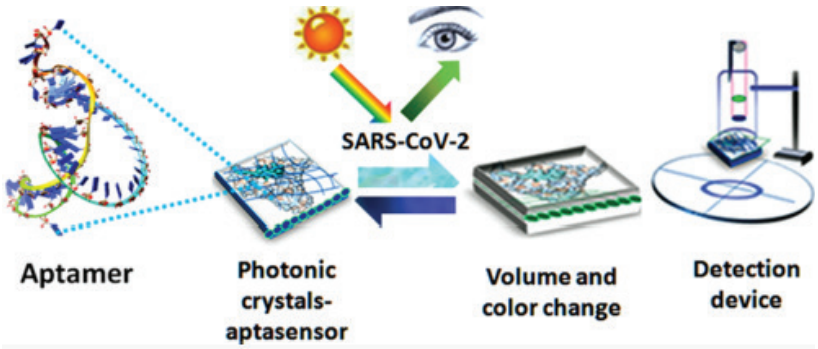
Photonic crystals decorated aptasensor for SARS-COV-2

Ghulam Murtaza, Aysha Sarfraz Rizvi and **Zihui Meng**

Beijing Institute of Technology, China

The frequent emergence of variants of concern (VOC) of SARS-CoV-2 necessitates a sensitive and all-inclusive detection platform that remains viable despite the virus mutations. In this context, we targeted the receptor-binding domain (RBD) of glycoprotein (S-protein) of all VOC and constructed a consensus RBD (cRBD) based on the conserved amino acids. Then, we selected a high-affinity ssDNA novel aptamer specific for the cRBD by an in silico approach. The selected aptamer is utilized to fabricate a photonic crystal (PC)-decorated aptasensor (APC-sensor), which consists of polystyrene nanoparticles polymerized within a polyacrylamide hydrogel. cRBD-responsive ssDNA aptamers are crosslinked in the hydrogel network, which selectively bind to the cRBD and SARS-CoV-2 in saliva samples. The binding response can be visually monitored by swelling of the hydrogel and color generation by diffraction of light from PCs and can be quantified by the diffraction ring diameter or a spectrometer. The sensor delivers a LOD of 12.7 ± 0.55 ng mL^{-1} for the cRBD and 3 ± 18.8 cells mL^{-1} for SARS-CoV-2 in saliva samples, with a rapid response of 5 min. The sensor can be stored and regenerated without loss of activity. It can be utilized as a point-of-care testing (POCT) for SARS-CoV-2 diagnosis.



Biography

Ghulam Murtaza is a postdoctoral researcher at the School of Chemistry and Chemical Engineering, Beijing Institute of Technology, where he works on the photonic crystals platforms that can be used for the detection of biological markers. He obtained his Ph.D. from the Beijing Institute of Technology studying photonic crystal sensors and his interests include 2D photonic crystal sensors for the detection of viruses, bacteria, and biomarkers of significant diseases.

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Application of the static structure factor for efficient characterization of finite-size particle-films

P. Weroński and **K. Pałka**
Polish Academy of Sciences, Poland

Monolayers of micro- and nanoparticles on solid substrates have many practical applications. They include electrochemical, piezoelectric, and plasmonic sensors; catalysts; antimicrobial and antireflective surfaces; or substrates for spectroscopy. Once produced, the particle systems usually need to be tested to ensure their high quality and functionality. The main objective of our research has been to develop a cheap and accurate method for efficient characterization of particle films. We have demonstrated that the multidimensional function of static structure factor is a promising candidate for this purpose. To compute Its continuous, ensemble averaged approximation, we may Fourier transform the radial distribution function calculated over an appropriate range of interparticle distance and system parameters. To calculate a discrete approximation of the structure factor for a sample monolayer image, on the other hand, we need to compute the squared modulus of the discrete Fourier transform of the digital image. Then, performing a least-squares fit of the continuous approximation to the discrete data, we can estimate the system parameters, with no identification of individual particles. To validate our approach, we have first determined parameters of a dense array of monodisperse hard spheres, generated by event-driven molecular dynamics. The particle radius, surface coverage, and size of analyzed area have been found with standard errors on the order of 1%. Then, using images of monolayers published in the literature, we have demonstrated a practical application of the approach to determine important parameters of random particle ensembles at lower surface coverage. For that, we have used a 4D structure-factor function of the waive number, particle surface coverage, and diameter of analyzed area, computed for hard disk systems generated with the model of random sequential adsorption. Our results suggest that the novel approach can be generalized for films of charged particles by simply increasing the dimensionality of the structure-factor function.

Biography

Paweł Weroński studied Physics at the A. Mickiewicz University in Poznań, Poland, and graduated as MS in 1989. He then joined the research group of Prof. Adamczyk at the Institute of Catalysis and Surface Chemistry, Polish Academy of Sciences (ICSC-PAS). He received his PhD and DSc degrees in 2000 and 2008, respectively, at the same institution. He earned two postdoctoral fellowships: at the Chemical Engineering Department of Yale University and at the Theoretical Division of Los Alamos National Laboratory. He works as an Associate Professor at the ICSC. He has published more than 50 research articles in SCI(E) journals.

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The effect of particle content and sintering time on the properties of Al-Al_9Co_2-$Al_{13}Co_4$ composites, made by powder metallurgy

I. Bahaj[1], M. Kaddami[1], A. Dahrouch[2], N. Labjar[3] and **M. Essahli[1]**

[1]Université Hassan I – Settat, Morocco
[2]Institut de Criminalistique de la Gendarmerie Royale, Morocco.
[3]Mohammed V University in Rabat, Morocco

In the current study, aluminum matrix composites made of Al-Al_9Co_2-$Al_{13}Co_4$ are developed using powder metallurgy with a flow of N_2 at a temperature of 600°C. In this study, the impacts of process variables such cobalt concentration (0.5, 1, 3, and 5%at.) and sintering time (4, 8, 24, 48, and 72 hours) on hardness were examined. X-ray diffraction analysis, scanning electron microscopy coupled with energy dispersive X-ray spectroscopy were used to evaluate the crystalline phase and microstructure of the composites made using the powder metallurgy process. A micro-Vickers hardness tester was used to test the mechanical properties. During heat treatment, mixed products $Al_{13}Co_4$ and Al_9Co_2 were generated in the aluminium matrix through reactive diffusion in solid state. The results show, on the one hand, that the obtained alloys have microhardness values that are significantly higher than those of pure aluminum (49 ± 4 HV). In contrast, the microhardness of alloys based on the compositions 'Al-0.5% Co' and 'Al-1%Co' increases with the sintering time and achieves a maximum value of 153.89 ± 4.85 HV and 141.49 ± 7.81 HV, respectively, at a sintering time of 72h. Nevertheless, the microhardness decreases with longer sintering times of 72h for the higher compositions that were studied 'Al-3%Co' et 'Al-5%Co'. After 48 h of sintering, the microhardness of the 'Al-3% Co' alloy falls from 131.88 ± 2.50 HV to 102.67 ± 4.33 HV. For the alloy 'Al-5%Co', it decreases from 93.87 ± 2.50 HV to 64.65 ±2.50 HV after 24 h of sintering. This decrease in hardness is explained by the generation of a large amount of pores during the sintering of the alloys with large compositions. The electrochemical behavior of these composites was studied in this work.

Biography

BAHAJ Imane is a PhD student at Hassan First University. He belongs to Morocco. He obtained his master degree in applied chemistry option: Physical-Chemistry of Materials in 2017 from Mohamed First University, at the Faculty of Sciences Oujda. At present, he joined the research laboratoty; Physical-Chemistry of Process and Materials; in 2018. He prepared his thesis under the theme of 'Thermodynamic of the Elaboration of materials composites and evaluation of their mechanical,thermal and electrochemical properties'. Their interest is to have the materials stable thermodynamically with good mechanical resistance and higher durability. He is looking for in parallel a postdoc who is interested in the following fields: Batteries, Storage Energy, Hydrogen Storage, Materials Science,Thermodynamic, Electrochemistry.

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Integrative and functional analysis of scientific production aspects by simplex simulation approach

Semmar Nabil[1] and **Hammami Asma**[2]

[1]*Pasteur Institute of Tunis, Tunisia*

[2]*University of Carthage, Tunisia*

Evaluations of scientific productions are traditionally made by h-index which is defined by only the most cited publications neglecting significant part of scientists' productions. Also, h-index can be rapidly increased by networking effects (friendship citations) leading to critical evaluation aspect of scientific productivity under reduced conception and frequent manipulation ways. This calls for bibliometric revisions through more integrative and more robust ways. In this framework, a new simplex simulation approach was developed for functional evaluations of scientific productions by highlighting regulation trends between structural variables of publications, and by considering whole sets of papers. Initially, publications are classified according to predefined criteria; then, their contents are structurally characterized by relative levels of production and cooperation variables including the numbers of pages, figures, tables, authors, affiliations, countries, etc. Using Scheffé's mixture designs, simplex simulation iteratively combined structural variability of different publications' classes by varying their relative weights. In response to combinations, a complete set of smoothed barycentric publication patterns was calculated. This response matrix represented system backbone from which regulation trends between production and cooperation variables were highlighted for different publications' class. Application was illustrated by analyzing populations of Tunisian biological and medical researchers initially classified into 6 classes combining three h-index ranges with two citation levels of papers (h or < h). Production variables showed positive trends leading to higher vs lower productivity ratios in scientists' classes associated with lower and higher h-index ranges, respectively. Moreover, papers' citations were improved by slight increase vs significant decrease of coauthors' numbers, respectively. These functional results highlighted production ratios and trends that are inaccessible by h-index. By its integrative and flexible aspects, simplex simulation approach calls for developing international projects aiming for scientific productivity analyses at different scales (scientists, institutions, countries, etc.) by considering open classification criteria.

Biography

Nabil Semmar, PhD in phytochemistry (Lyon 2000), is full Professor in biological engineering at the University of Tunis El Manar (Tunisia). Since 2004, he teaches biostatistics and data mining to license, master, engineer and doctorate levels. He followed long multidisciplinary training (1988-2004) combining biological and chemical fields with computational tools (Algiers-Marseilles-Lyon-Paris). In PhD, he developed a new simplex simulation method helping to highlight regulation processes governing polymorphic patterns in metabolic systems from chromatographic data. Since 2007, he published his simulation approach in many fields including plant metabolism, animal behaviors, environment assessment, pharmacology, food control, chemical synthesis and scientific production analysis. He was invited by several organisms including IAEA (Vienna, 2008) and Federal University of Parana (Brazil, 2017) to present his simulation approach. Since 2009, he edited 3 international books and 14 book chapters. In 2016, he cofounded the laboratory of bioInformatics, bioMathematics and bioStatistics in Pasteur Institute of Tunis.

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The versatility of Fe_2TiO_5 as a water splitting photocatalyst

M. A. Melo

Fluminense Federal University, Brazil

Very recently, pseudobrookite Fe_2TiO_5 has been surfaced as a promising photocatalyst for the oxidation half-reaction of overall water splitting. This semiconductor is inexpensive, non-toxic, possesses a relatively small band gap, and presents adequate structural and photochemical features. In this seminar, I will talk about the performance of Fe_2TiO_5 nanoparticles as a suspended water splitting photocatalyst, both in the pristine form and after specific modifications, such as doping and loading of cocatalysts onto the surface of the nanoparticles. The pristine nanoparticles were synthesized through a facile solvothermal method, also used for the doping processes, whereas sputtering deposition was employed for the cocatalyst loadings. All these approaches were efficient to prolong the charge carrier's diffusion length, reduce charge recombination, and accelerate the kinetics of the redox reactions at the solid/liquid interface, under visible light illumination. The procedure generated single-phase pristine, Sn- and Nb-doped Fe_2TiO_5 nanoparticles with dimensions close to 30 nm and optical band gap values of 2.1 eV. When aqueous suspensions of pristine Fe_2TiO_5, 1.0 at% Sn-doped Fe_2TiO_5 and 1.5 at% Nb-doped Fe_2TiO_5 were irradiated by simulated sunlight for 5h, evolutions of 59.2, 297.6 and 344.0 mol h^{-1} g^{-1} of O_2 were observed, respectively. These results reflect the substantial improvement that doping Fe_2TiO_5 with Sn and Nb confers to its photocatalytic water splitting activity. On the other hand, the deposition of nanostructured NiO, Co_3O_4, $NiFeO_x$ and $CoFeO_x$ cocatalysts resulted in O_2 productions of 204.0, 470.4, 504.0, and 448.0 mol h^{-1} g^{-1} within 5h. Electrochemical and photoelectrochemical measurements indicated that reductions in the charge carrier transfer resistance at the solid/liquid interface plays an important role for the performance improvements of the modified nanomaterials. Overall, this work illustrates how structural alterations of a potential photocatalyst can improve photochemical energy conversion.

Biography

Mauricio A. Melo is currently an adjunct professor at the Fluminense Federal University (UFF) in Rio de Janeiro, Brazil. He graduated and received his MA and PhD degrees in Inorganic Chemistry from the University of Campinas (UNICAMP). From 2015 to 2018, he worked as a postdoctoral researcher at the University of California, Davis (UCD). He was also a postdoctoral fellow at the University of São Paulo (USP) in 2019. His range of knowledge encompasses materials chemistry and solar energy conversion into fuels with inorganic nanomaterials as photocatalysts.

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Material futures past: Digital materiality of the internet of things

G. Briscoe

Royal College of Art, United Kingdom

One of the enduring propositions of technology futures is the crafting of material artefacts with Internet connectivity, allowing for the embodiment of a congruent digital shadow.

Such propositions have a long history, dating back to the 1990s, which saw the rise of the Internet and the ongoing miniaturisation of transistors for the rise of mobile phones. It was envisaged that these resources could be successfully combined to achieve the complexity and scale required for the Internet of Things (IoT). Also, this provides such propositions with the opportunity to evolve with our cultural aspirations, while reflecting on the current state of perceived technological development. So, we consider to what extent past technology futures of digital materiality for the IoT have been realised, including hybrid artefacts that are transcendent across the physical and the digital, between the material and the immaterial. While these 'technology futures' have been proffered through many media depictions, seemingly heading towards everyday environments, the vast majority never arrive. We therefore propose a model for understanding, from a speculative design approach, the pathways of

Figure: *Tate's Sideshows - explicit demonstration of congruent*

how emerging technologies become realised in real-world applications and technology-related imaginaries, as well as how they 'could' be realised in credible near- futures. We also suggest reasons why these future visions of the IoT in everyday environments so often fail to be realised, and how to present more plausible depictions. This includes understanding failed propositions focused on utilitarian artefacts, and better understanding material culture for the ubiquitous embodiment of digital materiality in plausible depictions. We conclude by considering what is required for credible, engaging and critical speculations on understanding digital materiality for the IoT, including potentially preferable futures of connecting all human-made objects in the world to the Internet.

Biography

Gerard Briscoe is a Research Fellow at the Royal College of Art's Helen Hamlyn Centre for Design. His research concerns Technology Futures, focusing on interdisciplinary design- computing research in designing digital cultures for preferable futures. Distinct phenomena of these digital cultures have emerged, including the shrinking of physical distance and the dissolution of material reality. So, It involves exploring speculative design for equity in emerging technologies for all abilities, which requires understanding digital materiality, resistance to digitisation and cyborg post-humanism. His expertise in interdisciplinarity comes from nearly two decade's experience with inter- and multi-disciplinary research. Specifically, between computing research with first natural sciences, then social sciences, followed by business research, and most recently design research. He gained his B/MEng in Computing, and PhD in Electrical and Electronic Engineering, from Imperial College London.

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3D printing in biotechnology: Supply chain independent single-use plasticware for cell culture

L. Achleitner[1,2] and **P. Satzer**[2]

[1]*Austrian Centre of Industrial Biotechnology, Austria*

[2]*University of Natural Resources and Life Sciences, Austria*

The current shortages in single use (SU) supply chains show how dependent both industry and academia are from only a few vendors worldwide. This is severely hindering fundamental research and process development for the COVID pandemic response and will do so in future. With 3D printing technology we can manufacture SU equipment on demand and on site. In this study we investigated different commercially available low-cost materials and their compatibility for cell culture. We identified poly lactic acid (PLA) as perfect candidate for 3D printed parts for cell culture applications.

The worldwide supply chain issues for SU shaking flasks and bioreactors prompted us to develop 3D printed counterparts to maintain our HEK293 cell culture intended for bionanoparticle production. The shaking flasks were designed in Autodesk inventor 3D CAD. Materials tested represent the market of different 3D printing technologies and low-cost materials, ranging from UV-polymerizing resin printers to thermoplastic printers. The different materials were tested with HEK293 cells under standard conditions. Cell growth and viability were monitored daily. Our tests showed that only PLA has the same growth behavior as the commercially available SU flasks. We suspect that volatile organic compounds (VOC) inhibit cell growth for resin-based materials and have a toxic effect on the cell culture. We were able to show that heat treatment to reduce the VOC concentration was of partial success (data not shown). Moreover, we present the application for insect cells intended for virus like particle production and show the potential uses of customized equipment such as custom-made bioreactors with geometries that are not possible to achieve with any other methodology than 3D printing.

While 3D printed SU ware is very unlikely to be universally adopted as a full replacement for all SU-labware, it could be of interest to low-income countries, given the sharp decrease in prices of 3D printers in recent years and low-costs of PLA filament (~15 €/kg equivalent to ~33 $/lb).

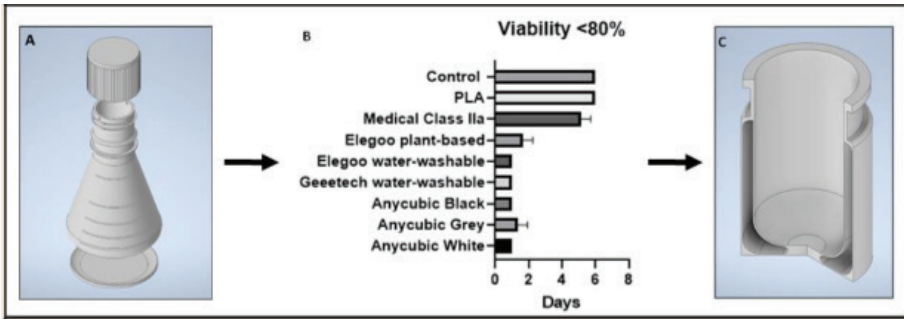

Figure: Geometry of 3D printed shaking flasks. B) Time until viability <80% for respective resins including standard deviations (n=3). C) Geometry of commercially available bioreactor.

Biography

Lena Achleitner is a PhD candidate at the austrian centre of industrial biotechnology in Vienna, Austria working on process development for novel vaccines. She discovered 3D printing for biotechnology during her Master thesis on continuous protein purification with hydrocyclones and enjoys exploring the potentials of 3D printing for cell culture applications together with her supervisor Peter Satzer.

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Photonic interconnects for scalable and energy-efficient deep learning accelerator

Ke Wang[1], Yuan Li[2], Hao Zheng[3] and **Ahmed Louri[3]**

[1]University of North Carolina at Charlotte, USA
[2]George Washington University, USA
[3]University of Central Florida, USA

The complexity and size of recent deep neural network (DNN) models have increased significantly in pursuit of high inference accuracy. Chiplet-based accelerator is considered a viable scaling approach to provide substantial computation capability and on-chip memory for efficient process of such DNN models. However, communication using metallic interconnects in prior chiplet-based accelerators poses a major challenge to system performance, energy efficiency, and scalability. Photonic interconnects can adequately support communication across chiplets due to features such as distance-independent latency, high bandwidth density, and high energy efficiency. Furthermore, the salient ease of broadcast property makes photonic interconnects suitable for DNN inference which often incurs prevalent broadcast communication. In this paper, we propose a scalable chiplet-based DNN accelerator with photonic interconnects. This research introduces (1) a novel photonic network that supports seamless intra- and inter-chiplet broadcast communication, and flexible mapping of diverse convolution layers, and (2) a tailored dataflow that exploits the ease of broadcast property and maximizes parallelism by simultaneously processing computations with shared input data. Simulation results using multiple DNN models show that our proposed design achieves reduction in execution time and energy consumption, as compared to other state-of-the-art chiplet-based DNN accelerators with metallic or photonic interconnects.

Perfect flexural wave absorber and its applications

Xiaopeng Li, Ziqi Yu and **Taehwa Lee**
Toyota Research Institute of North America, USA

Among different types of elastic waves, flexural wave is common in thin structures and plays a key role in vibrations of structures. The recent progress on the designs of flexural wave absorbers is not only continually pursuing small sizes and lightweights over broad bandwidth but also achieving unique behaviors. Recently, non-Hermitian systems have attracted great attention on wave manipulations due to the extraordinary wave control abilities by introducing lossy or active elements. One of the exotic behaviors that could be achieved in such non-Hermitian systems is unidirectional zero reflection, which occurs at the so-called exceptional points. Here, we design and experimentally demonstrate extremely asymmetric flexural wave near-unit absorption and unidirectional zero reflection at the exceptional point with a metalayer composed of a pair of loss-induced asymmetrical resonators. The mechanism behind such extremely asymmetric behaviors is explored. Also, we find that the exceptional point and critical coupling condition are simultaneously fulfilled by the metalayer. Numerical and experimental results are compared, and a good agreement is found. A design of broadband absorption is further suggested and validated through numerical simulation in the end. The results shown in this work not only provide a fundamental understanding of asymmetric flexural wave absorption in the transmission problem, but also offer a remarkable way to tailor flexural wave propagation.

Retail technology acceptance model for online at offline

Sookhyun Kim
East Tennessee State University, USA

The purpose of the study is to examine consumers' intention to accept/resist the retail technologies and to identify factors that affect their intention. The objectives of the study are to 1) identify the factors that influence customers' technology acceptance 2) thoroughly review the technologies available in the market that could be implemented at offline stores and create values for the consumers, 3) measure customers' acceptance/resistance on the technologies selected through literature review, and 4) provide a guideline to select suitable technologies and identify factors that need to be improved to increase consumers' acceptance for each technology selected for this study. A quantitative research with a survey method was employed. From the literature reviewed, the technologies selected to examine consumers' acceptance/resistance are Wi-Fi availability, face recognition sensor, augmented reality, virtual reality/Google glass, mobile application for styling help, interactive touch screen, 3D hologram/printer, and QR code/smart shelves. For each technology, the proposed relationships were tested. The results of mean difference tests show that participants are willing to use Wi-Fi, and an app for styling help at offline stores due to high usefulness, ease of use, compatibility and risk reduction. Meanwhile, they are reluctant to use the face recognition sensor because they perceive low usefulness, low risk reduction, and lack of compatibility; however, the ANOVA result shows that if this technology is improved in compatibility and convenience, participants would have a positive attitude and high intention to use. Also, depending on the consumers' shopping orientation and the types of technology profile, they evaluated a technology differently. For an unfamiliar technology, consumers need to evaluate before confirming their intention to use (i.e. the mediating effect of evaluation between consumer's profile and intention to use). Not all technologies require high usefulness for high intention to use, contrary to previous research.

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Evaluating the properties of concrete pavements containing crumb rubber and recycled steel fibers using response surface methodology

Ali Zarei[1], Hamed Rooholamini[2] and **Togay Ozbakkaloglu[2]**
[1]*University of California, Iran*
[2]*Texas State University, USA*

Stockpiles of discarded tires are a global concern. Since tire incinerating results in severe air pollution, reusing tires as tire rubber particles can reduce environmental pollution. A recycled tire, including rubber and recycled steel fiber, can be introduced in cement concrete. This study aimed to investigate the effects of crumb rubber and recycled steel fiber on the conventional concrete pavement's short- and long-term performance. The impact of crumb rubber (Cr) (0–20%) and recycled steel fiber (F) (0–0.5%) on the compressive, splitting, and flexural strength, as well as abrasion and freezing–thawing resistance of concrete, was evaluated through response surface methodology (RSM). The results indicated that fiber's addition to the concrete mix had a remarkable influence on flexural strength in low content and enhanced post-cracking ductility of rubberized concrete. Furthermore, incorporating crumb rubber as fine aggregate led to a reduction in the abrasion resistance and increased sensitivity to freezing–thawing in the presence of saline solution. According to optimization results, the most appropriate way to benefit from the desirable characteristics of rubberized concrete while minimizing the crumb rubber inclusion's adverse effects is through the addition of fibers into the concrete mixtures.

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Thermal study of the internal flow in a circular tube with vibrational ball turbulators

Milad Saadat[1], Alireza Aghlichanche[2], Ali Ataelahi[2], Omid Mohammadi[2] and **Mohammad Behshad Shafii[2,3]**

[1]*Northeastern University, USA*
[2]*Sharif University of Technology, Iran*
[3]*Sharif Energy, Water and Environment Institute (SEWEI), Iran*

Flow turbulators have promising heat transfer applications. Here, the novel design proposed in our previous study (*vibrational ball turbulators*, VBTs, mounted on an *elastic* wire inside a circular tube) is investigated experimentally from heat transfer and thermal performance standpoints. The effects of diameter (Y) and longitudinal distance (pitch, X) ratios of VBTs, the Reynolds number, and the axial tension of the wire (σ_0) on the average Nusselt number (Nu), the average Nusselt number ratio (Nu divided by that of a plain tube, Nu_p), the friction factor ratio (f/f_p) and a parameter called the thermal performance factor ($\eta=(Nu/Nu_p)/(f/f_p)^{1/3}$) are studied. Different ball diameter (Y=0.3, 0.38, and 0.46) and ball pitch ratios (X=1.53, 2.3, and 3.07) are utilized at Reynolds numbers between 10,000 and 15,000. VBTs are thermally advantageous, and for X=1.53 and Y=0.46, Nu/Nu_p and f/f_p peak at 2.3 and 18.06, respectively, averaged over all Re. However, η is maximum (1.2, Re-averaged) for the minimum X (=1.53) and, counterintuitively, the minimum Y (=0.3). Increasing σ_0 also has an adverse effect on η. A correlation to predict η as a function of X, Y, and Re is proposed. Also, to bridge the gap between the thermal response and vibrational behavior of the system (which was studied in our earlier work), another correlation for η as a function of *Re* and dimensionless VBT amplitude and frequency is introduced and indicates that increasing the vibration amplitude (or reducing the frequency) slightly deteriorates η.

The application of nano-silica gel in sealing well micro-annuli and cement channelling

Olayiwola Olatunji Mayowa
University of Louisiana, USA

The use of nano-silica gel to seal cement channels and fractures is a novel application demonstrated in this work. Cementing is a crucial step in the drilling process and is vulnerable to cracking when downhole conditions vary throughout the course of a well's life. This study examines the use of micro-sized cross-linked nano-silica gel as a sealant material to reduce damaged cement sheaths. An experimental setup was used to study fluid leakage through cement channels. The effect of the cement channel size was investigated using a diameter of 0.05 inches. When the nano-silica content of the sealing gel rose from 13% to 25%, the sealing effectiveness increased from 86 to 95%. This indicates how the sealing gel's capacity to obstruct fluid flow is influenced by the amount of nano-silica present in the gel. This study suggests a novel strategy for enhancing cement zonal isolation and reducing cement failure's effects on the oil and gas sector.

Gas sensing properties of undoped and doped semiconductor material by using solvothermal synthesis

Goban Kumar Panneer Selvam
CINVESTAV, Mexico

A novel solvothermal synthesis method based on sol-gel processing was prepared to deposit tin oxide thin films on glass substrate at high temperature for gas sensing application. Structure and morphology of tin oxide was analyzed by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). The SEM analysis how sphere shape in tin oxide nanoparticles. The structure characterization of tin oxide studied by X-ray diffraction shows 8.95 nm (calculated by sheers equation). The UV visible spectroscopy indicated a maximum absorption band shown at 390nm. Further dope tin oxide with selected metals to attain maximum sensitivity using dip coating technique with different immersion and sensing characterization are measured.

Glass materials for gamma radiation shielding in medical applications

J. Elías and **M. Vallejo**
Universidad de Guanajuato, Mexico

In several applications of radiation sources there is a need of have a direct view, instead of using remote vision, for example in hospital and clinics with X-ray units or gamma radiation. Lithium tetraborate ($Li_2B_4O_7$) glass matrices doped with six transition metals: Ag, Cd, Cr, Cu, Mn, and Zn were synthesized, using the melt-quenching method. Radiation shielding and optical parameters are studied in this work. Absorption spectra of the samples show the characteristic surface-plasmon bands of these transition-metals nanoparticles. The fluorescence bands of each transition-metal nanoparticle ensembles in the tetraborate glass matrices are identified by recording the fluorescence spectrum. Fluorescence analysis shows the characteristic emission of the transition metals mentioned and their enhancement is explained. The theoretical values of radiation shielding parameters mass attenuation coefficient (MAC), half value layer (HVL), tenth value layer (TVL), mean free path (MFP) and effective atomic number (Zeff) were calculated for the glass samples from 0.015 to 15 MeV using the Phy-X program to analyze which sample has the best radiation shielding response. It should be noted that the samples made in this work present a better response than high-performance heavyweight concrete mixes using the coarse aggregates of magnetite.

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Anti-abrasive graphene enhanced architectural paint-The future of graphene's role in the paint industry

A. de Toledo Correa and **V. Sullas Teixeira Peressinotto**

Gerdau Graphene, Brazil

Since the discovery of Graphene in 2004, its extraordinary chemical, physical, electrical, thermal, and mechanical properties have captivated the world and led to its inventors winning the Nobel Prize. Graphene is considered to be the strongest material on Earth, is a one to ten atom-thick sheet of densely-compacted carbon that can be modified for various uses and added to industrial materials. Graphene can be used to produce durable coatings that do not crack; are resistant to water, oil, and other liquids; and have antimicrobial, anticorrosive, and anti-UV properties.

In 2022, Gerdau Graphene, the nanotechnology company pioneering advanced graphene-enhanced materials for industrial applications, announced that it has created a new water-based architectural paint that is significantly more durable and resistant to abrasion than traditional paints. The new paint is ideal for use on concrete, cement, metal, and asphalt, such as on sidewalks, bicycle lanes, garages, staircases, sports courts, and a wide array of commercial and industrial areas. Its parent company, Gerdau, began applying the new paint to its factory floors in March, making it the world's first large-scale use of a water-based graphene-enhanced architectural paint. The company is already selling its proprietary graphene additives as development prototypes to major paint producers in the Americas.

The new graphene-based floor paint is extremely abrasion-resistant and requires less maintenance and repainting over its lifetime compared with traditional paints. Based on the performance gains of the new product, it's clear that graphene will have a transformational impact on the entire paint industry. Gerdau Graphene has already painted the specialty steel plant in São Paulo in March of this year and has since moved to paint all their assets in Brazil in the coming months. This new paint has been commercialized for key clients and partners in the construction industry to paint industrial, commercial, and residential building floors. Gerdau

Graphene will continue to optimize the additives to meet the needs of customers and scale commercialization of these paint products globally.

- The development of the graphene-based paint started in December 2021 and is

the result of a partnership with Grafftex, a Brazilian paint manufacturer, and Polystell, a company focused on research and development of chemical additives.

- Gerdau Graphene created the graphene technology used to disperse graphene into a paint additive.
- Because graphene comes in a variety of types and shapes, each of which has unique properties, significant research and testing was required to determine the best graphene format needed to produce a superior paint product.
- Graphene additives need to be customized based on each paint manufacturer's unique formula and ingredients.

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Biopolymer-based membranes: Green technologies for the separation of oil–water mixtures and the reduction of oil pollution

M.A. Mironov[1], V.M. Kuimov[1], A.N. Kryazhov[1], A.A. Elagin[2] and **A.I. Yagupov[1]**

[1]SPC BioMicroGel Lls, Russia

[2]Biomicrogels UK Limited, United Kingdom

Oil spills create a serious damage to the ecosystem, which leads to the death of plants, algae, birds and fish. Wastewater from oil refineries, oil producing enterprises and produce water cause significant environmental damage. Membranes occupy a special place in water treatment technologies because they have many advantages such as high technological efficiency, multiple use capability and environmental friendliness. Development of biopolymer-based membranes for separation of oil-water mixture is one of the perspective ways for protective of environmental from oil pollutions.

Our review is focused on the demonstration properties of biopolymer-based membranes and commercially available filtering material under trade mark Spilltex®. Spilltex® is modification of cotton textile by biopolymers such as polysaccharides in form of microgels. These biopolymers are obtained from natural raw materials such as sugar beet pulp and apple pomace under trade mark Biomicrogel®. Spilltex® demonstrate super hydrophilic properties, which allows it to selectively pass water flux and repulse the oil droplets.

Flux of purified water through the Spilltex® is more than 4 times higher than for similar membranes and separation efficiency of oil-water mixtures is 99,9%. Various industrial applications of Spilltex® was demonstrated including oil spill response, protection of shoreline from oil and separation oil-water mixtures in pilot trials.

The Spilltex® are promising eco-friendly technologies for separation of oil-water mixtures, oil spill response, wastewater treatment of oil refineries and oil producing enterprises. Spilltex® can be used as a filter material in filters, as skimmers, as protective barriers to trap petroleum products in shallow rivers, filtering material to protection the shoreline from oil spill, as well as for the manufacture of nets for manual collection of petroleum products. Spilltex® can be applicate in petroleum, chemical and even in food industries, because they are made from biodegradable materials.

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Effect of projectile rotation on high-velocity impact fracture

A. Radchenko, P. Radchenko and **S. Batuev**
Siberian Branch Russian Academy of Sciences, Russia

This study explores the effect of rotation of an ogival high-strength steel projectile on its fracture during high-velocity collision with a steel target of finite thickness. The considered range of impact angles is from 0° to 75°. The initial projectile velocity is 1000 m/s. The rate of projectile rotation about the longitudinal axis is varied from 0 to 10 000 rps. The behavior of the projectile and target materials is described by an elastic-plastic model. The limiting value of the plastic strain rate is used as a fracture criterion. Finite element simulation is carried out using an original algorithm and EFES 2.0 software package for modeling the fragmentation of interacting bodies with the formation of new contact and free surfaces, as well as erosion fracture of materials. The adequacy of the mathematical model and the numerical algorithm is confirmed by good agreement between experiment and simulation. The results obtained show that the projectile rotation has a significant effect on the fracture of interacting bodies and the projectile kinematics. It enhances the plastic deformation of the projectile in the contact area and erosion fracture, and increases the occurrence of a ricochet by reducing the impact angle. In the case of an oblique impact, with increasing impact angle α to 70, the volume of the fragmented material (debris) of the head for both the rotating and nonrotating projectile increases, leading to a decrease in the kinetic energy of the projectile part that penetrates the target.

Transfer printing on cotton knits

E. B. Sanzheeva, O. V. Kozlova, O. I. Odintsova and **T. N. Zelenkova**
Ivanovo State University of Chemical Technology, Russia

In the work, preference was given to synthetic polymers—modifiers of acrylic and urethane nature of domestic production. These are polymers of a series of lacrotenes, ruzins, laruses, as well as polymers based on urethanes—aquapols. For comparison, polymers from foreign manufacturers were used, widely spread both in sublimation printing and in Russian textile industries for textile materials finishing. The effectiveness of using the above-mentioned modifiers as primers for thermal printing was evaluated by a set of qualitative indicators of the colors: color saturation (intensity), the strength of the colors to friction, the degree of transfer of the dye from the paper substrate to the fabric. For the sublimation transfer of dyes to the fabric, a thermal press, model SFS-MO_4B, was used. The objects of the study were bleached cotton knitted fabric. Dispersed dyes of domestic production which were used for printing on paper and when choosing optimal conditions for the transfer and fixation of dyes on fabric. At the first stage, in order to select the most effective polymers as modifiers of textile material.

Nanocomposite adsorbent based on natural zeolite for selective removal of 137Cs from high salt solutions

Yu. Bondar and Yu. Olkhovyk
National Academy of Sciences of Ukraine, Ukraine

The development of effective adsorbents for the selective removal of radionuclides from contaminated waters is a topical issue to reduce the amount of hazardous liquid radioactive waste and ensure radiation safety.

Synthesis of composite adsorbents based on natural zeolites with a sorption-active inorganic phase incorporated into their porous structure is considered a promising approach to the manufacture of low-cost adsorbents with high selectivity.

This study concerns the synthesis of a novel nanocomposite adsorbent based on clinoptilolite tuff of the Sokyrnytsia deposit (Ukraine) for selective removal of 137Cs radionuclides. The composite adsorbent was fabricated by a two-stage synthesis: preliminary chemical treatment of the clinoptilolite tuff (ClT) grains with subsequent in situ formation of potassium copper ferrocyanide (KCuFC) nanoparticles within the CIT pores.

The efficiency of the synthesized adsorbent in selective removing cesium ions was evaluated under various experimental conditions. Unlike natural ClT samples, the composite ones (ClT-KCuFC) have been found to exhibit fast adsorption rate, high adsorption capacity over a wide pH range, and unique selectivity to Cs ions in model high salt solutions with sodium and potassium ions, as well as enhanced fixation of adsorbed cesium ions.

The synthesized adsorbent has a lot of advantages, such as its simplicity and low-cost fabrication process, chemical resistance, radiation and thermal stability, high selectivity to Cs ions in high salt solutions (for example, sea water).

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Effect of salt solution on the optimum lime contents of bentonite and silt

Zi Ying[1,2], Yu-Jun Cui[2], Myriam Duc[3] and **Nadia Benahmed[4]**

[1]*Southeast University, China*
[2]*École des ponts ParisTech, France*
[3]*Aix-Marseille University, France*
[4]*Université Gustave Eiffel, France*

In practice, prior to treating a soil with lime, the optimum lime content required for the cation exchange and for providing sufficient Ca^{2+} and high pH for pozzolanic reaction with the minimum dosage of lime, should be determined. The optimum lime content is water chemistry and clay mineralogy dependent. In this study, the different lime dosages were added in MX-80 bentonite and silt suspensions, which were prepared with deionised water (DW) and synthetic seawater (SSW), respectively. Then, the pH measurement was conducted to determine the optimum lime contents of MX-80 bentonite and silt. The continuous base (1-mol/L NaOH solution) titration test was conducted on silt/MX80 suspensions as well, in order to highlight the lime (Ca^{2+}) role. Then, the impacts of salt solution and lime on the material behaviour such as dissolution and/or precipitation of new compounds were discussed, based on the measurement of pH followed by the quantification of the major species in the supernatants of MX80-lime/NaOH suspensions. Results showed that the optimum lime content increased with the increase of salt concentration, which could be attributed to the consumption of OH^- ions by Mg^{2+} and Ca^{2+} ions in the salt solution, producing the precipitations of $Mg(OH)_2$ and $CaCO_3$. Due to the higher cation exchange capacity and higher bentonite solubility of MX-80 compared to silt, a higher lime addition was required to reach the optimum lime dosage pH threshold for MX-80 bentonite. The pH of the tested suspensions was found to be lower than that of blank deionised water and synthetic seawater, as OH- ions could be consumed by the material adsorption, dissolution of clay minerals and pozzolanic reaction. However, the pH of MX80-SSW-NaOH suspensions was higher than that of blank synthetic seawater in case of titration of NaOH solution from 2.5 mL to 6 mL. This is because some Mg^{2+} and Ca^{2+} ions were adsorbed on the clay mineral surface through cation exchange process and less OH- ions were consumed by the production of $Mg(OH)_2$ and $CaCO_3$ in the MX80-SSW-NaOH suspensions as compared to blank synthetic seawater.

Review of in-memory stateful logic gates from the perspective of materials to circuit

Nuo Xu
National University of Defense Technology, China

Combining Boolean logic and nonvolatile memory functions, memristor-based stateful logic gates can alleviate the data movement during the computing process to achieve futuristic in-memory computing. This may solve the problem of the von Neumann bottleneck in the current computing architecture. In this review, the recent developments in memristor-based stateful logic gates are discussed from the perspectives of materials to circuit. The stateful logic gates correspond to the in-memory logic gates, with the resistance as the physical entities of inputs and outputs. The review firstly summarizes the developments in stateful logic primitive gates reported in the past decade including the material classification, the circuit structure, the logic mapping and the trigger conditions. Then, the methods for allocating the logic gates onto the crossbar array are explained, which are for implementing the complex computing instances in the crossbar array. Finally, the merits and evaluations of using different stateful logic gates to construct the in-memory computing paradigm are discussed.

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Recent progress on Titanium Sesquioxide

Yangyang Li
Shandong University, China

Titanium sesquioxide (Ti_2O_3) is drawing broad attention due to its fascinating physical properties and promising applications in the fields of energy, biomedicine, and electronics, among others. Its richness is due mainly to the strongly correlated 3d1 electrons on the Ti^{3+} sites. In stark contrast to titanium dioxide (TiO_2), Ti_2O_3 has an ultra-narrow bandgap (~ 0.1 eV) at room temperature, resulting from strong correlation among the 3d1 electrons. Distinct electrical and optical properties are introduced in Ti_2O_3, accompanied with varied intriguing applications. Remarkable photothermal conversion, infrared photodetection, and electrocatalytic properties have been reported and explored in the last few years. Based on its unique and excellent properties, Ti_2O_3 has been utilized in seawater desalination, electrocatalytic water splitting, cancer therapy, hydrogen production, mid-infrared photodetection, nitrogen fixation, Li-ion batteries, etc. Herein, the fabrication, structural and electronic properties of Ti_2O_3 are comprehensively introduced, with a focused summary of recent research progress on its applications. Finally, current challenges, opportunities and future perspectives of Ti_2O_3 are discussed.

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Pan-cancer multi-omics analyses reveal TOP2A as an oncogene causing poor prognosis in multiple tumors

Guanghao Li and Yawen Wu
Qilu Medical University, China

Background: The topoisomerase II alpha (TOP2A) gene, which is located on chromosome 17 in humans, is an important nuclear protein that controls the topological state of DNA during DNA replication and transcription. A growing body of evidence indicates that TOP2A play a critical role in cancer progression and metastasis formation. However, no studies have conducted systematic analysis of TOP2A from a pan-cancer perspective.

Method: Based on the multi-omics data of pan-cancer in the TCGA database, we explored the value of TOP2A in pan-cancer using various bioinformatics algorithms.

Result: The expression of TOP2A was upregulated in almost all types of cancer. High expression of TOP2A was associated with intratumoral subtype heterogeneity, metastasis, cancer progression and poor prognosis in multiple cancer types. In addition, extensive genomic alterations and abnormal epigenetic modification pattern mediated the dysregulation of TOP2A expression in tumors. More importantly, high expression of TOP2A showed significant positive correlation with multiple cancer markers, including RNAss, LOH, MATH, TMB, MSI, HRD, neoantigen, tumor ploidy. In tumor microenvironment analysis, we found that the high expression of TOP2A can increase the tumor purity and mediate immunosuppression via the recruitment of Th2 cell and MDSC in almost all tumors. Compared with some famous markers, TOP2A was also able to predict the response to immunotherapy

accurately in a wide variety of cancer types. In anticancer drug screening, etoposide, TPCA-1 and vorinostat were identified as potential effective drugs for targeting TOP2A. Pathway enrichment analysis showed that TOP2A can activate apoptosis, cell-cycle and EMT in almost all tumors. Finally, experiments performed in vitro demonstrated that knockout of TOP2A can inhibite hepatocellular carcinoma cell proliferation, colony formation, migration and cell-cycle.

Conclusion: Our study revealed that TOP2A may serve as an oncogene and play tumor-promoting roles from a multi-omic perspective. High expression of TOP2A might be a potential diagnostic and prognostic marker. Therefore, we proposed that targeting TOP2A may help might contribute to change immunosuppressive microenvironments and improve the long-term prognosis of cancer patients.

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Photocatalytic NO conversion at $Bi_2Ti_2O_7$: Co-effect of plasmonic Bi and oxygen vacancy

R. Hailili and **Q. H. Zhu**

Beijing University of Technology, China

Effective removal of atmospheric NO has raised worldwide interest owing to environmental issues e.g., photochemical smog, acid rain and ozone pollution. With an unpaired electron (π*2py)1}, NO is chemically active and reacts with oxygen readily. However, the reaction activity significantly descends when the concentration of NO is lower than the ppm, and its long-term exposure even at a low level (the indoor concentration of NO is 200 ppb) still causes serious respiratory diseases. Thus, it is urgent to develop environmentally friendly methods to remove NO at the level of hundreds of ppb in indoor circumstances. Herein, porous Bi@$Bi_2Ti_2O_7$ with a rich-oxygen vacancy (Vo) was fabricated via a one-pot hydrothermal method. Specific UV, Vis, and NIR LED laser irradiation experiments to evince that as-prepared Bi@$Bi_2Ti_2O_7$-Vo possesses full spectrum responsive photocatalytic activity. Remarkably, the optimized composite photocatalyst exhibited a photocatalytic efficiency of 79%, more than double higher than that of its counterpart, $Bi_2Ti_2O_7$ (31.79%), for removing ppb-level NO in continuous flow under visible-near infrared (Vis-NIR) irradiation (λ > 420nm). The enhanced photocatalytic performance was attributed to the synergistic effect of plasmonic Bi (ca. 2 nm) and Vo, which was revealed by control experiments and theoretical calculations. The presence of Bi and Vo benefits the adsorption and photocatalytic activation of NO ($NO(g) \rightarrow NO^* \rightarrow NO_2^* \rightarrow NO_3^*$) as supported by DFT calculations. Moreover, Bi not only broadens light absorption to near-infrared, but also inhibits the generation of toxic intermediates and alleviates the inactivation of Bi@BT-Vo-4. Furthermore, the adsorption and photocatalytic conversion pathway of NO was explored by in situ DRIFTS, suggesting that NO^+ as intermediate species is crucial to improve the selectivity of NO converting to nitrate. This work provides a new perspective on constructing full-spectrum-driven photocatalysts for environmental remediation.

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A review of the life cycle carbon footprint of electric vehicle batteries

Pengwei Li[1] and **Xiaoning Xia**[2]

[1]*Northeastern University, China*

[2]*Chongqing University, China*

Facing increasingly severe climate change, countries and regions around the world are actively promoting the electrification of the transportation sector and encouraging the use of electric vehicles (EVs) to replace traditional internal combustion engine vehicles (ICEVs). However, the consumption of energy, resources, and power during battery production and use results in EVs not being as low-carbon as we expect. Therefore, the carbon emissions of batteries should be fully considered when promoting EVs. In this context, we systematically reviewed the life cycle carbon footprint of batteries. Specifically, the carbon emissions of batteries in the production, use, secondary utilization, and recycling phases are summarized, and the main influencing factors of carbon emissions in different stages are analyzed. Furthermore, the relevant suggestions for reducing the life cycle carbon footprint of batteries are proposed, which provides guidance for the large-scale deployment of EVs, reducing transportation carbon emissions, achieving carbon neutrality, and sustainable development of energy, environment, and economy.

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Green synthesis of silver nanoparticles using the plant extract of acer oblongifolium and study of Its antibacterial and antiproliferative activity via mathematical approaches

Tariq Aziz, Muhammad Naveed, Bakhtawar Bukhari, Sumera Zaib, Muhammad Adil Mansoor, Ayaz Ali Khan, Muhammad Shahzad, Anas S. Dablool, Mashael W. Alruways, Abdulraheem Ali Almalki, Abdulhakeem S. Alamri and **Majid Alhomrani**

Jiangsu University, China

In this study the antibacterial and antifungal properties of the silver nanoparticles synthesized with the aqueous plant extract of Acer oblongifolium leaves are defined using a simplistic, environmentally friendly, reliable, and cost-effective method. The aqueous plant extract of Acer oblongifolium, which served as a capping and reducing agent, was used to biosynthesize silver nanoparticles. UV visible spectroscopy, X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and scanning electron microscopy were used to analyze the biosynthesized Acer oblongifolium silver nanoparticles (AgNPs). Gram-positive bacteria (Bacillus paramycoides and Bacillus cereus) and Gram-negative bacteria (E. coli) were used to test the AgNPs' antibacterial activity. Presence of different functional groups were determined by FTIR. The AgNPs were rod-like in shape. The nanoparticles were more toxic against Escherichia coli than both Bacillus cereus and Bacillus paramycoides. The AgNPs had IC50 values of 6.22, 9.43 and mg/mL on HeLa and MCF-7, respectively, proving their comparatively strong potency against MCF-7. This confirmed that silver nanoparticles had strong antibacterial activity and antiproliferative ability against MCF-7 and HeLa cell lines. The mathematical modelling revealed that the pure nanoparticle has a high heat absorbing capacity compared to the mixed nanoparticle. This research demonstrated that the biosynthesized Acer oblongifolium AgNPs could be used as an antioxidant, antibacterial, and anticancer agent in the future.

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Highly efficient microwave-assisted synthesize of high-entropy oxide nano-powder for anode Lithium-battery application

Hossein Minouei[1], Mehdi Kheradmandfard[2], Nikolai Tsvetkov[3] and **Sun Ig Hong[1]**

[1]*Chungnam National University, South Korea*

[2]*Yonsei University, South Korea*

[3]*Korea Advanced Institute of Science and Technology, South Korea*

The fabrication of the electrodes with high capacity and stability is one of the major challenges in the development of Li-ion batteries. In this research, a novel green low-temperature microwave-assisted method was used for the synthesis of high-entropy oxide (HEO) nanoparticles. The XRD, HR-TEM, and EDS–STEM analyses were used to study the phase, structural and chemical composition investigations of synthesized nano powders. The results indicated that HEO nanoparticles with five metallic cations (Co, Ni, Mg, Cu, Mn) formed dual phases (rock-salt/spinel) structure with average particle size of 105 nm. The proposed HEO as anode materials for Li-ion batteries, exhibited good lithium storage properties with the impressive stability as was demonstrated during 1000 cycles at 1 A/g. The method used in this research has several significant advantages, compared to other conventional techniques including very high fabrication speed (few minutes), low synthesis temperature, nanoscale and highly pure products, and low cost. This newly developed method can be used as an excellent synthesis technique in high-entropy ceramics field, particularly for Li-ion batteries.

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Mechanical and magnetic properties of soft magnetic Fe-Ni permalloy produced by directed energy deposition processes

Farahnaz Haftlang, Eun Seong Kim, Soung Yeoul Ahn, Hyeonseok Kwon, Gang Hee Gu and **Hyoung Seop Kim**

Pohang University of Science and Technology, South Korea

The present study investigated the microstructural evolutions and mechanical and magnetic properties of Fe-50%Ni (wt%) alloy fabricated by the directed energy deposition additive manufacturing process under different energy densities. The samples with high relative density (~97-99%) and homogeneous microstructures were successfully fabricated from the pre-alloyed Fe-50%Ni powders with an average particle of 102µm. Mechanical properties of the printed samples were characterized via uniaxial tensile test, Vickers microhardness, and electron backscatter diffraction. The as-print microstructures contained a single FCC phase with relatively elongated grains in the building direction. The optimum sample which was produced under the highest laser power had the microhardness of ~ 167 HV, ultimate tensile strength of ~493 MPa, yield strength value of ~315 MPa, and total elongation of ~38.7%; thus, it was completely comparable with other Fe-based soft magnetic materials. In the case of all samples, the dislocation activity in the form of substructure development was the predominant deformation mechanism in the as-printed samples. Moreover, the highest saturation magnetization (Ms) and Curie temperature of 151 emg/g, 477°C, respectively, were achieved in the sample produced with the highest laser power and energy density; further, the lowest coercivity was 3.16 Oe obtained. The current investigation, thus, showed that a good combination of good mechanical performance and high magnetic properties could be accomplished through the DED process in the Fe-50%Ni soft magnetic permalloy by using the optimum processing condition.

Empirical analysis of the relationship among urbanisation, economic growth and ecological footprint: Evidence from Eastern Europe

Kwaku Addai, Berna Serener and **Dervis Kirikkaleli**
European University of Lefke, Turkey

In recent environmental sustainability literature, ecological footprint is largely seen as the most appropriate indicator of environmental destruction. However, due to lack of clarity in its relationship with economic growth, ecosystem services, biodiversity, and human wellbeing, serious academic and political attention on environmental sustainability has not really reflected on ecological footprint. Using Augmented Dickey Fuller (ADF) Unit Root Test, Westerlund Cointegration test, Common Correlated Effects, and Dumitrescu Hurlin Causality approaches, we conduct Empirical Analysis of the Relationship among Urbanisation, Economic Growth and Ecological Footprint: Evidence from Eastern Europe between 1998Q4 and 2017Q4. We address the following protracted questions in the literature: (1) Can we find a relationship between ecological footprint, urbanization, and growth (2) What explains the relationship, if any? The outcomes of the Westerlund Cointegration test reveals a cointegration relationship among the variables, (ii) the outcome of the Dumitrescu Hurlin Causality test indicates that there is a long-run unidirectional causality running from economic growth to the ecological footprint and (iii) urbanization does not homogeneously cause ecological footprint. The study has serious implications for regional policy actions that could support the reduction of ecological deficits through growth and urbanization policies towards improving regional environmental quality.

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Electromagnetic adsorption and polarization mechanism on reservoir sandstone with nanofluid interaction for oil mobility

Surajudeen Sikiru[1], Oyelakin Idris Oyewale[1] and **Sikiru Yesirat Adebukola[2]**

[1]*Universiti Teknologi PETRONAS, Malaysia.*

[2]*Ladoke Akintola University of Technology, Nigeria*

Using present approaches, improving oil mobility from reservoirs with high temperatures and pressures is unfeasible. As a result, injection of dielectric nanofluid driven by an electric field has been proposed to increase oil mobility in terms of diffusion coefficient and assessment of interfacial tension. When exposed to a direct electric field, nanoparticles are activated, allowing them to travel more effectively and affect oil characteristics. The electronic characteristics of four nanoparticles were simulated and characterized in terms of band structures and partial density of state: zinc oxide, copper oxide, graphene, and magnetite. Following an examination of nanoparticles' influence on oil adsorption energy, two nanoparticles with good dielectric and magnetic characteristics and diverse surface chemistry, Graphene and Magnetite, were chosen. In the preliminary adsorption investigation, oil was represented by Decane and Hexadecene. According to the findings, nanoparticles have a high influence on heavy molecular chains (Hexadecene) and a low impact on low molecular chains (Decane). Magnetite's contact with the rock-oil interface lowered adsorption energy from 23.99Kcal/mol to 21.63Kcal/mol (for Decane) and from 28.53Kcal/mol to 18.81Kcal/mol (for Hexane) (for Hexadecene). Because Decane had a limited impact, it was employed as an oil candidate in following investigations. In addition, the influence of salinity on the performance of nanoparticles was studied in adsorption research. Salinity increases from 0ppm to 11000ppm (0ppm, 3000ppm, 7000ppm, and 11000ppm) causes additive decrease with a more obvious influence on graphene. Following this, the diffusion coefficient of Decane via a simulated Angsi field sandstone structure was calculated at 120°C after verifying the simulation methods and before and after exposure to the action of nanoparticles and an electromagnetic field. There is a trend in the concentration effect of nanoparticles on Decane diffusivity for Graphene (from 0.01wt

percent to 0.05wt percent and 0.1wt percent). Magnetite performed best at 0.05wt percent. The addition of an externally provided electric potential of 2V/cm and 0.05wt percent nanofluid concentration at 11000ppm salinity resulted in increases of 1088.89% and 644.44% for Graphene and Magnetite, respectively. Because interfacial tension is another component that influences the effectiveness of oil mobilization by nanoparticles, the activation of nanoparticles at the interface of oil and water by an electric field was also explored experimentally. The experimental Interfacial Tension findings proved the effectiveness of applied electromagnetic potential in activating nanofluid performance. The application of 2V/cm lowered interfacial tension by 99.49 percent for Graphene and 15.66 percent for Magnetite at the measurement equipment's highest practicable operational heat state of 100oC. Graphene's greater effect can be ascribed to its hydrophobicity and strong dielectric properties.

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Surface treatment to improve water repellence and compatibility of natural fiber with polymer matrix: Recent advancement

Mohammed Mohammed[1], Rozyanty Rahman[1], Aeshah M. Mohammed[2], Azlin F. Osman[1], Tijjani Adam[1], Bashir O. Betar[3] and **Omar S. Dahham[4,5]**

[1]*Universiti Malaysia Perlis, Malaysia*
[2]*University of Karbala, Iraq*
[3]*University of Malaya, Malaysia*
[4]*Al-Farabi University College, Iraq*
[5]*Cihan University-Erbil, Iraq*

Because of rising levels of environmental awareness and diminishing oil supplies, numerous efforts have been made to replace synthetic fibres in fiber-reinforced composites with natural fibres reinforced composites. This is in response to the fact that the world requires a greater quantity of materials that are less harmful to the environment. Numerous researchers around the world have been inspired to investigate the potential applications of natural fiber due to their low cost, low density, abundance, and biodegradability. However, natural fibers have a number of drawbacks, some of which include significant mechanical characteristics dispersion, insufficient interfacial interactions with polymeric or cementitious matrices, and excessive moisture absorption, which can lead to swelling and degradation. Other drawbacks include low chemical and fire resistance. As a consequence of this, there is a significant amount of interest in modifying the surface of natural fiber utilising a number of distinct approaches. This article provides an overview of natural fibres, including their characterization and the challenges associated with incorporating natural fibres into polymer matrices. The primary objective of this article is to conduct a literature review on the surface treatments of natural fibres, specifically alkali, silane, acetylation, and benzoylation, which are all utilised to lessen the amount of moisture that the fibres absorb as well as the rate at which the fibres deteriorate. This is done in an effort to counteract the obvious drawbacks of these treatments and effectively employ them in a variety of application domains. There has also been discussion regarding the impact that these surface treatments have on the hydrophilicity, surface chemistry, interface bonding, mechanical characteristics, and thermal performance of natural fibre. In addition, we carried out an exhaustive study of the surface treatment of natural fibre by utilising nanoparticles in order to boost the hydrophobicity of the natural fibre and the interfacial bonding between the natural fibre and the polymer matrix. If successful, this could lead to an increase in the natural fiber's strength as well as its dimensional stability. As a consequence of this, the review article may make an important contribution for researchers who are interested in coating and treating natural fibre to further improve the surface characteristics of the fibre.

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Earth construction in Najd of Saudi Arabia

Mohammad Sharif Zami

King Fahd University of Petroleum and Minerals, Saudi Arabia

'Najd' is an Arabic word that means 'highland' and it is the central region of Saudi Arabia surrounded by Sharqiyah from east, Hejaz from west, Asir and Najran from south. Historically, earth is the major construction material of Najd for the last hundreds of years. Earth building in Arabian Peninsula traced back to thousands of years and archaeological evidence shows usage of sun dried mud brick in Najd from Abbasid era. Usage, types, construction techniques and quality of earth-based material in the Najd region greatly varies. However, the durability and resilience of sun dried earth-based material in Najdi vernacular and historic buildings proved that it is worth researching and to use this material in urban construction. Aside from its durability and easy availability, the rich insulation quality of earth-based construction material made it historically appropriate and suitable to be used in Najd region. In summer, when in Najd region temperature goes up even as far as 54 0C, the earth walls keep the interior of rooms cool. On the other hand, in winter, during bitterly cold nights the earth wall makes the rooms containing desirable heat. However, during 1970-80s, a number earth structures in Najd collapsed due to heavy rain made the Saudi Arabian government banning the use of earth for building houses. It is the agenda of this paper that with innovative stabilisation of Najdi soil can potentially and safely be used in construction. The aim of this paper is to investigate on the typologies and suitability of locally available Najd soils appropriate for earth building. To achieve the aim, the paper critically reviews the up-to-date literatures and refine the information to establish whether locally available Najdi earth-based material is safe to use in construction.

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Heat transfer of magnetohydrodynamic stratified dusty fluid flow through an inclined irregular porous channel

Salman Saleem[1] and **Gajendran Kalpana**[2]

[1]*King Khalid University, Saudi Arabia*

[2]*Mount Carmel College, India*

The primary objective of the study is to explore the phenomena of dusty fluid flow through an inclined irregular channel under the impact of the transversely applied magnetic field of fixed strength. The density and viscosity of the working fluid are assumed to vary along with the height of the channel as it behaves as a replica of many real-world mechanisms. Hence, a stratified dusty fluid through a channel that tilts to an angle q is the main objective of the present study. The prescribed flow is mathematically modelled, and it is approached numerically under two distinct boundary conditions. The finite difference technique is employed to discretize the system of equations and solved using the Thomas algorithm. The velocity and temperature fields are discussed for different pertinent parameters which influence the flow. The friction factor and heat transfer rate are discussed as it has been a subject of interest in recent decades. The results show that the stratification decay parameter leads to enhancement in the momentum of the fluid flow. The temperature field is found to be higher in the convective boundary than the Navier slip boundary.

Real-space imaging of charge carrier diffusion lengths in perovskites single crystal

Razan Nughays and **Chen Yang**

King Abdullah University of Science and Technology, Saudi Arabia

Understanding the charge carrier dynamics that occur on the surface of photoactive materials at the nanometer and femtosecond scales is one of the keys to optimizing the performance of a variety of light-conversion devices, including solar cells. Unfortunately, most of the pump-probe characterization techniques available are surface-insensitive and obtain information mainly from the bulk due to the large penetration depth of the excitation and probe pulses. One technique, however, is unique. Ultrafast scanning electron microscopy (USEM) is superior in visualizing carrier dynamics at the surface of materials with high spatial-temporal resolution (i.e., nanometer (nm) and femtosecond (fs) scales, respectively). Here, we successfully used USEM, for the first time, to uncover the tremendous effect of different surface orientations and termination of perovskite single crystals on the charge carrier behaviour of MAPbI3 perovskites, the most common and efficient absorber layer in perovskite solar cells. Time-resolved snapshots of secondary electrons (SEs) and density functional theory (DFT) calculations clearly demonstrate that charge carrier diffusion, surface carrier concentration, and surface trap density are strongly facet-dependent. For instance, the results indicate that charge carriers along the (001) crystal orientation displayed a maximum diffused area of 22 micrometers within 6.0 nanoseconds. In contrast, the (100) facet formed defect states and showed a large surface work function that completely prevented charge carrier diffusion and dark contrast formation. Our findings provide the key to further optimizing the surface of perovskite crystals, thus paving the way for even more efficient solar-cell devices based on perovskite single crystals.

Microstructure and electrochemical properties of Al-5Zn - 0.2Sn – 0.2Bi - xSb as a novel electrode for batteries applications

Mahmoud Ibrahim Abbas

Suez University, Egypt

In the present research, the corrosion characteristics and discharge properties of Al–Zn-Sn-Bi-xSb alloy as novel anodes for batteries applications have been examined in 4 M KOH solution. All anodes have been prepared from pure metals (Al, Zn, Sn, Bi and Sb) via stir casting method. Optical microscopy, scanning electronic microscopy (SEM) attached with energy-dispersive X-ray spectroscopy unit (EDS), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), immersion testing and different electro-chemical methods have been applied to investigate the microstructure, morphology and the electrochemical properties of the fabricated ingots. The outcomes illustrated that additions of Sn, Bi and Sb to Al-5Zn alloy refine the grains and give higher corrosion resistance and discharge performance than Al-5Zn anode. Further, the outcomes revealed that increasing Sb content reduces the amount of Al-13Zn intermetallic precipitates and increases the solubility of Zn in α-Al matrix, causing a reduction in hydrogen release reaction of anodes.

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Bone regeneration by hydroxyapatite-gelatin nanocomposites

Sahar I. Mostafa and **Nesma M. Abdelfattah**

Mansoura University, Egypt

Millions of people in the world are suffered from osteoporosis and bone fractures. Hydroxyapatite as a bioactive material was explored as a substitute for bone defect or osteoporosis.

Objectives: Preparation and characterization of a series of new biocompatible injectable bone paste (IBP) nanocomposites, hydroxyapatite-gelatin (HA-Gel) and hydroxyapatite-Gelatin-alendronate (HA-Gel-Ald np).

Methods: IBP nanocomposites were synthesized from mixing different ratios of gelatin to aqueous solutions of both $Ca(NO_3)_2.4H_2O$ and $(NH_4)_2HPO_4$ to obtain (HA-Gel np), while the target nanocomposites, HA-Gel-Ald np, were obtained by submitting aqueous solution of alendronate (Ald) to and HA-Gel np nanocomposites. The composites formation was discussed based on FTIR, XRD, SEM and EDX measurements. The cytotoxicity of the nanocomposites on stem cells were assessed using MTT assay.

Results: The FTIR, XRD, SEM and EDX analysis indicated the success in isolating the nanocomposites, HA-Gel np and HA-Gel-Ald np, with different ratios. Although the cytotoxicity data show significant effect of the prepared IBP nanocomposites ($p = 0.00$), their interaction together had no significant effect ($p = 0.624$).

Conclusion: New composites combine Gel, HA and Ald nanoparticles were successfully synthesized which may potentially be used as a bone tissue scaffold. These composites are considered non-toxic and the presence of Ald on HA-Gel-Ald nps showed higher cells viability than those of HA-Gel nps, and improves osteoblast proliferation, cells attachment and spreading.

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Rodenticidal activity of some quinoline-based heterocycles derived from hydrazide-hydrazone derivative

Mohamed M. Kaddah[1], Abdelgawad A. Fahmi[2], Sameh A. Rizk[1] and Sayed K. Ramadan[1]

[1]Ain Shams University, Egypt

[2]Cairo University, Egypt

Quinolines are found in a variety of synthetic heterocycles to enhance their pharmacological properties such as antiviral, anticancer, anti-inflammatory, and insecticidal activity. In addition to anticoagulant medication. Noteworthy, cilostazol (6-[4-(1-cyclohexyl-1H-tetrazol-5-yl)butoxy]-3,4-dihydro-2-(1H)-quinolinone), has been known to inhibit phosphodiesterase type 3 (PDE III), and increasing the intracellular level of cAMP and activating protein kinase A (PKA).

The cAMP/PKA pathway was reported to potentiate the opening of mitochondrial Ca^{2+}-activated K^+ (mitoKCa) channels and confers cardioprotection. In turn, cilostazol has been reported to directly activate sarcolemmal large-conductance Ca^{2+}-activated K^+ channels. Also, the possibility of cilostazol was tested towards opening mitoKCa channels and protecting hearts against ischemia/reperfusion injury.

2-cyano-N'-((2-oxoquinolin-3-yl)methylene) ethanohydrazide (3) was reported and converted into some quinoline-based heterocycles with the objective of evaluating them as potential rodenticidal agents against first and second-generation anticoagulants like chlorophacinone, brodifacoum, warfarin, and cilostazol

Anticoagulant rodenticides (ARs) when ingested, these poisons cause internal bleeding by inhibiting the production of blood-clotting agents.To receive a lethal dose of first-generation anticoagulant rodenticides (FGARs), the rodent must consume multiple portions of the bait. Second-generation anticoagulant rodenticides (SGARs) are extremely toxic, and rodents can receive a lethal dose in a single feeding. A poisoned rat makes easy prey, which can lead to secondary poisoning in predators such as owls and other raptors that eat the rodent.

The experimental results of the newly synthesized compounds new generation are summarized. A series of quinoline-based heterocycles like chromene and pyridine derivatives was screened as rodenticidal agents against second-generation anticoagulants. Three compounds 5, 6, and 7 exhibited a stronger rodenticidal effect than the other compounds which were examined by oral toxicity of new generation against (Chlorophacinone, Brodifacoum, and Warfarin) anticoagulants to laboratory rat. This may be due to their presence in more tautomeric structures. Thus, they may serve as rodenticidal products.

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120 Gbps SAC-OCDMA-OAM-based FSO transmission system: Performance evaluation under different weather conditions

Somia A. Abd El-Mottaleb[1], Mehtab Singh[2], Ahmad Atieh[3] and **Moustafa H. Aly[4]**

[1]*Alexandria Higher Institute of Engineering and Technology, Egypt*

[2]*Chandigarh University, India*

[3]*Optiwave System Inc., Canada*

[4]*Arab Academy for Science, Technology & Maritime Transport, Egypt*

A novel 120 Gbps free space optics (FSO) transmission scheme is introduced by combining orbital angular momentum (OAM) multiplexed signals with spectral amplitude coded (SAC)-optical code division multiplexing access (OCDMA) technique. Four OAM beams, each carrying three independent channels with 10 Gbps data rate, are used for increasing the capacity of the FSO system to 120 Gbps. Enhanced double weight (EDW) codes are employed for the SAC-OCDMA system. The proposed system is simulated and its performance is compared for the twelve channels under different weather conditions including clear air (CA), varying levels of rain, haze and fog conditions. The obtained results reveal that longer propagation distances between transmitter and receiver are possible with a bit error rate (BER) of ~10-5. The possible distances are, respectively, 300 m, 160 m, 200 m, and 150 m, under CA, heavy rain (HR), heavy haze (HH), and heavy fog (HF), with a system capacity of 120 Gbps.

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Diode laser–assisted inferior turbinoplasty in resistant cases of allergic rhinitis: A clinical and histopathological study

Naser Nagieb Mohamed, Waleed Mohamed Basha Amin Khamis, Eman Hassan Abdelbary and **Tariq Yousuf Alkabeer**

Zagazig University and Hospital, Egypt

Chronic nasal obstruction owed to inferior nasal turbinate hypertrophy is one of the most common problems encountered in rhinology. When medical management fails, surgical reduction of hyperplastic inferior nasal turbinate is often used. Diode laser is appropriate for the use in the nasal turbinate. This study was designed to define the histopathologic changes in the inferior turbinate post diode laser turbinoplasty and evaluate the outcome in patients having allergic inferior turbinate hypertrophy that has not responded to the medical treatment. A prospective single-cohort study was carried out. Under general anesthesia, 18 patients underwent inferior turbinoplasty using diode laser 980 nm in the contact mode submucosally under guidance of a 4-mm nasal endoscope 0°. Inferior turbinate mucosa biopsy specimens were taken at the time of surgery, and after 3 months, they were histopathologically examined with assessment of the patients' symptoms. At 3 months postoperatively, histopathologic assessment demonstrated marked structural changes in diode laser–treated inferior turbinates including the predominance of fibrous tissue with diminution of seromucinous glands, venous sinusoids, and inflammatory cell infiltrate. Concurrently, 16 patients (89%) had no nasal obstruction, 15 patients (83%) had moderate-to-good improvement of rhinorrhea, whereas 13 patients (72%) had moderate-to-good improvement of sneezing. Diode laser produces histopathologic changes in the inferior turbinate soft tissues, providing excellent ablation of the soft tissue with controllable performance and good hemostasis. Therefore, it is a safe, minimally invasive, and effective procedure in relieving nasal obstruction secondary to inferior turbinate hypertrophy as well as other symptoms of allergic rhinitis.

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Synthesis and physicochemical properties of the nanocomposites based on sodium carboxymethyl cellulose and selenium nanoparticles

Yunusov Khaydar Ergashovich

Uzbekistan Academy of Sciences, Uzbekistan

The present study reports a simple chemical synthesis of selenium nanoparticles in the structure of the polymer and evaluates its potential biological application as an anticancer agent.

Stabilized selenium nanoparticles in the solution of sodium-carboxymethylcellulose (Na-CMC) with a degree of substitution - 0.85 and degree of polymerization - 600 were synthesized. Physic-chemical properties of sodium-carboxymethylcellulose solutions contained selenium nanoparticles were studied. When selenium (IV) oxide was reduced in the presence of an aqueous solution of carboxymethylcellulose, a change in the color of the colloidal solution from yellowish orange to red was observed, which causes the formation of selenium nanoparticles.

The reduction of selenium oxide SeO_2 (IV) with ascorbic acid $C_6H_8O_6$ in aqueous solutions of Na-CMC proceeds according to the reaction equation (1).

(1) $SeO_2+2C_6H_8O_6= Se0+2C_6H_6O_6 +2H_2O$,

which leads to the formation of zero-valence selenium Se0 (in the form of a red-orange solution) and dehydroascorbic acid which leads to the formation of zero-valence selenium Se0 and dehydroascorbic acid.

It has been established that spherical monodisperse selenium nanoparticles with sizes of 2-14 nm are formed at low concentrations of SeO_2. With an increasing selenium oxide concentration in Na-CMC solutions, an increase in the size of spherical nanoparticles to 4–25 nm is observed. With a further increase in the concentration of selenium oxide in Na-CMC solutions, the emerging spherical nanoparticles of selenium acquire trigonal forms and their sizes reach 4–28 nm in thickness and 12–60 nm in length.

The shape and size of selenium nanoparticles in the structure of sodium carboxymethylcellulose were determined by atomic force microscopy and UV - spectroscopy methods. It was found that with increasing concentration of selenium oxide in sodium-carboxymethylcellulose solutions, as well as in films, the size and shape of selenium nanoparticles changed during the process of chemical reduction.

Obtained biodegradable materials, containing selenium nanoparticles can be used in medicine as an anticancer drug for the treatment of cancer disease.

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Growth of perfect GaAs epitaxial layers on a silicon substrate

A. Razzokov[1], A. Saidov[2] and **Kh. Eshchanov[1]**

[1]*Urgench State University, Uzbekistan*

[2]*Academy of Sciences of the Republic of Uzbekistan, Uzbekistan*

In order to grow GaAs epitaxial layers on a relatively inexpensive Si substrate, an environmentally friendly liquid phase epitaxy method was used. For this purpose, $Si_{1-x}Ge_x$ epitaxial layers were first grown on the Si substrate as a buffer layer ("bridge"). Because the unit crystal lattice constants of Ge and GaAs are very close (aGe=5.658 Å, aGaAs=5.653 Å), it is easy to grow GaAs epitaxial layers on $Si_{1-x}Ge_x$ epitaxial layers. Using this $Si_{1-x}Ge_x$ buffer layer, GaAs epitaxial layer production was achieved in one-step technological conditions. Under different technological conditions (during the growth of epitaxial layers, the temperature range is 1050-600°C, the forced cooling rate is 0.5-1.5°C/min, and the distance between horizontal substrates is 0.5-1.5 mm (consists of.) the growth direction of the grown $Si_{1-x}Ge_x$ epitaxial layers and the dislocation density at the substrate-film interface, the reasons for the occurrence of dislocations, as well as the chemical composition of the surface were studied. Under selected optimal growth conditions, the dislocation density was reduced to $4 \bullet 10^3$ cm^{-2}. The samples had photosensitivity over a wide range of photon energies (1-2 eV), including the intrinsic absorption bands of contact semiconductors.

Optimal process regimes for growing perfectly crystalline epitaxial layers and structures are reported. Based on the results of the above research, it was possible to obtain the Si-$Si_{1-x}Ge_x$ -$Si_{1-x-y}Ge_xSn_y$ structure.

$Si_{1-x}Ge_x$ can be used as a buffer layer to mitigate the lattice mismatch between the substrate and the film when creating new heterostructures in the future. Including Si-$Si_{1-x}Ge_x$-$(Ge_2)_{1-x}(ZnSe)_x$, Si–$Si_{1-x}Ge_x$–ZnSe, Si–$Si_{1-x}Ge_x$–$(Ge_2)_{1-x-y}(GaAs)_x(ZnSe)_y$, Si–$Si_xGe_{1-x}$–$Ge_{1-x}Sn_x$, Si-$Si_{1-x}Ge_x$-$Al_{1-x}Ga_xAs$, Si-$Si_{1-x}Ge_x$-$Al_{1-x}Ga_xP$ can open wide possibilities for obtaining heterostructures. This should improve the structural quality of heterostructures, which is an important physical factor in semiconductor device fabrication.

Investigation of EMI shielding effectiveness of a novel highly flexible SWCNT/EMA nanocomposite at a very low percolation threshold

S. Sit, N.C Das and **G. Chakraborty**
Indian Institute of Technology Kharagpur, India

The rising trend of electromagnetic pollution has motivated us to develop a novel electromagnetic interference shielding (EMI) material by adopting a facile, industry viable, and cost-effective solution mixing strategy. Single-walled carbon nanotubes (SWCNT) as conductive fillers is employed in a lightweight, highly flexible ethylene methyl acrylate (EMA) polymer to fabricate the superior electrically conductive and efficient EMI shielding material at a relatively lower percolation threshold limit compared to other carbonaceous fillers. The morphological characterization of the fabricated nanocomposite, using field emission scanning electron microscope (FESEM) and transmission electron microscope (TEM) reveals excellent degree of distribution and dispersion of CNTs, respectively, justifying the efficacy of the adopted processing method. The mechanical properties characterization is done through tensile testing, revealing the increment of strength and stiffness with CNT loadings, and however retaining the high flexibility of the nanocomposites. The investigation of DC and AC electrical conductivity displays considerable improvements with very low amount of conductive filler loading. The EMI shielding efficiency increases monotonically with the addition of SWCNTs and the electrical conductive network formation is attained at just 1.96wt% of SWCNT loading resulting in more than 20 dB of EMI shielding effectiveness (EMI SE) dominated by absorption mechanism to fulfill the industrial requirement along with excellent mechanical properties improvement, and the highest SE is 45 dB at 15wt% of reinforcement facilitating their potential use in both industry and academia.

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Optimization and prediction on the mechanical behavior of granite particle reinforced Al6061 matrix composites using deer hunting optimization based DNN

Koli Gajanan Chandrashekhar

Sanjeevan Engineering & Technology Institute, India

The enhancement in the mechanical characteristics of aluminum alloy is always an essential need for the development of industrial technologies. The work presented is focused on the development of Al6061 composite reinforced with granite particles using the stir casting technique at four different proportion rates such as 2%, 4%, 6%, and 8% of granite particles. The developed composites were subjected to heat treatment as per T6 temperature conditions for different aging time durations (1 to 9 h). The mechanical characteristics such as hardness, ultimate tensile strength, and yield strength analysis are performed for both the casted and heat-treated granite reinforced aluminum specimens. Deer hunting optimization (DHO) is used to optimize the better-reinforced aluminum alloy from the heat-treated and heat untreated specimens. Besides, the hybrid deep neural network (DNN) is used to predict the experimented mechanical characteristics and compared with other similar predicted neural networks. Such optimization and prediction behavior are performed in Matlab software. From the experimentation, the hardness is better for heat-treated Al6061 reinforced with 8% of granite particles, besides the yield and the ultimate tensile strength is optimal for 6% granite reinforced Al6061. The proposed DNN-DHO provides nearer values to the experimented mechanical characteristics with minimal error than the predicted outcomes of Particle swarm optimization (PSO) based DNN and DNN alone. The DNN-DHO predicted optimal mechanical characteristics are 68.45 BHN of hardness, 199.67 MPa of ultimate tensile strength, and 100.01 MPa of yield strength. From the overall findings, heat-treated Al6061 with 6% and 8% granite offers superior mechanical properties.

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BERT pre-processed deep learning model for sarcasm detection

Saumya Bhardwaj and **Manas Ranjan Prusty**
Vellore Institute of Technology, India

In today's scenario, stating statements in a sarcastic manner has become the latest trend. Every youngster around us uses sarcasm as an indirect way to say a negative statement. With the growth of artificial intelligence and machine programming in the field of natural language programming (NLP), the detection of sarcasm efficiently and accurately has become a challenge. To contribute as a solution to this ever-growing field of interest, this paper proposes a novel approach for sarcasm detection with the use of machine learning and deep learning. This approach uses bidirectional encoder representations from transformers (BERT) to pre-process the sentence and feed it to a hybrid deep learning model for training and classification. This hybrid model uses convolutional neural networks (CNN) and long short-term memory (LSTM). This proposed model has been experimented to distinguish between sarcastic statements and simple statements on two datasets. The accuracy of 99.63%, the precision of 99.33%, recall of 99.83% and a F1-score of 99.56% were achieved using the trained model. These results are obtained after performing tenfold cross-validation on the proposed model using the news headline dataset.

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Study on early stage hydration of cementitious system in presence of silica nanoparticles

U. Sharma

CSIR-Central Building Research Institute, India

Application of silica nanoparticles (SNPs) in cementitious system has been widely explored during last decades as they provide higher mechanical strength and acceleration in hydration process (1-7). However, size, shape and physical state of SNPs in cementitious system have not been well understood. Most of the researchers used colloidal nanosilica which causes agglomeration and therefore weaker zone formation takes place (6-10). We have prepared cost effective uniform size (30-70nm) SNPs, which can be well mixed with cementitious materials. A systematic hydration study has been carried out on tricalcium silicate (C_3S) (major component of Portland cement) so as to understand the kinetic behaviour of cementitious system in first 24h. The present work is focused on the effect of particle size and form (i.e. colloidal and powder) of silica nanoparticles (SNPs) on its early age reactivity. Three different types of commercially available SNPs i.e. Elk microsilica (100-300 nm), colloidal SNPs (8-15 nm) and powder SNPs (10- 70 nm) were used for the study. The results showed that the colloidal and the powder SNPs have higher reactivity than the microsilica. Furthermore, FTIR and ^{29}Si-NMR results revealed that in the presence of the colloidal and the powder SNPs, the structure of C-S-H gel was more ordered as the Q_2 and Q_3 peaks were very shaper and intense. However, with microsilica, unreacted silica peak Q_4 peak was present showing the slower reactivity of microsilica. Further, it was also observed that in presence of powdered SNPs, the polymerization rate of silicate chain is higher as compared to the colloidal SNPs.

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Process intensification and optimization for sonocrystallisation of uranium peroxide

Shrishma Paik[1,2], S K Satpati[1,2] and **D K Singh[2]**

[1]Bhabha Atomic Research Centre, India

[2]Homi Bhabha National Institute (HBNI), India

Peroxide precipitation is an emerging process in nuclear technology and one of the well-known method for production of first intermediate uranium compound before uranium bearing fuel production. Though the conventional method of precipitation is practiced worldwide, it suffers from the limitation of non-uniform particle formation and lesser control over particle growth and size. Hence there is always a scope to study the effect of novel technique for process intensification. Application of ultrasound or sonochemical technique is one of the techniques which can intensify the crystallization event to a large extent by the impact of its cavitaional process imparting micromixing, enhanced mass transfer and the effect of additional spontaneous nucleation. It also facilitates in enhancing the crystal shape and size with better consistency and can control physical and morphological characteristics of the powder in several ways. Here, study was carried out for establishing important process parameters namely uranium cocn and temperature for ultrasonic precipitation compared to conventional methods in laboratory scale with a ultrasound horn at 35 KHz. Uranyl nitrate with 30% hydrogen peroxide was used for the reaction in 1 litre scale. No appreciable difference in the phases have been found from the XRD study. However a more homogeneous, regular and smooth crystalline appearance is observed in sonochemical precipitation route compared to conventional route under SEM study at 100 g/L uranium with 60◦C temperature. The crystal shape is rhombohedra with a spherical aggregation in comparison to needle shaped crystals in conventional route. Significant improvement is also seen in specific surface area and tap density of the prepared powder in sononchemical route. The powders obtained from this novel technique are having recovery more than 99.9% w.r.t. uranium. The purity of the synthesized powder also meets the specification of nuclear grade quality. Overall, the sonochemical method of precipitation of uranium peroxide is a fast, simple, convenient and intensifying technique imparting appreciable morphology and physical characteristics over the conventional precipitation process.

Utilization of nanocomposites for water remediation

R. Garg

Galgotias College of Engineering and Technology, India

In the present study, biosynthesized silica-based zinc oxide nanocomposites (nano-SZO) have been explored as nanoadsorbent for sequestrating heavy metal ions viz. Ni^{2+}, Cd^{2+} and Cu^{2+} from synthetic medium. The nanocomposites have been obtained by utilization of agricultural waste by means of green synthetic approach with an average particle size of 30.52 nm and a pH at zero-point charge as 4.8. The process has been optimized at a pH equal to 5.0 for Ni^{2+} and 6.0 for Cu^{2+} and Cd^{2+}. Adsorption was best described by Langmuir isotherm and the highest value of maximum adsorption capacity, qm of nano-SZO was obtained for Cu^{2+} (32.53 mg/g), Ni^{2+} (32.10 mg/g), and Cd^{2+} (30.98 mg/g). The studied heavy metal ions are considerably adsorbed by the nano-SZO through chemisorption by active binding with polyhydroxy functionalities attached at the surface of the nanoadsorbent. Thus, the biosynthesized nano-SZO can be utilized as eco-friendly and efficient nano adsorbents for the sequestration of heavy metal ions.

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Engineering at the nanoscale: A strategy for developing high performance functional materials from biopolymers

Sabu Thomas

Mahatma Gandhi University, India

Green chemistry started for the search of benign methods for the development of nanoparticles from nature and their use in the field of antibacterial, antioxidant, and antitumor applications. Bio wastes are eco-friendly starting materials to produce typical nanoparticles with well-defined chemical composition, size, and morphology. Cellulose, starch, chitin and chitosan are the most abundant biopolymers around the world. Cellulose nanoparticles (fibers, crystals and whiskers) can be extracted from agrowaste resources. Chitin is the second most abundant biopolymer after cellulose, it is a characteristic component of the cell walls of fungi, the exoskeletons of arthropods and nanoparticles of chitin (fibers, whiskers) can be extracted from shrimp and crab shells. Starch nano particles can be extracted from tapioca and potato wastes. These nanoparticles can be converted into smart and functional biomaterials by functionalization through chemical modifications due to presence of large amount of hydroxyl group on the surface. The preparation of these nanoparticles includes both series of chemical as well as mechanical treatments; crushing, grinding, alkali, bleaching and acid treatments. Since large quantities of bio wastes are produced annually, further utilization of cellulose, starch and chitins as functionalized materials is very much desired. The cellulose, starch and chitin nano particles are currently obtained as aqueous suspensions which are used as reinforcing additives for high performance environment-friendly biodegradable polymer materials. These nanocomposites are being used as biomedical composites for drug/gene delivery, nano scaffolds in tissue engineering and cosmetic orthodontics. The reinforcing effect of these nanoparticles results from the formation of a percolating network based on hydrogen bonding forces. The incorporation of these nano particles in several bio-based polymers have been discussed. The role of nano particle dispersion, distribution, interfacial adhesion and orientation on the properties of the ecofriendly bio nanocomposites have been carefully evaluated.

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Green energy production by non-photocatalytic water splitting using Co_3O_4 and use in supercapacitor

Rajiv Kashyap Gurpreet Kaur and **Ramesh K. Sharma**
Panjab University, India

The generation of electricity from water molecules dissociation without going through any photo catalytic route i.e., hydroelectric power cell has opened up a new field of green energy generation that is environmentally friendly. Water dissociation has already been shown at ambient temperature using specially tailored nanoporous and oxygen-deficient metal oxides. We have acquired oxygen defect and strain induced Co_3O_4 by heat treatment in muffle furnace. XRD, FTIR and FE-SEM confirms formation of compound, porosity and size of particles. Photoluminescence spectroscopy (PL), EPR and XPS verified the oxygen vacancy created. BET confirms porosity and provide surface area and pore size distribution of Co_3O_4 synthesized. The acid base pair formed by the cation–oxygen vacancy pair on the Co_3O_4 surface attracts polar water molecules, causing them to chemidissociate into OH^- and H_3O^+ ions. Furthermore, chemisorbed surface hydroxyl ions give a high surface charge potential for the dissociation of physisorbed multilayers of water molecules, and some H_3O^+ ions become trapped inside the nanopores. The trapped ions inside the nanopores provide enough potential for adsorbed water molecules to physi-dissociate further. As a hydroelectric cell, a round pellet with a diameter of 3.5 cm and a thickness of 1 mm of Co_3O_4 was created. This cell of 1.75 cm radius produced open circuit voltage (Voc) of 1.1 V and short circuit current (Isc) of 220 mA.

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Enhanced visible light transmittance and phase transition in ZnO/VO_2 / AL_2O_3 bilayer thin film for energy efficient smart windows

Chirag Saharan[1], Pawan S Ranaa[1] and **Manish Kumar[2]**

[1]*Deenbandhu Chhotu Ram University of Science and Technology, India*

[2]*Pohang Accelerator Laboratory, South Korea*

To ameliorate the limitation of low visible light transmittance of smart window, single phase Vanadium dioxide (VO_2) and bilayer of Zinc oxide ZnO/VO_2 on Al_2O_3 substrate were fabricated using the Radio frequency (RF) sputtering technique. These films were deposited at 500 degrees Celsius and GIXRD was performed at different temperature ranges starting from 28 degrees Celsius which goes up to 90 degrees Celsius. Structural Phase transition was witnessed from monoclinic to rutile phase after a critical temperature (Tc) of 68 degrees Celsius. Structural characterization was done using the X-rays diffraction(XRD) analysis technique at grazing incidence mode by using monochromatic X – rays (λ = 0.06926 nm). Further, the morphology of the surface structures was studied by using field emission scanning electron microscopy (FESEM). The visible light transmittance change was studied using the Ultra Violet (UV) – Vis spectroscopy in transmittance mode at room temperature. This increased transmittance of the bilayer deposited can be a potential way out to have more efficient smart windows.

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Synthesis and characterization of novel $CoCr_2O_4$@GeO_2@ZnO core-shell nanostructure: Focus on electrical conductivity and gas sensing properties

S. S. Kushare, V. D. Bobade and **A.V. Borhade**

HPT Arts and RYK Science College, India

An effort has been made to develop and synthesize novel $CoCr_2O_4$@GeO_2@ZnO core-shell nanostructure gas sensor via sol-gel method. The products obtained were analysed by X-ray diffraction (XRD), scanning electron microscopy (SEM), high resolution transmission electron microscopy (HR-TEM), energy dispersive X-ray analysis (EDAX), and Brunaure-Emmet-Teller (BET) analysis. In the present study gas sensing properties of $CoCr_2O_4$, $CoCr_2O_4$@GeO_2 and $CoCr_2O_4$@GeO_2@ZnO were studied. The thick films of cobalt chromite and core-shell CoCr2O4@GeO_2 and $CoCr_2O_4$@GeO_2@ZnO were prepared by screen printing technique. The sensing efficiency of these films was checked for various gases including CO, CO_2, Cl_2, H_2, NH_3 and H_2S. Among these metal oxide-based sensing materials, $CoCr_2O_4$@GeO_2@ZnO shows highest response at 200 0C for H_2S is 627.01, as compared $CoCr_2O_4$@GeO_2 is 524.01. The pure chromite ($CoCr_2O_4$) shows NH_3 gas response is 513.21 at 250 0C. The gas response, selectivity, thermal stability and recovery time of sensor is also studied. The humidity dependence of the sensor response for $CoCr_2O_4$@GeO_2@ZnO was investigated within the test chamber at 100 0C. The statistical analysis data for gas detection is also predicted.

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Suppression limit cycles in 2x2 nonlinear systems with memory type nonlinearities

K. C. Patra

C. V. Raman Global University, India

In today's scenario, nonlinear self-sustaining oscillations otherwise called as limit cycles are one of the most important entity that limits the performance of most of the physical systems in the world. It is a formidable task to suppress the limit cycles for 2x2 systems with memory type nonlinearity in particular. Backlash is one of the nonlinearities commonly occurring in physical systems that limit the performance of speed and position control in robotics, automation industry and other occasions. The feasibility of suppression of such nonlinear self-oscillations has been explored by using pole placement technique. The novelty of the work lies with the investigation in case of the memory type non-linearity like backlash especially which is an inherent Characteristic of a Governor used for usual load frequency control of an inter-connected power system and elsewhere. Suppression of Limit Cycle using pole placement is adopted either arbitrary or optimal selection using Riccati Equation through State Feed Back. The Governing equation is d/dt [X(t)]=(A-BK)X: which facilitates the determination of feedback gain matrix K for closed loop Poles/ Eigen values placement where the limit cycles are suppressed/eliminated in the general multivariable systems. The analysis is based on harmonic linearization using graphical method which has been substantiated by digital simulation / use of SIMULINK Tool Box and the same have been illustrated through example.

The Poles / Eigen values are determined for Limit Cycling Systems with Memory type nonlinearities whose describing functions (harmonic linearization) are complex functions of X and ω. Hence, it is felt necessary to develop a graphical technique using harmonic balance method. The poles of such systems are placed suitably so that the systems do not exhibit limit cycles.

There is ample scope of extension of the present work for prediction of limit cycles and it's suppression in 3 X 3 or higher dimensional systems.

Performance analysis of planar heterojunction perovskite solar cell

Gaurav Kumar and **Jaspinder Kaur**
National Institute of Technology, India

Performance Analysis of Planar Heterojunction Perovskite Solar Cell Featuring Double Hole Transport Layer & Backplane Perovskite photovoltaic cells will be presented by Gaurav Kumar – Masters of Technology (Delhi, India) – Perovskite Cells have attracted appreciable importance from many researchers in the recent decade due to its reduced thickness, very less fabrication cost, and impressive photovoltaic performance. In this work, the authors investigated the simulation-based performance analysis of solar cells with perovskite $CH_3NH_3PbI_3$ material. In the given paper authors have proposed the design of SnO_2 (electron transport layer)/ $CH_3NH_3PbI_3$ (active layer)/ SiGe and Spiro-OMeTAD (Hole Transport Layers)/ SiGeSn (Backplane) based solar cell may be grown on the glass substrate. The simulation of the predicted device is compared with the already existing perovskite solar cell performance parameters and comparatively higher conversion efficiency was obtained for the proposed structure. In this proposed work, the consequence of perovskite layer thickness, different doping

concentrations of perovskite (active) layer, hole transport layers (HTLs), Ge mole fraction of SiGe hole transport layer, hole mobility of Spiro-OMeTAD layer and backplanes on the characteristic performance of the proposed solar cell have been analysed. The maximum conversion efficiency of 28.57% is reported for the given structure, having an amalgamation of two non-identical hole transport layers which ensures considerable photon conversion efficiency. Hence, this current work would propose a stepping stone in the advancement of high-performance perovskite photovoltaic cells in comparison with the pre-existing ones.

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Design and analysis of wheelchair based on rocker-bogie mechanism

Rohan Kulkarni, Aditya Kulkarni, Kshitij Dwivedi, Nikhil Mahale and **Ganesh Lohiya**
Vishwakarma Institute of Technology, India

The present form and the design of the wheelchair suffer from drawbacks such as movement restricted along flat surfaces only, issues related to stability, and inability to move along the staircases or uneven surfaces. The attempts for getting improved movement of the wheelchair seem to be in the developing stage, and the authors felt a need to design a safe wheelchair to overcome the drawback with a rocker boogie mechanism and relevant analysis of the chair. The present work encompasses a study of a boogie rocker mechanism, design calculation for its implementation in wheelchair applications, and modelling the proposed wheelchair using CAD software. The present work further focuses on calculating stress, strain, total deformation, and frictional stress associated with the designed model. The calculated values of the aforementioned parameters using finite-element analysis are in close agreement with their analytically calculated values. Thus, practical execution of the proposed mechanism for field application shows good potential for developing a safe, stable, and all-terrain wheelchair for the patient's benefit.

Interplay of proximity effects in superconductor/ ferromagnet heterostructures

Asif Majeed, Harkirat Singh and **Junaid Ul Ahsan**

National Institute of Technology, India

Because of the possibility that they may be used in superconducting spintronics devices, the study of proximity effects in superconductor/ferromagnet hybrid nano-structures is now receiving a great deal of attention. The magnetic field intrinsic to the ferromagnet can alter the characteristics of the hybrid structure and may manifest itself in a variety of ways of which the spin-triplet correlations are of primary importance. With us the objective is to explore the production of Long Ranged Triplets and their effects on the density of states and critical temperature of the structure. We make use of an epitaxial system consisting of NbN(S-layer)/GdN(F-layer), that has different degrees of in-plane spin orbit coupling which arises from magnetocrystalline anisotropy and serves as a source of LRTs. The work is supported by Science & Engineering Research Board (SERB), a statutory body of the Department of Science & Technology (DST), Govt of India for financial support (Grant No. MTR/2021/000524).

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A systematic investigations on effect of annealing temperature on magnetic properties of a promising soft magnetic $Co_{35}Cr_5Fe_{10}Ni_{30}Ti_{20}$ high entropy alloy

Rajesh K. Mishra[1] and **Rohit R. Shahi**[2]

[1]*IFTM University, India*

[2]*Central University of South Bihar, India*

It is now known that the magnetic properties of HEAs are significantly affected by the processing parameter. A selected $Co_{35}Cr_5Fe_{10}Ni_{30}Ti_{20}$ HEA has been synthesized through the mechanical alloying technique. XRD analysis confirmed the formation of fcc and minor fraction of intermetallic R-phase at as synthesized state. The value of Ms and Hc for the synthesized HEA has found to be 75.16 emu/g and 12.92 Oe respectively. In order to investigate the thermal stability and phase transformation, the synthesized HEA was vacuum annealed at different temperatures. Annealing at different temperatures induces vital effect on the structural, microstructural and magnetic properties of $Co_{35}Cr_5Fe_{10}Ni_{30}Ti_{20}$ HEA. The XRD patterns of the annealed (at 200°C, 700°C, 790°C, 870°C and 965°C) samples revealed the formation of fcc and minor intermetallic R-phase similar to the as synthesized sample, with change in the relative volume phase fraction of the fcc and R-phase. However, for 500°C annealed HEA, a new bcc phase evolved along with the primary fcc and R-phase. The microstructure of the low temperature annealed (at 200°C and 500°C) HEAs shows the similar morphology to the as synthesize HEA, whereas high temperature annealed (700°C to 965°C) HEAs revealed the formation of tiny spherical particles over the large grains. The value of Ms and Hc for the 200°C annealed HEA is found to be similar to the as synthesized HEA, while it increased (both Ms and Hc) for 500°C annealed HEA. However, a drastic change in the value of Hc has been observed for the high temperature annealed HEAs (700°C to 965°C). The value of Hc of the high temperature annealed HEAs decreased six times to the as synthesized HEA and found in the range of 1.66 to 1.95 Oe. In addition, the value of Ms has also changed after high temperature annealing. The 790°C annealed HEA exhibited

excellent soft magnetic characteristics having high Ms (90.79emu/g) and low Hc (1.66 Oe) as compared to the presently studied other samples and also to the previously reported soft magnetic HEAs by others. The concluding reason behind the high value of Ms for annealed HEAs are a decrease in lattice parameter, i.e., improved magnetic interaction and a change in volume phase fraction of synthesized phases. However, the soft magnetic behavior of high-temperature annealed HEA is attributed to the synergetic effect of the decrease in magneto-crystalline anisotropy, particle size, and surface anisotropy. The value of Ms and Hc for the 790°C annealed HEA is comparable to some commercial soft magnets, such as Supermalloy, Ni-Zn ferrite, and Mn-Zn ferrite. Thus, the designed and developed $Co_{35}Cr_5Fe_{10}Ni_{30}Ti_{20}$ HEA showed excellent soft magnetic characteristics even after annealing at high temperatures and may be further considered for industrial applications.

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Impact of technostress on continuance intentions to use mobile technology

Abedulkarim Ayyoub[1], Zuheir N. Khlaif[1,2] and **Mageswaran Sanmugam[2]**

[1]An Najah National University, Malaysia

[2]Universiti Sains Malaysia, Malasia

With rapid development of emerging technologies, teachers have been required to integrate mobile technology into their practices to improve learning outcomes. However, teachers have been reluctant to integrate technology into teaching because of technostress. Many studies have investigated the reasons and consequences of technostress in different contexts more than education, specifically teachers in K-12. The boundary condition of using new technology which consider in this study technostress as a boundary condition that influences perceived usefulness for continuance intentions of using mobile technology. Therefore, the purpose of the study was to investigate the impact of technostress on continuance intentions of using mobile technology in K-12 schools in Palestine, as well as develop a model that describes how technostress and perceived usefulness influence the continuation of mobile technology integration in schools in the Palestinian context. Therefore, the researchers proposed a model to describe the relationship among technostress, perceived usefulness, and K-12 teacher attitudes toward and continuance intentions to using mobile technology in the Palestinian context. A quantitative approach was used to collect data from 367 teachers from different backgrounds using online survey. Path analysis was used through using SPSS and AMOS to find out the goodness of fit and the relationship among the constructs of the proposed model. path coefficients of the model and table 1 to introduce Goodness-of-fit indices for the proposed model. The findings revealed that technostress has non-significant direct effects on continuance intentions of using portable technology, where perceived usefulness plays a crucial role in continuance intentions. Technostress has negative effects on both perceived usefulness and teachers' attitudes toward mobile technology.

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Evaluation and optimization of kraft delignification and single stage hydrogen peroxide bleaching for Ethiopian sugarcane bagasse

Medhanit Mamaye[1], Zebene Kiflie[1], Sisay Feleke[2] and **Abubeker Yimam[1]**

[1]*Addis Ababa University, Ethiopia*

[2]*Ethiopian Agricultural Research Council Secretariat, Ethiopia*

The current study investigated the Ethiopian sugarcane bagasse during its delignification using the Kraft pulping process and bleaching by single stage hydrogen peroxide process. The multilevel categoric experimental design was used to appraise the effects of the independent process variables (temperature, NaOH concentration, and time) on the pulp yield and kappa number during the Kraft pulping process. The central composite experimental design of response surface methodology was used to appraise the effects of independent bleaching variables (bleaching temperature, H_2O_2 concentration, and time) on the pulp yield, brightness, and whiteness during the bleaching process. The optimal pulp yield was 38.41% with 17.68 kappa number. The bleached pulp yield for the pulp with kappa number of 17.68 and the pulp with kappa number of 8.41 were 84.12% and 83.91%, respectively. The brightness and whiteness for the pulp with kappa number of 17.68 were 61.92% and 85.36%, respectively. Similarly, for the pulp with a kappa number of 8.41, the brightness and whiteness were 68.35% and 91.43%, respectively. Paper from the pulp with kappa number of 17.68 has higher tensile, burst, and tear strength. The study shows the promising utilization of the Ethiopian sugarcane bagasse for paper production via the Kraft delignification and single stage hydrogen peroxide bleaching.

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Bacterial removal efficiency of Moringa stenopetala and Cadaba farinosa from surface water: Laboratory-based cross-sectional study

Amanuel Ejeso[1], Demamu Tagele Haligamo[2] and **Embialle Mengistie Beyene[1]**

[1]*Hawassa University, Ethiopia*

[2]*Arba Minch University, Ethiopia*

Background: Consumption of polluted surface waters are leading to waterborne diseases, especially in developing countries, which results in the deaths of millions of people annually around the world. Ethiopia, like the rest of developing countries, suffers a lot of water-associated health problems. Chemical disinfectants are in use to disinfect water with some drawbacks like expensiveness, unavailability, and detrimental effect on human health. Researchers are on the search for non-expensive and locally available methods, and natural plants are the ones in the study. Thus, this study is designed to test Escherichia coli (E. coli) removal efficiency of Moringa stenopetala (M. stenopetala) and Cadaba farinosa (C. farinosa) from surface water.

Methods: A cross-sectional study was conducted from June to July 2021. A 14L water sample was collected from Lake Hawassa. A 30, 60 and 100 mg weights of the leaf and seed powder dosages of M. stenopetala and C. farinosa at contaminant settling times of 30, 60 and 90 minutes were used. Each one-liter water sample was treated with each of the dosages. *E.coli* count, temperature, pH and turbidity were measured using standard methods for water and wastewater analysis. Statistical package for social sciences (SPSS) version.23 was used for analysis. Treatment differences between plant parts and association between variables were also tested.

Result: The result indicated that raw water samples having 18 initial E. coli colonies per 100mL of water showed zero E. coli colonies per 100mL of water after treatment with 30mg dosage of M. stenopetala seed, 30mg dosage of C. farinosa seed and 60mg dosage of M. stenopetala leaf after 90 minutes of settling time, but C. farinosa leaf was unable to reduce E. coli colonies to zero per 100mL of water. M. stenopetala leaf showed the highest turbidity reduction of 83.3% at 60mg dosage. A pH of 7.30 and 8.50 and a temperature

of 20°C-23.5°C were recorded. There was a significant difference in E. coli removal between C. farinosa seed and leaf. Turbidity was identified as a factor that positively affects *E. coli* removal during M. stenopetala seed and leaf. Dosage and settling time were also identified as predictors of *E. coli* removal.

Conclusion: M. stenopetala and C. farinosa have antimicrobial properties against E. coli, but only M. stenopetala showed *E. coli*, turbidity, and pH values within the recommended World Health Organization standards. So, we suggest M. stenopetala as a promising natural disinfectant that needs attention from organizations working on the water.

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Evaluation of maize cob ash as partial replacement for mineral filler in hot-mix asphalt concrete production

K. Destaw, G. Nigus, M. Awoke, Y. Worku and **S. Abebe**
Debre Tabor University, Ethiopia

The effect of maize cob ash as a partial replacement of conventionally used filler material in hot mix asphalt for binder course was evaluated. All the volumetric properties and the physical properties of the asphalt mixture were evaluated to determine the optimum replacement of MCA in the production of binder courses for heavy traffic roads. The content of crushed stone dust (CSD) filler was replaced with MCA at a rate of 0% (control), 25%, 50%, 75%, and 100% by weight of CSD. A total of thirty (30) mix specimens prepared, fifteen asphalt concrete samples were prepared by a 6% of crushed stone dust as filler by weight of aggregate with bitumen content between 4.5% and 6.5% at varying increments of 0.5% by total weight of the mix to determine the optimum bitumen content. The remaining specimen was prepared at 5.30% OBC to find out the optimum replacement rate of maize cob ash (MCA). The stability, flow, unit weight, voids filled with asphalt (VFA), air voids, and voids in mineral aggregate (VMA) were determined. The values of stability, flow, unit weight, air voids and voids in mineral aggregate and voids filled with asphalt at 75 % replacement of crushed stone dust with maize cob ash were, 11.7 KN, 3.13 mm, 2.360 g/cm^3, 4.0 %, 14.58 %, and 72.56 %, respectively. Research findings indicated an optimum value of maize cob ash could be replaced the crushed stone dust is 75% by weight of CSD filler or 4.5% by weight of aggregate in the production of hot mix asphalt binder course for heavy-trafficked roads. Hence, the maize cob ash is recommended to use as a replacement for CSD fillers in the hot mix asphalt binder course.

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Status, characterization, and quantification of municipal solid waste as a measure towards effective solid waste management: The case of Dilla Town, Southern Ethiopia

WM. Fereja and **DD. Chemeda**
Dilla University, Ethiopia

The aim of this study is to assess the status of solid waste management (SWM) and to characterize and quantify the municipal solid waste as a measure towards effective management in Dilla, Ethiopia. Surveys for household residents and SWM operators, repeated field investigations, on-site waste measurements, characterizations, and quantification were conducted. The average per-capita waste generation rate among residential households was found to be 0.475 kg/capita.day. The majority of waste was organic (68.40% by weight), suggesting a strong resource recovery potential in terms of animal feed or compost. Recyclable wastes 1.90% plastics and 1.50% papers by weight. Whereas, 0.30% metals, 0.30% glass, 0.50% leather and rubber, 19.60% inert 0.96% textiles, and 6.90% miscellaneous by weight were obtained. Poor household wastes source segregation attitudes and practices and disposing of in unsanitary landfills are revealing the main solid waste management problems faced. Other SWM barriers are ineffective solid waste fees system, lacking equipment and trained manpower, inappropriate collection routes; unavailability of collection vehicles, illegal solid waste disposal, and inappropriate setting of community containers. To enhance SWM public awareness, re-usage, recycling, composting, providing equipment and facilities, provision of incentive and other financial policies and other provisions currently lacking and inappropriate must be provided. The municipal authorities of the town may use this work as a bench mark and can push environmental protection authorities to reexamine the implementation of their policies and strategies with regard to the human and environmental health conditions of the town.

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Textile effluent treatment methods and eco-friendly resolution of textile waste water: Review

Bantamlak Birlie[1] and **Aklilu Azanaw**[2]

[1]*Bahir Dar University, Ethiopia*

[2]*Bahir Dar Textile Share Company, Ethiopia*

The ever-increasing demand for textile products, textile mills, and their effluent have all increased in recent years, resulting in a serious pollution problem around the world. Many chemicals used in the textile industry are harmful to the environment and human health. Dyes are considered major contaminants among the many compounds found in textile effluent. Water pollution produced by the discharge of untreated wastewater and the use of toxic chemicals, during processing, are global environmental issues linked with the textile industry. Textile mills discharge a considerable amount of wastewater that contains poisonous and dangerous substances that harm the environment. When hazardous wastes are released into the air, water, or on land, they can quickly travel throughout the ecosystem, causing higher health risks. The global environmental problems associated with the textile industry are related to water pollution caused by the discharge of untreated effluent, and the use of toxic chemicals, during processing. Textile effluent is a critical environmental concern because it reduces oxygen concentrations due to the presence of hydrosulphides and blocks the passage of light through water bodies, both of which are harmful to the water ecosystem. Thus, this review focuses on textile effluent treatment techniques and the physical-chemical treatment parameters taken into consideration during primary, secondary, and tertiary treatment. It also discusses effluent of biological-oxygen-demand (BOD) and chemical-oxygen-demand (COD), total dissolved solids (TDS), total suspended solids (TSS), and turbidity. With more severe restrictions expected in the future, control measures must be implemented to minimize effluent pollution. As a result, new treatment procedures and environmentally friendly chemicals must be employed to reduce the impact of textile effluent on humans and the environment. As a result, the article review covers all of the causes of textile effluents, wastewater reuse, and energy generation, as well as its treatment approaches and future perspectives.

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Pelletization of mixed torrefied corncob and khat stem to enhance the physicochemical and thermal properties of solid biofuel and parametric optimization

Bulcha Jifara[1], Melkiyas Diriba[1] and **Abnet Mengesha[2]**

[1]Haramaya University, Ethiopia

[2]Welkite University, Ethiopia

Integrated Pelletization of torrefied biomass is used to improve the energy density, handling, and combustion properties of produced solid biofuels. The goal of this study was to use a mixture of corn cob and khat stem through a combination of torrefaction and co-pelletization processes. The response surface methodology was used to investigate the optimization of co- pelletization parameters. Torrefied biomass blending ratio and particle size were chosen as independent factors. The dependent variables were heating value, bulk density, and durability of torrefied mixed pellets. According to the analysis of variance, the biomass blending ratio and particle size were discovered to be significant study parameters that influenced the heating value, bulk density, and durability. The interaction effects of the parameters chosen are well fit by the second-order quadratic model equation. For a maximum heating value of 26.4 MJ/kg, a bulk density of 808 kg/m^3 and durability of 94.48%, the optimum values of the influencing parameters were 0.33 g/g % mixing ratio and 0.5 mm particle size. The physicochemical properties of the mixed torrefied pellet obtained under optimal conditions were compared to those of torrefied corn cob and khat stem. Pelletization of torrefied bio-residues had a significant effect on all of the properties studied, according to the findings. The torrefied pellet produced had good properties in terms of heating value, bulk density, and durability.

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Li_2MnO_3 content effects on thermal, structural, electrical and electrochemical properties of xLi_2MnO_3-(1-x)$LiNi_{0.9}Zn_{0.1}O_2$ cathode materials

Paulos Taddessea and Wondimu Baranab

Arba Minch University, Ethiopia

The majority of commercial lithium-ion batteries (LIBs) employ $LiCoO_2$ as a cathode material. The high cost, limited resources as well as the toxicity of Co, and safety issues associated with $LiCoO_2$ cathode has led to the development of other cathode materials. In the past decades, different types of alternative cathodes were developed and great improvements have been achieved. Currently, the mixture of Li_2MnO_3 and $LiMeO_2$ (Me = Ni, Co, Mn, etc) with a general formula of xLi_2MnO_3-(1-x)$LiMeO_2$ have received great attention due to they provide a higher energy density than that of $LiCoO_2$, $LiMn_2O_4$, $LiFePO_4$, etc.

In this study, xLi_2MnO_3-(1-x)$LiNi_{0.9}Zn_{0.1}O_2$ (x = 0.1, 0.2 and 0.3) cathodes were prepared by two steps solid-state reaction method. The target of the research work is to investigate the effect Li_2MnO_3 content on the thermal, structural, electrical and electrochemical properties of xLi_2MnO_3-(1-x)$LiNi_{0.9}Zn_{0.1}O_2$ cathode materials. Layered crystalline phases (space groups of C^2/m for Li_2MnO_3 and R_3m for $LiNi_{0.9}Zn_{0.1}O_2$) were detected in all cathodes. The structural parameters were greatly influenced by the contents of Li_2MnO_3 in xLi_2MnO_3-(1- x) $LiNi_{0.9}Zn_{0.1}O_2$. The electrical conductivities were found in the range of $1.2x10^{-6}$ to $2.7x10^{-6}$ S/cm. The dielectric spectra revealed the interfacial polarization Maxwell–Wagner type dielectric dispersion existing in all samples. The cathodes delivered the discharge capacities of 149 (x = 0.1), 151 (x = 0.2) and 157 mAh/g (x = 0.3) with capacity retention between 94.6 and 96.8% when they were cycled from 3.0 to 4.5 V under 0.1C rate. The x = 0.3 cathode exhibited the highest cyclic performance (96.8%) due to its lower cations disorder. From this study, it was identified that The structural parameters, electrical, dielectric and electrochemical properties were found to be affected by the Li_2MnO_3 content in xLi_2MnO_3-(1- x)$LiNi_{0.9}Zn_{0.1}O_2$ lattice.

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Households' preference for reliable electricity: Evidence from Hosanna and Durame towns of Southern Ethiopia

T. Wakjira and **T. Kefale**
Salale University, Ethiopia

The reliable and renewable Electricity services have a substantial contribution to the environment, economy, and social cohesion. Nevertheless, in developing countries like Ethiopia, electricity services are irregular and unreliable. The study aims to analyse households' preference for reliable electricity services using primary data collected from 210 sample households in Hosanna and Durame towns of Southern Ethiopia. The households' preferences were analysed using the choice experiment valuation technique. The study used both Conditional and Mixed Logit models to estimate the mean and marginal Willingness to Pay (WTP) for the attributes. The result suggests that households are willing to pay 230.84 ETB ($8.34), 229.34 ETB ($8.2), 2230 ETB ($8.3), and 230 ETB ($8.26) per month for improvement scenario one, two, three and four respectively in addition to the current monthly charge. Hence, the government should heavily invest in improving electricity transmission and distribution capacity besides up scaling the generation capacity.

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Formulation, in vitro characterization and optimization of taste-masked orally disintegrating co-trimoxazole tablet by direct compression

Tafere C[1], Yilma Z[1], Abrha S[2] and **Yehualaw A[1]**

[1]*Bahir Dar University, Ethiopia*

[2]*University of Canberra, Australia*

Background: Orally disintegrating tablet (ODT) is a dosage form that overcomes the problem of swallowing which is very prevalent. Co-trimoxazole (CTX) is given for patients with HIV as prophylaxis of opportunistic infection. Esophageal candidiasis, one of AIDS defining opportunistic infection (OI), affects up to 1 out 5 people with AIDS. This OI is manifested by painful swallowing. Therefore, CTX ODT offers the advantage of easy swallowing thereby improving patient compliance.

Objective: The objective of this study was to formulate, characterize & optimize CTX ODT.

Method: Co-trimoxazole ODTs were prepared by direct compression. Two taste masking techniques were employed, addition of sweetening agent, and solid dispersion by using Eudragit E-100 at different ratios (1:1, 1:2 and 1:3). Taste masking was determined by comparing taste threshold value and in vitro drug release. Preliminary study was used to investigate the effect of three independent variables on Disintegration time, friability and wetting time (WT). From the preliminary study, the factors that were found significant were further optimized using central composite design (CCD). Design-Expert 8.0.7.1 software was employed to carry out the experimental design.

Result: The bitterness threshold concentration of Trimethoprim was found to be 150 µg/ml and the in vitro drug release of the three batches of drug to polymer ratio (F1:1, 1:2 and 1:3) was 2.80±0.05, 2.77±0.00 and 2.63±0.00 respectively. From the optimization study, the optimal concentration for the super Disintegrant was 8.60% w/w and a CF of 11.25 KN which gave a rapid disintegration and WT of 13.79 and 23.19 seconds respectively and a friability of 0.666%.

Conclusion: In this study, co-trimoxazole ODT was formulated successfully. Optimization of the response variables was possible and the predicted optimal conditions were confirmed experimentally and were found to be in good agreement within 5% of the predicted responses. The successful formulation of CTX ODT can solve difficulty of swallowing of conventional tablets for some group of patients.

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Removal of fluoride in groundwater by adsorption using hydroxyapatite modified Corbula trigona shell powder

N. S. Yapo[1], S. Aw[1], B. G. H. Briton[1], P. Drogui[2], K. B. Yao[1] and **K. Adouby[1]**

[1]*Institut National Polytechnique Félix Houphouët-Boigny, Côte d'Ivoire.*

[2]*Université du Québec, Canada*

Corbula trigona shell powder (CTSP) was modified by a hydrothermal method using phosphoric acid in order to remove fluoride ions from groundwater. This method was performed by keeping the Ca/P molar ratio constant at 1.67. Fourier Transform Infrared Spectroscopy (FT-IR), X-Ray Diffraction (XRD) and scanning electronic microscopy (SEM) analysis confirmed the formation of hydroxyapatite (Hap) after CTSP pre-treatment. Batch adsorption experiments were conducted in beakers containing modified-CTSP (with a dose varying from 0.1 to 0.8 g) in the presence of 100 mL of groundwater contaminated by 2.20 mg/L of fluoride. Adsorption kinetics indicated that the adsorption process is governed by pseudo-second order kinetics. The reaction rate constant for fluoride removal was 0.161 g mg-1 min-1. Adsorption isotherms showed that fluoride removal was mainly controlled by physical adsorption with the maximum adsorption capacity of 4.517 mg g-1. The relatively low enthalpy value (ΔadH0 < 200 kJ.mol-1) indicated that during adsorption process, very low interactions occurred between fluoride and modified-CTSP. The adsorption process was spontaneous, endothermic and irreversible in nature. The best results (89 % of fluoride removal) were recorded at pH 7.5 ± 0.1 in 175 min with a concentration of 5 g/L of modified-CTSP. From a cost-effectiveness point of view, the removal and desorption efficiency of fluoride were evaluated. The results of this study show a gradual decrease in the removal efficiency of fluoride on HAp during the different regeneration cycles. Indeed, the maximum adsorption capacity was 89.3 % during the first cycle and gradually decreased with the increase of the number of cycles. Thus, Hap3 could be used up to 5 times during fluoride removal with a loss of nearly 56 % of its adsorption efficiency. The results obtained showed that Hap derived from Corbula trigona shell waste can be a promising sorbent for groundwater defluoridation in developing countries.

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Nonlinear dynamic response of the Mooney–Rivlin hyperelastic beam under a distributed

H. Khani Arani and **M. Shariyat**
K.N. Toosi University of Technology, Iran

In this paper, force vibration and the dynamic lateral deflections of the hyperelastic thin beam based on a Mooney-Rivlin model and under a distributed load are studied. The surrounding elastic medium is simulated as a Pasternak foundation to study the effects of both normal and shear effects. Using Hamilton's principle, Von Karman assumptions, Euler-Bernoulli beam theory, and Left Cauchy-Green deformation tensor, the governing equations of motion and related boundary conditions are obtained. The combination of the nonlinear and coupled motion equations and boundary conditions is solved by an iterative 2D differential quadrature (DQ) spatial-discretization and Newmark's time-marching methods. In this regard, the dynamic lateral deflections are plotted to study the effects of thickness and length of the beam, surrounding elastic medium, different boundary conditions, the constitutive parameters of the hyperelastic material, and distributed compressor load magnitude. Results show the key roles of the constitutive parameters of the hyperelastic material, the combination of the edge conditions, and the shear stiffness parameters of the foundation on the dissipation manner of the vibration and performance of the structure. Furthermore, results show that the linearization errors are significant for larger loads and looser boundary conditions.

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Influence of pre-straining on the texture, localized mechanical properties and corrosion behavior of a magnesium alloy

M. Sabbaghian[1] and **N. Fakhar**[2]

[1]*University of Tehran, Iran*

[2]*Hamedan University of Technology, Iran*

Magnesium (Mg) is an attractive material to develop biodegradable parts such as orthopedic devices and cardiovascular stents. Pure Mg suffers from high corrosion rate and relative low strength. To overcome these limitations, grain refinement, textural engineering and alloying are being considered. In the present investigation, an Mg–Zn–Zr (ZK60) alloy, a biocompatible and conventional material, with an initial basal texture component was used. It was deformed at strain rate of 0.01 s–1 via compressive loading to different amounts of strains of 10, 20 and 30 % to study the effects of evolution of basal texture, twinning and second phase particles on the corrosion resistance and shear strength. Microstructural and textural analysis were carried out by scanning electron microscopy and electron backscatter diffraction techniques. As a novel useful method, shear punch test was performed to determine the mechanical strength of the deformed specimens. Corrosion behavior was studied by using electrochemical tests such as polarization and electrochemical impedance spectroscopy. The results exhibited that by increasing the amounts of strain, grain size of the initial un-deformed material decreased, and the basal planes gradually rotated away from the surface. Moreover, second phase particles distributed more uniformly at the whole microstructure. Compressive deformation also resulted in the appearance of extension twins in the microstructure, especially inside the remained coarse grains. Shear strength was enhanced after 10, 20 and 30 % compressive strain due to the finer grain size, more homogenous distribution of particles, and non-basal texture component. The highest corrosion resistance which was at the appropriate range for biomedical applications was obtained in the sample processed via 20 % strain. It was attributed to the finer grain size and an optimum volume fraction of extension twinning, both of which can improve the corroded layer stability and adherence to the substrate.

New method of computing the Riemann mapping function via real-valued kernel

Shwan H. H. Alshatri

Azmar College for gifted Students, Iraq

A new boundary integral equation to compute the Riemann mapping function for bounded simply connected regions corresponding to a real valued kernel is presented. Based on the multiplication of the Kerzman-Stien Trummer integral equation (KST) by the penalty function such that the complex-valued kernel is transformed into a real-valued kernel, we derive a new boundary integral equation and prove its uniqueness. Numerical results using the Nystrom method with the trapezoidal rule yield approximations of high accuracy when compared with exact solutions for test regions.

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A predictive mimicker of fracture behavior in fiber reinforced concrete using machine learning

Sikandar Ali Khokhar, Touqeer Ahmed and **Rao Arsalan Khushnood**

National University of Sciences and Technology (NUST), Pakistan

Due to the exceptional qualities of fiber reinforced concrete, its application is expanding day by day. However, its mixed design is mainly based on extensive experimentations. This study aims to construct a machine learning model capable of predicting the fracture behavior of all conceivable fiber reinforced concrete subclasses, especially strain hardening engineered cementitious composites. This study evaluates 15x input parameters that include the ingredients of the mixed design and the fiber properties. As a result, it predicts, for the first time, the post-peak fracture behavior of fiber-reinforced concrete matrices. Five machine learning models are developed, and their outputs are compared. These include artificial neural networks, the support vector machine, the classification and regression tree, the Gaussian process of regression, and the extreme gradient boosting tree. Due to the small size of the available dataset, this article employs a unique technique called the generative adversarial network to build a virtual data set to augment the data and improve accuracy. The results indicate that the extreme gradient boosting tree model has the lowest error and, therefore, the best mimicker in predicting fiber reinforced concrete properties. This article is anticipated to provide a considerable improvement in the recipe design of effective fiber reinforced concrete formulations.

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Image fusion using wavelet transformation

Shahid Naseem and **Umer Farooq**

University of Education, Pakistan

Image fusion used to retrieve data from an input image and put it into a single output image to make it more informative and useful than any of an input image. It improves the quality and information of data. Image fusion generally utilized in intelligent robots, sound system camera combination, clinical imaging, and production process checking, electronic circuit structure and examination, sophisticated machine/gadget diagnostics, and smart robots on sequential construction systems. The image quality depends upon the application. This paper presents a literature review on different spatial and frequency domain of Image fusion combination methods such as Simple average, Max-Min, Weighted, PCA, HIS, Wavelet Transform, DCT dual-tree CWT, multiple wavelet transform DWT and Combination of curvelet and stationary transform. The Fusion of the Image is frequently required to mix pictures that are caught from the tool. Complex Wavelet-based combination methods have been used in joining perceptually essential highlights. A tale picture combination system dependent on the doubletree complex wavelet change is introduced right now. Double tree CWT is an expansion to discrete wavelet change (DWT), etc. Different quality measures have examined to play out a quantitative examination of these strategies such as Q-move DT-CWT. It expels the ringing antiquities presented in the intertwined picture by relegating appropriate weighting plans to high pass wavelet coefficients and low pass coefficients autonomously. It also combine pixels of an image using CWT rather than traditional DWT.

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Structural, dielectric and diluted magnetic semiconductor responses in doped ZnO nanoparticles for spin-based electronics

Aurangzeb Khan[1] and **Rajwali Khan**[2]

[1]*Abdul Wali Khan University, Pakistan*

[2]*University of Lakki Marwat, Pakistan*

The effect of Cerium and Cobalt co-doping on the structure, dielectric and magnetic responses of Cerium (fixed) and Co co-doped ZnO nanoparticles (NPs) annealed in an air/oxygen (O_2) atmosphere at 600°C was studied. High co-doping caused a reduction in dielectric properties due to the substitution of Cerium (fixed) and Cobalt ions into the host ZnO. Substitution of Zinc ions with Cerium (fixed) and Cobalt ions enhanced the dielectric and electrical conductivities of the samples due to an increase in available charge carriers. A significant change in the hysteresis loop was observed and characterized by the change from diamagnetic response of ZnO to ferromagnetic (FM) when co-doped with Cerium (fixed) and Cobalt ions. Room-temperature ferromagnetism (RTFM) in the ZnO lattice samples mainly emanated from oxygen vacancies and Zinc interstitials. However, with changes in dopant concentration only from 1% to 2% and then 4%, remanant magnetization (Mr) first increased from 0.4213 emu/g to 0.5688 emu/g and then decreased drastically to 0.4638 emu/g. The enhanced dielectric and magnetic properties of the 2% co-doped sample are strongly correlated to the increase in O_2 vacancies. The Ce and Co doped is a new study for diluted magnetism semiconductor applications. Therefore, this high ferromagnetism is best or spin-based electronics. In this work, results have demonstrated that (Cerium (fixed), Cobalt) co-doped ZnO have tuneable RTFM, and the introduction of O_2 vacancies is an approach to enhance high-temperature ferromagnetism. These co-doped ZnO nanoparticles are best for Spin-based electronics and Memristive devices for Resistive Random Access Memory (RRAM) Applications.

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Threshold switching performance in Nickle-Zinc-Oxide diffusive memristor for bio-inspired artificial nociceptor

Rajwali Khan[1] and **Aurangzeb Khan**[2]

[1]*University of Lakki Marwat, Pakistan*

[2]*Abdul Wali Khan University Mardan, Pakistan*

In neuromorphic computing, the memristor's biomimetic features as an electronic synapse and neuron have motivated the emergence of new information technology. A nociceptor is the essential and unique sensory neuron receptor capable of detecting harmful signals and providing a quick warning to the central nervous system to initiate a motor response in the human body and humanoid robotics. We report that the memristor-based-nociceptor characteristics for electronic receptors are illuminated in P++-Si/Ni-ZnO/Au devices. The introduction of Nikle-doped Zinc oxide (NZO) layer between a P++-Si electrode and an Au electrode is used to eliminate the surface effects of the NZO layer, resulting in improved volatile threshold switching performance. The conduction mechanism analysis shows that the NZO layer acts as a barrier between the electrodes, in which the oxygen defects create localized trap sites for electron hopping in a low electric field as well as assisting electron tunneling in a high electric field. The P++-Si/NZO/Au memristor shows several keys nociceptive functions, including threshold, relaxation, allodynia, and hyperalgesia, depending on the strength, duration, and repetition rate of the external stimuli. Such nociceptive characteristics are attributed to the electron trapping/detrapping to/from the traps in the NZO layer. NZO based metal oxide devices of this type yield multifunctional nociceptor performance that is fundamental for artificial intelligence systems applications, representing an essential step in realizing neural integrated devices with nanometer-sized features.

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Controlled size synthesis of ZnO and PEG-ZnO NPs and their biological applications

Abid Ali Khan

University of Lakki Marwat, Pakistan

The objective of this study was to synthesize the smallest possible size of ZnO NPs using modified wet chemical synthesis method and to prepare core shell using polyethylene glycol (PEG) as shell material. Advanced and sophisticated techniques were used to confirm the synthesis, size and shape of these NPs. Rounded, clustered NPs of size 5.343 nm were formed. Both the plain and core shell NPs were tested against MDR bacteria (E. cloacae, E. amnigenus, Shigella, S. odorifacae, Citrobacter and E. coli). Both of the NPs showed excellent antibacterial properties whereas E. cloacae showed maximum zone of inhibition of 16 mm, 27 mm and 32 mm for 500 µg/ml, 1000 µg/ml and 1500 µg/ml respectively for plain ZnO NPs and 18 mm, 28 mm and 35 mm for 500 µg/ml, 1000 µg/ml and 1500 µg/ml for core shell NPs. These NPs were also biocompatible on human red blood cells showing little hemolysis of only 4% for 70 µg/ml for plain NPs and 1.5% for 70 µg/ml for core shell NPs. Core shell NPs were highly biocompatible because of the PEG. Their therapeutic effect as photosensitizers in photodynamic therapy (PDT) for cancer treatment was also monitored. The cytotoxicity of ZnO and PEG-ZnO was evaluated using MTT assay. Our results demonstrated that these NPs could generate ROS inside tumor cells after irradiation which inturn initiates apoptotic pathway leading to cell death hence proving to be an effective candidate for PDT.

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A pathway towards sustainable development: Exploring the dynamic effects of macroeconomic policies on the environmental quality in developing countries

Shaista Noureen[1] and **Muhammad Zubair Chishti**[2]

[1]*Quaid-i-Azam University, Pakistan*

[2]*University of Chakwal, Pakistan*

The global acceptance of, and belief in, technical improvements to mitigate natural resource scarcity has resulted in not just smugness in the handling of environmental issues, but also certain incorrect foundations for policymaking. Environmental contamination has been a subject of research around the world because of its impact on billions of people. According to existing literature, CO_2e, CH_4 and N_2O are the primary causes of environmental degradation. However, in recent years, research on environmental degradation and climate change has focused on the consumption of non-durable energy resources and gases fuel sources. In this regard, the current research covers a knowledge vacuum by establishing a new model that combines macroeconomic policies, GDP, FFC, and REC with environmental quality, including greenhouse gas emissions, for 16 developing ASIAN nations from 1990 to 2017. The Kao and Westerlund cointegration test validates the variables' long-run relationship. Slope homogeneity and cross-section dependence tests, second-generation panel unit root test, Westerlund co-integration test, and cross-sectional autoregressive distributed lag were used to examine the data. The results of the econometric approaches are as follows: Firstly, the expansionary monetary and fiscal policies exacerbate the harmful effects of CO_2, methane, and nitrogen oxide. Contractionary fiscal policy, on the other hand, is an effective approach for mitigating CO_2e's negative impacts. Secondly, expansion and contraction in the monetary policy, respectively, degrade and improve environmental conditions. Thirdly, both the gross domestic product as well as the use of fossil fuels are linked to pollution. Fourth, renewable energy resources improve air quality by lessening emissions of carbon dioxide, methane, and nitrogen oxides. The findings of this study may be useful in this regard. To achieve long-term favorable economic performance while also reducing environmental deterioration in the country, the government should consider taking efforts to limit carbon dioxide emissions from diverse businesses that contribute to climate change.

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Packaging materials for fresh produce; A case study to preserve the quality of longan fruits

Muhammad Rafi Ullah Khan[1] and **Chongxing Huang**[2]

[1]*Pak-Austria Fachhochschule Institute of Applied Sciences and Technology, Pakistan*

[2]*Guangxi University, China*

Packaging materials play a significant role in food quality preservation, shelf-life extension and food safety. These packaging materials when combined with other materials play a synergetic role. Any change in these packaging materials will have a different effect on the quality of a targeted product. Therefore, in this study, fresh longan fruits which are highly perishable in nature were selected. Oriented polypropylene (OPP) and polyethylene (PE) of different thicknesses (20, 40, and 60 µm) were selected as different packaging materials. As only packaging materials alone could not extend the storage life, therefore, the fruits were first packaged in these bags and fumigated with propyl disulfide (PD) by attaching sterile gauze inside the wall of the packages. All the packages were heat sealed and stored at 12° for 18 days. Fruits packaged in open net packages served as control. Packaging materials played a significant role in the shelf life of longan fruits. The results showed fruit packaged in OPP and PE significantly prevented losses of water, microbial decay (DI), and maintained color compared to the control treatment. Among these packaging materials, OPP-20 and OPP-40 best maintained the overall quality of fruits and extended the shelf life to 18 days, followed by 15 days in OPP-60, PE-20, and PE-40 and 12 days in PE-60 packaging films. Although fruits in control packaging materials were able to store until day 9, however, quality of the fruits was very poor and was acceptable up to day 6 only. Therefore, OPP-20 and OPP-40 packaging materials could be applied commercially for a wide range of food products to preserve their quality.

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Torrential rains, widespread floods, soil degradation due to climate change and role of materials in green technology therein

Bashir Ahmad[1], Muhammad Ammar Bashir[2] and **Muhammad Saad Bashir[2]**

[1]DHA Suffa University, Pakistan

[2]Baqai Medical University, Pakistan

Recent torrential rains and widespread floods especially in South Asian landscape and Pakistan in Particular have implications on the future shape of our planet. Apart from enormous relocation of the inhabitants, the prominent environmental impact is degradation of soil caused by the unusual gushing waters. It also results into landslides, pushing heavy stones and soil in enormous quantities to riverine and finally into the sea. According to the report of United Nations Office for Coordination of Humanitarian Affairs (UN OCHA), till 2nd September 2022, the numbers of destroyed houses in Pakistan due to recent heavy rains and flash floods are over 436,000 (Pakistan, 2022). 80 districts out of 160 have been declared calamity hit which means almost 50% of the total populations. This is not the end; the situation is worsening as more rains pour in and water flows down from upper parts of the country. Only in KPK Province 1,600 km of roads got destroyed out of total length of 2388 km which means 67% of the total road network.

The cataclysmic floods have caused around $18 billion to country's teetering economy, wiping out more than 8 million acres of crops and displacing more than 33 million people (Pakistan's Deadly Floods Come Amid Deluge of Crises, 2022). How much is the transportation of mud, minerals, plants, crops, animals and human-beings into the sea is yet to be calculated. The volume of water and pattern of rainfalls with which it swept away natural and manmade structures has no example in the history of Pakistan. This is the effect of roaring climate change which is under discussion for the last few decades but with cursory remedial measures. The earth surface of Pakistan, for example, will have different face when the present rising waters recede.

The soil degradation in this case can include loss of organic matter, decline in soil fertility, changes in structural condition, irreparable erosions, added acidity, adversity of salinity and other effects of multiple pollutants. The question is that if it continues with the onset of yearly monsoon, then what will be the shape

of our planet in few decades onward? At the same time, how would it impact the texture seawaters; obviously adverse to the present state? Does it mean that we are heading towards physical end of our planet? The questions need serious thinking and solutions for retaining the natural-balance state and shape of our planet for the future generations.

Green technologies are considered environment friendly in view of its production processes and supply chain mechanism. It means clean energy production, the use of alternative fuels, and technologies that are less harmful to the environment than fossil fuels. The next question is how to implement those remedial measures including green technologies? It needs purely scientific and managerial answers; as every puzzle has a solution, so is the case of preserving the shape and state of the earth planet. With Pakistan as case study, this paper intends dilating upon soil degradation impacts of the recent floods, consequent shape of the earth surface, possible impacts of inflowing materials into the sea and remedial measure including green technologies.

Role of blockchain technology in supply chain management: Evidence from Chinese firms

Junaid Jahangir and **Hanaan Ehsan**
Preston University, Pakistan

This study aims to provide empirical evidence to support the role of blockchain technology in supply chain management in Chinese firms. The data were gathered through a survey of the employees of the Chinese firms. A sample of 100 respondents was taken for this study. Hypotheses were tested through SmartPls 4.0. Empirical evidence suggests that Chinese firms using blockchain technology can have a more effective and influential supply chain management system. A group of knowledgeable individuals provided the task of gathering the necessary information, and questionnaires were sent to businesses located in China's major metropolitan areas of Beijing, Shenyang, Wuhan, Guangzhou, and Shenzhen. A similar study must be replicated in various other contexts to measure the similarity of the results with finding from new perspectives. The paper provides the support and guidance of blockchain technology to enhance supply chain management systems in Chinese firms.

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Machine learning techniques for dental disease prediction

Md. Ariful Islam Arif[1], Iffat Firozy Rimi[1], Sharmin Akter[1], Md. Riazur Rahman[1], A. H. M. Saiful Islam[2] and **Md. Tarek Habib[1]**

[1]*Daffodil International University, Bangladesh*

[2]*Notre Dame University Bangladesh, Bangladesh*

Oral diseases are increasing at the same rate as infectious diseases and non-communicable diseases all over the world. More than eighty percent of the total population suffers from one or more dental diseases, of which periodontitis, gingivitis, and carcinoma are among them. In this work, we used a machine learning approach for dental disease prediction in the context of the daily behavior of the people of a country. We discussed with the concerned doctors and the dentist the important factors of dental disease. By talking to a doctor or someone with experience in the field, we can find out if there are certain habits or characteristics that cause tooth loss or are more likely to cause disease. With all these important factors in mind, we started collecting data from real people and dental disease patients. Generally, processing the data is very important in creating a machine learning model because, while training from the collected original data, some unexpected or incorrect data may show bias during model training. After data collection and preprocessing, we used nine eminent machine-learning algorithms namely k-nearest neighbors, logistic regression, SVM, naïve Bayes, classification and regression trees, random forest, multilayer perception, adaptive boosting, and linear discriminant analysis. For the task of assessment, we reviewed the performance of each classifier using accuracy and some noteworthy performance metrics. The logistic regression classifier outflanks every single other classifier regarding all measurements utilized by accomplishing an accuracy approaching 95.89%. On the basis thereof, AdaBoost shows not only deficient consequences of an accuracy approaching 34.69% but also some deficient outcomes in other metrics.

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Cost effectiveness of forest restoration in Nepal: A case from leasehold forestry initiatives

Sony Baral[1], Bijendra Basnyat[2], Kalyan Gauli[3] and **Bikash Adhikari[1]**

[1]*Tribhuvan University, Nepal*

[2]*United Nations Development Programme, Nepal*

[3]*GIZ, Nepal*

Forests are depleted throughout the world in the 1990s, since then various efforts have been undertaken for the restoration of the forest. A government of Nepal promoted various community based forest management in which leasehold forestry was the one introduce in 1990s aiming to restore degraded forests land. However, few attempts have been made to systematically evaluate its cost effectiveness. Hence the study assesses the cost effectiveness of leasehold forestry intervention in the mid-hill district of Nepal following the cost and benefit analysis approach. The study followed quasi-experimental design and collected costs and benefits information from 320 leasehold forestry groups (with intervention) and 154 comparison groups (without intervention) through household survey, forest inventory and then validated with the stakeholders' consultative workshop. The study found that both the benefits and costs from intervention outweighed without situation. The members of leasehold forestry groups were generating multiple benefits from the forests, such as firewood, grasses, fodder and fruits, whereas those from comparison groups were mostly getting a single benefit. Likewise, extent of soil carbon is high in leasehold forests. Average expense per unit area is high in intervention sites due to high government investment for capacity building. Nevertheless, positive net present value and internal rate of return was observed for both situations. However, net present value from intervention, i.e., leasehold forestry is almost double compared to comparison sites, revealing that community are getting higher benefits from restoration. The study concludes that leasehold forestry is highly cost-effective intervention that contributes towards forest restoration that brings multiple benefits to rural poor.

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Recent Technological Advances in the Management of Chronic Wounds - A Literature Review

Benson G. Ongarora

Dedan Kimathi University of Technology, Kenya

Wound treatment comprises a substantial portion of the healthcare budgets in developed countries. Studies suggest that about 50% of patients admitted in hospitals have wounds, while 1 - 2% of the general populations in developed world suffer from chronic wounds. Chronic wounds fail to repair themselves within the expected period of 30 days. Technologies have been developed to address challenges encountered during wound care with the aim of alleviating pain, promoting healing or controlling wound infections. The objective of this work is to explore the technological improvements that have been made in this field over time. In order to gain insight into the future of wound management, a systematic review of literature on the subject was conducted in scientific data bases (PubMed, Scopus, Web of Science, Medline, and Clinical Trials). Results indicate that wound dressings have evolved from the traditional cotton gauze to composite materials embedded with appropriate ingredients such as metal-based nanoparticles. Studies on biodegradable dressing materials are also underway to explore their applicability in dressing large and irregular wounds. On the other hand, conventional drugs and traditional formulations for management of pain, inflammation, infections and accelerating healing have been developed. However, more research needs to be carried out in order to address the issue of microbial resistance towards drugs. Drugs for managing other ailments also need to be designed in such a way that they can augment wound healing. In addition, it has been demonstrated that a coordinated integration of conventional and traditional medicine can produce laudable results in chronic wound management. Accordingly, collaborative efforts and ingenuity of all players in the field can accelerate technological advances in wound care market to the benefit of the patients.

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An efficient method to find a smooth robot joint trajectory based on MQ-RBFs

N. Bendali and **A. Said**
Djilali Bounaama University, Algeria

A new technique to generate smooth motion trajectories for robot manipulators using multiquadric radial basis functions (MQ-RBFs) is presented in this paper. In order to get the optimal trajectory, two objective functions are minimized that are proportional to the execution time, the integral of the squared jerk (which denotes the time derivative of the acceleration) along the whole trajectory. Also, the proposed interpolation technique is introduced for solving the trajectory planning problem in the joint space, where the interpolation of via-points takes into account boundary conditions and also satisfies kinematics limits of velocity, acceleration, and jerk. Then, the proposed approach is compared with a set of classical interpolation techniques based on radial basis function models and cubic splines. Finally, the proposed technique has been tested for the six-joint PUMA 560 manipulator in case of minimum time-jerk and results are compared with those proposed of other important trajectory planning techniques. Numerical results show the competent performances of the proposed methodology to generate trajectories in short total transfer time and with high smooth profile.

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Utilization of airborne magnetic and ground geophysical models in regional exploration of mineral deposits in inland basins in southeastern Nigeria

I. J. Arinze[1], C. O. Emedo[1,2], C. C. Ani[3], E. I. Akaerue[1,4] and S. Abdullahi[5]

[1]*University of Nigeria, Nigeria*
[2]*Federal University of Technology Akure, Nigeria*
[3]*Ebonyi State University, Nigeria*
[4]*University of Calabar, Nigeria*
[5]*Federal University, Nigeria*

In this study, airborne and ground-based geophysical data are analysed to identify areas that are favourable for mineral-ore occurrence as well as image sub-surface geological structures of mining interest. To achieve these objectives, four basins (Abakaliki, Ikom-Mamfe, Bamenda, and Oban Massif), occupied by several mining districts in south-eastern Nigeria are selected due to the presence of mineralized veins, primarily consisting of galena (PbS), sphalerite (ZnS), and barite ($BaSO_4$) in their order of relative abundance. Of these basins, the Abakaliki and Ikom-Mamfe Embayment (IME) is studied in relation to unraveling mineral-bearing geological structures with mining implications. The study's main purpose is to improve the process of 'ground selection' for mining operations and thus, halt the cancellation and abandonment of exploration and mining contracts within the areas. The total magnetic intensity data (TMI) was reduced to the equator to prepare the magnetic data for further enhancements. The first vertical derivative (FVD) was applied to enhance the residual features while the tilt derivative were computed to delineate edges of sub-surface source bodies. Thereafter, lineaments were identified as a reliable indicator of mineral-bearing geological structures. Results show the presence of aeromagnetic anomalies, which reflect the existence of sub-surface mineral-bearing structures and/or near-surface or exposed crystalline basement complex rocks that have been intruded by igneous bodies, in the basins. It is observed that major lineament orientations in the Abakaliki Basin and Bamenda Massif are NE-SW and NW-SE, and in the IME and Oban Massif NE-SW and NNE-SSW, while the dominant lineament trend for the entire study area is in NE-SW direction. The models of ground geophysical traces obtained from

the IME and Abakaliki Basin show outstanding anomalies characterized mainly by low resistivity and moderate to high chargeability values at shallow depths (2.50 - ~40 m), with the results indicating good correlation. On the other hand, the host rock is clearly mapped, showing substantial chargeability and resistivity contrast. Analysis of the integrated results suggests that the location of the delineated ore bodies corresponds to zones of moderate to high magnetic intensity, zero tilt angle contour, high analytical amplitudes and dense lineament occurrence, which shows reasonable agreement between both primary research data. These geophysical anomalous sites require test drilling to confirm their certainty and ascertain their depth persistence. This work, therefore, demonstrates the efficiency of airborne magnetic data as a suitable first-pass ground selection tool for mineral ore exploration in inland basins.

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Asymmetric impact of public debt on economic growth of Nigeria

Abdulkarim Yusuf[1] and **Hussaini Abdulkarim**[2]

[1]*Nigeria Police Academy Wudil, Nigeria*

[2]*Nasarawa State University, Nigeria*

Debt overhang is crowding-out private investment and limiting government's ability to invest in critical infrastructure that supports poverty reduction and inclusive growth in Nigeria. The effect of public debt on economic growth has been extensively analysed by a variety of studies, but the empirical evidence more often than not remains controversial and ambiguous. One common hypothesis of previous studies is that they have assumed that the effect of public borrowing on growth is symmetric. The main purpose of this study is to investigate the asymmetric impact of government debt on economic growth in Nigeria for the period 1980 to 2018 using the Nonlinear Autoregressive Distributed Lag approach. The co-integration test established a long-run nonlinear relationship between economic growth and the indicators of public debt. The findings indicate an asymmetric relationship between inflation rate and economic growth while external debt and debt service payment showed significant evidence of a linear relationship with growth both in the long and short-run. The outcome of the analysis show that an increase in the general price level significantly impedes growth, whereas a decrease in price level inhibits growth in the long-run but motivates growth in the short-run. Positive and negative changes in the stock of external debt indicate the same effects of promoting growth in the long and short-run, while positive and negative changes in debt service payment confirmed the same effect of suppressing growth. Domestic debt had a linear long-run effect on growth but an inverted short-run effect, whereas foreign reserve holding had an asymmetric long-run effect and a symmetric short-run effect on growth. Positive and negative changes in domestic borrowing hinder growth in the long and short run whereas an increase in the stock of external reserves stimulated long and short-run growth. To mitigate the negative effects of unsustainable public debt, the study advocated for fiscal reforms that effectively reduce deficit financing, improve domestic revenue generation, and infrastructure spending, as well as strong corporate governance and institutions.

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Effect of solid-state fermentation on the essential oil yield of curcuma longa residues

Doriane DJUFFO TEGOUNDIO and **Sylvie NGUIKWIE KWANGA**
University of Douala, Cameroon

The solid waste of Curcuma longa rhizomes generated after its cold juice process making is mostly unused and discarded even though they can contain essential oil. Conventional techniques such as hydrodistillation can be used to extract essential oil, but this generally results in low essential oil yield and inefficient extraction time. Solid-state fermentation as a pre-treatment of distillation could improve the yield of essential oil. In this study, we evaluated the effect of solid-state fermentation on the yield of extraction of Curcuma longa solid wastes essential oil. The solid-state fermentation was carried out naturally without any addition of inoculum and the extraction was performed by hydrodistillation. Under experimental conditions at room temperature (25°C) with a moisture content of 44% and anaerobically in the dark, the treatment of 7 days of solid-state fermentation followed by 2h of hydrodistillation provided the highest yield of 1.21% as compared to non-fermented of 0.35% and of 0.96% relative to the raw plant f experiments was then carried out by a Doehlert matrix to optimize the yield of extraction. Two independent variables, namely the distillation time and the fermentation time, were studied. Under optimal experimental conditions of 10 days and 4 hours, a yield of 1.96% was obtained validating the statistical model. The solid-state fermentation applied before the hydrodistillation step has been successful and proves its potential to improve the efficiency of essential oil extraction.

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The potential application of palm kernel shells and waste plastics in asphaltic mix for sustainable pavement construction

Latifatu Mohammed[1], Mutala Mohammed[1], Trinity Ama Tagbor[1], Margaret Mary Bruce-Mensah[1], Samuel Tekpetey[1], E. A. Armoo, Rejart Adomah[1], Thomas David Arthur[2], Francis Boateng Agyenim[1], F. B. Agyenim[1], J. Y. Amoah[1], G. N. Laryea[1] and **Mehmet Serkan Kirghiz[3]**

[1]CSIR, Institute of Industrial Research, Ghana
[2]Associated Consultants Limited, Ghana
[3]Istanbul University-Cerrahpasa, Turkey

The depletion of the natural aggregate due to the high demand for road and building construction requires alternative materials to replace natural aggregates (NA). Ghana produces approximately 1.7 million tons of plastic waste annually with only about 2 % being recycled. Palm kernel shells (PaKS) and waste plastics (WP) have been investigated individually as a partial replacement for natural aggregate and as binder respectively. But a performance evaluation of the combination of these two has not been tested. This project has the objective to evaluate an asphaltic mix consisting of PaKS and its potential application for road pavement. The study investigated the potential of using PaKS as a partial replacement for NA and WP as an additive binder. The obtained optimum bitumen content was used to prepare the modified asphalt samples by replacing the NA with PaKS at 0% 10%, 20%, and 40%. The WP which was added as an additive was varied from 0%, 2%, 4%, 6% 8% and 10%. The physical and volumetric properties of the different asphaltic mixes (AM) were determined using the Marshall Method. The split tensile and water susceptibility of some selected composites were also determined. At 5.2 % optimum bitumen content, the Marshall Stability value of the different mix trails increased from 4.2 kN to 25 kN and the flow value increased from 2.2.0 mm to 5.0 mm. the compressive strength for the different trial mixes was in the range of 3 – 5.8 Nmm^2 and the split tensile strength of the unconditioned samples in the range of 0.3 – 0.55 Pa.

The novelty of incorporating agro-processing waste and waste plastics into asphalt mix can bring cost savings in road construction and effective waste management. It is recommended that to ascertain the practical applicability of the composite materials, further testing and field trial are needed.

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