4TH EDITION

MATERIALS SCIENCE AND ENGINEERING AND THEIR IMPACT ON THE ENVIRONEMENT

PROCEEDINGS BOOK

ICMSE

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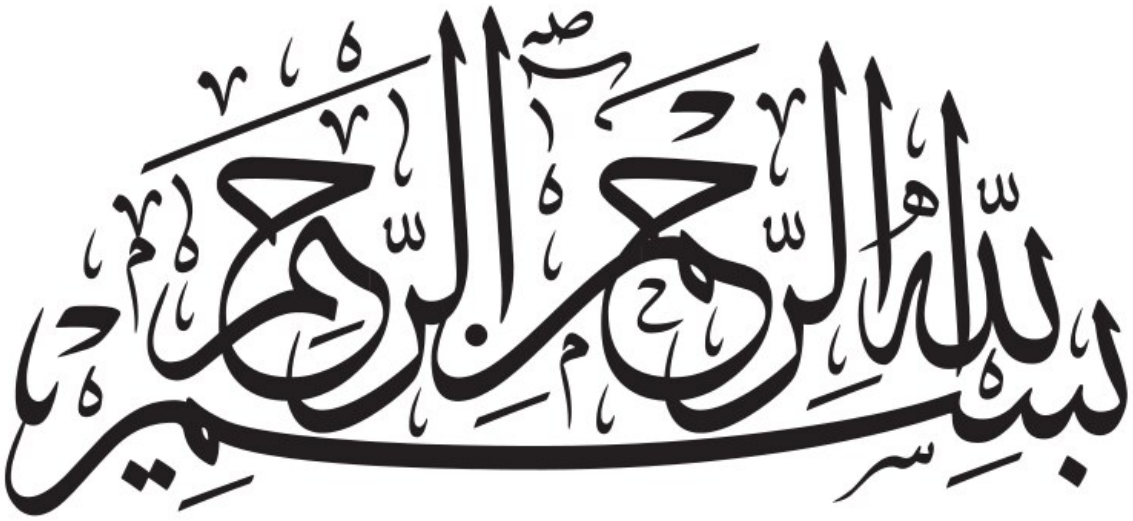
NOV 15-17

SCAN ME

ICMSE
THE INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND ENGINEERING AND THEIR IMPACT ON THE ENVIRONMENT

https://www.univ-sba.dz/icmse2025

Organized by the Laboratory of Physico-Chemistry of Advanced Materials (LPCMA)


بسم الله الرحمن الرحيم

FOREWORD

This fourth edition of the International Conference on Materials Science and Engineering and their Impact on the Environment (ICMSE@2025) will be organized by the Laboratory of Physico-Chemistry of Advanced Materials (LPCMA) at Djillali Liabés University in Sidi Bel-Abbès.

ICMSE@2025 provides an opportunity to promote communication between scientists and industry professionals to exchange information, ideas, and experiences in the development of new and innovative approaches to materials and their applications in energy and renewable energies, materials science and engineering, environment and sustainable development, biotechnology, and electrical engineering.

The goal of the conference on materials science and engineering and their impact on the environment (ICMSE@2025) is to provide expert information on recent advances in key areas of materials science and engineering. Computational methods in materials science offer powerful support tools for making decisions regarding material choices and designs that meet specific application requirements in studies related to energy, nanotechnology, and materials.

This meeting, aiming to take stock of the current state of research in the field of materials science, will be an opportunity to develop fruitful collaborations and partnerships among researchers, academics, and industry professionals.

IMPORTANCE OF THE TOPIC

This conference will focus on the latest interdisciplinary research in the prediction of new materials to address the challenges in energy, climate change, and environmental protection. It serves as a crucial event for senior and young researchers, students, and industry professionals working in this field worldwide.

OUR OBJECTIVE

This fourth international conference on materials science and engineering and their impact on the environment will facilitate a scientific gathering bringing together researchers and industry professionals at both national and international levels. The primary goal of this event is to foster the exchange of new studies and findings through plenary sessions, oral presentations, and posters. All scheduled presentations aim to initiate scientific discussions on the selection of materials with low environmental impact and environmentally friendly characteristics. This event combines modeling, simulation, and experimental approaches, drawing upon robust multidisciplinary expertise in physics, chemistry, physicochemistry of materials, process engineering, heat transfer, fluid dynamics, electrical engineering, meteorology, applied mathematics, and statistics.

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Program of The 4th edition of the international conference on materials science and engineering and their impact on the environment -ICMSE'2025-

Saturday, November 15, 2025

08.00	Welcoming participants, distribution of documents and check in		
09.00 – 10.00	**Opening Ceremony**		
	A word from Pr AMERI Mohammed the President of the ICMSE 2025 Conference.		
	A word from Pr ATTOUCHE Mohammed Kadi The dean of the faculty of exact sciences		
	A word from Professor AMARNA Messaoud: Director of the Human Rights Laboratory at Algiers 3 University, Secretary General of the National Federation of Higher Education and Scientific Research.		
	A word from Pr BOUZIANI Merahi the Rector of the Djillali Liabès University of Sidi Bel Abbès.		
10.00 – 11.00	 **<u>Lecture 1</u> : Pr Harith Ahmad – Univ of Malaya, Malaysia** **2D Materials as Saturable Absorbers to Generate Ultrashort Pulses** **CHAIRMAN :** Pr BOUZIANI Merahi – Pr BOUHAFS Bachir		
11.00 – 12.00	**Coffee Break & Poster Session 1** **Evaluators:** **Dr DRIZ Hafida** **Dr TAYEBI Nadjia** **Dr BELDI Lilia** **Dr MOULESSEHOUL Atika**		
12.00 – 13.00	 **<u>Lecture 2</u> : Pr El-Hadj KADRI - UFR Sci et Tech, Univ. Paris** **Concrete Pumping Techniques in Construction Sites** **CHAIRMAN** :Pr Mouffak Benchohra – Pr CHAABANE Lynda Amel		
13.00 – 14.30	**Lunch**		
14.30 – 16.00	**Oral Communications - Session 1 (Room A)** **Evaluators:** **- Pr HEIRECHE Houari** **- Pr BENZAIR Abdenour**	**Oral Communications - Session 2 (Room B)** **Evaluators:** **- Pr HARRACHE Djamila** **- Pr BOUYAKOUB Zahira**	**Oral Communications - Session 3 (Room C)** **Evaluators:** **- Dr KANDOUCI Chahinaz** **- Dr ALAMI AHMED**
16.00 – 17.00	**Coffee Break & Poster Session 2** **Evaluators:** **Pr TOUMI Fouzia** **Pr BENNABI Faiza** **Dr KHALDI Amina** **Dr CHIALI CHARIF Khadidja**		

Sunday, November 16, 2025

09.00 – 10.00



Lecture 3 : Pr. YARUB AL-DOURI - Eur Aca of Sci, Belgium

Nanomaterials-based greening the desert

CHAIRMAN :Pr LABIDI Salima – Pr AMERI Mohammed

10.00 – 11.00



Lecture 4 : Pr. Mouffak Benchohra - Djillali Liabes University Sidi Bel Abbes

Existence and controllability for evolution equations with delay

CHAIRMAN :Pr DJEBBARI Ali – Pr ELAHMAR Sidahmed

11.00 – 12.00 — **Coffee Break & Poster Session 3**

Evaluators:

Pr FASSI Benatou

Pr ABID Hamza

Dr AMERI Ibrahim

Dr BLAHA Lamia Farah

12.00 – 13.00



Lecture 5 : Pr. BOUHAFS Bachir - Djillali Liabes University Sidi Bel Abbes

Nos Recherches en Matériaux : À Côté de l'Essentiel ? De l'Empirique à l'ab Initio : Révolution ou Stagnation ?

CHAIRMAN :Pr BOUKLIE Hacene Amine - Dr KANDOUCI Chahinaz

13.00 – 14.30 — **Lunch**

14.30 – 16.00	**Oral Communications - Session 4 (Room A)** **Evaluators:** **- Pr ELAHMAR Sidahmed** **- Pr DJEBBARI Ali**	**Oral Communications - Session 5 (Room B)** **Evaluators:** **- Pr CHAABANE Lynda Amel** **- Dr KHALDI Amina**	**Oral Communications - Session 6 (Room C)** **Evaluators:** **- Dr DRIZ Samia** **- Dr OUAHAB Iman**

Check Out and Departure

Monday, November 17, 2025

09.00 – 13.00	**Online Session 1** - Dr KANDOUCI CHAHINAZ - Dr BLAHA LAMIA FARAH	**Online Session 2** - Pr BOUKLIE Hacene -Dr KHATIR Radja	**Online Session 3** - Dr DRIZ Samia - Dr OUAHAB Iman	**Online Session 4** - Dr Ezzine Mohammed - Dr BEDDAD Boucif	**Online Session 5** - Pr Chaabane Lynda Amel - Dr MAHDJOUB kheireddine
14.00 – 17.00	**Online Session 6** - Dr KANDOUCI CHAHINAZ - Dr BLAHA LAMIA FARAH	**Online Session 7** - Pr BOUKLIE Hacene -Dr KHATIR Radja	**Online Session 8** - Dr DRIZ Hafida - Dr OUAHAB Iman	**Online Session 9** - Dr Ezzine Mohammed - Dr BEDDAD Boucif	**Online Session 10** - Dr AMERI IBRAHIM - Dr MAHDJOUB kheireddine

List of Oral Communications

Oral Communications - Session 1 (Room A)
Mme Chouikhi Manel Safia Superabsorbent Acrylamide-Based Hydrogels as Intelligent Materials for the Efficient Removal of Methylene Blue from Aqueous Solutions
Mr FERHATI Mounir Effects of nitrogen incorporation on the optoelectronic properties of AlSb for photovoltaic applications: a first-principles calculation
Mr BOUFATAH MOHAMMED REDA Artificial Intelligence for Physics
Mr Hamza SOUALHI Calcul et prédiction de la viscosité plastique des bétons écologiques et conventionnels
Mr Charef mustapha abd el djabar Microbial Fuel Cells for protection of natural resource
Oral Communications - Session 2 (Room B)
Mme SETTI AHMED Kheira Fluorouracil quantification by LC-MS/MS in plasma of cancer patients
Mme BAGHDAD Chaimaa Bioformulation with Biosurfactants and Encapsulated Lipases Enhances Petroleum Hydrocarbon Biodegradation
Mme EL MAHI Fatima Zohra The environmental effects of plastic detritus
Mme Chaabane Lynda Amel Self-supporting structure vs confined masonry: What construction choices for seismic zones?
Oral Communications - Session 3 (Room C)
Mr Rahmani Mohamed Modeling the Impact of C60/SnO_2 ETLs and Metal Back Contacts on Lead-Free Perovskite Solar cells
Mr Chalal Yahia Algeria's Offshore Wind Potential: Spatial Identification and Energy Assessment in the Western Exclusive Economic Zone.
Mme Abir Rezzoug Ceramic Waste based-Geopolymers: An Eco-Approach to Minimize Raw Material Extraction
Mr hadjouni amine Numerical Investigation by Using SILVACO TCAD to reduce Rear Contact Recombination of InGaN Solar Cells via BSF Layer Engineering
Mme DRIZ Samia Phase-Change Material–Enabled Optical Reconfigurable Intelligent Metasurfaces for Dynamic Atmospheric Turbulence Compensation in Free-Space Optical Communications

Oral Communications - Session 4 (Room A)
Mr Hammouche KHALES Simulation Study of the Surface Passivation Influence on GaAs Schottky Solar Cell Performances
Mme Zahia Aidene Empirical and Theoretical Study of Noise Folding in Fully Perturbed Low-Rank Matrix Models Using Schatten-p Minimization
Mr Dra Rafik Arselen Recovery of chemical waste in a new cementitious matrix: effects of expired paint transformed into aggregates, powdered soda, and recycled aggregates
Mme Belhoula Rim Roukya Ab-initio Study of the influence of Zn incorporation on electronic structure and optical properties of Transition-Metal Mxenes $Ti_3C_2O_2$.
Mr Mohammad Faizal Ismail Design and Deployment of Fiber Bragg Grating-Based Tilt Sensors for Real-Time Slope Monitoring
Oral Communications - Session 5 (Room B)
Mr DENNAI BENMOUSSA Numerical study the degradation of III-V semiconductor-based tandem solar cells in the space environment
Mme Chafia METAOUI Quantum Complex Materials :Realizations and Challenges
Mr Bouhadef Bachir Electronic, and thermoelectric properties of half-heusler compounds PtTiM (M=Si, Ge): a first principles study
Mr Zabat walid chawki Optimization of the workability of glass powder self- compacting concrete using the Taguchi design method
Mme TAYEBI Nadjia Étude des propriétés optoélectroniques du composé ternaire CdSSe
Oral Communications - Session 6 (Room C)
Mr REZIG Walid Textile Wastewater Treatment via Photodegradation with a Diatomite-Based Magnetic Ferrite Catalyst
Mme RIH Aicha Impact of wastewater treatment plants in the province of Mascara on the environment (western Algeria)
Mr NEMOUCHI Hichem Impact of High Photovoltaic Penetration on Transmission Power System Stability and Operational Planning
Mme Zahira Amel BOUYAKOUB How Desalination Affects Our Planet
Mme Moulessehoul Atika Étude comparative de la dépollution des eaux usées par procédé de précipitation contrôlée

List of Poster Communications

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P-002	**Mr BOURAGBA Djamel**	Prediction of optoelectronic properties for Be0.750Cd0.250Se ternary alloy with (TB-m BJ) approach for photovoltaic applications
P-003	**Mme BENABBOUN Radjaa**	Ab-initio investigation of half-metallic ferromagnetism in half-Heusler compounds XYZ (X=Rb and Cs ; Y= Cr ; Z=Se)
P-004	**Mr Khelil Mohamed**	Structural and electronic properties of the quaternary Ga1-xSb1-yTlxBiy alloys
P-005	**Mme BOUKAIS Meriem**	Simulation of The Base Layer for Solar Cells Based SiGe
P-006	**Mme BENAOUINA Fatima-Zohra**	Energy Materials (Molecular Design and Nonlinear Optical Properties of 2 Nitrophenyl 4 (Octyloxy) Benzoate for Energy Materials Applications)
P-007	**Mme Driz Hafida**	Enhancing Earthen Dikes With Binders: A Civil Engineering Approach for Agricultural Irrigation and Drought Resilience
P-008	**Mr Zouaoui BENAYAD**	Numerical study of a water/soil heat exchanger "Cooling using geothermal energy"
P-009	**Mme Dendane amina**	Supervised Machine Learning for Predicting and Optimizing $MAPbI_3$ Perovskite Solar Cell Performance
P-010	**Mr SAIDIA Larbi**	Theoretical investigation of the plasma chemistry of CO2 with 4% of O2 by non-thermal plasma discharge
P-011	**Mr AMERI Ibrahim**	Spray coated of Pure and Molybdenum doped ZnO and the effect of doping on structural, optical and morphological properties
P-012	**Mme Amel SLAMANI**	Insight into Structural, Electronic, Mechanical and Thermoelectric Properties of In2PbSnCl6 promising Double perovskite
P-013	**Mme Amel SLAMANI**	Discovery of the Physical Properties of Transition Metal Oxide Spinel Via First Principles Calculations
P-014	**Mme Bounouara zohra**	Effect of kaolinite on the mechanical and hydraulic properties of a compacted clay from Oran, Algeria
P-015	**Mme nesrine Hamidane**	Computational exploration of the structural, elastic, and optoelectronic properties of cubic $GaPbBr_3$ perovskite for photovoltaic applications"
P-016	**Mme Ouafa Hamidane**	Investigation of the thermodynamic and electronic properities of Double PerovskiteBa2YNbO6
P-017	**Mme Halima Boubekeur**	Simulation of a microgrid integrating photovoltaic generation and a battery storage system into the power grid
P-018	**Mme Ammour Soumia**	Étude des Propriétés Statiques de Diffusion des Mélanges Binaires de Polymères Ramifiés en Étoile.
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P-030	**Mme Tebboune Wafa**	Stability response of advanced composites plates subjected to thermal loading via a refined HSDT
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P-038	**Mr BENALIA Kamal**	Development and microstructural characterization of a composite based on PLA and common Reed fibers
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P-055	**Mme El AHMAR Rajaa**	Crafting and Understanding a Conductive Polymer Composite Material
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P-075	**Mr ABBES El Habib**	Influence of Hydrostatic and Uniaxial Pressure on the Electronic and Magnetic Properties of Ferromagnetic Full-Heusler Alloys: A First-Principles Investigation
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P-080	Mme Kenza ZAIBAK	Detecting energetic Structures in Turbulent Wall Jet Using Wigner-Ville Distribution
P-081	Mme Fatiha Saadaoui	STRUCTURAL, ELASTIC, AND ELECTRONIC PROPERTIES OF Ti3InN ANTIPEROVSKITE
P-082	Mme BENZAIDI Orkia	Preparation of porous carbon with a large specific surface area from Quercus suber for highly efficient dye removal
P-083	Mme Amira Delloum	Structural and Electronic Properties of GaAs/GaBi Superlattice: Insight from First-Principales calculations
P-084	Mme Henen BERROUNA	Properties of the Anti-perovskite Compounds Ag_3SX (X = I, Br, and Cl): Structural, Elastic, and Thermoelectric Analysis
P-085	Mme Nor El-Houda Maameri	Retrait des bétons autoplaçants fibrés contenant du laitier
P-086	Mme Mimouna BENTAHAR	Synthesis of Hydrogels Based on Macromonomers and Acrylamide via Radical Polymerization
P-087	Mme CHIKH Hadjer	Design of a Poly(Glycidyl Methacrylate-co-Maleic Anhydride) Copolymer Material for Selective Cationic Dyes Removal in Water Treatment
P-088	Mme Wahiba El Mestari	Full Factorial Design Approach to Optimizing Genetic Algorithms for Wind Farm Layout
P-089	HADER Abderrahmane	Numerical Modeling of Particle Trajectories in a Semi-Industrial Eddy Current SeparatorMiloua Fethi, Touhami seddik, Aksa Wessim, Tilmatine Amar
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Mme Rania GHRIEB	Nanotechnology-Enabled Permeable Pavements: Toward sustainable Urban Water Management
Mme Rania GHRIEB	Assessing The Efficacy of Permeable Pavement as a Low Impact Development (LID) Solution for Enhancing Urban Resilience and Groundwater Recharge
Mme BRADA Marwa Ilham	Structural Insights into Fresh vs. Dried (45 °C) Strawberry Extraction Residues Using FTIR Spectroscopy
Mme Nesrine GUENANE	Thymus algeriensis: When Aroma Turns into Remedy
Mr OUNOUGHI Nabil	Investigation of Gamma-Ray Shielding Properties of transparent glass Using PHITS Monte Carlo code
Mme DAHNOUN KHEIRA	Criblage des bactéries métallorésistantes à partir de sols agricoles
Mme Terras ines	Propriétés conservatrice des extraits de pistacia lentiscus et pistacia atlantica dans un produit cosmétique crème
Mr Abdelkader Bouarfa	Deep Learning Approaches for Free Space Optical (FSO) Communication: Toward Sustainable and Energy-Efficient Networks
Mohamed El Hadi BENSSASSI	Solar-driven photocatalytic degradation of emerging contaminants in aquatic environments using bismuth oxide/titanium dioxide heterojunctions: performance, stability, and environmental relevance
Mahmoud MOSTEFA TOUNSI	Neural Network–Driven Control of a Thirteen-Level Cascaded H-Bridge Inverter for Photovoltaic Energy Conversion with Intelligent MPPT
Mme Wissam DJAMAI	Green Synthesis of Nanoparticles Using Biomolecules from Azolla pinnata
Mme BOUDEHANE Esma	Comparative Evaluation of Antioxidant Activity and Phenolic Content in Two Extra Virgin Olive Oils Using the FRAP Assay
Mme Awatef DALI	Environmentally Friendly Oxidation Process Using Periodate Activation for Water Purification
Mme Mahida Badra	Separation of Isobutanol-Water heterogeneous azeotrope: process intensification for sustainable development
Mme BENDEBANE Salima	Optimization and Characterization of Electrodeposited Zn–Mg Alloy Coatings: Application of Experimental Design Methodology
Mme BOUZIANI Messeouda	Synthesis and study of a eutectic mixture CXB-SAL and DFT molecular
Mr Mohammed Elamine Merabti	From Experimental Complexity to Modeling: The Role of Design- Expert in The Adsorption of Emerging Micropollutants
Mme Wafà BENSTAALI	Enhancing of CdS/ Sb2Se3 hetro-junction with Cu2O as BSF
Mr BADA Abdelmalek	Investigating the effect of using clay in construction on the thermal loads of desert houses
Online Communications - Session 9	
Mr Mohamed KOUACHI	Simulation-based analysis of tool dimensions impact on heat generation during the butt-joint friction stir welding (FSW)
Mme Tsouri Fadwa Yassamine	Natural Alternatives to NSAIDs: Anti-Inflammatory Potential of Citrus Peel Extracts
Mme ledia mersel	Removal of Non-Steroidal Anti-Inflammatory Drugs from Water Using Chitosan–Montmorillonite Beads
Mme atouani hadjer	Assay of phenolic compounds and determination of antioxidant activity of methanolic extracts of Periploca Laevigata from the Bechar region
Mme Amel ABALACHE	Enhancement of PHBV Biocomposites Using Chemical Treatments Spanish Broom Fibres
Mme BOUDINAR Naouam	Structure, Microstructure, Morphology and Magnetic Properties of Nanostructured Fe – (Ni, Cu, S) Powders Synthesized by mechanical alloying Process

Mme AZARRIH Amina	Activated Biochar in Cementitious Materials: Chromium Removal and Mechanical Property Enhancement
Mme BENOUADAH Nacera	Valorisation of xylan from Algerian eucalyptus
Mme Bendjazia Rania	Chemical Composition, Metabolic Disruption, and Toxicity of Ruta Essential Oil Mixtures Against a Mosquito Vector
Mme Sedjar Sarah Kawther	High-Fidelity Simulation and Smart Optimization of Next-Generation Silicon PV Devices
Mme SADDIKIOUI Leila	Valorization of Shrimp By-products into Biopolymers: A Step Toward Sustainable Marine Resource Management
Mme BENALIOUA Bahia	Synthesis and application of a new composite heterojunction supported on modified clay in the photodegradation of cefazolin under visible light irradiation.
Mme CHABANE Fatima Zohra	Hypolipidemic and hypoglycemic effects of the Magnesium supplementation in rats with Type 2 Diabetes
Online Communications - Session 10	
Mme BENDEBANE FARIDA	Optimization of Rodhamine B Removal from Aqueous Solution by Green Emulsion Liquid Membrane Prepared by Clove oil
Mr Boublenza Salim Mouad	Etude et réalisation d'une chambre de stérilisation à l'ozone des accessoires médicaux en milieu hospitalier
Mme Bnecheikh yasmina	Morphological and Optical Optimization of Silicon Nanowire Arrays for Enhanced Photovoltaics
Mr BENHAMID Abdelkader	Legal Protection of Water Resources from the Risks of Advanced Chemical Industries.
Mme BENAISSA YAMINA	Study of the Antioxidant and Aromatic Properties of Pomegranate Bark and Lemon Zest in Infusion
Mme bouziani souad fatima zahra	Isolement, Activité Antimicrobienne et Identification Moléculaire des Actinobactéries du Genre Streptomyces
Mme MELLOUK SENIA	Preparation of new adsorbents by chemical activation of marine algae for wastewater treatment
Mme DAOUDI Islam	Prescribed Performance Network Control for Fractional-Order Nonlinear chaotic Systems
Mme OUIDED DJEGHBOUB	Etude expérimentale des nanoparticules Au/CeO2 et Ag/CeO2
Mme AIT KACI Abdelouahab	Biodegradable PLA-diss fiber Composite material processed via Powder Technology
Mme Imane BOUALEM	Geographical Conditioning and Traditional Hybrid Wall Systems: The Case of the Ziban Region, Algeria
Mme Mostefaoui mohammed	Degradation Mechanisms and Early Performance Losses of Silicon Solar Modules in the Algerian Sahara
Mme SOUAAD HAMOUDI	Removal of Cationic Malachite Green with Adsorption on Agricultural Waste.
Mme Ayouz Katia	Development and study of the electrochemical properties of nanocomposite metal oxide-based for energy storage application
Mme Belbachir Raghed	Structural, Elastic, Electronic, and Magnetic investigations of Full-Heusler Compound Fe2OsIn: FP-LAPW Method
Mme Rabah SAHLI	Natural bond orbitals and molecular electrostatic potential analysis of heteropolyoxoniobates
Mr OUHIB RACHID	Wastewater Treatment and Agricultural Reuse: Examining the Process, Benefits, and Potential Problems
Mr Sadouki bouamama reda	The Role of AI-Enhanced Massive MIMO Systems in Improving Energy Efficiency and Environmental Protection
Mme Samira BELKHOUANE	investigates CZTS-based materials and their related structures for use in solar energy applications.
Mr LAOUFI SAMIR	Design, optimizati0n and management of renewable energy sources in a micr0-grid
Mme chiali charif khadidja	Evaluation of minerals composition of two orange varieties (Citrus Sinensis L and Citrus clementina) by X-ray fluorescence (XRF) spectra
Mme Imane Zaamouchi	Copper(II) coordination polymer: synthesis, structural characterization, and catalytic performance in 4-nitrophenol reduction
Mr Abdessamad Dib	Central Limit Theorems for Functional Index Models with Missing Data: Applications to Degradation of Materials
Mr Mohamed Hichem ELAHMAR	DFT studies of the physical properties of perovskite hydride materials ABH3 (A = K, Li ; B = Ca)

Partners

Speakers Abstracts



HARITH AHMAD

Professeur

BIOGRAPHY

Professeur **Harith Ahmad** obtained his degree in Physics from University of Malaya, Kuala Lumpur in 1979 with First Class Honors. Subsequently, he pursued his further study at University of Wales (Now University of Swansea) in MSc in Ionization Physics (1980) and Ph.D. in Lasers (1983). Since his returning he has actively involved in promoting research in lasers and laser applications. He has garnered numerous grants from Ministry of Science and Technology (Malaysia), Telekom Malaysia (Equivalent to British Telecoms) and many other sources. With this large fundings he has built up a very equipped facility in lasers, beginning with gas lasers moving towards solid state lasers. Various optical techniques were developed such as Q-switching, mode locking, and sophisticated approached as optical parametric oscillation and optical parametric amplifier. Frequency doubling, tripling and others are also undertaken during this period from 1983 to 1995. From here, Harith Ahmad ventured in optical fiber devices together with Telekom Malaysia establishing a research facility in optical based fibre devices. He has collaborated with Optoelectronics Research Centre, University of Southampton under the guidance of Sir Prof. David Payne and other members of the centre. It is the first of its kind in ASEAN region. This was further expanded into the national centre for photonics research by the government of Malaysia.

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2D Materials as Saturable Absorbers to Generate Ultrashort Pulses

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Abstract:

Of late, 2D materials have attracted great interest due to their excellent properties and versatility for various applications. This presentation will present the use of 2D materials as saturable absorbers to generate ultrashort pulses. The primary interest of ultrashort pulses is mainly towards medical and industrial applications. Ultrashort mpulses were historically demonstrated a few decades back, but the designs were generally based on bulk optics. This makes the miniaturization of laser systems a difficult task. Compact systems can be realized using optical fibers, such as Ytterbium- (Yb 3+), Erbium- (Er 3+), and Thulium (Tm 3+)-doped fibers, together with the 2D materials to generate output pulses in the pico- to femtosecond regimes. The keynote will discuss mthe different gain mediums mentioned, such as Yb 3+ , Er 3+ , and Tm 3+ , especially the designs produced at the Photonics Research Centre, Universiti Malaya. On top of this, the mhistorical background and importance of saturable absorbers from the early days until recently will be discussed. In summary, the use of ultrashort pulses in medical, dental, and industrial applications will be presented.

YARUB AL-DOURI

Professeur



CONTACT

Experimental and Theoretical
NANOTECHNOLOGY,
Editor-in-Chief (Scopus-indexed Q3)
https://etnano.com/

Nano-Micro Letters,
Associate Editor (IF = 36.3)
https://www.springer.com/journal/40820

BIOGRAPHY

Prof. Dr. **Yarub Al-Douri** is a Fellow of European Academy of Sciences. Al-Douri is winner of the prestigious Khalifa International Award for Date Palm and Agricultural Innovation 2024. He has initiated Nanotechnology Engineering MSc Program and Nano Computing Laboratory. He has received numerous accolades including winner of IAAM Scientist Award by International Association of Advanced Materials, Sweden 2022, World's Top 2% Scientists by Stanford University, USA 2024, 2023, 2022, 2021 & 2020, World's Top 2% Scientist Career-Long Citation Impact by Stanford University, USA 2020, OeAD Award, Austria 2020, Japan Society for the Promotion of Science (JSPS) Award 2019, Asian Universities Alliance (AUA) Award 2019, the total is 76 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Springer,IF=36.3,Q1), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY (Scopus-indexed Q3), Editor-in-Chief of World Journal of Nano Science and Engineering. His research field focuses on nanotechnology, renewable energy, nanoelectronics, nanomaterials, modelling and simulation, semiconductors, optical studies. Finally, Al-Douri is a public figure at international media in the UK, Singapore, Malaysia, Qatar and UAE. Al-Douri has more than 939 publications including Citations < 15700, h-index = 68, i10-index = 281 and US$ 5.1M research grants. Finally, Al-Douri is one of the Middle-East, North of Africa, Malaysia and Southeast Asia's most renowned scientists known for his contributions in Nanotechnology and renewable energy, and a public figure at international media in the UK, Singapore, Malaysia, Qatar and UAE.

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Nanomaterials-based greening the desert

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Abstract:

The desertification land is the degradation mainly in dry lands resulting from various factors, including climatic variations and human activities. It is a serious environmental problem to affect the global ecosystem, climate, agricultural production and human development. As a result, extra measures must be taken to reduce its consequences. The most properties of desert soil are the prevailing component in soils that are sand, low content of clay and organic matter. In this context, nanotechnology is an innovative technology that has shown promising opportunities to apply in environment, agriculture and energy because nanomaterials. However, there is a little effort made to use nanotechnology to combat desertification that affects the lives of millions of people. In this framework, integrated use of inorganic nanomaterials (nanoclay-nanozeolite) and organic nanomaterials (nanobiochar) is considered a useful management strategy for improving desert soil quality and crop productivity.



KADRI EL-HADJ

Professeur

BIOGRAPHY

Professor **El-Hadj Kadri** is a Full Professor of Civil Engineering (Exceptional Class) at the University of Cergy-Pontoise, France, and a senior researcher at the Laboratory of Mechanics and Materials in Civil Engineering (L2MGC). He obtained his Engineering degree from the National School of Public Works of Algiers, followed by a Master's degree (DEA), a PhD, and an Habilitation to Supervise Research (HDR) from French institutions. His career combines extensive industrial experience in construction engineering with a distinguished academic trajectory. He has held several academic and administrative positions, including Deputy Director of L2MGC and Head of multiple academic programs and national research projects. Professor Kadri has supervised numerous doctoral and master's theses and has been recognized with several national awards for research excellence. His research focuses on eco-friendly concretes, cementitious materials, rheology and tribology of fresh concrete, and concrete pumpability. He has published extensively in international peer-reviewed journals and has led many industrial and international collaborative projects. Professor Kadri is also actively involved in scientific evaluation, editorial activities, and international research networks in the field of construction materials.

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Concrete Pumping Techniques in Construction Sites

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Abstract:

Lors de la conception et de la réalisation d'un projet, de nombreux paramètres doivent être maîtrisés pour obtenir un rendu final conforme aux attentes des maîtres d'ouvrage et des maîtres d'œuvre et à la volonté esthétique des architectes et le respect des délais de réalisation. Parmi ces paramètres, la mise en œuvre du béton occupe une place importante. La technique la plus avantageuse est le 'Pompage des bétons', qui consiste à refouler, par l'intermédiaire d'une pompe, le béton dans une tuyauterie. Cette technique est de plus en plus utilisée dans le monde avec le développement des constructions en taille (Gratte ciel) et en forme (forme de plus en plus complexe). Le pompage est une technique unique et industrielle dédiée à la mise en œuvre du béton. Il permet d'apporter des réponses concrètes aux problématiques des chantiers tels que :

- L'adaptation à la configuration des différents chantiers et à leur accessibilité.
- Le respect de la cadence des chantiers.
- La qualité et le confort des travaux.

Pour pouvoir utiliser la technique de pompage, il est évidemment nécessaire que le béton soit pompable. Certains bétons ne le sont pas : si on essaie de les pomper, la tuyauterie se bouche et l'écoulement s'arrête. Il faut alors impérativement démonter la tuyauterie et la déboucher, ce qui est source de perte de temps et d'argent (immobilisation du chantier, perte éventuelle de tuyauterie). Comment savoir que le béton n'est pas pompable ? Quel sont les frottements des

bétons dans le tuyau de pompage ? Quel est la relation entre la pression de pompage et le débit ?.Pour assurer une bonne pompabilité, le béton doit rester homogène tout au long du pompage en se glissant dans les conduites comportant des coudes et des rétrécissements sans causer de blocages dans les tuyauteries. Avec l'apparition des nouveaux bétons écologiques et à faible impact environnemental (avec additions minérales), ces bétons ont une viscosité très élevée il est nécessaire de bien connaitre leurs comportements tribologique et rhéologique pour maitriser le pompage de ces bétons. La rhéologie du béton est un facteur d'influence direct sur la relation entre la pression de pompage et le débit.

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BACHIR BOUHAFS

Professeur



CONTACT

PhD - Professor (Full) at University of Sidi-Bel-Abbes - Department of Physics
Founding member of the Algerian Academy of Sciences and Technology (AAST)
Head of the Modeling and Simulation in Materials Sciences Laboratory (LMSSM)
Motivated by purpose and powered by curiosity, I approach every role with commitment and heart. Known for being dependable, calm under pressure, and always open to feedback.

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BIOGRAPHY

Professor **Bachir Bouhafs** is an internationally renowned Algerian physicist, an expert in solid-state physics and innovative materials. Born in Algeria, he has dedicated his career to teaching and research, transforming the field of materials science through his pioneering work. He graduated with a DES (Diploma of Specialized Higher Studies) in Physics from the University of Oran in 1990, obtained a Magister degree in 1994 from the University of Sidi Bel Abbès, followed by a Doctorate in 1999 from Djillali Liabès University. A professor at Djillali Liabès University since 1994, he has supervised more than 32 doctoral theses and numerous Master's theses. Director of the Laboratory for Modeling and Simulation in Materials Science since 2005, he leads national and international projects on nanotechnology and optoelectronics. He led a Franco-Algerian cooperation project from 2000 to 2004 with CRISMAT in Caen and completed a postdoctoral fellowship at CIAMAT in France in 2001-2002, funded by the Islamic Development Bank. Author of over 220 articles with an h-index of 42, he received the SCOPUS AWARDS and the THOMSON, REUTERS Award in 2010. As a founding member of the Algerian Academy of Sciences and Technologies, Professor Bachir Bouhafs embodies academic excellence and inspires a new generation of scientists through his commitment to innovation and international cooperation. During this plenary session, Professor Bouhafs will share his perspectives on advanced materials, stimulating new breakthroughs for the scientific community.

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Our Research in Materials: Missing the Essential? From Empirical to Ab-Initio: Revolution or Stagnation? An Assessment of Algerian Research: Current Status, Challenges, and Future Directions

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Abstract:

This paper presents a critical assessment of Algerian research in materials science, examined through the lens of its methodological transition from empirical approaches to ab-initio calculations. While the scientific community possesses recognized expertise in major material families (Heusler alloys, perovskites, MAX phases, 2D materials, etc.) and masters the fundamental structure-property relationships, a severe diagnosis emerges. The analysis reveals a paradox: visible academic output contrasts with limited socio-economic impact and a difficulty in keeping pace with the international state of the art.

This relative stagnation is attributed to major structural obstacles: the persistence of repetitive studies on model systems, the absence of a coordinated national vision and strategy, and, most critically, severely limited access to the intensive computing resources (HPC) essential for modern methods. The examination of practices shows an underutilization of powerful ab-initio calculation codes, even though many are available open-source, and a default dependency on semi-empirical methods due to resource constraints.

In light of this observation, this contribution proposes a strategic roadmap for the 2026-2030 period. It advocates for an intellectual and organizational revolution, shifting from a logic of academic production to one of impactful innovation. The identified priority actions include the development of a dedicated national materials strategy, a massive and coordinated investment in national HPC infrastructure, and the promotion of structured partnerships with industry. The ultimate goal is to transform existing potential into concrete leadership, aligning Algerian research with the global frontiers of material discovery and design, particularly through the integration of artificial intelligence and quantum computing approaches.



MOUFFAK BENCHOUHRA

Professeur

BIOGRAPHY

Professeur **Mouffak Benchohra** Full Professor at Djillali Liabes University of Sidi Bel Abbes, Algeria, where I have worked since October 1994. My educational background includes a Master's degree in Nonlinear Analysis at Tlemcen University in Algeria in 1994, and a Ph.D. in Mathematics at Djillali Liabes University, Sidi Bel Abbes, Algeria in 1999.

My research interests include a range of topics such as fractional differential equations, evolution equations and inclusions, control theory and applications, among others. With over 680 papers and 12 monographs published, I have been recognized as a Highly Cited Researcher in Mathematics by both Thompson Reuters (2014) and Clarivate Analytics (2017–2018). I am among the world's top 2% researcher in 2020, 2021, 2022, 2023, 2024, 2025 released by Stanford University.

Throughout my academic career, I have held several positions of responsibility, including the Head of Department of Mathematics at Djillali Liabes University, Sidi Bel Abbes. Additionally, I am privileged to serve on the Editorial Board of 10 international journals, where I contribute my knowledge and expertise to advance research in my field.

I created this website to share my study efforts, collaborations, and accomplishments with fellow scholars and students all over the globe. You can learn more about my studies, publications, awards, and work expertise by visiting this page. Please feel free to browse my website and contact me if you have any queries or would like to talk study possibilities.

CONTACT

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Existence and Controllability for Evolution Equations with Delay

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Abstract:

In this talk we present some recent results on the existence and controllability of mild solutions of various classes of semi-linear integro-differential equations with delay in Banach spaces. We consider the exact (complete) controllability, the approximate controllability and the trajectory controllability for various classes of semilinear functional integro-differential equations with delay in Banach and Fréchet spaces. Some equations involving impulsive effect are also considered.

Key words: Semi-linear integro-differential equations, Mild solution, Fixed point, Complete controllability, approximate controllability, trajectory controllability, Semigroup, Resolvent, delay, impulses, Banach space, Fréchet space.

Oral Communications

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Simulation Study of the Surface Passivation Influence on GaAs Schottky Solar Cell Performances

Hammouche Khales[a], Arslane Hatem Kacha[a], Boudali Akkal[a], Zineb Benamara[a]

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Abstract:

There is tremendous interest for high conversion efficiencies of solar cells, by different research laboratories, where photovoltaic energy is indicated to be the dominant energy by mid-century. In this context, the economic constraints convert the challenge into the need for devices with high conversion efficiency and low manufacturing costs. In order that, the solar cells based on the Schottky diode are interesting for the simplicity of their manufacturing process. However, the major drawback of these devices is related to the quality interface between the contact metal and the semiconductor which determine the final electrical properties. This adversely impacts the performance of Schottky devices based on GaAs substrates suffering from of a high surface density of recombination centers. Surface passivation of the GaAs substrate through a nitridation process appear as good technique techniques to reduce charge density and defect energy levels for the improvement of Schottky GaAs solar cells efficiency.

We present in this study the effect of Schottky diode parameters on GaAs solar diode performances. The simulation study of Au/GaAs Schottky solar cell is performed by using Atlas Silvaco tool. The simulated structures are two Schottky devices fabricated with passivated and unpassivated GaAs substrate. The current-voltage I-V forward characteristics of Au/GaAs device is analyzed by comparison between simulated and the experimental results to evaluate the current conduction mechanisms in the structure. The study explores the influence of physical parameters and interface state densities on the I-V characteristics in order to predict the photovoltaic properties of such devices and showing how to enhance their performances.

Key words: solar cell, Schottky diode, GaAs, Nitridation.

OR-002

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Modeling the Impact of C60/SnO_2 ETLs and Metal Back Contacts on Lead-Free Perovskite Solar cells

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Abstract:

In this study, I simulated a perovskite solar cell using SILVACO software to analyze the effects of both the type and thickness of the electron transport layer (ETL), as well as the work function of the back contact, on the cell's performance. Two different materials were used as ETL: C60 and SnO_2. The results showed that increasing the thickness of the C60 layer led to a significant decrease in cell efficiency, highlighting the importance of precise thickness control to reduce recombination and improve charge transport. In contrast, varying the thickness of SnO_2 had no noticeable effect on performance, indicating the stability and effectiveness of this material over a wide thickness range. Regarding the work function, several metals (Au, Cu, Fe, Ag, Ni) were tested as back contacts, and the results revealed no significant impact on the efficiency or photovoltaic properties of the cell, implying that any of these metals can be used without negatively affecting performance. These findings demonstrate that choosing the appropriate ETL and controlling its properties is crucial for optimizing cell performance, while the work function of the back contact is not a limiting factor, offering great flexibility in material selection based on cost or ease of fabrication

Key words: Perovskite, work function, ETL, back contact.

OR-003

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Algeria's Offshore Wind Potential: Spatial Identification and Energy Assessment in the Western Exclusive Economic Zone.

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Abstract:

Offshore wind energy is emerging as a strategic pillar in the transition toward carbon neutrality, particularly in the Mediterranean context. This study presents a first academic assessment of Algeria's offshore wind potential, focusing on the western sector of its Exclusive Economic Zone (EEZ). A multi-criteria spatial analysis identified an area of approximately 2,922 km² as suitable for offshore wind development, with 93% of this area favorable to floating wind technology us it goes form 50m to 1000 m depth. Within this region, 11 zones were delineated as priority sites.

Energy production simulations, based on the 10 MW Vestas reference turbine, indicate capacity factors exceeding 40% in the most exposed floating zones, where mean wind speed exceeds 7 m/s. Using an optimized array configuration (Li et al., 2024), the theoretical density reaches 3.54 MW/km². The aggregated potential output is estimated at 10.34 GWh per hour for all identified sites, of which 9.69 GWh/h originates from floating offshore wind farms. Average capacity factors were 35.9% for floating and 26.6% for fixed installations.

These findings highlight the western Algerian waters as a promising frontier for offshore wind deployment, providing essential input for marine spatial planning and the long-term diversification of Algeria's energy mix.

Key words: Offshore Wind Energy, Algeria, Renewable Energy, Marine Spatial Planning.

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Ceramic Waste based-Geopolymers: An Eco-Approach to Minimize Raw Material Extraction

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Abstract:

In response to growing environmental concerns and the depletion of natural resources, this study investigates the valorization of ceramic sanitary-ware waste (CSW) as a sustainable precursor in geopolymer production. By replacing natural raw materials, CSW contributes to the conservation of non-renewable mineral resources. The research focuses on the influence of sodium hydroxide molarity (10M–16M) on the thermal resistance of CSW-based geopolymers. While higher molarity improves early compressive strength, it was found to reduce thermal stability over time when exposed to elevated temperatures. These findings highlight the need to optimize alkaline activation to ensure both mechanical performance and long-term durability, reinforcing the value of ceramic waste in sustainable material development.

Key words: Geopolymer, Ceramic Waste, Molarity, Thermal Resistance, Natural Resource Protection

OR-005

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Numerical Investigation by Using SILVACO TCAD to reduce Rear Contact Recombination of InGaN Solar Cells via BSF Layer Engineering

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Abstract:

In this research endeavor, the p-InGaN/n-InGaN/n^+-InN solar cell architecture has been subjected to numerical analysis utilizing the SILVACO-TCAD simulator software. This analysis has been facilitated by the incorporation of a heavily doped InN layer serving as a back-surface field (BSF) within the structural configuration situated between the absorber layer and the back-contact layer. The influences of the thickness and acceptor concentration of the absorber layer, buffer layer, and BSF layer, have been studied on solar cells parameters, such as the open-circuit voltage, short-circuit current, fill factor, efficiency and with the quantum efficiency of the solar cell. The findings from these investigations indicate a performance enhancement resulting in a power conversion efficiency (PCE) of 24.43%, with a short-circuit current density (JSC) of 38.05 mA/cm² and an open-circuit voltage (VOC) of 0.821 V, alongside a quantum efficiency exceeding 78.32% within the wavelength range of 300–900 nm attributed to the integration of the InN BSF layer.

Key words: GaN, III-V, SILVACO, Solar Cells, 2D simulation

OR-006

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Empirical and Theoretical Study of Noise Folding in Fully Perturbed Low-Rank Matrix Models Using Schatten-Minimization

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Abstract:

This paper studies low-rank matrix reconstruction under noise folding in a fully perturbed model, where both the original matrix and the measurement operator are imprecisely known. Using Schatten-p ($0 < p < 1$) minimization and the restricted isometry property (RIP), we establish sufficient condi- tions ensuring robust and stable recovery, along with explicit upper bounds on the recovery error. Numerical experiments on synthetic and image data confirm the theoretical results and demonstrate the superior performance of the non-convex Schatten-p approach over nuclear norm minimization.

Index Terms—Low-rank matrix recovery, Noise folding, Re- stricted isometry property, Perturbation analysis, Non-convex Schatten−p norm minimization.Dye, Brilliant Green, Photocatalysis, Optimisation, Box-Behnken Design, UV Irradiation.

OR-007

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Impact of High Photovoltaic Penetration on Transmission Power System Stability and Operational Planning

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Abstract:

The large-scale integration of photovoltaic (PV) power plants is transforming transmission systems by reducing synchronous generation and introducing significant variability. This paper evaluates the effects of high PV penetration on both dynamic frequency stability and operational planning. A simulation framework is developed to assess system performance under multiple PV penetration scenarios ranging from low to high shares of total generation. The study first analyzes frequency stability by examining the rate of change of frequency (RoCoF) and frequency nadir following disturbances, identifying the penetration thresholds beyond which operational security cannot be guaranteed. In parallel, the paper investigates the role of PV forecasting errors on reserve requirements and transmission scheduling. Results highlight that increased PV penetration magnifies the need for spinning and non-spinning reserves, while also causing congestion and curtailment risks in transmission networks. The combined analysis provides new insights into the operational and stability limits of transmission systems with high renewable penetration and emphasizes the importance of coordinated planning for secure grid integration.

Key words: Photovoltaic penetration, frequency stability, system inertia, forecasting uncertainty, reserve requirements, transmission congestion, curtailment, renewable energy integration.

OR-008

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Ab-initio Study of the influence of Zn incorporation on electronic structure and optical properties of Transition-Metal Mxenes $Ti_3C_2O_2$.

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Abstract:

MXenes, a family of 2D materials have attained marked attention due to their diverse compositions, abundant surface functional groups, flexible structure, and excellent stability[1], their stoichiometric formula is $M_{n+1}X_nTx$, where M is an early transition metal such as Ti , Cr, Ta, X is carbon(C) or nitrogen(N) ,Tx is functional termination such as O ,F,OH [2]. Ti3C2O2 MXene has been proposed as a promising electrode material for alkali-ion batteries and for climate monitoring applications owing to its tunable physical and chemical properties without sacrificing the excellent metallic conductivity and their exceptional thermal stability[3], [4] .In this study, we present a comparative study of the electronic structures and the optical properties for the **$Ti_3C_2O_2$** Mxenes and a double transition metal **$Ti_2ZnC_2O_2$ and $TiZn_2C_2O_2$** Mxenes **.** All calculations were performed using density functional theory implemented in the **Quantum Espresso package**[5].The results highlight the influence ofZn on the electronic and optical characteristics of these MXenes, revealing significant variations in their band structures and band gaps, which are crucial for understanding their potential applications in electronics, energy storage and catalysis.

Key words: Electronic properties , Density Functional Theory, DTM Mxenes.

References :

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Textile Wastewater Treatment via Photodegradation with a Diatomite-Based Magnetic Ferrite Catalyst

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Abstract:

This research explores the structural and chemical characteristics of ferrihydrite silicide, a material with established applications in integrated circuit contact terminals. A combination of analytical techniques—including X-ray diffraction (XRD), X-ray fluorescence (XRF), infrared (IR) spectroscopy, and scanning electron microscopy (SEM)—was used for comprehensive material characterization. The ferrihydrite silicide was synthesized through two distinct approaches: ex-situ thermal treatment and in-situ formation during sputter deposition on silica derived from diatomite. The preparation involved introducing ferrite into the diatomite matrix via the reaction of $FeCl_2$ with NaOH, facilitating ferrihydrite deposition. XRD results revealed that the original diatomite displayed an amorphous structure, which transitioned to a more ordered crystalline form upon conversion of ferrihydrite into various iron oxides. Identified crystalline phases included maghemite, magnetite, akaganeite, hematite, goethite, and schwertmannite. The photocatalytic activity of the ferrihydrite-modified diatomite (FMD1) was tested using Vat Green 03 dye as a model pollutant. The degradation efficiency was found to be highly pH-dependent, with maximum performance

observed under acidic conditions (pH 4). These outcomes underscore the potential of FMD1 as an effective photocatalyst for dye removal in wastewater treatment, particularly in environments with low pH.

Key words: ferrihydrite, silicide, diatomite, photocatalytic, dye.

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The environmental effects of plastic detritus

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Abstract:

This work illustrates the environmental impacts of plastic waste. All areas of activity have been impacted by plastic materials: packaging, agriculture, construction, agro-food, transportation, and the medical field. Among other things, these materials' varied characteristics account for their increased use. Over the past few years, environmental protection has been mandated as a fundamental consideration in the process of economic and social development. The trend toward more compact manufacture and consumption of plastic materials exacerbates the problem of plastic waste. One of the most crucial issues for maintaining the quality of the environment is the sustainable management of plastic waste, mostly for population health.

One of the most promising approaches to managing plastic waste is valorization.

Key words: environmental effects, plastic waste, and valuations.

References :

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[2] S. L. Lyles, S. Vattikuti, G. Kinney, A. Smith, B. R. Gautam, and C. M. Adhikari, "Structural Stability and Electronic Structure of (Ti,Ta)2C

MXenes," *J. Nepal Phys. Soc.*, vol. 10, no. 1, pp. 8–14, Dec. 2024, doi: 10.3126/jnphyssoc.v10i1.72828.
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Optimization of the workability of glass powder self- compacting concrete using the Taguchi design method

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Abstract:

This study investigates the optimization of the workability of Self-Compacting Concrete (SCC) incorporating recycled glass powder (GP) as a supplementary cementitious material (SCM) using the Taguchi design of experiments (DOE) approach. Recycled glass powder was employed as a partial replacement for cement to enhance sustainability and reduce environmental impact. A total of 18 concrete mixes were designed and proportioned based on the Taguchi orthogonal array method to systematically evaluate the influence of key mix parameters on fresh concrete performance. The fresh properties of SCC, including slump flow diameter, T50 flow time, and Visual Stability Index (VSI), were measured to assess flowability, filling ability, and segregation resistance. The Taguchi method facilitated the identification of optimal factor levels for achieving improved workability while minimizing experimental trials. The results demonstrate the potential of glass powder as an effective SCM in SCC, providing both environmental and performance benefits when appropriately optimized through statistical design methods

Key words: Self-Compacting Concrete, Recycled Glass Powder, Rheology, Taguchi design method

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Self-supporting structure vs confined masonry: What construction choices for seismic zones?

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Abstract:

In seismic zones, the structural system selected has a critical impact on the safety and durability of buildings. This study presents a comparative analysis between two structural approaches: traditional reinforced masonry and a self-stable structure based on geometric stability principles. Numerical simulations and structural analyses—both static and dynamic—were conducted to assess displacements, stress distribution, and failure modes. Results show that properly reinforced masonry provides good lateral resistance, while self-stable systems offer advantages in terms of energy dissipation and stress redistribution. The study concludes with recommendations for structural design adapted to seismic constraints and local construction practices.

Keywords: Self-stable structure, Reinforced masonry, Seismic zones, Structural performance, Energy dissipation

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Design and Deployment of Fiber Bragg Grating-Based Tilt Sensors for Real-Time Slope Monitoring

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Abstract:

Landslides remain a significant environmental hazard, threatening human lives and infrastructure. This study presents the design and deployment of a real-time slope monitoring system installed at Universiti Malaya. The system utilizes Fiber Bragg Grating (FBG)-based tilt sensors, distributed across upslope and downslope areas to detect surface ground movement with high sensitivity. A remote, solar-powered monitoring enables continuous data acquisition, processing, and transmission, providing early-warning alerts through our self-developed interface. Field integration procedures of the sensors involved custom coating and mounting solutions to ensure reliable long-term performance under harsh outdoor conditions. By leveraging photonics sensing and engineering innovation, the system provides a cost-effective and scalable solution not only for slope failure risk mitigation, but also in wider structural health monitoring applications.

Key words: Fiber Bragg gratings (FBG), ground movement monitoring, landslides, optical fiber sensors, real-time monitoring.

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Étude comparative de la dépollution des eaux usées par procédé de précipitation contrôlée

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Abstract:

La pollution des milieux aquatiques par les phosphates issus principalement des détergents et des engrais, constitue une cause majeure d'eutrophisation. Afin de limiter ce phénomène, des procédés physico-chimiques, notamment la cristallisation contrôlée sous forme de phosphate ammoniaco magnésien ou struvite ($MgNH_4PO_4 \cdot 6H_2O$), sont de plus en plus étudiés pour leur efficacité dans l'élimination du phosphore. Dans ce contexte, l'objectif principal de la présente étude est de suivre la cristallisation de la struvite, à 25 °C et à un pH optimal de 8,5, à partir d'eaux phosphatées réelles, et d'étudier l'effet des conditions environnementales sur les étapes de la cristallisation et la morphologie des cristaux de struvite.

Une étude comparative est présentée relative à l'efficacité de ce procédé par rapport à deux types d'eaux usées : des effluents industriels issus d'une usine de fabrication de détergents (WWH) et des eaux usées urbaines (WWT). Dans les deux cas, les conditions expérimentales ont été standardisées et le rapport molaire ajusté à 1:1:1 pour les ions phosphate, magnésium et ammonium afin de favoriser la précipitation optimale de la struvite. Les solides récupérés ont été caractérisés par MEB, IRTF et DRX.

À la lumière des résultats, il apparaît que les précipités formés dans tous les échantillons d'eaux traitées ont été caractérisés par MEB, DRX et IRTF, comme étant du phosphate ammoniaco magnésien (struvite) pur. L'observation par MEB montre, dans les deux types d'eau usée, de grands agrégats de struvite de taille allant jusqu'à 91.6 µm et 69.2 µm, respectivement. Le procédé donne une élimination significative du phosphore (sous forme de phosphate) de 67 % pour l'eau usée industrielle et de 62 % pour l'eau usée urbaine, confirmant ainsi la reproductibilité du procédé, quel que soit le type d'effluent. Il apparait alors, que le taux de sursaturation est le facteur le plus important qui influence ce processus de cristallisation. De plus, dans ce processus de cristallisation, le précipité de phosphate sous forme de struvite pourrait être utilisé comme une ressource alternative et inépuisable de phosphore et d'azote et peut être aussi valorisé comme fertilisant en agriculture.

En conclusion, la précipitation du phosphore naturellement présent dans l'eau, sous forme de struvite, constitue une alternative intéressante pour le traitement des eaux phosphatées usées aussi bien industrielles qu'urbaines.

Mots-clés: Phosphates, Struvite, Déphosphatation, Eaux usées, précipitation contrôlée, Effluents industriels.

Référence:

Atika Moulessehoul, Djamila Harrache, et al (2024). Phosphorus removal and recovery from water and wastewater by the struvite crystallization. ***Desalination and Water Treatment***, 320, 2024, 100902. https://doi.org/10.1016/j.dwt.2024.100902.

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How Desalination Affects Our Planet

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Abstract:

Faced with the growing scarcity of drinkable water globally, seawater desalination is increasingly viewed as a viable solution to meet the world's water needs. While this approach offers certain benefits, it's crucial to acknowledge the substantial environmental consequences associated with it. One of the major concerns is the significant energy demand of desalination processes, which contributes to the escalating problem of global warming.

Although desalination has been implemented and refined over the years in countries like Algeria, our understanding of its overall environmental impact remains limited due to a lack of extensive research. Therefore, it's essential to thoroughly investigate the potential effects of desalination on the surrounding ecosystem. Key areas of focus include the discharge of byproducts into the marine environment, the emission of air pollutants, and the overall energy requirements of the desalination processes themselves. By carefully examining these aspects, we can gain a more comprehensive understanding of the true environmental footprint of seawater desalination.

Keywords :

Desalination, drinking water, economy, impact on environment and society.

OP-016

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Superabsorbent Acrylamide-Based Hydrogels as Intelligent Materials for the Efficient Removal of Methylene Blue from Aqueous Solutions

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Abstract:

Water is the essential element of life: it is indispensable for human consumption, agriculture, and sanitation. Its contamination has severe health and environmental consequences. Among the most dangerous pollutants, dyes from industrial effluents render water unusable and pose a serious threat to humans, animals, and ecosystems. The textile industry, in particular, is one of the main sources of these harmful substances discharged into aquatic environments.

In response to this issue, hydrogels emerge as intelligent materials capable of trapping dyes in aqueous media. These three-dimensional polymeric networks possess strong hydrophilicity and exceptional swelling capacity, enabling them to absorb water as well as organic molecules such as dyes.

The aim of this work is the development of a superabsorbent hydrogel based on acrylamide, exhibiting remarkable swelling and hydrophilic properties, and capable of efficiently adsorbing methylene blue from aqueous solution. This material opens promising perspectives for the sustainable treatment of dye-contaminated water.

Key words: Hydrogel, Acrylamide, Methylene Blue, Wastewater Treatment.

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Structural, electronic and optical properties of rock salt $Mg_xCd_{1-x}O$ for optoelectronic applications: a first-principles approach

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Abstract:

We performed full-potential linearized augmented plane wave (FP-LAPW) to investigate the optoelectronic properties of $Mg_xCd_{1-x}O$ ternary alloys and their end binaries in the zinc-blende structure. We assessed $Mg_xCd_{1-x}O$ alloys over the entire S concentration range (with x from 0 to 1). The equilibrium structural parameters were determined by total energy minimization using the generalized gradient approximation (GGA- WC). Electronic properties of $Mg_xCd_{1-x}O$ ternary alloys in zinc blende structure, including band structures, band gaps values and density of states, are calculated via (TB-mBJ). The equilibrium lattice parameters and bulk modulus were calculated and analyzed for binaries and ternaries. The obtained results for the band structures are compared with the existing data in the literature. The calculated electronic band structures show that $Mg_xCd_{1-x}O$ ternary alloys have a direct band gap along with a semiconductor nature. In addition, the optical properties were calculated and discussed in details. Generally, we noticed that $Mg_xCd_{1-x}O$ ternary alloys possess a broad absorption spectrum covering the UV-Vis region and therefore make them suitable candidates for photovoltaic applications.

Keywords: $Mg_xCd_{1-x}O$ ternary alloys, Full-potential linearized augmented plane wave; (TB-mBJ) approach; Optical parameters, Photovoltaic; absorption coefficient

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Microbial Fuel Cells for protection of natural resources

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Abstract: the unsustainable nature and the environmental impact of fossil fuels have shifted attention to renewable energy and fuel cells, especially in the transportation sector. In this study, the generation of electricity based on the electrons released from biochemical reactions facilitated by microbes is evaluated. Microbial fuel cell (MFC) represents an eco-friendly approach to generating electricity while purifying wastewater concurrently, achieving up to 50% chemical oxygen demand removal and power densities in the range of 420–460 mW/m^2. The system utilizes the metabolism power of bacteria for electricity generation. This mini-review is quite comprehensive. It is different from other reviews, it is all-inclusive focusing on the; types of MFCs; substrates and microbes; areas of applications; device performances; design, and technology configuration. All these were evaluated, presented and discussed which can now be accessed in a single paper. It was discovered that higher power density and coulombic efficiency could be achieved through proper selection of microbes, mode of operation, a suitable material for construction, and improved MFC types. Also, the full-scale application of MFC is impeded by material and the wastewater low buffering capacity. Though the electricity generated is still at the demonstration stage, to date, there is no industrial application. Therefore, this study reviewed articles on the technology to set new and insightful perspectives for further research and highlighted steps for scale-up while reinforcing the criteria for microbe selection and their corresponding activity.

Keywords fossil fuels, Microbial fuel cell, power densities

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Artificial Intelligence for Physics

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Abstract:

The integration of artificial intelligence (AI) is currently revolutionizing physics research, introducing new paradigms for analysis and experimentation. Starting with a consideration of the diversity of human intelligences and their function in the scientific method, this conference offers a cross-disciplinary perspective on AI in the service of physics.

A technical overview of machine learning (ML), deep learning (DL), and physics-informed neural networks (PINN) will be presented, demonstrating how these methods revolutionize the modeling, simulation, and investigation of intricate physics phenomena. While DL enables the capture of large-scale nonlinear relationships, PINN incorporates the fundamental laws of physics as explicit constraints, opening the door for significant advancements in the resolution of differential equations or inverse optimization, whereas ML primarily depends on the exploitation of experimental data. The presentation will also address the concept of Large Language Models (LLM) and prompt engineering techniques, which expand reasoning, explanation, and hypothesis generation capabilities from natural language. Finally, concrete examples from the theoretical physics laboratory will illustrate the real impact of these methods in physics, whether in weather forecasting, the search for HSE electronic bandgaps

or the optimization of interaction potentials in molecular dynamics. Thus, this presentation proposes a dialogue between cognitive diversity, advanced numerical methods, and new forms of intelligence.

Key words: Artificial Intelligence, Machine Learning, Deep Learning, Physics-Informed Neural Networks, Physical Prediction

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Numerical study the degradation of III-V semiconductor-based tandem solar cells in the space environment

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Abstract:

A tandem solar cell is a photovoltaic device made of different absorber materials, instead of just one for single cells. Such cells are able to exceed the Shockley-Queisser limit. In the case of III-V semiconductor materials, they have demonstrated efficiencies greater than 38%. For this reason the space industry is starting to use multi-junction solar cells. These cells are exposed to a radiation environment composed mainly of electrons and protons. In this context, we will study the functioning of tandem photovoltaic cells based on III-V semiconductors by two-dimensional digital simulation under illumination with an AM0 spectrum performed under SILVACO / ATLAS. than we simulate the effects of irradiation of tandem photovoltaic cells based on III-V semiconductors by starting from SRIM - 2013 we will be particularly interested in irradiation by low energy protons (10 keV to 10 MeV) for study the degradation of tandem solar cells in the Space Environment and its influence on the performance of these cells.

Key words: . solar cells; semiconductor III-IV; tandem; the Space Environment; SILVACO-Ticad, SRIM-2013.

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OR-021

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Quantum Complex Materials :Realizations and Challenges

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Abstract:

On celebrating event of the centenary international year of Quantum Mechanics , by UNESCO and International Academy of Sciences ? let's give a tribute to all scientists having working to develop this fields projected on many life applications benefits …!! My modest contribution focus ,is centered on peculiar study, developed on such emergent arising of Quantum Complex Materials .They are qualified by novels smarts properties revealed by strong correlations exchanges du to many spin body electrons (Si , Sj) interacting between them ,then with orbital momentum (Si , Li) ,also interacting with atomic nucleus ,so that influencing behaviors ,must be explained by quantum mechanics modeling tools .The concept of stable equilibrium point ,corresponding to a minimal Eigen total energy of targeted material sample assumed like a quantum well , is so different from the unique classical thermodynamic one .More surprising effects display numbered other distant stables equilibrium points doted by interesting new phenomena ,

Recent material science classifies them : (advanced , sophisticated , multifunctional) new materials .We list certain : superconductivity, half metal, semi metal , topological insulator , meta material, spin glass , spintronic , magneto electronics , thermoelectric , magneto calorie , magneto optic , induce new types of quasi particles , giant n^{th} harmonic generation, resonances phenomena ,evanescent waves , (exciton ,plasmon, polaron, skyrmion ,magnon photon ,positron ,negatron) as quantum states .Industry manufactures them like magnificent devices ,engines , screens , quantum black box ,cells , sensor , informatics memories and junctions .A perfect coordination is established between three options : Material Science , Quantum Mechanics and Physics Particles , to enhance technologies.

Key words: Condensed Matter ;Quantum Wells ;Transfer Phenomena ;Strong Correlations ; Meta Materials ; Quasi Particles.

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OR-022

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Electronic, and thermoelectric properties of half-heusler compounds PtTiM (M=Si, Ge): a first principles study

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Abstract:

In this work, we employed first-principles calculations based on density functional theory (DFT) implemented within the WIEN2k package to investigate material properties of PtTiM alloys (M = Si, Ge). This investigation composed of structural, mechanical, electronic, and thermoelectric characteristics.. The obtained results demonstrate that PtTiSi and PtTiGe exhibit both anisotropic and elastically stable characteristics. An indirect bandgap semiconducting behavior was observed for both alloys with bandgaps of 1.2 eV and 1.05 eV for PtTiSi and PtTiGe, respectively. Analysis of Young's and shear modulus revealed that PtTiSi possesses superior stiffness compared to PtTiGe. Moreover, this research suggests the potential of these alloys as efficient thermal insulators for solar heating applications. Finally, we compute the temperature-dependent thermoelectric properties using the BoltzTrap code, providing valuable insights into their potential applications in thermoelectric devices.

Key words: DFT, Half-Heuslers, Wien2k, Thermoelectric, Electronics.

OR-023

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Phase-Change Material–Enabled Optical Reconfigurable Intelligent Metasurfaces for Dynamic Atmospheric Turbulence Compensation in Free- Space Optical Communications

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Abstract:

This paper proposes a novel approach to enhance the performance and reliability of Free-Space Optical (FSO) communication by integrating an Optical Reconfigurable Intelligent Metasurface (ORIM) into the receiver system, placed in front of or on the existing FSO receiver lenses. FSO links, while offering several advantages, are highly susceptible to atmospheric turbulence, which distorts the optical wavefront, leading to significant signal fading and link outages. Conventional adaptive optics systems, designed to correct these aberrations, are often bulky, complex, and power-intensive. We propose the design and the feasibility study of an ORIM by leveraging the tunable properties of nanomaterials to create a compact and energy-efficient solution. ORIM can dynamically corrects wavefront aberrations in real-time by actively tuning the optical properties of its nanostructured elements. Among the most promising material types for such devices are Phase-Change Materials (PCMs) — notably $Ge_2Sb_2Te_5$ (GST), its low-loss derivative GeSbSeTe (GSST) for near-infrared applications (NIR) and wide-bandgap compounds like Sb_2S_3 and

Sb_2Se_3, which are well- suited for telecom wavelengths (C-band)—as well as Transparent Conducting Oxides (TCOs) like Indium Tin Oxide (ITO), which exhibit high optical transparency and epsilon-near-zero (ENZ) properties. These materials combine fast switching speeds with a large and non- volatile change of optical properties, making them well-suited for real-time atmospheric turbulence compensation in an FSO system. The core of this research is a simulation framework in OptiSystem where the ORIM's functionality is modeled as a custom correction block, inserted in the optical path immediately before the photodetector. This model emulates the metasurface's ability to counteract phase distortions induced by turbulence, thereby preserving the signal's integrity. Simulation results reveal notable improvements in Bit Error Rate (BER) and Q-factor, even under strong turbulence conditions, confirming the feasibility of this approach. The findings underline the pivotal role of emerging functional materials in enabling next-generation intelligent metasurfaces for optical wireless technologies.

Keywords: FSO, Atmospheric Turbulence, Intelligent Metasurfaces, PCMs, OptiSystem Simulation.

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OP-024

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Calcul et prédiction de la viscosité plastique des bétons écologiques et conventionnels

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Abstract:

Cet article présente un nouveau modèle rhéologique permettant d'estimer la viscosité plastique du béton écologique (béton à forte teneur en addition minérale) et du béton ordinaire. Le modèle proposé repose sur l'hypothèse que le béton se divise en deux échelles : la pâte (eau, ciment, addition et superplastifiant) et les granulats (sable et gravier). Les prévisions du modèle sont évaluées à l'aide de résultats expérimentaux obtenus à grande échelle à l'aide d'un nouveau rhéomètre récemment mis au point, doté d'une nouvelle géométrie de lame afin de minimiser la ségrégation du béton pendant l'essai. L'évaluation du modèle proposé à l'aide des résultats expérimentaux a montré que le modèle correspond bien à la viscosité des bétons écologiques (avec ajout de minéraux) ainsi qu'à celle des bétons ordinaires (sans ajout). Le modèle développé décrit bien la viscosité du béton en fonction de la nature et du taux de remplacement par des additions minérales ajoutées et de l'effet du superplastifiant. La validation a montré que le modèle prédit la viscosité du béton avec une erreur d'environ ± 11 %.

Key words: Viscosité plastique, béton écologique, rhéologie, addition minérale, superplastifiant, modèle de viscosité.

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Etude des propriétés optoélectroniques du composé ternaire CdSSe

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Abstract:

Actuellement les progrès technologiques et industriels dépendent fortement de l'avancement de la recherche dans le domaine des matériaux dont de nouvelles caractéristiques doivent être prises en compte. Notre investigation sur le composé étudié aujourd'hui nous renseigne sur les différentes propriétés optoélectroniques.

Cette étude est une contribution à la compréhension des propriétés physiques de ce matériau. Le travail réalisé a été effectué grâce à la méthode de premier principe basée sur le formalisme de la théorie de la fonctionnelle de la densité DFT en vue d'étudier les propriétés optoélectroniques. Cette méthode a été codée selon le package WIEN 2k. Le potentiel d'échange et de corrélation est traité par l'approximation du gradient généralisé GGA-PBE et par l'approximation du potentiel modifié de Becke-Johnson mBJ-GGA-PBE.

Dans un premier temps, nous avons présenté une étude détaillée sur les propriétés électroniques et optiques des deux composés binaires parents CdS et CdSe. Ensuite nous avons calculé les propriétés électroniques de l'alliage ternaire considéré dans la phase zinc-blende pour les différentes concentrations x (x = 0 ; 0.25 ; 0.50 ; 0.75 ; 1). D'après les résultats des structures de bandes et des densités d'états en utilisant la GGA-PBE et la mBJ-

GGA-PBE, il est clair que l'alliage $CdS_{1-x}Se_x$ présente un caractère semi-conducteur dans la phase citée. CdS et CdSe ainsi que leur alliage possèdent un gap direct dans la direction $\Gamma \longrightarrow \Gamma$. Les valeurs des gaps calculés par l'approximation GGA se rapprochent de celles de l'expérience.

Nous avons aussi déterminé les propriétés optiques des deux binaires CdS, CdSe et de leur alliage ternaire CdS1-xSex telles que l'indice de réfraction n(ω), la dispersion des parties réelle ε1(ω) et imaginaire ε2(ω) de la fonction diélectrique et du coefficient d'extinction K(ω) calculée avec les deux approximations : la GGA-PBE et la mBJ-GGA-PBE.

Key words: DFT, FP- LAPW, alliage semi-conducteur, optoélectronique, concentration x.

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OR-026

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5-Fluorouracil quantification by LC-MS/MS in plasma of cancer patients

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Abstract:

Background

5-Fluorouracil (5-FU) has been extensively employed as an anticancer medication. However it may result in severe toxicity.

Patients and Methods

6 cancer patients were included in this study. Blood samples were collected. After extraction with organic solvent, 5-FU plasma level was evaluated using liquid chromatography–mass spectrometric (LCMS/MS) method equipped with C18 column with a mobile phase consisting of formic acid and methanol.The optimum flow rate and column temperature were also determined.

Results

Results show no toxicity among femeles (100%), with plasma uracil levels ≤ 12 ng/ ml , whereas 2 of the 3 males experienced toxicity (≥ 18 ng /ml). On the other hand one can show that the age can be potential factor since all patients ≤ 60 years tolerated the treatment.

Conclusions

The LC-MS/MS method could be successfully applied to assess the toxicity in patients subjected to *5-FU* based *chemotherapy*.

Key words: Toxicity, 5fluorouracil , cancer, plasma, LC-MS/MS

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Harnessing Microbial Diversity for Sustainable Hydrocarbon Pollution Mitigation

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Abstract:

Hydrocarbon pollution poses a major threat to biodiversity and environmental health [1]. The use of microorganisms has been highlighted as a promising alternative for the bioremediation of petroleum hydrocarbons [2]. In this context, our study explores microbial diversity as a natural resource for bioremediation strategies.

Microorganisms isolated from crude oil–contaminated sites were screened for hydrocarbon tolerance, degradation capacity, and biosurfactant production. Two selected isolates demonstrated significant biodegradation capacity, achieving 47.0% and 49.6% hydrocarbon degradation, respectively. When applied as a consortium, their performance was markedly enhanced, reaching 64.3% degradation efficiency. In addition, biosurfactants were successfully extracted from culture supernatants, confirming the ability of the isolates to produce surface-active compounds that increase hydrocarbon bioavailability and represent an eco-friendly alternative to chemical surfactants.

Our findings highlight the crucial role of microbial biodiversity in mitigating pollution and reducing its associated risks. This work underlines the potential of bioremediation as a

sustainable approach to restore contaminated environments and protect ecosystem and human health.

Keywords: Biodegradation, Biosurfactants, Microbial diversity, Bioremediation, Hydrocarbon pollution

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Impact du plomb sur l'environnement et la santé

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Abstract:

Le plomb est un métal mou qui a eu beaucoup d'application au fil des ans. Le plomb contamine l'environnement y compris le sol, air et eau via les activités humaines et sa présence naturelle, s'accumulant dans les organismes et présentant des risques pour la santé. Selon l'organisation mondiale de la santé, l'exposition au plomb a causé plus de 1,5 million de décès dans le monde en 2021, principalement en raison d'effets cardiovasculaires..

L'objectif de cette étude bibliographique c'est de connaitre les sources d'exposition au plomb dans l'environnement, Comment le plomb affecte l'environnement ainsi que les effets du plomb sur l'environnement et la santé.

Il n'existe pas de seuil au-dessous duquel l'exposition au plomb n'aurait pas d'effets nocifs.Il est crucial de réduire l'exposition en nettoyant les poussières, en utilisant des filtres à eau et en gérant les déchets, car même de faibles quantités de plomb peuvent être dangereuses, particulièrement pour les jeunes enfants.

Mots clés : Plomb, environnement, santé, exposition, jeunes enfants.

Poster Communications

P-001

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Title: Optoelectronic properties of MgSO ternary alloys in rock salt phase

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Abstract:

We present a theoretical study on the structural and optoelectronic properties of MgS_xO_{1-x} ternary alloys in rock salt phase. These properties have been described using the full-potential linearized augmented plane wave (FP-LAPW) formalism within the framework of density functional theory (DFT). Structural properties and total energies of MgS_xO_{1-x} ternaries have been calculated using generalized gradient approximation of Wu and Cohen (WC-GGA) approach for different concentrations (x). Based on the regular solution model, we have determined the thermodynamic stability of MgS_xO_{1-x}. In addition to (WC-GGA) approach, we have employed (TB-mBJ) approach to study the electronic properties. Furthermore, we investigated in detail the optical properties of MgS_xO_{1-x} ternaries. The calculation confirms that the MgS_xO_{1-x} ternary alloys are promising candidate for optoelectronics, and in particular for photovoltaic application.

Key words: Ternary alloys; Optoelectronic properties; Density functional theory (DFT); (TB-mBJ)

P-002

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Title: **Prediction of optoelectronic properties for $Be_{0.750}Cd_{0.250}Se$ ternary alloy with (TB-m BJ) approach for photovoltaic applications**

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Abstract:

We present an ab-initio investigation of optoelectronic properties of $Be_{0.750}Cd_{0.250}Se$ ternary alloy**.** These properties have been calculated using the first-principles calculations based on the density functional theory. Generalized gradient approximation of Wu and Cohen (GGA-WC) has been used to compute the structural properties The evaluated lattice constant (in Å) and bulk modulus (in GPa) of are 5.5057 and 71.6365 respectively, and are very close to the existing data in the literature. we used the (LDA) and the recently (TB-m BJ) approaches to calculate the electronic and optical properties of the ternary. The electronic result show that the $Be_{0.750}Cd_{0.}$250Se has a direct-band gap semiconductors equal to 3.649 eV. The optical properties, including complex dielectric function, complex refractive indices, absorption coefficient, optical conductivity and normal-incidence reflectivity have been calculated and analyzed. Based on the obtained results,$Be_{0.750}Cd_{0.}$250Se ternary alloy can be utilized is suitable candidates for photovoltaic applications.

Keywords: FP-LAPW method; ternary compounds; $Be_{0.750}Cd_{0.250}Se$; Electronic structure; Optical properties.

P-003

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Ab-initio investigation of half-metallic ferromagnetism in half-Heusler compounds XYZ (X=Rb and Cs ; Y= Cr ; Z=Se)

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Abstract:

In this work, first principle calculation of structural, electronic, magnetic and thermodynamic properties of the half-metallic ferromagnetic Half-Heusler compounds RbCrSe and CsCrSe are presented. We have applied the full-potential linearized augmented plane waves plus local orbitals (FP-LAPW+lo) method based on the density functional theory (DFT). For the exchange and correlation potential generalized-gradient approximation (GGA) is used .

We found that the RbCrSe and CsCrSe in the ferromagnetic state are more favorable than the antiferromagnetic state and they exhibits half-metallic ferromagnetism, the computed equilibrium lattice parameters agree well with the available theoretical and experimental data. The calculated total magnetization of 1 μB is in excellent agreement with recent experiments.

We give also a comparison between the standard generalized gradient approximation (GGA) and the modified Becke–Johnson exchange potential approximation (mBJ–GGA) on the electronic and magnetic properties.

Key words: Half-Heusler compound; Half-metallic; Half-metal; FPLAPW + lo

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P-004

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Structural and electronic properties of the quaternary $Ga_{1-x}Sb_{1-y}Tl_xBi_y$ alloys

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Abstract:

We report on the structural and electronic properties of $Ga_{1-x}Sb_{1-y}Bi_yTl_x$ alloys, considering Tl and Bi substitutions in a cubic lattice for x = 0 and y = 0%, 25%, 50%, and 75%. First-principles calculations within PBE-GGA and TB-mBJ frameworks were employed. The lattice parameter fitted using **Vegard's law**. Band structure analyses reveal that the alloys display metalic, **half-metallic and semi-conductor** characters.**Key words:** Water table, Soil salinity, Hydro-halomorphy, Spatial variability, Gypsum crusts, Algerian Sahara, Oasis agriculture.

Keywords: Alloys; DFT; band gap; DOS

P-005

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Simulation of The Base Layer for Solar Cells Based SiGe

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Abstract:

The Silicon germanium alloys are of great interest for thin film solar cells, thanks to their adjustable bandgap and stronger absorption when compared to Si [1]. In this work we were simulated using the one dimensional simulation program called analysis of microelectronic and photonic structures (AMPS-1D). In the modeling, the thickness of the base layer was varied from 4 to 7 µm. The rest of layer's thicknesses were kept constant, by varying thickness of the base layer the simulated device performance was demonstrate in the form of current-voltage (I-V) characteristics and quantum efficiency (QE).

The simulation result shows that the maximum efficiency of 16.26 % has been achieved, with short circuit current density of 32.68 mA/cm^2 , open circuit voltage of 0.61 V and fill factor of 0.809. The obtained results show that the proposed design can be considered as a potential candidate for high performance photovoltaic applications.

Key words: SiGe, AMPS 1D, Base, Thin film, Simulation

P-006

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Molecular Design and Nonlinear Optical Properties of 2-Nitrophenyl 4-(Octyloxy) Benzoate for Energy Materials Applications

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Abstract:

The design of advanced energy materials with optical functionalities requires a clear understanding of their molecular and electronic structures. In this study, we examined the structural, electronic, and nonlinear optical (NLO) properties of 2-nitrophenyl-4-(octyloxy)benzoate (2-NPOB) to evaluate its potential as a functional material for energy applications. The molecular geometry was optimized using density functional theory (DFT), which provided detailed insight into torsion angles and bond lengths, helping to clarify its conformational behavior. Simulated FT-IR and $^{1}H/^{13}C$ NMR spectra were used to characterize vibrational and electronic features, showing good agreement with the expected molecular signatures. UV-Visible calculations identified the main electronic transitions, while molecular electrostatic potential (MEP) mapping highlighted regions of electrophilic and nucleophilic activity. In addition, the calculated dipole moment, polarizability, and first hyperpolarizability values confirm the strong NLO response of 2-NPOB, supporting its relevance for energy and optoelectronic applications. Overall, this work demonstrates how combining spectroscopic analysis with theoretical modeling can guide the development of new materials for sustainable energy technologies.

Key words: 2-NPOB, DFT, FT-IR, MEP, NLO.

P-007

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Enhancing Earthen Dikes with Binders: A Civil Engineering Approach for Agricultural Irrigation and Drought Resilience

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Abstract:

In recent decades, the agricultural sector has increasingly suffered the consequences of climate change, including the formation of cracks in arable soils and the degradation of vegetation cover, particularly during intense and atypical summer rainfall events. Earthen dikes play a key role in mitigating these effects by supporting the restoration of soil integrity and serving as essential barriers for crop irrigation and livestock watering. In civil engineering, these dikes are classified as hydraulic or geotechnical structures, commonly built using compacted soils—especially low-permeability materials such as clays. However, the accumulation of water or mud can significantly compromise their stability and functionality. This study explores the reinforcement of earthen dikes using widely available binders such as Portland cement, lime, and gypsum. The methodology involves mechanical and structural analysis to evaluate strength, deformation behavior, and resilience across different soil types, binder combinations, and concentrations. The objective is to improve the mechanical performance of these structures and enhance their effectiveness in supporting sustainable

agricultural water management. The proposed solutions aim to contribute to more resilient irrigation systems and promote economic gains through improved infrastructure in the agricultural sector.

Keywords: Engineering dikes, Climate change impacts, Hydraulic and Geotechnical Engineering, Binder utilization, economic benefits

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Title: Numerical study of a water/soil heat exchanger "Cooling using geothermal energy"

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Abstract:

In this project, we are trying to evaluate the performance of a water/soil heat exchanger (cooling case). The work concerns the improvement of heat transfer in U-shaped tube heat exchangers operating in convection. The characteristics of the flows and associated heat transfer around the studied system are mainly studied. We performed numerical simulations of our problem using the Ansys 15.0.0 software under the Ansys Fluent code for different Reynolds numbers, different geometries of U-shaped tubes, and a constant temperature around the ground. We carried out a test bench that allowed us to make a comparative study between a simple geometry, a geometry with undulating obstacles, and one with rectangular corrugations. The good agreement between the numerical results obtained shows that the use of rectangular obstacles has a good effect on the exchanger performance. The temperature difference observed in this study determines the possibilities offered to the technique of geothermal cooling for use in sites of various climates in Algeria.

Key words: Geothermal cooling, Heat exchanger, Performance, Ansys fluent.

P-009

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Title: **Supervised Machine Learning for Predicting and Optimizing $MAPbI_3$ Perovskite Solar Cell Performance**

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Abstract:

Hybrid organic–inorganic perovskites, and particularly $MAPbI_3$, stand out for their high efficiencies and strong potential in sustainable photovoltaic applications. In this work, we developed a comprehensive database gathering key parameters related to electron transport layers (ETL) and hole transport layers (HTL)—including stack sequences, thicknesses, deposition procedures, and additives—along with perovskite compositions, device architectures, and experimental photovoltaic performance indicators (Voc, Jsc, FF, and PCE).

Based on this dataset, we applied supervised machine learning methods to analyze the relationships between fabrication parameters and device efficiency. The trained models were further employed to predict the performance of novel perovskite compositions, particularly tin-based systems, paving the way for the design of high-efficiency and environmentally friendly solar cells.

This study highlights the potential of supervised machine learning as a data-driven approach to guide material selection and accelerate the optimization of perovskite photovoltaic devices.

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Key words:

Perovskite solar cells, HTL,ETL,machine learning, PCE

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Theoretical investigation of the plasma chemistry of CO_2 with 4% of O_2 by non-thermal plasma discharge

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Abstract:

This work is focused on modeling of the reaction kinetics of a gas mixture excited by an electrical discharge. We used a mixture consisting of (O_2 and CO_2). In this study, the kinetic model considers species that react with each other according to a set of selected reactions. This set is established from a critical analysis of published spectroscopic and kinetic data, based on several research studies. The selected reactions satisfactorily account for the kinetic behavior of the discharge and include the formation of ozone and the decomposition of carbon dioxide.

The chemical kinetics model is based on solving the system of differential equations using the fourth-order Range Kutta numerical method and allows us to determine the temporal variations of the species created in the discharge cell. It also highlights the effect of discharge parameters, namely the percentage of CO_2 in the CO2/O2 gaz mixture.

Key words: DBD, CO2/O2., Non thermal plasma., Plasma chemistry.

P-011

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Title: Spray coated of Pure and Molybdenum doped ZnO and the effect of doping on structural, optical and morphological properties

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Abstract:

Pure and Mo-doped ZnO thin films were synthesized via spray pyrolysis technique. The influence of Mo concentration on their structural, optical and surface morphological properties was investigated by using XRD, UV-VIS, SEM and AFM respectively.EDX analysis confirms ZnO formation with the presence of Mo dopant in the films. The XRD analysis confirmed that all the films have well crystallized with hexagonal wurtzite structure. All the synthesized films show high transmittance (above 83%) in the visible region of 400-700 nm. The surface morphology of the films indicated a remarkable increase in grain size with an increase in Mo concentration..As regards the band gap of the films, it was found that it increased from 3.23 eV to 3.275 eV as the concentration of Mo doping increased.

Key words: ZnO, Mo-doped ZnO, Spray Pyrolysis, band

P-012

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Insight into Structural, Electronic, Mechanical and Thermoelectric Properties of $In_2PbSnCl_6$ promising Double perovskite

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Abstract:

This study investigates the structural, electronic, mechanical and thermoelectric properties of double perovskites, with the primary aim of providing theoretical insights into their potential use in thermoelectric device technologies. The $In_2PbSnCl_6$ was optimized using the full-potential linearized augmented plane wave (FP-LAPW) method. The equilibrium parameters indicate that $In_2PbSnCl_6$ crystallize in tetragonal structure P4/mmm. Electronic calculations within the generalized gradient approximation (GGA) framework reveal that the material is an indirect band-gap semiconductor with a band-gap value of 1.263 eV. The evaluation of elastic constants confirms the mechanical stability of the studied double perovskite, while also indicating its ductile nature. These results not only verify the structural robustness under applied stress but also demonstrate its suitability for technological and structural applications where both stability and ductility are critical. The transport coefficients were computed with high accuracy using the BoltzTraP simulation package. The results show notable electrical

conductivity, a large Seebeck coefficient ($S = 1880\ \mu VK^{-1}$ at 300 K), and an average figure of merit close to unity ($ZT = 1$). These results emphasize the multifunctional potential of the material and point to its relevance for diverse applications, particularly in thermoelectric conversion and solar energy technologies.

Key words: FP-LAPW, Bands, mechanical stability, thermoelectric performance, Seebeck coefficient.

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Discovery of the Physical Properties of Transition Metal Oxide Spinel Via First Principles Calculations

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Abstract:

In this work, we report the trends in the physical properties of the Co-based Oxide spinel compound. The data are obtained from density functional theory (DFT) calculations using the full-potential linearized augmented plane wave (FP-LAPW) method. The computed equilibrium lattice parameter shows excellent agreement with the available experimental data. Particular attention has been given to the determination of the spin-polarized density of states (DOS) and band structure, which reveal the magnetic semiconductor nature of the compound with an indirect band gap. The DOS diagrams indicate a dominant contribution from the d-states. Furthermore, the significant total magnetic moment confirms the potential of this material for spintronic applications and magnetic recording.

Key words: DFT, DOS, magnetic moment, magnetic recording.

P-014

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Title: Effect of kaolinite on the mechanical and hydraulic properties of a compacted clay from Oran, Algeria

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Abstract:

The purpose of this paper is to study the effect of kaolinite content on hydraulic and mecanical characteristic of the clay of Oran. The study was carried out on the natural clay of the Krishtel (western Algeria), compacted under Standard Optimum Proctor conditions. These clay were treated at different percentages of kaolonite (1, 3, 5 and 7%).

The results show that the compaction characteristics are affected by the addition of kaolonite, the optimum water content increases and the maximum dry unit weight decreases in the presence of a large amount of kaolonite. In the case of the liquid limit decreases, and the plastic limit increases with the amount of kaolonite. The tests conducted to evaluate the hydraulic conductivity of the treated clay show an increase in permeability just after the treatment, followed a decrease as a function of the curing time measured by Falling-Head and Oedometer tests. These findings contribute to the development of effective and locally sourced materials for road construction.

Key words: kaolinite, clay of the Krishtel, materials for road.

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Title: "Computational exploration of the structural, elastic, and optoelectronic properties of cubic $GaPbBr_3$ perovskite for photovoltaic applications"

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Abstract:

We studied the structural, optoelectronic, and elastic properties of cubic perovskite $GaPbBr_3$ using density functional theory (DFT) within the WIEN2k code. The compound was confirmed to crystallize in the cubic phase (space group Pm-3m), with an equilibrium lattice parameter consistent with previous reports. Band structure calculations indicate semiconducting behavior, while optical analysis determined the absorption coefficient and the real and imaginary parts of the dielectric function. The computed elastic constants verify the mechanical stability of the compound, underscoring the potential of $GaPbBr_3$ as a promising candidate for photovoltaic applications.

Keywords: DFT, $GaPbBr_3$, WIEN2k, optoelectronic, photovoltaic

P-016

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Title: "Investigation Of the Thermodynamic And Electronic Properties of Double Perovskite Ba_2YNbO_6 "

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Abstract:

The cubic double perovskite Ba_2YNbO_6 compound was systematically studied with respect to its structural, electronic, and thermodynamic properties using density functional theory (DFT) within the generalized gradient approximation (GGA), as implemented in the Wien2k code. The optimized structural parameters were found to be in close agreement with the available experimental data. The electronic band structure, along with the total and partial densities of states, was analyzed to elucidate the nature of the band gap and the contributions of different atomic orbitals. The calculations reveal that the material exhibits a direct band gap at the Γ- Γ point of the Brillouin zone. In addition, thermodynamic properties such as the Debye temperature, bulk modulus, and heat capacity were evaluated under various temperatures and pressures. The findings demonstrate that both temperature and applied pressure play a significant role in determining the thermodynamic behavior of the compound Ba_2YNbO_6.

Keywords: DFT, Ba_2YNbO_6 , WIEN2k, Thermodynamic properties, Simulation.

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Simulation of a microgrid integrating photovoltaic generation and a battery storage system into the power grid

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Abstract:

The decentralization of energy production and the rise of renewable energies represent today a major challenge for the stability and flexibility of electrical grids. For this reason, microgrids have emerged as an innovative solution enabling the local integration of energy sources, particularly photovoltaics. This article presents a simulation of a microgrid integrating a battery energy storage system, connected to the power grid via a distribution transformer. The considered microgrid includes photovoltaic generation, a battery controlled by a controller ensuring the balance between production and consumption, and several residential loads. The simulations carried out under MATLAB make it possible to analyze the dynamic behavior of the microgrid, particularly in the face of solar irradiation variations and load fluctuations. The obtained results highlight the positive impact of the photovoltaic-battery coupling on voltage stability, energy flow management, and the reduction of consumption peaks.

Key words: Photovoltaic , Energy storage system, Microgrid , MATLAB

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Title: **Étude des Propriétés Statiques de Diffusion des Mélanges Binaires de Polymères Ramifiés en Étoile.**

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Abstract:

L'étude quantitative des propriétés de diffusion des systèmes polymères ramifiés de topologie arbitraire présente un grand intérêt dans la dernière décennie. Pour cette raison, le présent travail est consacré à l'étude des propriétés statiques de diffusion des mélanges de polymères ramifiés en étoile à branches linéaires A / polymère en étoile à branches linéaires B. Pour atteindre l'objectif de cette étude, nous avons utilisé l'approximation de la phase aléatoire (RPA). Nous avons également varié le nombre de ramifications f et comparé le comportement de diffusion des polymères ramifiés en étoile à leurs homologues linéaires ayant le même degré de polymérisation. Les courbes ainsi trouvées ont montré, en particulier, que le facteur de structure des systèmes polymériques d'une topologie donnée est plus important que celui des chaînes linéaires ayant le même nombre de monomères. Cela se produit pour toutes les valeurs du vecteur d'onde et des paramètres considérés. Cette différence montre clairement le rôle de la ramification des chaînes, qui conduit à une réduction des fluctuations de concentration des monomères.

Key words: polymères ramifié en étoile, approximation de la phase aléatoire RPA, facteur de structure, facteur de forme.

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A Tree-Based Machine Learning Reservoir Proxy Model for Optimizing Well Placement and Well Control Parameters

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Abstract:

In the present work, well placement (injectors and producers) and well control parameters were optimized with an objective of maximizing cumulative oil production (COP). A novel tree-based machine learning proxy, Extreme Gradient Boosting, was developed using dataset presented in previous studies in the literature and derived from a heterogeneous reservoir model of 2,304 grid blocks. The proxy model was integrated as the objective function within a Bayesian optimization framework to maximize oil recovery, while its hyperparameters were efficiently tuned using Tree structured Parzen algorithm. The final model exhibited high predictive accuracy, achieving an R^2 of 0.998 and an RMSE of 0.20, confirming both robustness performance and high precision, particularly after validating on an independent test set ensuring strong generalization and prevent overfitting. The optimized development plan yielded cumulative production slightly above 125 MMSTB, surpassing existing approaches in the previous studied. To the best of our knowledge, and within the presented dataset, this approach outperformed existing studies on the final optimized value across the three optimization strategies: (i) well control optimization, (ii) well placement optimization,

and (iii) combined well placement and control optimization—each providing higher recovery outcomes. The overarching objective was to accelerate field development planning by eliminating the need for repeated full-scale reservoir simulations, which are typically time-consuming and computationally intensive.

Key words: Extreme Gradient Boosting, proxy model, Bayesian, Optimization, Cumulative oil produced, Tree structured Parzen Estimator.

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Title: Molecular Dynamics: A New Perspective on the Mechanical Properties of Bituminous Materials

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Abstract:

Bitumen plays a fundamental role in road construction and surfacing, directly influencing the durability and performance of transport infrastructure. As a complex material, bitumen has a chemical composition that varies depending on its origin and refining processes. A deep understanding of its molecular composition and physical behavior is crucial for optimizing its properties and developing innovative materials. Molecular Dynamics Simulations (MDS) emerge as an essential method for exploring molecular-level interactions of bitumen, providing valuable insights into its characteristics.

This study focuses on the applications and advanced characteristics of MDS, highlighting molecular interactions, the behavior of different phases, and the mechanical and thermal properties of three types of bitumen: AAA-1, AAK-1, and AAM-1. Experimental results show that bitumen AAA-1 exhibits the highest Young's modulus (1.506 GPa), indicating superior stiffness compared to AAK-1 (1.348 GPa) and AAM-1 (1.337 GPa). This difference in stiffness can be attributed to the specific chemical composition of each type of bitumen, as

well as the molecular structure that promotes stronger bonds in the case of AAA-1. Furthermore, a systematic decrease in Young's modulus is observed with increasing temperature, emphasizing the thermal sensitivity of the materials. The simulations also reveal differences in anisotropy in the mechanical properties of the bitumens. For example, the Young's modulus along the Z-axis for AAA-1 reaches 2.218 GPa, while the modulus along the Y-axis is 1.099 GPa, indicating a more structured molecular organization in the Z direction, which enhances mechanical strength. In contrast, AAK-1 and AAM-1 show more homogeneous Young's moduli, suggesting a less oriented and more flexible structure.

The conclusion of this study underscores the potential of MDS to deepen research on bitumen, paving the way for a better understanding of the material and optimizing bituminous products and infrastructure. The results obtained not only identify the relationships between molecular composition and mechanical properties but also guide the development of bitumen formulations better suited to the specific requirements of road infrastructure. By integrating this knowledge, it becomes possible to design more durable and high-performing materials that meet contemporary challenges in road engineering. Thus, this research contributes to the advancement of construction technologies and the improvement of infrastructure durability, while offering prospects for future innovations in the field of bituminous materials.

Keywords: Molecular Simulation, Bitumen, Mechanical Properties, Young’s Modulus

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Study of the effect of dust on photovoltaic modules in the Naama region

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Abstract :

This study presents an experimental study using Arduino Uno aimed at analyzing the impact of dust on the performance of photovoltaic panels. Dust accumulation on the surface of solar modules is a major factor in the degradation of their performance. To quantify this effect, a series of experiments were carried out in real conditions, comparing the performance of clean panels and panels covered with different amounts of dust. The main electrical parameters such as current, voltage, maximum power and energy yield were measured. The results obtained show a significant decrease in output power and efficiency with increasing dust deposition. This work highlights the importance of regular cleaning of panels and provides recommendations to minimize energy losses due to fouling. These results can contribute to improving maintenance strategies and optimizing solar energy production in the Naama region which is exposed to dusty conditions and dry climate.

Keywords: Photovoltaics; Solar panel; dust; Arduino; power; Efficiency.

P-022

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Title: Synthesis of Ag_3O_4/TiO_2 nanocomposites, structural study

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Abstract:

Despite its abundance, chemical stability, non-toxicity and low price, titanium dioxide (TiO_2) has a limited absorption in the ultraviolet range, poor utilization of visible light and rapid recombination of electron-hole pairs (e^-/h^+). For these reasons, silver oxide (Ag_3O_4) is fixed on its surface to obtain a nanocomposite material significantly more effective in Environmental, energy, and technological applications. This study is based on the synthesis and the structural properties of silver oxide fixed on titanium oxide. The sample is synthesized via a facile chemical reaction, at room temperature. In a first step, the adsorption of silver ions on TiO_2 in wet conditions is optimized, where silver nitrate ($AgNO_3$) is used as silver source. In the second step, the sample is drying at 80°C for 24 hours. Finally, the sample Ag_3O_4/TiO_2 is ready to be characterized by the X ray diffraction (XRD), Transmission Electron Microscopy (TEM) and Fourier Transform Infrared Spectroscopy (FTIR). XRD pattern present the features of monoclinic silver oxide and anatase titanium oxide (TiO2) phases [1, 2]. These results are in good agreement with TEM results, which indicate uniform distribution of spherical shaped silver oxide nanoparticles fixed on titanium oxide surface

with an average size estimated 5 to 20 nm. FTIR spectroscopy allowed the observation of vibration band at 618 cm^{-1} corresponding to the metal-oxygen banding vibration of Ag-O [3]. This work underwrites to a high-performance material capable of efficiently utilizing visible light and improving the stability and overall efficiency of TiO_2.

Key words: TiO_2, Ag_3O_4/TiO_2, Ag_3O_4, TEM, Monoclinic silver oxide

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Numerical Simulation of the Nanomechanical Behavior of Phyllosilicates

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Abstract:

This study investigates the mechanical properties of materials at the nanoscale through the use of nanoindentation. This experimental technique is recognized as a highly effective tool for characterizing fine-structured materials, offering precise measurements of hardness and elastic modulus.

To complement the experimental approach, a two-dimensional numerical simulation of nanoindentation was carried out, focusing specifically on phyllosilicates—key constituents of clay materials. This simulation aims to enhance the understanding of their mechanical behavior and to capture the influence of their complex microstructure. Such understanding is crucial for the effective valorization of aluminosilicate-rich natural resources and industrial wastes, supporting sustainable construction practices and minimizing the use of non-renewable materials. The simulation results demonstrated strong agreement with experimental data, thereby validating the accuracy and relevance of the modeling approach used.

Key words: nanoindentation, phyllosilicates, nanoscale, numerical simulation, industrial wastes.

P-024

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Investigating the Structural, Thermodynamic, and Stability Characteristics of Co- and Mn-Based Full Heusler Alloys

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Abstract:

Ab-Initio calculation method was used to study the dynamical, thermal, mechanical, magnetic and electronic properties of the full-Heusler alloys $Co_2MnT_{1-x}Al_x$ (x= 0, 0.25, 0.50, 0.75, 1) using the (FP-LAPW) method. We have studied these properties in the following two structures cubic $L2_1$ $(Fm3m)$ and the inverse phase $C1_b$ $(F\bar{4}3m)$ phases in the configutation ferromagnetic. The most interesting aspects of these alloys are the half-metallic, the stability thermodynamic and mechanic. The results show that the dynamical, and mechanical properties of the $Co_2MnT_{1-x}Al_x$ (x= 0, 0.25, 0.50, 0.75, 1) are stable in the $L2_1$ structure, and we found the $Co_2MnT_{1-x}Al_x$ (x= 0.25, 1) is half-metallic ferromagnet then these results are good agreement with experimental and theoretical have been reported Thus, these results show that alloys are very good in the spintronic devices.

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Key words: Density functional theory; Phase stability; Heusler alloys; Ferromagnetism; Spintronics.

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Modèle gaz-sur-réseau dans le cas de l'adsorption gaz-solide.

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Abstract:

Le modèle gaz-sur-réseau a été utilisé pour la première fois en 1978, par De Oliveira et Griffiths pour décrire microscopiquement les propriétés de la croissance d'un film. Ce modèle est considéré comme une généralisation du modèle d'Ising à l'étude des phénomènes de surface. En effet, dans le modèle gaz-sur-réseau, on considère un gaz d'atomes adsorbé sur les sites d'un réseau semi-infini, et chaque site a juste deux états, l'un occupé et l'autre vide, chaque site peut être occupé au plus par un atome de gaz. Les occupations multiples de site ne sont pas autorisées.

Le modèle gaz-sur-réseau constitue l'outil principal de l'étude de l'adsorption, il permet d'obtenir tous les types d'isothermes observés expérimentalement, et c'est ce qui constitue la force de ce modèle. Il a été largement utilisé depuis plus de quarante ans jusqu'à aujourd'hui pour l'étude de l'adsorption sur plusieurs systèmes différents. Grâce à sa flexibilité et à la possibilité d'implémenter différents potentiels, ce modèle a évolué pour s'adapter à l'étude de problème de plus en plus compliqué et constitue aujourd'hui l'outil principal de l'étude de l'adsorption.

L'ensemble grand-canonique est le plus adapté à la simulation des phénomènes d'adsorption, car il permet de décrire les propriétés d'un système en équilibre avec un réservoir de chaleur et de particules.

Key words: adsorption, multicouches, modèle gaz-sur-réseau, ensemble grand-canonique.

P-026

ICMSE'2025

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Title: **Ab-initio study of KBiSr half-heusler thermoelectric conversion efficiency**

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Abstract:

First-principles calculations using full potential approximation implanted in the WIEN2K code, and semi-classical Boltzmann transport theory, implanted in the BoltzTrap code, were used to investigate electronic and thermoelectric properties of KBiSr Half-Heusler compound. The approximations used such as TB-mBJ potential and spin-orbit coupling (SOC) show a semiconducting behavior of the compound with an indirect bandgap of 0.95 eV.
To conclude on the possible manufacture of this compound, mechanical and dynamic and thermodynamic stabilities were examined, and the material is found to be stable.
By carrying out calculations on lattice thermal conductivity, effective mass of both electrons and holes of the compound and their respective relaxation times, and by using the deformation potential theory, we obtain the figure of merit ZT according to temperature and doping concentration in both charge carriers type.
The figure of merit ZT in KBiSr reaches a value of 1.56 at 1200 K and *n*-doping concentration of 1.7 10^{19} cm^{-3}, making it a good candidate for a high-temperature TE conversion.

Keywords
Half-Heusler, thermoelectric properties, first-principles, spin-orbit coupling, figure of merit.

P-027

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Title: Crystal structure and Hirshfeld surface analysis of mesitylene trapped in a 2,4,6-tris (4-Xphenoxy)-1,3,5-triazine

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Abstract:

Among host structures assembled by weak hydrogen bonds and intermolecular interactions reported in recent literature, the 2,4,6-tris (4-Xphenoxy)-1,3,5-triazine host (X-POT; X: Br, Cl, I) exhibits a robust architecture in channel or cage depending on the halogen atom.

In this study, our objective was to determine the crystalline structure of molecules isolated of 1.3.5-trimethylbenzene C_9H_{12} mesitylene (Mes) trapped in channels of 2,4,6-tris(4-bromophenoxy)-1,3,5-triazine $C_{21}H_{12}Br_3N_3O_3$ (BrPOT), using X-ray diffraction at 150K.

The complex crystallizes in the monoclinic crystal system with a $P2_1$ space group and two molecules in the asymmetric unit. In the crystal, the b axis is very short, so the molecules stack along this direction.

Hirshfeld surface analysis was used to explore intermolecular contacts in the crystals of the title compounds.

From X-ray diffraction and Hirschfeld surface analysis, no disorder was observed. Furthermore, there were no intermolecular interactions between the included molecule mesitylene (TMB) and the host molecule BrPOT, indicating that TMB is completely free within the molecular cage. This confirms that the channels of BrPOT crystals are capable of encapsulating aromatic molecules.

Key words: TMB, BrPOT, X-ray diffraction, Crystal structure

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ICMSE'2025

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Title: Thermal evolution of the inhomogeneous characteristics of tungsten/4H-SiC Schottky barrier diodes

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Abstract:

This work presents a detailed simulation study of the Schottky diode based on the Tungsten/4H-SiC structure using the Gaussian distribution model of barrier height inhomogeneities. The analysis focuses on the temperature dependence of the forward saturation current and total thermionic current. The thermionic emission mechanism is examined across a range of temperatures, highlighting its evolution with inhomogeneous barrier profiles. Current–voltage (I–V) characteristics are also simulated for different integration intervals to evaluate the sensitivity of electrical behavior to barrier fluctuation modeling. The results confirm the relevance of the Gaussian approach for accurately describing real diode behavior, especially at low and intermediate temperatures

Key words: Schottky diode, Tungsten/4H-SiC, Gaussian distribution, thermionic emission

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Structural, Elastic, Dynamic, and Magnetic Properties of $Co_2CrTi_xV_{1-x}$ Full-Heusler Alloys: A First-Principles Study

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Abstract:

This study employs first-principles calculations to explore the structural, elastic, dynamic, magnetic, and electronic properties of $Co_2CrTi_xV_{1-x}$ full-Heusler alloys, focusing on the competition between the ferromagnetic $L2_1$ and inverse XA structures derived from parent compounds Co_2CrV and Co_2CrTi. Our results show that the $L2_1$ structure is energetically preferred for both Co_2CrV and Co_2CrTi, with equilibrium lattice constants of 5.761 Å and 5.854 Å, respectively. Negative formation energies ranging from -0.035 eV to -0.153 eV for x = 0.25, 0.5, 0.75, and 1 confirm thermodynamic stability for $x \geq 0.25$. Mechanically, the alloys meet Born stability criteria, with elastic constants for x = 1 (C_{11} = 258 GPa, C_{12} = 149 GPa, C_{44} = 108 GPa), shear moduli of 75–82 GPa, and a peak Young's modulus of 215 GPa, indicating high stiffness. Ductility is supported by Pugh's ratio (< 0.57, e.g., 0.44 for x = 1) and Poisson's ratio (0.31–0.34). Dynamically, alloys with $x \geq 0.5$ exhibit no negative phonon frequencies, while x = 0 and 0.25 show potential instability due to weak soft modes at the Γ point; heat capacity nears ~25 J/mol·K at 300 K (e.g., 22.96 J/mol·K for x = 1). Magnetically, the alloys are ferromagnetic, with total magnetic moments decreasing from 4.83 μ_B (x = 0) to 4.06 μ_B (x = 1), achieving half-metallicity at x = 1. Spin-polarized density of states reveals conductive majority spin channels driven by Cr-3*d* states, with minor Co-3*d* contributions and negligible Ti-3*d* states near the Fermi level, where increasing Ti content reduces density of states, enhancing half-metallicity in Co_2CrTi. These findings highlight the potential of $Co_2CrTi_xV_{1-x}$ alloys for spintronic and magnetic applications, calling for further experimental validation.

Key words: Density functional theory; Phase stability; Heusler alloys; Ferromagnetism; Spintronics.

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Stability response of advanced composites plates subjected to thermal loading via a refined HSDT

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Abstract:

In this paper, a sinusoidal shear deformation theory is presented for thermal buckling analysis of composites plates. It is assumed that the plate is in contact with elastic foundation during deformation. This refined plate theory contains only four unknowns. It is assumed that the mechanical and thermal non-homogeneous properties of functionally graded plate vary smoothly by distribution of power law across the plate thickness. Using the non-linear strain-displacement relations, the equilibrium and stability equations of composites plates made of functionally graded materials are derived. The boundary conditions for the plate are assumed to be simply supported on all edges. The elastic foundation is modelled by two-parameters Pasternak model, which is obtained by adding a shear layer to the Winkler model. The effects of thermal loading types and variations of power of functionally graded material, aspect ratio,

and thickness ratio on the critical buckling temperature of functionally graded plates are discussed.

Key words: Composite plates, functionally graded materials, buckling, elastic foundations .

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P-031

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Impact de la substitution partielle du ciment par de la poudre de marbre sur les caractéristiques des mortiers à l'état frais et durci

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Abstract:

Dans un contexte de transition vers une économie circulaire et de réduction des impacts environnementaux, l'industrie du bâtiment joue un rôle clé. La production de ciment, bien que cruciale pour le développement des infrastructures, reste l'une des principales sources d'émissions de CO_2, représentant environ 8 % des émissions mondiales. Cette réalité impose un besoin urgent d'explorer des alternatives durables, notamment à travers l'utilisation de matériaux de substitution dans la formulation des ciments. Parmi ces matériaux, la poudre de marbre, résidu de l'industrie du marbre, émerge comme une option prometteuse. Dans cette optique, nous avons initié cette recherche visant à étudier l'effet de la substitution partielle du ciment (de 5, 10, 15 et 20 %) par de la poudre de marbre sur les caractéristiques des mortiers à l'état frais et durcis. Cinq mélanges de mortier sont élaborés, en respectant les mêmes proportions Eau/Liant (0.5) et Sable/Liant (3). Les caractéristiques des mortiers ont été évaluées grâce à des tests spécifiques : le test d'étalement sur la table à secousses et le test d'écoulement pour l'état frais, ainsi que les tests de propagation d'ondes ultrasonores, de résistance à la flexion et de résistance à la compression pour l'état durci.

Les résultats indiquent qu'un taux de substitution optimal de 10 % contribue à améliorer les propriétés mécaniques (résistance à la traction par flexion et à la compression) et physiques (vitesse de propagation des ondes ultrasonores) des mortiers, tout en favorisant leur maniabilité (réduction du temps d'écoulement à 5 secondes). Cette amélioration est attribuée à l'effet de remplissage des particules fines de marbre, qui densifie la microstructure et renforce la matrice cimentaire. Au-delà de 10 %, les performances déclinent en raison de la dilution de la phase active du ciment, mettant en évidence l'importance d'un dosage précis pour équilibrer performance technique et durabilité.

Key words: Poudre de marbre, substitution, maniabilité, résistances mécaniques.

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P-032

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Étude comparative des propriétés texturales d'argile anionique de type Al-Fe, développée par le biais de deux procédés différents de synthèse.

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Abstract:

Cette étude porte sur la synthèse et la caractérisation d'hydrotalcites (HDL) à base de fer et d'aluminium, avec pour objectif d'analyser leur texture, leur surface spécifique et leur distribution de taille des pores. Les matériaux ont été synthétisés par coprécipitation sous deux atmosphères différentes (air ambiant et azote) avec des rapports molaires Fe/Al variant de 2 à 5.

La synthèse des matériaux à base de fer sous air ambiant engendre toujours l'apparition d'impuretés pour tous les rapports molaires utilisés, mais sous azote, elles commencent à apparaitre à partir du rapport 3. L'atmosphère utilisée et la quantité de fer ajouté ont un impact sur la formation des impuretés. Quatre méthodes ont été utilisées pour l'étude texturale (BET, BJH, NLDFT, analyse fractale). Pour les matériaux préparés sous atmosphère ambiante, les résultats montrent que ces composés sont microporeux et la taille des pores ne

dépasse pas 2 nm. Les matériaux préparés sous atmosphère d'azote possèdent des pores de type mésoporeux.

Key words: Double hydroxyde lamellaire, coprécipitation , la méthode BET, la méthode BJH, la méthode NLDFT, Analyse fractale.

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Title: Electronic and Optical Transitions in $Cd_{1-x}Mn_xS$ Diluted Magnetic Semiconductors for Spintronic Applications

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Abstract:

This study investigates the electronic and optical behavior of the diluted magnetic semiconductor $Cd_{1-x}Mn_xS$ (x = 0.25, 0.5, 0.75) through ab initio calculations based on the Linear Muffin-Tin Orbital (LMTO) method within Density Functional Theory (DFT) and the Local Density Approximation (LDA). The binary compound CdS exhibits a direct band gap, while MnS displays semi-metallic behavior with spin-polarized states and an unusual negative real part of the dielectric function, Re(ε). For the ternary alloy $Cd_{1-x}Mn_xS$, modeled in the zinc-blende structure using an 8-atom supercell, the band structure analysis reveals a tunable electronic behavior. At low Mn concentrations (x = 0.25), the alloy maintains a direct band gap. Increasing Mn content (x = 0.5 and 0.75) leads to a transition toward semi-metallicity. These findings highlight the potential of $Cd_{1-x}Mn_xS$ for spintronic and optoelectronic device applications due to its controllable electronic and optical properties.

Key words: Diluted Magnetic Semiconductors, Spintronics, DFT, LMTO, Semi-metallicity

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Assessing the Effects of Climate Change on Water Quality in Hammam Boughrara Dam

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Abstract:

In semi-arid regions, water resources are becoming more vulnerable due to both climatic changes and human-induced pressures. This research focuses on the long-term variations in eight important water quality parameters—electrical conductivity (EC), dissolved oxygen (DO), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), bicarbonates (HCO_3^{-}), and sulfates (SO_4^{2-})—in the Hammam Boughrara Dam (located in northwestern Algeria) over an 18-year period (2005–2023). Monthly assessments of these parameters, alongside climatic factors such as rainfall, air temperature, and evaporation, were conducted.

The gathered data were analyzed using statistical and modeling techniques to separate the effects of human activities from those of climatic fluctuations.

The results indicated that human impacts, especially from untreated industrial effluents and wastewater, were primary contributors to water quality changes. Natural processes, like mineral dissolution and agricultural runoff, also played a significant role in altering water chemistry. Furthermore, climate factors were found to influence the seasonal behavior of water quality. Rainfall helped to dilute ionic concentrations and boosted dissolved oxygen levels, while evaporation led to the accumulation of salts and sulfates, which raised EC levels during dry periods. Temperature increases were linked to the enhanced breakdown of organic material, further contributing to oxygen depletion.

Seasonal trends were evident, with potassium and magnesium levels rising during the summer months due to soil leaching, while sodium and bicarbonates increased in winter due to carbonate dissolution. Sulfate levels peaked in the summer, primarily driven by industrial discharges and evaporation.

By employing a combination of multivariate analysis and non-linear modeling, this study establishes a robust framework for understanding the intricate interactions between climatic and human factors. The findings highlight the importance of using these advanced techniques for more effective water quality management in vulnerable semi-arid regions, offering insights for sustainable watershed management strategies.

Key words: Water Quality; Climate Variability; Human Impact; Semi-Arid Regions; Watershed Management

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Ab-initio investigation of half-metallic ferromagnetism in half-Heusler compounds XYZ (X=Rb and Cs ; Y= Cr ; Z=Se)

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Abstract:

In this work, first principle calculation of structural, electronic, magnetic and thermodynamic properties of the half-metallic ferromagnetic Half-Heusler compounds RbCrSe and CsCrSe are presented. We have applied the full-potential linearized augmented plane waves plus local orbitals (FP-LAPW+lo) method based on the density functional theory (DFT). For the exchange and correlation potential generalized-gradient approximation (GGA) is used .

We found that the RbCrSe and CsCrSe in the ferromagnetic state are more favorable than the antiferromagnetic state and they exhibits half-metallic ferromagnetism, the computed equilibrium lattice parameters agree well with the available theoretical and experimental data. The calculated total magnetization of 1 μB is in excellent agreement with recent experiments.

We give also a comparison between the standard generalized gradient approximation (GGA) and the modified Becke–Johnson exchange potential approximation (mBJ–GGA) on the electronic and magnetic properties.

Key words: Half-Heusler compound; Half-metallic; Half-metal; FPLAPW + lo

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P-036

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Title: Simulation and study of ITO/a.Si-H/$CH_3NH_3PbI_3$ Perovskite/C-Si/Ag solar cells under illumination using SCAPS-1D software

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Abstract:

The conversion efficiency of perovskite solar cells (PSCs) has recently reached 25.2% [1].

More than that in recent studies on thin film silicon hetero junctions, have evidenced the potential of these materials to realize low cost, high-efficient solar cells

In this work we then propose ITO/a.Si-H(P^+)/ $CH_3NH_3PbI_3$ (Perovskite) /C-Si(n^-)/Ag structure and show the influence of difference physics and geometrics parameters for Perovskite ($CH_3NH_3PbI_3$) layer on PV characteristics short circuit I_{CC}, open voltage V_{OC}, fill factor FF and efficiency η through SCAPS 1D software .

The best values for the PV parameters are 1.05V, 26.70 mA/cm2, 82.07% , 23.05 % for open voltage circuit V_{OC}, short circuit I_{CC} , fill factor FF and efficiency η respectively.

Key words: Perovskite solar cells, Amorphous silicon, crystalline silicon

[1] Fatima Maachou , Baya Zebentout , Abdelaziz Rabehi , Abdelmalek Douarad, MawloudGuermouic , and Zineb Benamara Semiconductors, 2025, Vol. 59, No. 5, pp. 441–451. © Pleiades Publishing, Ltd., 2025.

P-037

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Title: **Assessment of the saline soil's geotechnical characteristics using electrical remediation**

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Abstract:

This work focuses on soil contamination, a major global environmental issue, and evaluates the performance of the electrical technique for remediating saline fine-grained soils. The study was conducted on soil samples taken from the large sebkha of Oran, a region in western Algeria. The saline nature of the sebkha aggressively affects the foundations of civil engineering structures.

The electrical remediation approach relies on applying an electric field to promote the mobility and transport of ionic species through the soils. A voltage of 15 V was applied to the samples for 7 days, analyzing various parameters such as chemical composition, electrical conductivity and intensity, as well as the mechanical properties of the soils.

Experimental results show a significant reduction in salt concentrations, demonstrating the effectiveness of the electrical remediation. This method appears promising for decontaminating saline soils, although challenges remain for large-scale application, particularly due to environmental conditions and electrode configuration. This research paves

the way for further investigations into the optimization and implementation of this technology in situ.

Key words: saline soils, sebkha, electrical remediation, electrical conductivity, intensity, mechanical properties.

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Development and microstructural characterization of a composite based on PLA and common Reed fibers.

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Abstract:

The present study focuses on a biodegradable composite material based on polylactic acid (PLA) and common reed (CR) fiber developed by hot pressing.

The raw materials were first processed into powder (for PLA) and short fibers (Common reed). PLA-20%CR blends were then hot pressed at 180°C under 10 MPa during 5 minutes. The microstructural characterizations of the composite were carried out using scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC) and X-ray diffraction (XRD).

The results show that the composite exhibits a relatively homogeneous microstructure, with several regions showing a continuous interface between polylactic acid (PLA) and common reed fibers. However, in certain areas, interfacial adhesion appears to be insufficient. FTIR analyses nevertheless suggest fiber-matrix interactions through the formation of new chemical bonding groups.

Key words: Biodegradable composite, Common Reed, PLA, SEM, FTIR, DSC.

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Title: Study of the Effectiveness of FSW Welding of Aluminum Alloys in an Aqueous Environment

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Abstract:

Friction Stir Welding (FSW) is a solid-state welding process capable of joining materials that are difficult to weld using conventional fusion methods. It is energy-efficient and environmentally friendly, making it suitable for industrial applications. However, a major limitation of FSW is the softening in the weld zone, especially in heat-treatable aluminum alloys, caused by high thermal cycles. These thermal effects lead to the dissolution or coarsening of strengthening precipitates, which reduces the mechanical strengthof the joint.

To overcome this drawback, Underwater Friction Stir Welding (UFSW) has been developed as an effective solution. By performing the process in an aqueous environment**, UFSW provides natural cooling, which lowers the welding temperature, minimizes softening, and helps maintain a refined microstructure As a result, tensile strength and joint performance are significantly improved.

This review highlights the advantagesand key differences between FSW and UFSW, focusing on aspects such as material flow, heat generation process parameters, microstructure, and mechanical properties. Overall, studies confirm that UFSW is an enhanced version of FSW, offering better joint quality and improved performance,making it a valuable reference for researchers and engineers

Key words: fsw, ufsw, aluminium,

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Title: **Sintering behavior of primary mullite produced from in Algerian kaolin by XRD**

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Abstract:

In this paper, the phase transformation and kinetics of primary mullite (3Al2O3.2SiO2) was investigated through reaction sintering of Algerian kaolin of Djebbel Debbagh-Guelma located in the North-East of Algeria. The raw kaolin was wet ball milled for 5 h, dried and then compacted using a uniaxial press. XRD and FT-IR analyses were performed on samples heated at different temperatures (900-1250°C) with high heating rate and held for durations ranging from 5-80 min. The mullite formed from the kaolin was first detected at 1100°C for 5 min by XRD and tallies with FT-IR.

The activation energy for primary mullite formation was evaluated using the Kissinger equation. The growth morphology parameter (n) and the numerical factor (m) were both found to be approximately 2. Analysis of the results indicates that mullite crystallization in these materials follows a two-dimensional growth mechanism.

Key words: Kaolin, Primary mullite, Phase transition, Activation energy, XRD, FT-IR.

Title: **First-principles study of ferromagnetism in chromium selenide CrSe**

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Abstract:

This work presents a first-principles theoretical investigation of ferromagnetism and half-metallicity in chromium selenide (CrSe) binary compounds across five crystal structures: three cubic (NaCl, CsCl, zinc-blende) and two hexagonal (wurtzite, NiAs). Using density functional theory (DFT) with GGA-PBEsol and modified Becke–Johnson (mBJ) approximations, structural, electronic, and magnetic properties were studied via the full-potential linearized augmented plane wave (FP-LAPW) method. CrSe is found to be nonmagnetic in the CsCl structure but energetically favors a ferromagnetic phase in the other four, with NiAs as the most stable phase. The mBJ approximation predicts a total magnetic moment of 4 μB per unit cell for CrSe in zinc-blende and wurtzite, indicating half-metallic ferromagnetism with a metallic majority spin channel and a semiconducting minority spin channel. Magnetic moments are primarily localized on Cr 3d orbitals. The electronic structure and density of states analyses confirm the spin polarization and half-metallicity, making CrSe a promising candidate for spintronic applications. Due to the absence of experimental data, these results remain predictive.

Key words: Functional theory of density; FP-LAPW, GGA; mBJ approximation ;Electronic structure ; Semiconductor ;ferromagnetism ;Chromium selenide (CrSe) ;Half-metallicity ; Magnetic moment ;

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Investigation of the Impact of Light Intensity temperature and potential flaws on Solar panel Efficiency using Matlab Simulink

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Abstract

Renewable energies, including solar and wind power, have served as consistent energy sources for the past two to three decades and are now extensively used in numerous countries, both as small-scale home units and as large-scale energy farms at the state level.

This study outlines a technique for utilising Matlab/Simulink to model and simulate a photovoltaic (PV) module. We analysed the characteristics of the PV cells, I = f(V) and P = f(V), by mathematically modelling the PV modules. The purpose of this study is to ascertain the properties of the solar photovoltaic module at various temperatures and radiation levels. The attributes of solar cells under different radiation situations were examined in [200, 400, 600, 800 and 1000 W/m^2], which indicated that output power escalates with the intensity of solar radiation. Furthermore, the efficiency of solar cells decreased with an increase in the cell temperature even though the current slightly increased. The potential flaws in photovoltaic systems were also modelled, along with how they might affect the solar photovoltaic module's characteristics.

Keywords: Photovoltaics; Solar panel; irradiation; temperatures; poteniel flaws; Matlab Simulink.

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Studies of Inverted Organic Solar Cells through Simulation

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Abstract:

Organic solar cells (OSCs) have become an attractive alternative to inorganic solar cells in recent years because of their potential to be flexible, solution-coatable, low cost and weight, semitransparent, and easily integrated into different applications. Among all types of OSCs, bulk heterojunction-based polymers have been the most popular because of their high efficiencies. Here, the acceptor and donor materials are blended together to create an interpenetrating network with a thickness sufficient for photon absorption and a phase separation nearing the exciton diffusion length. In general, this technology has adopted two device structures including conventional and inverted structure where the polarity of electrode is reversed. In this work, an inverted bulk heterojunction solar cells for various materials as a hole transport layer and electron transport layer (ZnO, MoO_3, PEDOT: PSS, V_2O_5 and TiOx) are simulated. Then, the simulated results as function of different parameters such as temperature, thickness of HTL and ETL of the cell are investigated. Finally, we will present the numerical simulation results achieved and performance optimisation in inverted solar cells.

Key words: organic solar cells, inverted, simulation, electrical parameters.

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Title: **Great cell parameters study of superconductor material $SnNb_5Se_9$**

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Abstract:

In this work, we have studied the $SnNb_5Se_9$ compound. This is a superconductor compound. On the other hand, we presented the A-15 compound, mainly superconductors, insisting only on $NbSe_2$ compound. The inclusion of the A-15 chains in the $NbSe_2$ realized by solid state reaction [1], led to obtain new compound superconductor. We have studied the structural of superconductor material. Superconductor materials are used in fields large in physic and applications.

The structural study of new compound have characterized by infrared spectroscopy and X-ray diffraction. The results of this work confirm that $SnNb_5Se_9$ crystallize in the space group Pmmm. The parameters had refined another way the calculated for. When we realized a firstly by two programs Dicvol14 and Threior and so do not give a result. The morphology of these samples was studied by (S.E.M).

Key words: Superconductor, Parameter, Cell, Refined,

P-045

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Prospects and Challenges for Fuel Cell Technology Integration within Algeria's Emerging Hydrogen and Renewable Energy Strategy

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Abstract:

Algeria stands at a critical energy crossroads, endowed with immense solar potential and significant fossil fuel resources, yet facing growing domestic energy demand and global pressures for decarbonization. This positioning makes hydrogen and fuel cell technology not just an alternative but a strategic necessity for sustainable economic diversification and energy security. This study explores the integration potential of fuel cell systems within Algeria's nascent national energy framework, with a particular focus on their role in converting renewable hydrogen into clean, reliable power.

The analysis begins by assessing Algeria's foundational advantages: a world-class solar irradiance exceeding 2650 kWh/m²/year for green hydrogen production via electrolysis, and an existing natural gas infrastructure that offers a pathway for green hydrogen with carbon capture, utilization, and storage. Fuel cells are identified as a critical enabling technology to capitalize on this hydrogen production.

However, this integration is fraught with challenges. The study identifies several key barriers, including the high capital costs of fuel cell systems and electrolyzers, the need for a comprehensive hydrogen distribution and refueling network, a skills gap in advanced energy technologies, and the need for strong policy and regulatory frameworks to encourage private investment.

Key words: Fuel cells, green hydrogen, renewable energy integration, energy transition, SOFC, Energy Policy.

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Microstructural and Electrochemical Behaviour of Matrix-Body Drilling Tools Before and After TIG Hardfacing Repair in H_2SO_4 and NaOH Solutions

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Abstract:

This study examines the microstructural and electrochemical behavior of matrix-body drilling tools before and after TIG hardfacing repair in acidic (H_2SO_4) and alkaline (NaOH) media. These tools are widely employed in drilling operations, but little attention has been given to evaluating repair strategies. Since corrosion resistance strongly affects service life, its assessment is crucial for tool durability. Two sample types were investigated: as-infiltrated tools produced by spontaneous infiltration, and repaired tools, intentionally damaged then restored using WC-Ni/Cr TIG hardfacing. Electrochemical Impedance Spectroscopy (EIS) and potentiodynamic polarization (Tafel) were used for electrochemical characterization, while Optical Microscopy (OM) supported the microstructural analysis. Results revealed that in H_2SO_4, repaired tools displayed enhanced resistance compared to as-infiltrated ones, with only slight corrosion observed in the matrix. In NaOH, repaired tools exhibited a very significant improvement in corrosion resistance, with corrosion mainly confined to WC particles. Overall, the findings clearly demonstrate that TIG hardfacing is a viable and

effective repair strategy for matrix-body drilling tools, particularly by significantly improving their corrosion resistance. This provides a strong basis for extending service life while reducing both economic costs and environmental impact. Future work will aim at deepening the understanding of corrosion mechanisms to further optimize this repair approach.

Key words: Metal matrix composite, Drilling Tools, TIG Hardfacing, Corrosion Resistance.

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Title: Microstructural, mechanical and electrochemical behavior of a X60/316L cladding welded by TIG process

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Abstract:

TIG welding of X60/316L cladding joints produces heterogeneous microstructures at the three main interfaces: X60 BM/309 FZ, 316L BM/309 FZ, and the direct X60/316L boundary. In the as-welded condition, microstructural characterization by OM and SEM-EDS revealed elemental segregation, particularly at the X60/309 interface, where carbon enrichment led to harder microstructural features. The 316L/309 interface remained relatively stable with minimal redistribution, while the direct X60/316L interface showed chemical mismatch but limited transformation. Microhardness profiling confirmed these microstructural differences, highlighting significant gradients across the fusion zones: localized hardening near the X60/309 interface contrasted with the softer and more homogeneous 316L side. Electrochemical testing in 3.5 wt.% NaCl indicated that these heterogeneities strongly influence corrosion behavior, with the X60/309 interface being the most vulnerable. Complementary Kelvin Probe Force Microscopy (KPFM) further linked microstructural variations to differences in surface potential, reinforcing the role of interface chemistry and hardness gradients in governing early degradation processes.

Key words: Interface, Microstructure, cladding, Microhardness, KPFM.

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Title: Effect of isothermal aging on the microstructural evolution in Ti-6Al-4V titanium alloy: experimental investigation and thermokinetic simulation

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Abstract:

The precipitation mechanism and kinetics of the secondary α phase during short time duplex heat treatment of the Ti-6Al-4V alloy were studied in the present work. The isothermal precipitation kinetics was determined using in-situ isothermal electrical resistivity tests in a Gleeble 3500 thermomechanical machine performed at 500 °C preceded by a solution treatment at 800 °C . The precipitation process was also investigated by modelling using the nucleation – growth theory. Results indicated that the secondary α phase nucleation ended at an earlier stage of the precipitation and that the latter is mainly controlled by the growth of secondary α phase precipitates. Evolution of the elements contents showed that only the vanadium concentration in the β phase changed significantly during the isothermal aging. Thus, the growth of the secondary α phase is governed by the vanadium diffusion into the β phase.

Key words: Ti-6Al-4V, Sympathetic nucleation, Nucleation – growth, Gleeble machine.

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Experimental Investigation on Friction Stir Welding of AZ31 Mg Alloy for Automotive Application

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Abstract:

This investigation provides an experimental insight into the friction-stir welding of AZ31 Mg alloy to assess the joint quality and performance. Butt welds were produced by combining various welding parameters (rotation speed ω, traverse speed V, axial force F and tool tilt and tool geometry). The welds were analyzed using radiography inspection, microstructural analysis and microhardness testing. The results show that the rotation speed and transverse speed have a significant influence on the weld nugget development under the dual effect of plastic deformation and heat input. Defect-free welds were obtained in a wide range of optimal welding parameters, ranging from 950 rpm to 1560 rpm for the rotation speed and from 8 mm/min to 43 mm/min for the traverse speed at a constant axial force of 2 KN. Those combinations of parameters demonstrate grain refinement, due to dynamic recrystallization, and enhanced micro-hardness in the weld nugget (63 HV) compared to Base metal (54 HV) as the rotation speed increases. The study demonstrates a successful integration of the FSW process into the welding of AZ31 Mg alloy and suggests a weldability range for selecting parameters that facilitating the application of magnesium alloys in the automotive industry.

Key words: Friction stir welding, AZ31 Mg alloy, microstructure, micro-hardness.

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THEORETICAL STUDY OF THE MAGNETIC, ELECTRONIC AND STRUCTURAL PROPERTIES OF FULL HEUSLER ALLOYS

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Abstract:

The aim of this study is to exploit the structural, electronic, magnetic and thermodynamic properties of the full Heusler compound Ag2CrGa using the linear Muffin-tin-orbital (FP-LMTO) potential calculation method in the L21 phase by the local density approximations (LDA), local spin density approximations (LSDA). The calculation carried out on the structural properties such as the bulk modulus, pressure derivatives and electronic properties allowed us to deduce the nature of this alloy which turned out to be a metal. While the calculation of magnetic properties allowed us to evaluate the magnetic moment of the studied compound Ag2CrGa as well as the magnetic moments of each element constituting it. The calculated thermodynamic properties are the apparent variation of bulk modulus, heat capacity and Debye temperature from [0 to 1600 ° C.

KEY-WORDS: FP-LMTO method; full Heusler compounds, structural, Magnetic moment, elastic properties and thermodynamic properties.

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Study of the coating material composition and the emulsifier mass effects on the niflumic acid drug release using design of experiments

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Abstract:

Niflumic acid (NA), belonging to the fenamate family and nonsteroidal anti-inflammatory class of drugs (NSAIDs), is known both for its therapeutic efficacy as anti-inflammatory, antipyretic, analgesic drug, and its adverse effects upon the oral administration.

Since the objective of the pharmaceutical formulation is to reduce the drug side effects and to enable improved bioavailability and bio-absorption, our project is intended to prepare NA based microparticles using beeswax as natural based coating material. 2^2 factorial design is drawn in order to study and discuss the effects of both ß-CD concentration and emulsifier nature on the NA release kinetics in acidic medium. So the variables are beeswax:ß-Cyclodextrin ratio (X2) and emulsifier agent mass (X1) i.e. Tween 20 and Tween 80 and the considered response (Y) is the drug release rate after 2 hours of contact time.

The desired formulations are obtained by hot-melt method of microencapsulation and ß-CD: NA mixture or inclusion complex is obtained by co-precipitation method. The resulting

complexes and microspheres are characterized by determining the encapsulation efficiency and rate, and analysed by FTIR spectroscopy, scanning electron microscopy (SEM) and differential scanning calorimetry (DSC).

The release of niflumic acid from these formulations is carried out in acidic fluid at pH 1.2 and 37°C, reproducing the physiological gastric environment. The assay for determining the NA concentration is performed by UV-Visible spectrophotometry.

The release profiles results showed a rapid release of niflumic acid from Beeswax: ß-CD microparticles however a very slow NA release is observed from beeswax microspheres. By modelling using Minitab software, a relationship between variables and response is obtained (Eq. 1) demonstrating a synergistic effect of ß-CD concentration (X2) and antagonist effect of emulsifier molecular mass (X1) on the drug release.

$$Y\ \% = 37.574 - 21.016\ X1 + 27.374\ X2 - 13.431\ X1*X2 \qquad R^2 = 99{,}72\% \qquad \text{Eq. 1}$$

Also, the results showed that the beeswax matrix permits to retain effectively the niflumic acid in the acidic medium and consequently can reduce its gastric side effects. Finally, on the basis of the n value of Korsmeyer-Peppas model, the NA release mechanism is identified according to a non-Fickian diffusion and case-II of transport.

Key words: Niflumic acid, microencapsulation, inclusion complex, beeswax, ß-cyclodextrin, drug release

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Ferromagnetism in the half-heusler Compounds from first-principles calculations CoMnZ (Z= Si,Ge)

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Abstract:

The band structures and magnetic properties of the form XYZ compounds in the half heusler structure have been calculated with the full potential linear augmented plane wave (FP-LAPW) method within the spin density functional theory. The calculations reveal that the non-magnetic element can induce stable ferromagnetic state in alkali metals. Also it is found that the alkaline exhibit half-metallicity with integer magnetic moment of 1.00 μB per formula unit for CoMnSi and CoMnGe. The most stable atomic arrangement, where XYZ occupy the (0, 0, 0), (1/4, 1/4, 1/4) and (3/4, 3/4, 3/4) positions, with the most stable structure showing half-metallicity with the large HM gaps of 0.31 eV and 0.18 eV for CoMnSi and CoMnGe, respectively and that the minority-spin electrons are metallic, whereas the majority-spin electrons are semiconducting, for the majority spin channel the Fermi level is located in the band gap, and for the minority spin there is no energy gap around the Fermi level, which gives a direct evidence of the half-metallic behavior.

.**Key words:** Half-metallic, spintronics, Half Heusler compound.

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Theoretical and Spectroscopic Study of Thiazolic Materials for Application in Organic Heterojunction Photovoltaics

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Abstract:

The synthesis of new organic materials for photovoltaic cells, particularly those with active layers based on organic semiconductors, represents a true innovation by reducing fabrication costs, which are typically high in the photovoltaic sector. This study focuses on determining the photophysical properties of new thiazolic materials with potential for photovoltaic applications. To this end, UV-Visible spectroscopy was used for optical and optoelectronic characterization. In parallel, theoretical calculations based on Density Functional Theory (DFT), using the Gaussian09 software, were employed primarily to assess the photovoltaic properties of the considered materials.

We focused specifically on studying charge transfer mechanisms between newly synthesized thiazolic structures based on rhodanine and fullerene derivatives, which are widely recognized as reference electron acceptor materials. This charge transfer mechanism was investigated through the analysis of the frontier molecular orbitals (HOMO and LUMO), the energy gap, the electronic density of states, and the charge transfer rate. The photovoltaic performance of the analyzed materials was interpreted using parameters such as the open-circuit voltage (V_{OC}), the exciton binding energy (E_b), and the light-harvesting efficiency (LHE).

Key words: Photovoltaic, Semiconductor, DFT, Energy Gap.

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Title: **Filtralite® Pure as a Novel Filter Medium for Seawater Pretreatment: Characterization in Desalination Applications**

Presenting author's Benyahia khadidja[a], BENSAAD Naoual

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Abstract:

In seawater desalination processes, pretreatment plays a crucial role in protecting reverse osmosis (RO) membranes against fouling and reducing overall energy consumption. Conventional sand filters are widely used; however, their efficiency remains limited in retaining suspended solids, colloids, and chemical contaminants. In this context, our study focuses on the use of **Filtralite® Pure** as an innovative alternative filter media.

The material was characterized before and after seawater filtration using several analytical techniques: X-ray diffraction (XRD) to assess crystalline structure and stability, scanning electron microscopy (SEM) to examine surface morphology and porosity, and energy dispersive X-ray spectroscopy (EDX) to determine elemental composition and evaluate the retention of heavy metals and salts.

The results demonstrated that Filtralite® Pure significantly improved the quality of pretreated water compared to conventional sand filters

This study highlights the potential of Filtralite® Pure as a sustainable and efficient solution for seawater pretreatment, contributing to membrane fouling reduction and energy optimization in desalination plants.

Keywords: Filtralite® Pure, seawater pretreatment, XRD, SEM, EDX, fouling control, energy efficiency, sustainable desalination.

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Crafting and Understanding a Conductive Polymer Composite Material

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Abstract

This exploration delves into the creation and examination of innovative hybrid materials: sophisticated blends of a conductive polymer fortified with clay particles. Imagine composites meticulously crafted through a chemical ballet – the in-situ oxidative polymerization of aniline, dancing in the presence of montmorillonite's very fine particles.

Our analyses reveal a captivating interaction within the composite's architecture. The polymer chains insinuate themselves between the montmorillonite layers, forming a captivating interleaving structure.

Later, we put these intriguing environment

s to the test, tasking them with capturing methylene blue from water. Highly encouraging purification rates, showcasing a remarkable attraction between the materials and the dye.

Keywords

Dye, Clay, Environment, Adsoption.

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Évaluation de la qualité physico-chimique de l'eau de la commune de Tamalaka et Gambetta et leurs interactions sur les calculs

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Abstract:

L'eau de TAMALAKA est une eau souterraine provenant d'une source naturelle, est traditionnellement réputée pour ses bienfaits thérapeutiques, en particulier dans le traitement des lithiases urinaires. Afin de valider scientifiquement cette propriété, une étude comparative a été menée entre l'eau de TAMALAKA et celle du quartier de GAMBETTA. Cette étude visait à évaluer la qualité physico-chimique des deux eaux, ainsi qu'à examiner leur potentiel effet sur la dissolution des calculs urinaires.

Les résultats des analyses physico-chimiques ont indiqué que les deux eaux sont conformes aux normes de potabilité. Toutefois, l'eau de TAMALAKA se distingue par une minéralisation plus importante, notamment beaucoup plus bicarbonatée que celle de Gambetta, ce qui pourrait jouer un rôle dans le processus de dégradation des calculs.

Dans un second temps, des calculs urinaires de types rénal et vésical ont été immergés dans chacune des deux eaux. Après une période d'immersion, une modification significative des paramètres physico-chimiques des eaux a été observée, suggérant un début de processus de dissolution. Par ailleurs, une diminution notable de la masse des calculs a été enregistrée, particulièrement dans les échantillons immergés dans l'eau de TAMALAKA, mettant ainsi en évidence son pouvoir dissolvant plus prononcée.

Ces résultats soutiennent l'hypothèse selon laquelle la composition spécifique de l'eau de TAMALAKA pourrait contribuer à la dissolution partielle des calculs urinaires, apportant un appui scientifique à son usage traditionnel dans le traitement des lithiases.

Key words: Eau, qualité physico-chimique, calculs urinaires, TAMALAKA

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Impact de la nature de la matrice polymérique des formes galéniques sur le profil de libération de la Benzocaïne à pH=8

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Abstract:

Ce travail vise à étudier de manière approfondie la cinétique de libération contrôlée de la Benzocaïne, un anesthésique local, à partir de différentes formes galéniques solides élaborées sous forme de disques à base polymère.

Les systèmes médicamenteux ont été immergés dans un milieu physiologique simulant les conditions intestinales, à pH=8, et maintenus à une température constante de 37 °C, représentant la température du corps humain.

L'étude s'est focalisée sur le rôle de la matrice polymérique constituant la forme galénique, en tant que facteur déterminant dans la modulation du profil de libération de la Benzocaïne. Des polymères présentant des degrés variables d'hydrophilie ont été utilisés pour identifier les relations entre la nature de la matrice et la vitesse de diffusion du principe actif.

Il a été démontré que les matrices les plus hydrophiles permettent une pénétration plus rapide du fluide de dissolution, favorisant ainsi le gonflement de la matrice, et facilitant la diffusion du principe actif vers le milieu externe d'où l'importance du choix rationnel de la matrice polymérique en tenant compte du fait que le mécanisme de diffusion suit la loi de Fick.

Ces observations soulignent l'importance du choix rationnel de la matrice polymère dans la conception de systèmes de libération contrôlée dans le milieu intestinal et contribuent à l'optimisation des formulations pharmaceutiques à base de Benzocaïne.

Key words : Eudragit RL, Éthylcellulose, Benzocaïne, milieu intestinal, relargage.

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Study and dielectric characterization of a $MgAl_2O_4$-based humidity sensor synthesized by sol-gel

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Abstract:

This work focuses on the study of a $MgAl_2O_4$-based humidity sensor synthesized by sol-gel. $MgAl_2O_4$ spinel was chosen for its interesting properties: excellent thermal stability, high electrical resistivity, low ionic conductivity, a wide band gap , and high mechanical hardness. In addition, its surface characteristics promote the adsorption of water molecules, making it a particularly suitable material for humidity detection. The sample was obtained by sol-gel, followed by appropriate heat treatment to ensure a homogeneous crystalline structure. The sensor's performance was evaluated in terms of sensitivity and hysteresis as a function of relative humidity. The results highlight good sensitivity and low hysteresis, confirming the potential of $MgAl_2O_4$ as a promising material for the development of reliable and high-performance humidity sensors.

Key words: $MgAl_2O_4$, sol-gel, humidity sensor, sensitivity.

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Innovative Approaches for Flared Gas Utilization: Towards Energy Transition in the Petroleum Sector

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Abstract:

Gas flaring is a persistent environmental and economic issue in the petroleum industry, causing greenhouse gas emissions and the loss of valuable hydrocarbons. This study focuses on the recovery of flared gases from the Adrar refinery (RA1D) and their conversion into energy and high-value chemicals. Different valorization pathways were assessed, including electricity generation, the Gas-to-Liquids (GTL) process, ammonia synthesis, and the production of hydrogen, methanol, ethanol, and ethylene. Aspen HYSYS software was used to simulate and optimize these processes under realistic conditions. The results highlight the feasibility of transforming flared gases into useful resources, achieving both reduced carbon emissions and improved energy efficiency. This work illustrates a practical approach to turning pollutant emissions into opportunities, contributing to Algeria's energy transition and climate goals.

Key words: Flared gases, Valorization; Refinery, Aspen HYSYS, Hydrogen; GTL, Energy transition.

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Effet combiné des ultrasons et des surfactants sur la stabilité et les performances des membranes liquides émulsionnées pour l'extraction de cations métalliques

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Résumé:

La contamination de l'eau par les métaux lourds constitue un problème environnemental majeur. Les membranes liquides émulsionnées offrent une solution efficace pour leur extraction, dont la stabilité dépend des surfactants et des conditions opératoires. L'ultrasonification, combinée aux surfactants, améliore cette stabilité et renforce les performances du procédé. Le but de notre travail est dédié à l'étude de la possibilité d'extraction des ions du Ni(II) par un extractant Aliquat336 ,un tensio actif Span80, la membrane liquide émulsionnée (MLE) est la méthode utilisé pour effectuer cette extraction, par un procédé ultrason qui a été largement utilisé récemment, qui s'est dévoilé être une source d'énergie pratique dans les laboratoires de chimie. Les conditions opératoires optimales donnant un rendement d'extraction de R=96,7 %.

Mots Clés : Extraction, Nickel (II), Membrane liquide émulsionnée, ultrason

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Visible-Light Driven Photocatalyst for the Synergistic Degradation of Organic and Inorganic Pollutants

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Abstract:

Water pollution remains one of the most pressing global challenges, with industrial dyes and heavy metals contributing significantly to ecological degradation. This work reports the synthesis of a visible-light-active photocatalyst, designed to enhance heterogeneous photocatalysis within the framework of Advanced Oxidation Processes (AOPs). The catalyst was applied to the degradation of two representative contaminants: Rhodamine B, a toxic organic dye prone to bioaccumulation, and hexavalent chromium (Cr (VI)), a highly toxic heavy metal even at trace levels. The material, prepared via a solvothermal route, exhibited remarkable photocatalytic performance under visible light, achieving efficient decolorization of Rhodamine B and reduction of Cr (VI). These findings demonstrate the potential of the synthesized photocatalyst as a sustainable and cost-effective alternative for the treatment of industrial effluents, contributing to environmental protection and sustainable development goals.

Key words: Heterogeneous photocatalysis, Advanced Oxidation Processes, Visible light, Rhodamine B, Chromium (VI), Environmental remediation.

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Functionalization of Cellulosic Materials via Acrylic Acid Grafting: Application to Dye Adsorption

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Abstract:

This study focuses on the grafting of acrylic acid onto two cellulosic supports : ethyl cellulose and cellulose-based paper with the objective of enhancing their adsorption capacity for an industrial dye, methylene blue. The grafting process was initiated using potassium permanganate, which generates radical sites conducive to the covalent attachment of acrylic acid side chains to the main polymer backbone. The optimal reaction conditions involved a temperature of 70 °C, $KMnO_4$ concentration of 0.016 M, and grafting times ranging from 5 to 10 hours.

The grafted supports were characterized by infrared (IR) spectroscopy, revealing the characteristic bands of acrylic acid and confirming the success of the grafting reaction. A high grafting yield of 86% was achieved for ethyl cellulose, while grafted paper showed a significant improvement in grafting yield after 10 hours (up to 40%). Adsorption tests demonstrated that grafted ethyl cellulose exhibited a methylene blue adsorption capacity of up to 105% after 90 minutes of contact time, indicating the efficiency of the modified materials.

These findings are consistent with recent studies on the grafting of acrylic acid onto cellulosic substrates. For example, Aliyu and al, reported a grafting yield of 85% on acetylated cellulose extracted from maize cobs using ceric ammonium nitrate as an initiator [1]. Similarly, hydrophilic graft copolymers based on cellulose have shown high efficiency in dye adsorption, as demonstrated by Permatasari,and al [2] using pineapple peel cellulose and microwave-assisted activated carbon.

Key words: grafting, cellulosic supports, ethyl cellulose, cellulose-based paper, dye adsorption.

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Sn-Doped CdO thin films: Characterization and Investigation of Physical Properties

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Abstract:

Cadmium oxide (CdO) thin films doped with tin (Sn) were successfully deposited onto glass substrates using the spray pyrolysis technique at 350 °C. The influence of Sn doping on the structural, optical, and electrical properties of CdO films was systematically investigated. X-ray diffraction analysis revealed that the obtained films crystallize in a cubic structure with a preferential orientation along the (111) plane. Optical measurements showed an average transmittance of about 79% in the visible region, while the optical band gap values varied between 2.29 and 2.49 eV depending on the Sn concentration. Electrical characterization confirmed that all films exhibit n-type conductivity with significantly improved electrical performance compared to undoped CdO. The lowest resistivity of 7.85×10^{-4} Ω·cm was achieved for optimally Sn-doped films. These results demonstrate that Sn doping enhances the transparency and conductivity of CdO thin films, making them promising candidates for transparent conducting oxide (TCO) applications.

Keywords: CdO; thin films; Sn-doped CdO; spray pyrolysis technique.

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First-Principles Study of the Structural, Electronic, Elastic, and Thermodynamic Properties of the Half-Heusler Compound KLiS:

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Abstract:

In this study, we perform a comprehensive *ab initio* investigation of the structural, electronic, elastic, and thermodynamic properties of the half-Heusler compound KLiS, using density functional theory (DFT) within the generalized gradient approximation (GGA). The equilibrium lattice constant, bulk modulus, and total energy were determined by fitting the Murnaghan equation of state, confirming the structural stability of the compound. The calculated electronic band structure and density of states indicate that KLiS is a semiconductor, with the nature and magnitude of its band gap suggesting promising potential for optoelectronic applications. The computed elastic constants satisfy the Born stability criteria, demonstrating mechanical stability. From these constants, we derived Young's modulus, shear modulus, bulk modulus, Poisson's ratio, and Pugh's ratio, providing insights into the ductility, stiffness, and elastic anisotropy of the material. Furthermore, thermodynamic properties such as the Debye temperature, heat capacity at constant volume,

and thermal expansion coefficient were evaluated as functions of temperature using the quasi-harmonic Debye model, shedding light on its thermal response. Overall, these results provide a deeper understanding of KLiS and highlight its potential suitability for optoelectronic and thermoelectric applications.

Key words: DFT, half Heusler, semi conductor, thermodynamic properties

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Title: III-Arsenide Quantum Well Solar Cells: From Ideal Theory to Advanced Quantum Design–Application in $Al_xGa_{1-x}As$/GaAs Structure

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Abstract:

In this work, we present a combined analytical and simulation study of III-Arsenide based quantum well solar cells. The device key parameters such as the current-voltage characteristic, short-circuit current, open-circuit voltage, and fill factor are demonstrated using the ideal theory of quantum well solar cells. An advanced quantum design, involving the embedding of InAs quantum dots within an $Al_xGa_{1-x}As$/GaAs quantum well structure, is proposed to enhance device performance. Dot-in-well structures can be extended to other III-Arsenide quantum systems, offering pathways for broader application and improved efficiency.

Key words: III-Arsenide, quantum well solar cells, $Al_xGa_{1-x}As$/GaAs quantum well, InAs quantum dot.

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Electronic and Magnetic Properties of Ni2–xPtxMnGa Cubic Alloys

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Abstract:

In this study, we have established a careful analysis on the effect of Pt substitution at Ni sites on the electronic structure and magnetic properties of the Ni_2MnGa system in both cubic and tetragonal phases using FP-LAPW+*lo* method based on density functional theory. Two Pt concentrations were investigated x = 0.125 and 0.250 in $Ni_{2-x}Pt_xMnGa$ Heusler alloys using the supercell model. GGA+U calculations show that $Ni_{2-x}Pt_xMnGa$ alloys (x = 0, 0.125, 0.250) are stable in the cubic structure and the lattice parameters increase linearly with increasing platinum concentration. Band structure calculations show overlapping bands at the Fermi level indicating that these alloys are metallic. The atomic and total magnetic moments increase with increasing Pt concentration, which is responsible to the strengthening of ferromagnetism in these alloys. The anisotropy energy calculations predict that [100] and [010] axis are the easy and hard one respectively in our cubic ferromagnetic Pt doped Heusler. Our Pt doped Ni_2MnGa alloys could be synthesized to obtained novel shape memory alloys.

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Evaluating the Performance of a Cu-LDH Composite as an Adsorbent for Coomassie Brilliant Blue Dye

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Abstract:

This study presents the synthesis and characterization of a copper-based layered double hydroxide (Cu-LDH) composite via the coprecipitation method. The composite material aimed to effectively remove the anionic dye "Coomassie Brilliant Blue" (CBB). The synthesized nanocomposites were characterized using various techniques. The adsorption of CBB dye was investigated by studying various physicochemical variables, including contact time, and initial dye concentration. The contact time for efficient CBB dye removal was determined as 10 min, respectively. The results showed that Cu-LDHs exhibited a high adsorption capacity for CBB dye, with a maximum removal efficiency of 85% which could be achieved within 10 min, and the Cu- LDHs improved an experimental adsorption capacity at equilibrium q_{max} = 80 mg/g. Langmuir isotherm model provided a good ft to the equilibrium data, indicating monolayer adsorption.

Key words: LDHs; Coprecipitation; CBB Dye, Removal.

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Title: Characterization and photodegradation study of membrane based on Polysulfone

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Abstract:

The fundamental performance and efficiency parameters of membranes include selectivity, water flux, fouling resistance, and stability under chemical, mechanical, and thermal stresses, as well as long-term durability under operational conditions. Surface characteristics such as hydrophilicity, roughness, and average pore size and structure also play a crucial role in determining membrane behavior [1,4]. In this study, Polysulfone (PSf) was selected as the base material for membrane fabrication, as it is one of the most widely used polymers in pressure-driven membrane processes due to its excellent mechanical strength, chemical resistance, and thermal stability [2,3].

In this work; polysulfone-based membranes for nanofiltration prepared by the precipitation immersion method were developed. Three types of solvent were used; dymethilacettamide (MADc) and dymethilformamide DMF and chloroforme. These membranes are modified by adding a hydrophilic polymer, polyethyleneglycol (PEG), to two molecular weights 400 and 6000, whose purpose is to influence the molecular weight of PEG with differents concentrations on the thermo-mechanical properties of our membranes. To characterize our

materials, we used several analytical techniques such as DSC, MEB, and aging study. The experience has shown that the best method of developing nanofiltration membranes PSF-based PEG-modified is the immersion precipitation method and the good choice is DMAc. The results found confirm the existence of a flexibility threshold for the PEG400 and PEG6000 ; moreover, a comparative study has been made between the different production methods.

Keywords: Polysulfone, Polyethylene glycol, TiO2, dymethilacettamide, Dymethilformamide ,chloroformre

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[4]Shafiq Uz Zaman ; Fabrication and characterization of TiO2-hydroxyapatite composite-loaded Polysulfone membranes with integrated biocompatibility for dialysis application ; Artificial Organs ;00:1–13. 2024**Key words:** Perovskite solar cells, $MAPbI_3$, ZnO, NiOx, Spiro-OMeTAD, P3HT, thickness, temperature, stability, efficiency.

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Real-Time Solar Trajectory Tracking Using an Intelligent Dual-Axis Solar Tracker for Enhanced Photovoltaic Efficiency

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Abstract:

Photovoltaic conversion is one of the most promising solutions to meet the growing demand for clean and sustainable energy. However, the efficiency of fixed solar panels remains limited due to the continuous variation in the sun's position. To overcome this limitation, we have developed an intelligent dual-axis solar tracker capable of continuously optimizing the panel's orientation to enhance its energy yield. The system is based on a robust mechanical structure driven by two stepper motors and a DC motor, all managed through dedicated control circuits. The tracking is controlled by an Arduino Mega microcontroller, which receives real-time data from light, wind, dust, and voltage sensors in order to adjust the panel's position according to environmental conditions.

This work involves the integration of an astronomical calculation module and artificial intelligence algorithms, enabling prediction of the sun's trajectory and dynamic tracking

optimization. In addition, a mobile application developed using Flutter provides users with a user-friendly interface for monitoring, remote control, and energy performance analysis. Experimental tests demonstrated real-time tracking of the sun's trajectory, confirming the relevance and effectiveness of intelligent solar tracking. Beyond improved efficiency, the system also offers protective features against adverse weather conditions and enhances the overall durability of the installation. Ultimately, this work contributes to the promotion of renewable energy in Algeria and opens up practical application prospects in isolated rural areas, agricultural sites, and microgrids.

Key words: photovoltaic energy, intelligent solar tracker, Arduino microcontroller, mobile application, renewable energy.

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Advanced Power Conversion Technologies for Renewable Integration: Solid-State Transformers and Dual Active Bridges

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Abstract:

In the context of global energy transition, electrical grids must meet growing demands for efficiency, flexibility, and integration of renewable energy sources. Traditional electromechanical transformers are now reaching their limits in addressing the needs of smart grids, electric vehicles, and hybrid AC/DC infrastructures.

This work presents the study and modeling of two emerging power electronics technologies: the Power Electronic Transformer (PET), particularly in the form of the Solid-State Transformer (SST), and the Dual Active Bridge (DAB) converter. The SST enables multi-level AC/DC-DC/AC conversion, offering compactness, galvanic isolation, and bidirectional energy flow management, while the DAB ensures bidirectional DC/DC conversion with an efficiency above 96%, thanks to the use of semiconductors and Zero-Voltage Switching (ZVS).

Simulations in MATLAB/Simulink and practical tests confirm the relevance of these architectures for critical applications such as fast-charging stations for electric vehicles, railway traction systems, and the integration of renewable energy. The results demonstrate high compactness, reduced losses, and electromagnetic stability suitable for constrained environments.

The combination of the SST and DAB offers a promising approach to addressing the challenges of decarbonization, digitalization, and reliability of modern electrical grids, paving the way for applications in hybrid microgrids and the future of electric mobility.

Key words: Power Electronic Transformer, Solid-State Transformer, Dual Active Bridge, smart grids, renewable energy.

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Adhesion and Tribological Properties of an Aluminum Bronze Coating Developed by Thermal Spraying

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Abstract:

Thermal spraying has recently gained attention as a cost-effective and efficient surface engineering technique, providing excellent results in component restoration and protection. In the shipbuilding industry, many parts are exposed to severe environmental conditions that accelerate wear and degradation. Since several of these components are not produced in large quantities, their replacement is often costly and time-consuming, leading to extended maintenance delays. Copper-based alloys are widely employed in applications such as oil and gas pipelines, heat exchangers, propellers, and valves due to their outstanding resistance to both wear and corrosion. In this context, our study focuses on evaluating the feasibility of using aluminum bronze coatings to enhance the wear resistance of mechanical components. To this end, we performed a mechanical characterization to evaluate the adhesion strength between the coating and the substrate, followed by tribological tests to assess wear behavior in terms of mass loss and friction coefficient.

Keywords: Thermal spraying, Aluminum Bronze coating, wear resistance, Friction coefficient, Adhesion.

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Etude des propriétés structurales des couches minces d'oxyde de cadmium (CdO) synthèse par la technique de spray pyrolysis

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Abstract:

Des couches minces d'oxyde de cadmium (*CdO*) ont été déposées avec succès sur des substrats de verre amorphe par la technique de spray pyrolysis à une température de *573 °K*, en utilisant une solution aqueuse de poudre de nitrate de cadmium 4-hydrate à une concentration de 0,1 *M*. Les études de diffraction des rayons *X* (*DRX*) ont révélé une structure cristalline cubique. Les méthodes modifiées de Williamson–Hall et de Warren–Averbach sont utilisées avec succès pour analyser le profil de la raie *DRX* afin de déterminer la taille des cristallites, la densité des dislocations et la distribution de la taille des cristallites dans les couches minces de *CdO* . La taille des cristallites (*D*) et les largeurs intégrales (*d*) (*D = 44,139 nm* et *d = 32,237 nm*) sont obtenues par la méthode de Williamson Hall modifiée, tandis que les tailles de grains moyennes pondérées en surface et en volume obtenues par la méthode de Warren-Averbach modifiée sont respectivement ⟨*x*⟩ *vol = 46,06 nm* et ⟨*x*⟩ *aire = 29,7 nm*. Les paramètres de taille (*Lo*), de densité de dislocations (*ρ*), de rayon de coupure externe effectif (*Re*) et de disposition des dislocations (μ) obtenus par la méthode de Warren-Averbach sont respectivement de *35,53 nm*, *2,0 × 1015 m⁻²*, *2,7 nm* et *0,31 nm*. La distribution de la taille des cristallites (*x*) dérivée de la *DRX* et estimée du paramètre de taille est la fonction de distribution des cristallites *f(x)* log-normale.

Key words: couches minces, d'oxyde de cadmium (*CdO*), la technique de spray pyrolyse, diffraction des rayons *X* (*DRX*), la taille des cristallites, dislocations.

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Title: Exploring Perovskite Oxides as Promising Materials for Spintronic Devices

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Abstract:

Recent advances in the field of spintronics have significantly increased interest in Heusler alloys and perovskite oxides due to their promising electronic and magnetic properties. Spintronic devices primarily rely on a strong imbalance between spin-up (majority) and spin-down (minority) electrons, ideally achieving 100% spin polarization at the Fermi level. A particularly important class of materials for these applications includes certain perovskite oxides, which are known to exhibit half-metallic ferromagnetism (HMF), a key property for efficient spin injection and transport.

In this work, we present a comprehensive investigation of the structural, electronic, and magnetic properties of the perovskite oxide $SnCrO_3$ in its stoichiometric ABO_3 composition. Our study is based on first-principles calculations carried out using the full-potential linearized augmented plane wave (FP-LAPW) method within the framework of density functional theory (DFT), as implemented in the Wien2k computational package. For the

exchange-correlation functional, the generalized gradient approximation (GGA) according to the Perdew–Burke–Ernzerhof (PBE) formulation was employed.

Our computational results demonstrate that the $SnCrO_3$ compound stabilizes in a cubic perovskite structure at equilibrium. Moreover, the electronic and magnetic characteristics indicate that such materials hold great potential for spintronic applications, especially where high spin polarization is required. This suggests that perovskite oxides like $SnCrO_3$ could play a crucial role in the development of future spin-based technologies.

Key words: Spintronics ; perovskite oxide ; FP-LAPW ; Wien2k ; DFT ; $SnCrO_3$.

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Title: Electronic and Magnetic Insights into Heusler Compounds for Spintronic Devices

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Abstract:

Half-metallic ferromagnets (HMFs) among Heusler compounds are pivotal for advancing spintronic devices. This study delves into the structural, electronic, and magnetic characteristics of Co_2MnSn, a prominent HMF with significant potential in spintronics. Employing the full-potential linearized plane wave plus local orbital method (FP-LAPW+lo) with the generalized gradient approximation (GGA-PBE) for electronic exchange-correlation energy, we comprehensively analyze Co_2MnSn's properties. Key ground state attributes such as equilibrium lattice constant, bulk modulus, and its pressure derivative are computed and compared with experimental data, offering fresh insights into its applicability in spintronic technologies. Our findings reveal Co_2MnSn's robust half-metallic ferromagnetism, crucial for spin-polarized current applications in devices. The calculated electronic structure confirms the material's high spin polarization and potential for efficient spin injection. Structural analysis highlights its stability and mechanical properties, essential for device fabrication processes. Magnetic investigations demonstrate strong ferromagnetic ordering, reinforcing its suitability for spintronic applications where spin coherence and efficiency are paramount.In

conclusion, this study underscores Co_2MnSn as a promising candidate among HMFs, characterized by its favorable electronic and magnetic properties validated through rigorous computational methods. These insights not only advance fundamental understanding but also pave the way for targeted experimental investigations and device integration, propelling spintronics towards enhanced performance and functionality.

Key words: *Spintronics ; Heusler compounds ; half-metallic ferromagnets ; FP-LAPW+lo ; GGA-PBE.*

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Influence of Hydrostatic and Uniaxial Pressure on the Electronic and Magnetic Properties of Ferromagnetic Full-Heusler Alloys: A First-Principles Investigation

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Abstract:

In this work, we explored the influence of hydrostatic and uniaxial pressures on the electronic and magnetic properties of the Rh_2MnAl full-Heusler alloy using density functional theory (DFT) as implemented in the Wien2k simulation package. Structural optimization reveals that the compound stabilizes in the cubic $L2_1$ structure with a predominant ferromagnetic phase. The electronic and magnetic properties were calculated within the generalized gradient approximation (GGA), including spin–orbit coupling (GGA + SOC). Results indicate that Rh_2MnAl exhibits ferromagnetic metallic behaviour, with a total magnetic moment of 4.075μB. Experimentally, Masumoto et al. reported the successful synthesis of this alloy and confirmed its cubic ground-state structure. Our study further demonstrates that the Slater–Pauling rule is fulfilled under hydrostatic and uniaxial strains of 5.7% and 10.2%, respectively, yielding an integer total magnetic moment of 4.000 μB, although half-metallicity could not be confirmed. Beyond 3% strain, spin polarization displays opposite trends depending on whether hydrostatic or uniaxial pressure is applied.

Key words: full-Heusler, DFT, GGA, SOC, hydrostatic and uniaxial strains.

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Exploring the Mechanism of Tb^{3+} Luminescence Quenching by Inter-Valence Charge Transfer in $YP_{1_x}V_xO_4$

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Abstract:

Simple sol-gel method was used to synthesize nanoscale yttrium phosphate-vanadates doped Terbium with general formula $YP_{1_x}V_xO_4$: 1 at. % Tb^{3+} ($1 \geq x \geq 0$). The structural analysis reveals that the progressive insertion of vanadate groups $(VO_4)^{3-}$ in YPO_4 lattice, alter the structural, morphology and spectroscopic properties. Blue and green PL emissions of Tb^{3+} and $(VO4)^{3-}$ were observed in $YP_{1_x}V_xO_4$. It is found that $YP_{0.5}V_{0.5}O_4$: 1 at. % Tb^{3+} presents the highest Tb^{3+} emission, indicating that a high energy transfer efficiency is correspond to 50% vanadium content. As the vanadium content increases, the distance Tb^{3+} -V^{5+} becomes shorter and the excitation spectra are redshifted indicate the lowering of Inter-Valence Charge transfer (IVCT) position of the nanophosphors.

Key words: $YP_{1-x}V_xO_4$, 1 at. % Tb^{3+}, Nanophosphors, Photoluminescence, IVCT.

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First-Principles Insights into the Structural Stability and Semiconducting Nature of FeVSb Half-Heusler

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Abstract:

The structural, electronic, elastic, and vibrational properties of the half-Heusler compound FeVSb have been investigated using first-principles calculations within the density functional theory framework DFT and the generalized gradient approximation GGA. Total energy analysis confirms that the cubic $C1_b$ non-magnetic configuration represents the most stable ground state, with a negative formation energy supporting its structural stability. Elastic constants and phonon dispersion spectra further validate the mechanical and dynamical stability of this phase. Electronic structure calculations reveal that FeVSb is a semiconductor with an indirect band gap of 0.34 eV. These results provide valuable insight into the intrinsic characteristics of FeVSb and highlight its potential as a promising candidate for future applications in thermoelectric and electronic devices.

Key words: Half-Heusler alloys, DFT, Phonon spectra,GGA, semiconductor.

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Innovative Clay-Catalyzed Approach for the Synthesis and Structural Characterization of Poly(N-vinylcarbazole-co-1,3-dioxolane)

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Abstract:

Poly(N-vinylcarbazole) (PNVC) is a conjugated thermoplastic polymer of major scientific and industrial interest because of its wide range of applications in charge transport materials, optoelectronics, photocopying, and electrophotography. Recent research has expanded their applications in the biomedical field to include biosensors, cell markers, radiation protectors, and antibacterial coatings. This polymer is particularly appreciated for its photoconductive, electrochemical, and optical properties as well as its thermal and chemical stability; however, its common use is limited because of its poor mechanical characteristics and fragility (Tg = 227 °C), which considerably limits its commercial applications. Attempts to improve the characteristics of PNVC have focused on copolymerization. In addition, the use of traditional initiators in polymer synthesis processes has several disadvantages (toxicity, non-recoverability, extremely high cost, pollutants, and harm to health). To improve the mechanical properties of PNVC, we performed a series of cationic copolymerization reactions of N-vinylcarbazole with 1,3-dioxolane using Maghnite-H as a green catalyst (an activated

Algerian clay of the montmorillonite type). Several reactions were performed in solution while varying the amount of catalyst, temperature, and time to determine the optimal operating conditions for the synthesis of N-vinylcarbazole-based copolymers. The detailed characterization of these materials was carried out using FTIR, UV, and NMR spectroscopy. In this study, we developed a new method of synthesis via a cationic route using a green catalyst. From the results obtained, it can be observed that clay exhibits a high catalytic efficiency. This observation is based on the high yield obtained using very small amounts of the catalyst.

Key words: N-vinylcarbazole, poly(N-vinylcarbazole), cationic copolymerization, Maghnite-H.

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Title: Structural, electronic and optical properties of rock salt $Mg_xCd_{1-x}O$ for optoelectronic applications: a first-principles approach

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Abstract:

We performed full-potential linearized augmented plane wave (FP-LAPW) to investigate the optoelectronic properties of $Mg_xCd_{1-x}O$ ternary alloys and their end binaries in the zinc-blende structure. We assessed $Mg_xCd_{1-x}O$ alloys over the entire S concentration range (with x from 0 to 1). The equilibrium structural parameters were determined by total energy minimization using the generalized gradient approximation (GGA- WC). Electronic properties of $Mg_xCd_{1-x}O$ ternary alloys in zinc blende structure, including band structures, band gaps values and density of states, are calculated via (TB-mBJ). The equilibrium lattice parameters and bulk modulus were calculated and analyzed for binaries and ternaries. The obtained results for the band structures are compared with the existing data in the literature. The calculated electronic band structures show that $Mg_xCd_{1-x}O$ ternary alloys have a direct band gap along with a semiconductor nature. In addition, the optical properties were calculated and discussed in details. Generally, we noticed that $Mg_xCd_{1-x}O$ ternary alloys possess a broad absorption spectrum covering the UV-Vis region and therefore make them suitable candidates for photovoltaic applications.

Keywords: $Mg_xCd_{1-x}O$ ternary alloys, Full-potential linearized augmented plane wave; (TB-mBJ) approach; Optical parameters, Photovoltaic; absorption coefficient

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Detecting energetic Structures in Turbulent Wall Jet Using Wigner-Ville Distribution

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Abstract:

A Wigner Ville Distribution (WVD) has been widely applied to time series of signal due to its ability of revealing temporal information of energetic event together with its spectral information. For this reason, the WVD seems a very good tool for a detailed study into the dynamics of spatial structures, particularly the structures that arising in turbulent flows. In this paper, we perform a multi-scale decomposition by Wigner Ville Distribution to velocity field of turbulent wall jet. The result shows that, the energetic structures are the most irregular features in the velocity field corresponding to passage of eddies.

Key words: Wigner Ville Distribution, energetic structures, Turbulent flow, time series of signal.

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Title: STRUCTURAL, ELASTIC, AND ELECTRONIC PROPERTIES OF Ti_3InN ANTIPEROVSKITE

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Abstract:

We investigated the structural, elastic, and electronic properties of Ti_3InN antiperovskite. Our calculations were done within the full potential-linearized augmented plane wave (FP-LAPW) method based on the density functional theory (DFT) as implemented in the code wien2k. we use the generalized gradient approximation (GGA_PBE), the generalized gradient approximation (GGA_PBEsol) and the local density approximation LDA for the structural and elastic properties to describe the exchange-correlation potential. We calculated the electronic properties using the GGA_PBE. The result obtained of lattice parameters calculated with GGA-PBE is in good agreement with the experimental data.

On the other hand, Ti_3InN are mechanically stable, elastically anisotropic, moreover, the electronic properties calculations show that Ti_3InN is a metal. The found results are compared to the experimental data and other theoretical calculations.

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Title: Preparation of porous carbon with a large specific surface area from Quercus suber L for highly efficient dye removal

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Abstract:

The fruit of Quercus suber L (QsL), a readily available biomass, was used as a precursor to prepare porous carbon with a large specific surface area and high adsorption capacity for dyes. After preparation, QsL was chemically activated, and zinc chloride proved to be a better activator than phosphoric acid and potassium hydroxide. The porous carbon derived from QsL had numerous micro- and mesopores, and its specific surface area reached 1985.06 m² g^(−1). The performance of PCQL (porous carbon produced from the fruit of Quercus suber L) was evaluated by adsorption of a cationic methylene blue dye from water. The PCQsL was characterized by immediate analysis, such as BET surface area, FT-IR analysis and pHzpc. In addition, the effect of various operational parameters such as pH, contact time, adsorbent dose, initial dye concentration and temperature on the removal of dyes from synthetic wastewater was studied.

Key words: Adsorption, Activated carbon, The fruit of Quercus suber L, Biomass Chemical activation, micro- and mesopores.

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Structural and Electronic Properties of GaAs/GaBi Superlattice: Insight from First-Principales calculations

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Abstract:

The investigation of III-V semiconductor superlattices, specifically GaAs/GaBi and GaAs/GaBiAs systems, has gained significant attention due to their potential applications in optoelectronics, photovoltaics, and high-efficiency devices. In this work, we constructed layered supercells to simulate superlattice structures with different growth orientations ((001), (111), and (011)) using the WIEN2k package. Structural and electronic properties are explored by varying Bi composition and superlattice thickness, with special emphasis on lattice mismatch effects and bandgap engineering. This study highlights the feasibility of designing novel heterostructures and provides a pathway toward optimized semiconductor devices.

Key words: III-V Materials, Wien2k, Superlattices, DFT.

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Properties of the Anti-perovskite Compounds Ag3SX (X = I, Br, and Cl): Structural, Elastic, and Thermoelectric Analysis

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Abstract:

The increase in demand for clean energy technology has led academics to investigate environmentally sustainable alternatives to conventional semiconductors. Silver chalcohalide anti-perovskites, often overlooked, present a viable lead-free alternative. This research utilized first-principles calculations grounded in the FP-LAPW method to forecast the structural, electrical, elastic, and thermoelectric characteristics of Ag3SX (X = I, Br, Cl) compounds. The GGA-PBE and TB-mBJ exchange-correlation functionals were employed. Optimized structures indicated lattice constants of 5.020 Å, 4.93 Å, and 4.89 Å for Ag3SI, Ag3SBr, and Ag3SCl, respectively. Electronic structural calculations revealed that these materials are indirect bandgap semiconductors. The bandgap values, ascertained using GGA and mBJ approximations, were 0.598 eV, 0.809 eV, and 1.042 eV (GGA), and 1.678 eV, 1.939 eV, and 2.231 eV (mBJ) for Ag3SI, Ag3SBr, and Ag3SCl, respectively. The density of states study elucidated the orbital interactions within the molecules. Elastic constants and associated properties were calculated, and thermoelectric metrics, such as Seebeck coefficient, electrical conductivity, thermal conductivity, power factor, and figure of merit, were assessed as a function of

temperature. The findings indicate that these p-type chemicals may be utilized in mitigating global warming issues via thermoelectric energy conversion.

Key words: Anti-Perovskite, Wien2k, DFT, GGA, mBJ, FP-LAPW

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Retrait des bétons autoplaçants fibrés contenant du laitier

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Résumé:

Le secteur de la construction consomme une grande quantité de ressources naturelles et d'énergie et produit une grande quantité de déchets. L'une des solutions pour réduire ses effets négatifs consiste à recycler les déchets afin de produire des matériaux respectueux de l'environnement. Cette recherche présente une étude expérimentale sur l'effet des fibres d'acier issues du recyclage de pneus usés sur les propriétés du béton autoplaçant conçu avec des agrégats recyclés et du laitier granulé de haut fourneau en remplacement du ciment en poids. Le module d'élasticité a été mesuré à 28 jours et le retrait total a été évalué sur des éprouvettes prismatiques pendant 180 jours. Les résultats ont montré que l'ajout de fibres améliore le module d'élasticité, et l'incorporation de fibres avec du laitier a réduit les déformations du retrait total en diminuant le risque de fissuration.

Mot-clés: Béton autoplaçant, fibres d'acier recyclées, laitier, retrait, module d'élasticité.

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Synthesis of Hydrogels Based on Macromonomers and Acrylamide via Radical Polymerization

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Abstract:

Our study focuses on the preparation of hydrogels by copolymerization of prepared macromonomers with acrylamide. The radical polymerization of the styrene oxide macromonomer **PSTO(AM)** with acrylamide **(AC)**, initiated by benzoyl peroxide **(POB)**, leads to the formation of hydrogels. we prepared a series of hydrogels based on **PSTO/AM** acrylate and acrylamide by radical polymerization. The composition was varied by adjusting the acrylamide content (**20%**, **50%**, and **80%**) using two types of macromonomers, **PSTO(1%AM)** and **PSTO(3%AM)**, with benzoyl peroxide **(POB)** as the initiator.The obtained products were characterized using various analysis techniques.Characterization by Fourier-transform infrared (FTIR) spectroscopy confirmed the structure of the poly(STO-co-AC) hydrogel networks. Optical microscopy observations revealed a progressive increase in porosity with increasing AC content. At higher concentrations, the hydrogels exhibited a distinctly macroporous structure.

Key words: hydrogel, styrene oxide macromonomer PSTO/AM, Acrylamide AC, benzoyl peroxide, radical polyrimezation

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Design of a Poly(Glycidyl Methacrylate-co-Maleic Anhydride) Copolymer Material for Selective Cationic Dyes Removal in Water Treatment

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Abstract:

In this study, a copolymer material based on poly(glycidyl methacrylate-co-maleic anhydride) [P(GMA-co-MA)] was synthesized and characterized for the selective adsorption of cationic dyes from aqueous solutions. The chemical structure of the copolymer was confirmed by Fourier Transform Infrared Spectroscopy (FTIR), revealing the successful incorporation of both glycidyl methacrylate and maleic anhydride monomers. Morphological analysis via Scanning Electron Microscopy (SEM) showed a porous surface favorable for dye adsorption. X-ray Diffraction (XRD) patterns indicated an amorphous structure, which is beneficial for interaction with dye molecules. Adsorption tests were conducted using different cationic dyes. The copolymer material demonstrated high adsorption capacities and selectivity towards these dyes under optimized conditions. The results highlight the potential of this hydrophobic copolymer as an effective and reusable adsorbent for water purification applications targeting hazardous cationic dye pollutants.

Keywords: Copolymer, Cationic dyes, Adsorption, Water treatment.

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Title: Full Factorial Design Approach to Optimizing Genetic Algorithms for Wind Farm Layout

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Abstract:

Wind energy represents a key pillar of renewable power, combining substantial environmental advantages with economic potential. Nevertheless, its spatial variability makes the optimal design of wind farms a challenging task. This study addresses the layout optimization problem by systematically adjusting genetic algorithm (GA) parameters through the design of experiments (DOE) approach. A full 2^2 factorial design was applied to assess the effects of crossover and mutation probabilities, with the objective of improving convergence speed and algorithm robustness. The methodology was validated on a hypothetical wind farm constrained by unidirectional wind and spatial limitations, where the fitness function explicitly incorporated wake effects to maximize energy production. The optimized GA demonstrated significant improvements in performance compared with previous works. Furthermore, the calibrated parameters enabled the placement of additional turbines, thereby enhancing land-use efficiency without extra costs. Statistical evaluations, including ANOVA and response surface modeling, revealed strong interaction effects between GA parameters, highlighting the superiority of structured parameter tuning over conventional trial-and-error

strategies. Beyond its methodological advances, this research provides a data-driven framework with direct implications for practical applications such as smart grid integration and adaptive renewable energy systems. Overall, the findings confirm that systematic GA tuning plays a decisive role in improving wind farm performance, energy efficiency, and economic viability.

Key words: wind farm optimization, genetic algorithms, designs of experiments, wake effect, full factorial design, parameter tuning

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Numerical Modeling of Particle Trajectories in a Semi-Industrial Eddy Current Separator

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Abstract:

This study presents a numerical model based on the finite element method to analyze the electromagnetic behavior of non-ferrous metallic particles within an eddy current separator (ECS). The developed model operates as a black box, taking as input parameters the rotor speed, particle size, and the distance between the particle and the rotor, in order to estimate the intensity of the electromagnetic force acting on the particle. The magnetic field was computed using COMSOL Multiphysics and subsequently coupled with a program developed in MATLAB to simulate the trajectories of conductive particles. The results highlight the significant influence of rotor speed and particle size on the separation efficiency, whereas the particle–rotor distance exhibits an inverse effect on the induced force. The simulations allow accurate prediction of the system's electromagnetic behavior and provide a means to optimize the operational conditions of the separator. Furthermore, the study emphasizes the importance of particle size reduction in industrial applications to enhance the dissociation and separation of ferrous and non-ferrous materials.

Key words: Eddy current separator, The separation force, Particle trajectories, Separation efficiency.

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Title: optoelectronic properties of the $Dy_2Be_2GeO_7$ complex oxide via ab-initio methods

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Abstract:

Technological advancement relies fundamentally on a thorough understanding of materials and their physical properties. Among these, complex oxides represent a distinctive class of materials whose unique characteristics make them highly promising for various technological applications. These materials exhibit a wide range of functional properties, such as high-temperature superconductivity, multiferroicity, and catalytic activity, which are largely governed by their intricate crystal structures and electron correlations.

In the present study, first-principles calculations were carried out using the Full-Potential Linearized Augmented Plane Wave plus local orbitals (FP-LAPW + lo) method, as implemented in the WIEN2k computational code, within the framework of density functional theory (DFT). To approximate the exchange and correlation effects, the PBE-GGA formalism of the "generalized gradient approximation" is used. Furthermore, "Tran-Blaha modified Becke–Johnson potential" is used to better describe the electronic structure. The electronic properties are determined with spin-polarized inclusions and the optical properties are examined with a detailed discussion of different optical parameters The $Dy_2Be_2GeO_7$ complex oxide with a non centrosymmetric tetragonal structure shows a negative birefringent, therefore it is a possible candidate for applying to the birefringent field and nonlinear optical process.

Key words: FP-LAPW + lo, DFT, PBE, GGA.

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First-principles calculation of structural and thermodynamic properties of the $Dy_2Be_2GeO_7$ complex oxide

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Abstract:

The advancement of functional technologies critically depends on the ability to control and understand the physical properties of complex materials. Complex oxides, governed by strong electron correlations and structural complexity, host a wide range of emergent phenomena—including unconventional superconductivity, multiferroicity, and enhanced catalytic responses—positioning them at the forefront of material science research.

In the present study, first-principles calculations were carried out using the Full-Potential Linearized Augmented Plane Wave plus local orbitals (FP-LAPW + lo) method, as implemented in the WIEN2k computational code, within the framework of density functional theory (DFT). The exchange-correlation interactions were treated using the Perdew–Burke–Ernzerhof (PBE) parametrization of the generalized gradient approximation (GGA), ensuring a reliable description of the structural propertie. The calculated equilibrium structural parameters show excellent agreement with available experimental data, validating the accuracy of the computational approach. Furthermore, the thermodynamic behavior of the

studied compounds was investigated through the quasi-harmonic approximation (QHA), considering temperature and pressure ranges from 0 to 700 K and 0 to 10 GPa, respectively. This analysis provides valuable insights into the stability, thermal expansion, and heat capacity of the materials, which are essential for their potential integration into advanced technological systems.

Key words: FP-LAPW + lo, DFT, PBE, GGA, QHA.

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Bacillus amyloliquefaciens as a Biological Platform for the Sustainable Biofabrication of Enzymatic Materials

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Abstract:

The frontier of sustainable materials science increasingly focuses on harnessing biological systems for the eco-efficient synthesis of functional materials. This study introduces a robust biofabrication platform based on a polyextremotolerant strain of *Bacillus amyloliquefaciens*, isolated from Algerian agro-waste, for the high-yield production of pectinase-based enzymatic materials. By valorizing fruit processing residues as the sole carbon source, this platform converts low-value biomass into high-value catalytic materials, aligning with principles of circular bioeconomy. Under optimized fermentation conditions, the strain demonstrated markedly enhanced pectinase productivity while significantly reducing production costs, setting a benchmark for scalable and cost-effective biomanufacturing. The resulting enzymatic material exhibits exceptional structural stability and sustained catalytic performance under

challenging industrial conditions, including high alkalinity, salinity, and temperature. This work advances beyond conventional enzyme production, offering an integrated, scalable pipeline that redefines waste-to-materials conversion and provides a sustainable alternative to traditional chemical catalysts. The proposed platform not only delivers a viable solution for environmentally responsible industrial applications, particularly in food processing, but also establishes a versatile blueprint for the biofabrication of a broader range of enzymatic materials, placing synthetic biology at the forefront of next-generation sustainable material innovation.

Key words: Biofabrication, Enzymatic Materials, *Bacillus amyloliquefaciens*, Sustainable Biomaterials, Green Synthesis, Agro-waste Valorization, Polyextremotolerant Biocatalysts, Circular Bioeconomy.

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Exploring the structural, electronic and thermoelectric properties of Cesium based double perovskite Cs_2MgCuX_6(X=Br,I)

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Abstract:

Lead-free double perovskites are considered among the most promising materials in modern technology due to their unique physical and chemical properties, which combine efficiency, sustainability, and ease of fabrication. In this work, we focus on exploring the structural, electronic, and thermoelectric properties of cesium-based double perovskites by performing first-principles calculations within the framework of density functional theory (DFT). The calculations reveal that the two compound are stable in the magnetic phase. Furthermore, the electronic properties indicate half-metallic behavior for both compound where the energy band gap E_g for Cs_2MgCuI_6 compound was found to be 1.02eV, while for $Cs_2MgCuBr_6$ it reached 1.71 eV in the spin-up state. In contrast, under the spin-down state, both compounds exhibit metallic behavior. Additionally, the thermoelectric properties were investigated, revealing key parameters including the Seebeck coefficient, electrical conductivity which provide valuable insights into the materials' performance for energy conversion applications.

The electrical conductivity of Cs_2MgCuI_6 exhibited an increasing trend with rising temperature, whereas $Cs_2MgCuBr_6$ showed a decreasing trend. These observations provide valuable insights into the materials' performance for energy conversion applications. The Seebeck coefficient displayed a significant increasing trend for $Cs_2MgCuBr_6$ compared to Cs_2MgCuI_6. These observations provide valuable insights into the materials' performance for energy conversion applications. Furthermore, the thermoelectric figure of merit (ZT) was calculated, reaching values of 0.39 and 0.47 for Cs_2MgCuI_6 and $Cs_2MgCuBr_6$, respectively. We hope that these investigated results are encouraging and demonstrate the potential applicability of these compounds in the fields of optoelectronics, spintronic devices, and photothermal energy applications

Key words: density functional theory (DFT), Lead-free double perovskites, Thermoelectric Properties, Electronic Properties.

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Title: Smart Photovoltaic Systems Optimized by the Emperor Penguin Optimizer: Robust ANN-Based MPPT under Dynamic Environmental Conditions

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Abstract:

This work evaluates an Artificial Neural Network (ANN) based controller for maximizing energy efficiency in photovoltaic systems under changing irradiance and temperature, using the Emperor Penguin Optimizer (EPO) for metaheuristic weight tuning. The study compares three training regimes: a baseline ANN, one using Particle Swarm Optimization (PSO), and one using EPO, across over 10,000 simulated atmospheric scenarios. Results indicate that the EPO-tuned ANN achieves faster convergence within approximately 50 iterations, lower best cost, and maintains near-zero tracking error, demonstrating stable maximum power point tracking (MPPT) under varying conditions. The findings suggest that EPO-tuned ANN controllers are effective for resilient photovoltaic operation.

Key words: Emperor Penguin Optimizer, Artificial Neural Network, Maximum Power Point Tracking, Photovoltaic Systems, Swarm Intelligence, Optimization, Renewable Energy, Robust Control

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Title: Structural, electronic and optical properties of rock salt $Mg_xCd_{1-x}O$ for optoelectronic applications: a first-principles approach

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Abstract:

We performed full-potential linearized augmented plane wave (FP-LAPW) to investigate the optoelectronic properties of $Mg_xCd_{1-x}O$ ternary alloys and their end binaries in the zinc-blende structure. We assessed $Mg_xCd_{1-x}O$ alloys over the entire S concentration range (with x from 0 to 1). The equilibrium structural parameters were determined by total energy minimization using the generalized gradient approximation (GGA- WC). Electronic properties of $Mg_xCd_{1-x}O$ ternary alloys in zinc blende structure, including band structures, band gaps values and density of states, are calculated via (TB-mBJ). The equilibrium lattice parameters and bulk modulus were calculated and analyzed for binaries and ternaries. The obtained results for the band structures are compared with the existing data in the literature. The calculated electronic band structures show that $Mg_xCd_{1-x}O$ ternary alloys have a direct band gap along with a semiconductor nature. In addition, the optical properties were calculated and discussed in details. Generally, we noticed that $Mg_xCd_{1-x}O$ ternary alloys possess a broad absorption spectrum covering the UV-Vis region and therefore make them suitable candidates for photovoltaic applications.

Keywords: $Mg_xCd_{1-x}O$ ternary alloys, Full-potential linearized augmented plane wave; (TB-mBJ) approach; Optical parameters, Photovoltaic; absorption coefficient

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Experimental separation of micronized insulating mixtures by means of a rotating double-cylinder separator

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Abstract:

This study investigates the performance of a free-fall tribo-electrostatic separator equipped with two vertical rotating electrodes for sorting micronized plastic particles derived from waste electrical and electronic equipment (WEEE).In order to improve separation stability, the separator design reduces particle–electrode impacts and encourages the effective removal of finely ground particles from electrode surfaces.

To assess the impact of important operational parameters, experiments were conducted on a synthetic combination of white and grey polyvinyl chloride (PVC) particles.

The optimal conditions were determined to be an applied voltage of U = 18.3 kV, an electrode spacing of D = 7.0 cm, and a rotation speed of N = 325 rpm, resulting in both recovery and purity levels exceeding 90% for white (WPVC) and grey (GPVC) PVC products.

These results demonstrate the high efficiency and potential of the rotating-electrode tribo-electrostatic separator for the fine separation of micronized polymer waste from WEEE recycling streams.

Key words: electrostatic separator, micronized plastics, triboelectric charge, experimental design, colorimetry.

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Innovative Coagulation Strategies for Dam Water Treatment: Balancing Efficiency and Cost

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Abstract:

This study compares the efficiency of aluminum sulfate ($Al_2(SO_4)_3$) and ferric chloride ($FeCl_3$) as coagulants for treating Bouroumi Reservoir dam water in Algeria, focusing on water quality and cost-effectiveness. Laboratory experiments assessed turbidity, suspended solids, and organic matter removal, alongside economic analysis. Ferric chloride outperformed aluminum sulfate, reducing turbidity by 61% (vs. 56%) and removing organic matter more effectively while eliminating residual aluminum. Economically, ferric chloride saved $2,421.36 per million m^3 of treated water. These results endorse ferric chloride as a superior, cost-effective, and sustainable coagulant for dam water treatment.

Key words: Water treatment, Coagulants, Ferric chloride, Aluminum sulfate, Turbidity reduction

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Valorization of Biomaterials for the Textile Day by coagulation Flocculation Green Chemistry

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Abstract

This study aims to exploit *Moringa oleifera* seeds and use them for industrial wastewater treatment. The seeds were used as a liquid (extracts) as biocoagulants [1,2]. The objective of to optimize the factors influencing the removal of malathion by a physicochemical treatment, coagulation- flocculation, using an experimental design. By carrying out the tests and analysing the data, the screening of the factors made it possible to identify the optimum conditions necessary to obtain better elimination[3]. These operating conditions are pH, coagulant dose, the concentration of initial solutions, and stirring speed. Our study demonstrated the importance of applying the design of experiments methodology, particularly the response surface methodology (RSM)[4]. A full factorial design allowed the optimization of operational parameters affecting flocculation coagulation. Green chemistry offers a

sustainable and responsible approach to dye coagulation-flocculation, contributing to a more environmentally friendly future while meeting industrial needs [5]. Integrating green chemistry into dye coagulation-flocculation offers a sustainable advantage that meets today's environmental challenges while optimizing industrial processes.

Keywords: Optimization · Response Surface Methodology · Pesticide, Malathion · Coagulation-Flocculation, Green Chemistry.

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Title: Ab initio Investigation of the Electronic Properties of the Double Spinel $ZnFeSnO_4$: A DFT+U Approach and Analysis of Electronic Correlation Effects

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Abstract:

Double spinel oxides, with general formula $ABB'O_4$, have attracted increasing attention due to their promising electronic properties. In this work, we investigated the electronic structure of the double spinel $ZnFeSnO_4$ using density functional theory with the DFT+U approach. The analysis of the electronic band structure and density of states reveals the semiconducting nature of $ZnFeSnO_4$, with electronic features strongly influenced by the Fe and Sn contributions. The incorporation of the Hubbard U correction provides a more accurate description of the localized d-states, which are crucial for understanding the material's electronic behavior. These results highlight the potential of $ZnFeSnO_4$ for future electronic and optoelectronic applications.

Key words: Double Spinel Oxides, Electronic Properties, DFT+U

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Multi-Enzymatic Actinomycetes: Integrated Biotechnological Solutions from Soil Ecosystems

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Abstract:

Actinomycetes are essential components of soil microbial ecosystems, contributing to organic matter decomposition through diverse enzymatic activities. This study comprehensively evaluated the multi-enzymatic potential of chitinase-producing actinomycetes for integrated biotechnological applications.

Fifteen chitinase-producing strains were isolated and screened. The most performant strain underwent molecular identification via 16S rRNA sequencing, chitinase production optimization, and comprehensive enzymatic profiling including pectinase, cellulase, amylase, and gelatinase activities. Antimicrobial properties were evaluated against bacterial and fungal pathogens.

Molecular identification revealed Streptomyces species with 98-99% similarity. Optimization achieved 185% increase in chitinase production (62.4±4.1 U/mL). Multi-enzymatic characterization demonstrated exceptional activities: amylase (52.1±4.2 U/mL), pectinase (45.2±3.1 U/mL), cellulase (38.7±2.8 U/mL), and positive gelatinase activity. The strain showed enzymatic synergy with simultaneous production of all tested enzymes. Antimicrobial evaluation revealed strong antibacterial activity against S. aureus (18.5±1.2 mm), E. coli

(14.2±0.8 mm), and excellent antifungal activity against F. oxysporum (72.4% inhibition) and A. niger (68.1% inhibition).

We propose an integrated multi-enzymatic bioprocessing system utilizing the single-strain, multi-enzyme capabilities for simultaneous processing of diverse organic substrates. This approach offers advantages in agricultural waste management, biocontrol integration, and industrial bioprocessing while reducing system complexity and costs.

This research demonstrates the exceptional multi-enzymatic potential of soil actinomycetes, providing quantitative evidence for integrated biotechnological applications. The enzymatic synergies and antimicrobial properties position this strain as an innovative solution for sustainable biotechnology combining waste management and biocontrol functions.

Keywords: Multi-enzymatic actinomycetes, Enzymatic synergy, Integrated bioprocessing, Sustainable biotechnology

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Smart Hydroponic Farming System Based on AI-Driven Monitoring and Remote Control using IoT Technologies

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Abstract:

This article introduces an interdisciplinary concept of intelligent hydroponic agriculture through the integration of sophisticated water quality analysis and AI- and IoT-based system optimization. The study initially determines the physico-chemical aptness of four water supplies of the Maghnia area (Algeria) for hydroponic crop cultivation based on electrical conductivity (EC), total hardness, and ion composition (Ca^{2+}, Mg^{2+}, Cl^{-}) in line with FAO and expert agronomic recommendations. Results indicated that one of the water sources (Akid Abass) is directly suitable for hydroponics, while the others need treatment against salinity or ionic imbalance. Based on these findings, an intelligent hydroponic system was created, with real-time sensor networks and AI algorithms for monitoring and controlling the main environmental variables—temperature, humidity, pH, nutrients—of plant growth. The remote control through a mobile app offers real-time monitoring and automation of irrigation and fertilization. Experimental findings show increased crop productivity, energy and resource

saving, and great autonomy. The integration of water quality diagnostics with intelligent control systems highlights the promise of hydroponics as a feasible, scalable, and sustainable farming alternative for arid and semi-arid climates. This study emphasizes the necessity to converge environmental analytics with digital technologies for enhancing precision agriculture and food security.

Key words: *Smart Hydroponics, Artificial Intelligence, Water Quality Assessment, Controlled Environment Agriculture, Arid Region Agriculture, Algeria.*

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Eco-Friendly Extraction and Characterization of Natural pH Indicators from Hibiscus and Red Cabbage for Analytical Applications

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Abstract:

In the context of sustainable development, this study focuses on the extraction, characterization, and application of natural pH indicators derived from ***Red Cabbage (Brassica oleracea)*** **and** ***Hibiscus (Hibiscus sabdariffa)***. These plant-based extracts are proposed as eco-friendly, cost-effective, and biodegradable alternatives to synthetic indicators used in pH determination, particularly in biochemical applications such as urinary pH testing. Aqueous extracts were obtained through room-temperature maceration and filtered. The presence of anthocyanins and phenolic compounds was confirmed via thin-layer chromatography (TLC). UV-Visible spectroscopy demonstrated distinct absorption changes across the pH scale, indicating reversible and sensitive chromatic behavior. To improve the stability and handling of the indicators, encapsulation in sodium alginate was performed, resulting in colored beads. These beads were successfully used in both standard pH solutions and human urine samples, showing a strong correlation with results from conventional pH meters.
The findings support the potential of ***Red Cabbage*** **and** ***Hibiscus*** extracts as reliable and sustainable bio-indicators. Their implementation in clinical biochemistry for non-invasive urinary pH monitoring offers a promising, low-impact diagnostic approach, while also promoting the valorization of local plant resources.

Key words: Natural pH indicators, anthocyanins, Biochemical , encapsulation, alginate, Red Cabbage, Hibiscus.

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Sustainable Valorization of Marine Algae for the Protection and Development of Natural Resources

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Abstract

Marine algae are recognized as promising sources of bioactive metabolites, including phlorotannins, terpenoids, and halogenated compounds, which exhibit diverse antibacterial and antioxidant activities. Despite their potential, less than 10% of algal species have been investigated, underscoring the need to valorize this biodiversity. In this study, the combined effects of a red alga (*Asparagopsis taxiformis*) and a brown alga (*Dictyota dichotoma*) were evaluated for their antibacterial and antioxidant properties. Extracts obtained using aqueous, methanolic, and ethanolic solvents were tested against selected bacterial strains through the disk diffusion method, while antioxidant activity was assessed using the DPPH assay. Ethanolic extracts displayed the most significant effects, and their combination revealed a marked synergistic interaction, enhancing overall efficacy.

Furthermore, two topical formulations (a fluid lotion and an ointment) incorporating these algal extracts were developed. Stability tests, including homogeneity, pH measurement, centrifugation, thermal resistance, and spreadability, confirmed satisfactory performance. The results highlight the potential of marine algae as natural bioactive ingredients for innovative dermocosmetic products with therapeutic relevance. This research contributes to the

sustainable valorization of marine resources within the broader framework of natural resource protection and development.

Key words: *Asparagopsis taxiformis*; *Dictyota dichotoma*; antibacterial activity; antioxidant activity; synergistic effect; marine bioactives; dermocosmetic formulation; natural resource protection

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Impact du plomb sur l'environnement et la santé

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Abstract:

Le plomb est un métal mou qui a eu beaucoup d'application au fil des ans. Le plomb contamine l'environnement y compris le sol, air et eau via les activités humaines et sa présence naturelle, s'accumulant dans les organismes et présentant des risques pour la santé. Selon l'organisation mondiale de la santé, l'exposition au plomb a causé plus de 1,5 million de décès dans le monde en 2021, principalement en raison d'effets cardiovasculaires..

L'objectif de cette étude bibliographique c'est de connaitre les sources d'exposition au plomb dans l'environnement, Comment le plomb affecte l'environnement ainsi que les effets du plomb sur l'environnement et la santé.

Il n'existe pas de seuil au-dessous duquel l'exposition au plomb n'aurait pas d'effets nocifs.Il est crucial de réduire l'exposition en nettoyant les poussières, en utilisant des filtres à eau et en gérant les déchets, car même de faibles quantités de plomb peuvent être dangereuses, particulièrement pour les jeunes enfants.

Mots clés : Plomb, environnement, santé, exposition, jeunes enfants.

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Biodégradation and Bio-Receptive Performance of Jute Fiber-Reinforced Concrete for Adaptive Facades

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Abstract:

This study investigates the potential of jute fiber-reinforced concrete as a biodegradable and bio-receptive material, paving the way for sustainable and adaptive construction solutions. Specimens were immersed in a saturated $Ca(OH)_2$ solution and tested at different ages (7, 14, 28 days) to assess compressive strength, porosity, mass loss, pH, and chloride ion diffusion. The results highlight the influence of fiber biodegradation on the concrete's microstructure and performance. Numerical modelling, combining exponential growth and polynomial regression approaches, enabled the prediction of property evolution and the identification of correlations between parameters. The research concludes with concrete architectural applications, particularly the development of adaptive façades capable of transforming their texture, porosity, and color over time while maintaining acceptable performance levels.

Keywords: Jute, Concrete, Bioreceptive, Sustainability, Biodegradation, Porosity, Facades

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Title: Pesticides: Implications for Well-being and the Ecosystem

Awatif Amria MOULAY, Rachid OUHIB, Ahmed Oughila,
, Zahira Amel BOUYAKOUB

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Abstract:

The pervasive use of chemical pesticides, often referred to as plant protection products, presents significant risks to both human health and the well-being of ecological systems. Modern, large-scale agriculture, heavily reliant on these substances, is a major contributor to the alarming decline in biodiversity observed worldwide.

The destructive effects of pesticides have been recognized for a considerable period. These plant protection products disrupt ecological stability and exert substantial influence on human health and the integrity of the environment. While their application is governed by a series of regulations, further investigation and clarification are necessary to address remaining uncertainties and loopholes.

Keywords :

Chemical pesticides, impact on environment, human health, ecological systems, agriculture

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Title: Molecular Docking Analysis of Hydroxyisoleucine and Dimethylpyrazine as Potential Anti-Diabetic Agents Targeting Human Pancreatic α-Amylase

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Abstract:

Objective:

Type 2 diabetes mellitus is a major public health problem, and the inhibition of α-amylase represents a validated therapeutic strategy. This study aimed to evaluate the potential inhibitory activity of Hydroxyisoleucine and Dimethylpyrazine, two bioactive compounds, in comparison with the reference drug Acarbose, against human pancreatic α-amylase.

Methods:

Molecular docking was performed using MOE 2024 on the crystallographic structure of human pancreatic α-amylase (PDB ID: 1B2Y). The analysis focused on the five best binding poses within the active site of the enzyme. Root mean square deviation (RMSD) and S-score values were used as evaluation criteria for binding affinity.

Results:

Hydroxyisoleucine exhibited an RMSD of 1.9362 Å with an S-score of –3.7238, while Dimethylpyrazine showed an RMSD of 2.4089 Å and an S-score of –4.2824. Acarbose, used as a standard inhibitor, demonstrated superior binding with an RMSD of 2.0506 Å and an S-

score of –9.1532. Although Acarbose remains the most effective inhibitor, Hydroxyisoleucine and Dimethylpyrazine displayed relevant interactions, suggesting their potential as lead molecules for the design of novel anti-diabetic agents.

Key words: Type 2 diabetes, α-amylase inhibition, molecular docking, Hydroxyisoleucine, Dimethylpyrazine, Acarbose

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Title: Optimization of Coagulation Parameters for Methylene Blue Removal by a Natural Biocoagulant using Box–Behnken Experimental Design

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Abstract:

The contamination of water bodies by synthetic dyes such as Methylene Blue (MB) represents a persistent environmental problem due to their stability and toxic effects. This study aims to evaluate and optimize the coagulation process using a natural biocoagulant for the efficient removal of MB from aqueous solutions. The influence of key operational parameters: pH, biocoagulant dose, and coagulation time, was investigated through a systematic experimental approach.

A Box–Behnken design (BBD) under the Design-Expert software was employed to model and optimize the coagulation process, allowing for the identification of significant factors and their interactions affecting dye removal. The experimental results revealed that the optimal conditions were achieved at pH 6, a biocoagulant dose of 2 mL, and a coagulation time of 5 minutes. Under these optimized parameters, the MB concentration decreased from 50 mg/L to 16 mg/L, corresponding to a removal efficiency of approximately 68%.

The Box–Behnken model demonstrated good predictive accuracy, confirming the reliability of the optimization approach. These findings highlight the potential of natural biocoagulants,

combined with statistical design tools, as an eco-friendly and effective alternative for dye removal from industrial wastewater.

Key words: Methylene Blue, Biocoagulant, Design-Expert, Optimization.

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Synthesis of Bioplastics from Residual Biomass Reinforced with Plant Fibers or Olive-Leaf-Derived Iron Nanoparticles

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Abstract:

This study focuses on the synthesis of bioplastics using residual biomass such as potato peels, bakery waste, and bioglycerin. Two bioplastic formulations were developed: the first reinforced with natural plant fibers, and the second enhanced with iron nanoparticles biosynthesized from olive leaves, aiming to improve mechanical and functional properties. The goal is to valorize abundant agro-industrial waste while developing efficient biodegradable materials. All synthesized bioplastics were characterized by FTIR spectroscopy to examine their chemical structure, and mechanical tests were conducted to evaluate their hardness. The results demonstrate the potential of these materials as sustainable alternatives to petroleum-based plastics.

Key words: Bioplastic, Nanoparticl, Nioglycerin, Plant fibers, Patato peel

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Title: **Identification and Characterization of Saharan *Actinobacteria* as a Potential Source of Bioactive Compounds for Biotechnology and Human Health**

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Abstract:

Human pathologies, particularly infectious diseases, are becoming increasingly difficult to manage due to the rising inefficacy of conventional treatments and the alarming spread of antimicrobial resistance. These challenges highlight the urgent need for alternative therapeutic solutions derived from natural sources.

Actinobacteria are among the most prolific producers of bioactive secondary metabolites, including antibiotics (e.g., erythromycin), antitumor agents, and immunomodulators, making them valuable reservoirs for developing new therapeutic alternatives. In this study, two strains were isolated from Saharan soils and subjected to morphological, microscopic, and biochemical characterization. The isolates were Gram-positive, filament-forming, catalase-positive, able to metabolize sucrose, lactose, and mannitol, and exhibited strong hydrolytic activities (gelatinase, amylase, casein hydrolysis). Both strains were also capable of fixing atmospheric nitrogen, highlighting their ecological and biotechnological potential.

These findings reinforce the relevance of exploring extreme environments for novel *Actinobacteria* with therapeutic potential. This work contributes to the search for sustainable

bioactive compounds and aligns with the conference theme of biotechnology and human health.

Key words: Human pathologies; Antimicrobial resistance; Biotechnology; *Actinobacteria*; Saharan soils; Bioactive compounds; Therapeutic alternatives; Natural product chemistry

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Assessment of water chemistry and quality index for sustainable water resource management in arid regions: A case study from Bechar, Southwest Algeria

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Abstract:

The chemistry of water forms the basis upon which the suitability of water resources for drinking and irrigation is assessed, especially in arid and semi-arid regions. In this study, an attempt was made to analyze the physical and chemical parameters of groundwater and surface water from the city of Bechar, located in southwestern Algeria, where two main sources are exploited, representing 80% of the groundwater and 20% of the surface water. Approximately 154 samples were collected and analyzed for eleven key physical and chemical parameters, including temperature (T), electrical conductivity (EC), pH value, major cations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}), and major anions (SO_4^{2-}, HCO_3^{-}, Cl^{-}, NO_3^{-}). Among these parameters, the Water Quality Index (WQI) is used to determine the overall quality for drinking and irrigation purposes.

Surface waters, in particular, contained SO_4^{2-}–Cl^{-}–Ca^{+}–Mg^{2+}, while groundwater ranged between SO_4^{2-}–Cl^{-}–Ca^{+}–Mg^{2+} and HCO_3^{-}–Ca^{+}–Mg^{2+}. Most of the groundwater was classified as "good" for drinking, while the surface water required more careful monitoring. It was also

found that groundwater was better than surface water for irrigation. The mixing of dam water with groundwater resulted in variations in the chemical properties of the solution, including an increase in pH and a decrease in total salinity, as well as changes in the concentrations of major cations and anions. All these findings highlight the need to improve water resource management and sustainability.

Key words: Water chemistry, Groundwater, surface water, Algerian Sahara, Water Quality Index

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Magnesium, Stress, and Environmental Responsibility: Optimizing Dispensing in Pharmacy Stores in Tiaret

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Abstract:

Introduction: Magnesium, a mineral essential for proper physiological and neurological functioning, plays a crucial role in stress management and cognitive development. This study aims to demonstrate the benefits of magnesium supplementation in the treatment of stress in pharmacies, while briefly discussing the environmental implications associated with its increasing consumption.

Materials and methods: A cross-sectional study was conducted over three months among 99 pharmacies in the commune of Tiaret, with 100 questionnaires completed on site. This approach made it possible to draw up a precise inventory of magnesium use by the local population.

Results: The data collected show an improvement in 98% of patients who used magnesium, mainly to treat fatigue, insomnia, anxiety and depression (60% of cases). Adverse effects, although rare (7%), mainly include digestive disorders such as diarrhea and abdominal pain. A statistical analysis using the chi-square test highlighted a significant correlation between the

patients' profession and the type of magnesium delivery. However, no relationship was established between the duration of treatment and the improvement of stress.

Conclusion: The effectiveness of magnesium in stress management is confirmed by this study. However, the growing demand for magnesium-based food supplements raises environmental issues, particularly related to the extraction, processing and distribution of this mineral. It is therefore essential that pharmacists adopt a responsible approach, encouraging the rational use of magnesium while educating patients about the importance of sustainable consumption. Strict monitoring would not only ensure therapeutic efficacy but also limit the negative environmental impacts associated with excessive or inappropriate consumption.

Keywords: Magnesium; Stress; Magnesium supplementation; Environmental implications.

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Title: Evaluation of Phytochemical Profile and Antioxidant Properties of Hydro-Methanolic Extracts of *Atriplex halimus* L.

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Abstract:

Atriplex halimus L., a halophytic plant traditionally used in Algerian medicine, was investigated for its phytochemical composition and antioxidant potential using hydro-methanolic extracts from its leaves and stems. Both extracts contained comparable amounts of polyphenols (20.591 ± 0.049 and 24.189 ± 0.164 mg GAE/g DW), flavonols (4.799 ± 0.679 and 2.268 ± 0.171 mg QE/g DW), tannins (6.864 ± 0.343 and 10.895 ± 0.712 mg CE/g DW), and total antioxidant capacity (9.003 ± 2.344 and 9.251 ± 0.551 mg AAE/g DW) for leaves and stems, respectively. However, a significant difference was observed in flavonoid content, with leaves showing a much higher level (11.073 ± 0.162 mg QE/g DW) than stems (0.884 ± 0.376 mg QE/g DW). Reducing power was also stronger in the leaf extract (0.362 ± 0.005 mg/ml) compared to the stem extract (0.617 ± 0.016 mg/ml). DPPH radical scavenging activity was moderate in both parts, with IC_{50} values of 19.805 ± 3.032 mg/ml for leaves and 15.456 ± 3.785 mg/ml for stems. These findings highlight the potential of *A. halimus* as a natural source of antioxidants, particularly for its flavonoid richness and reducing capacity.

Key words: *Atriplex halimus* L, hydro-methanolic extract, phytochemical profile, antioxidant activity.

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Development of a New Corona Electrostatic Separator with Double Coaxial Cylindrical Electrodes for the Separation of Conductive and Non-Conductive Granular Mixtures

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Abstract:

A significant advancement has been achieved in the recycling of conductive and non-conductive materials from granular mixtures derived from industrial waste through the development of an innovative corona electrostatic separator. With its two vertical coaxial cylindrical electrodes, the suggested device offers a dependable and effective way to separate copper and polymers recovered from shredded electrical wires.It was discovered that attaining the best separation performance required careful control of crucial operational parameters, such as applied voltage and airflow rate. The ideal parameters were determined by experimental studies using a Response Surface Methodology (RSM) technique at 30 kV at 1690 m³/min. This resulted in recovery rates of 90% for both fractions, with purities of roughly 98% for copper and 80% for polymers.These results demonstrate the strong potential of the newly developed separator for large-scale industrial recycling. Further tests under various environmental conditions are recommended to assess the robustness and reproducibility of the electrostatic separation process.

Key words: Electrostatic separation, Corona discharge, Granular materials, Recycling.

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Optimization of Electrostatic Separation of Conductive Materials through Experimental and Numerical Approaches

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Abstract:

This study investigates the performance optimization of electrostatic separation for mixtures of conductive materials using both experimental and numerical approaches. Experiments were carried out on a laboratory-scale CARPCO electrostatic separator equipped with an S-shaped electrode configuration to enhance the electric field. High-speed imaging techniques were employed to visualize and analyze particle trajectories of copper, carbon, and aluminum.

Numerical modeling of the electric field distribution was performed using COMSOL Multiphysics to identify the active separation zones and better interpret the particle dynamics within the separator. The analysis demonstrated the multifactorial nature of the electrostatic separation process, emphasizing the strong dependence on field intensity and electrode configuration.

The combination of high-speed visualization, numerical simulation, and statistical optimization provides a comprehensive understanding and enhancement of electrostatic separation performance, paving the way for future industrial applications.

Key words: Electrostatic separation, Numerical modeling, High-speed imaging, Process optimization

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Optimising the operation of a new tribo-electrostatic separator with two coaxial vertical cylindrical electrodes

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Abstract:

Standard tribo-electrostatic separators use electrostatic forces to deflect the trajectories of triboelectrically-charged particles, in the electric field generated between two vertical plate electrodes connected to high-voltage supplies of opposite polarities . However, this device is often limited by the impact of the particles on the electrodes, lightening separation efficiency and end-product purity. To solve this problem, a research project has developed an innovative separator specifically designed to efficiently process granular plastic mixtures in recycling. The innovation lies in using two rotating co-axial vertical cylindrical electrodes and assisting the movement of the particles by a downwards oriented air flow, so that to reduce their impacts on the electrodes and improve the quality of the recovered products. The study optimized this device using experimental design methodology for surface responses, varying parameters such as high voltage and air flow. The optimal results revealed that a voltage of 50 kV combined with an air flow rate of 1700 m3/min enabled exceptional recovery and enhanced purity of polypropylene (PP) and high-impact polystyrene (HIPS) products. This optimization opens up promising prospects for the efficient recycling of granular plastics.

Key words: Electrostatic separation, Triboelectricity, Plastic wastes, Fluidized bed.

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Experimental and Numerical Analysis of a Coaxial Triboelectrostatic Separator for Binary Plastic Mixtures

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Abstract:

This article aims to present and analyze a new concept for a triboelectrostatic separator, in which the upper part of the device consists of two coaxial cylindrical electrodes, while the lower part comprises two conical electrodes that create a divergent electric field.

A combined experimental and numerical approach was used to identify and evaluate the main factors influencing the performance of the process.

Experiments conducted on three distinct binary mixtures of millimeter-sized PA (polyamide), PC (polycarbonate), and PVC (polyvinyl chloride) particles showed that more than 80% of the total mass can be recovered, with high purity rates reaching up to 90%.

These results highlight the effectiveness and potential of this new separator for the sorting and selective recycling of plastics.

Key words: Electrostatic separation, Electric field, Plastic particles, Triboelectricity.

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Prediction study of the physical properties of $RePb_3$ (Re=Ho, Tb, and Sm) rare earth intermetallic compounds: DFT calculation.

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Abstract:

Intermetallic compounds have a wide range of applications in different fields due to the broad variety of their electronic, magnetic, and mechanical properties. In recent years, researchers have paid great attention to ductile intermetallic compounds with the CsCl (B2type) crystal structure, which are attractive due to their high ductility and high fracture toughness at room temperature. In this work, we propose to predict the structural, electronic, and mechanical properties of $RePb_3$ (Re=Ho, Tb, and Sm) intermetallic compounds as a candidate to replace these B2 rare earth intermetalics compounds which crystallize in the cubic structure of type $AuCu_3$. We used the pseudo-potential PAW method based on the Density Functional Theory (DFT) implanted in VASP code; Our goal is to find materials with mechanical properties similar to those of B2 ductile rare earth intermetallic compounds [1-2].

Key words: Intermetallic compounds, ab-initio calculation, Electronic structure, elastic and mechanical properties.

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Electronic and magnetic properties of MAX phase Cr2SiC with GGA+U approximation

Presenting M.Benouis[a], Y.Azzaz[b], M.Ameri[c]

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Abstract:

In this work, we investigate the magnetic stability of Cr2SiC and electronic properties using the linear enhanced plane wave method (FP-LAPW) at full potential in generalized gradient approximation (GGA) and (GGA + U). An anti-ferromagnetic spin order of Cr atoms is shown to be the ground state of this compound. Based on its electron band structures and state density (DOS), Cr2SiC has a metallic character and from the analysis of the projected site and of the moment densities, it follows that the bond is obtained by hybridization of Cr-3d with C-2p and Cr-3d with Si-3p states. Also note that the Cr–C bond is more covalent than Cr–Si. In the ferromagnetic phase (FM), the calculation of the polarized spin indicates that the total magnetic moment of Cr2SiC increases from 1.99 to 2.34 μB. Finally, we expect that the theoretical study of this material will give an idea for experimenters in the future

Key words: Phase MAX GGA+U Cr2SiC compound

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Title: Evaluation of anti-obesity effect in vivo of terpenoids extracted from *Echium horridum.* B roots

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Abstract:

Over the past few decades, obesity has become a major global public health issue, according to the World Health Organization (WHO). Recent researches have highlighted the potential role of terpenoids as natural organic compounds in the prevention and treatment of obesity. The aim of this study is to investigate the anti obesity potential of terpenoids extracted from a medicinal plant : *Echium horridum* B (Eh), on Wistar rats. Terpenoids were extracted from Eh roots powder using Soxhlet extractor. However, adult male rats were divided into 2 groups : ones fed High fat diet HFD, and others were fed Normal diet ND. After 9 weeks of diet, rats fed HFD became obese, and were divided into 3 sub-groups and started a daily treatment for 4 weeks : HFD ; HFD+extract ; and HFD+Orlistat. Results showed a significant weight loss on the rats fed HFD+extract and HFD+ Orlistat in comparaison with positif control. Thi study suggets that terpenoids represent a promising natural approach for the prevention and management of obesity. However, more extensive human trials are needed to confirm their safety, optimal dosages, and long-term benefits.

Key words: *Echium horridum* B., terpenoids, anti-obesity effect.

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Title: PVC-CdS composite films, synthesis and optical properties

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Abstract:

This work presents the preparation and characterization of CdS/PVC nanocomposite thin films. CdS nanoparticles were synthesized by the hydrothermal method using thiourea ($CS(NH_2)_2$) and cadmium sulfate octahydrate ($(CdSO_4)_3 \cdot 8H_2O$) as precursors. The synthesized powder was then mixed with a PVC solution, and the films were deposited on glass substrates using the spin-coating technique.

X-ray diffraction confirmed the presence of CdS nanocrystallites in the PVC matrix. UV-Vis spectroscopy showed a blue shift in the absorption edge compared to bulk CdS, which can be explained by the quantum confinement effect. Raman spectra also indicated the incorporation of CdS into the polymer matrix, with the appearance of additional bands related to the small crystal size. Photoluminescence measurements revealed visible emission bands, suggesting that the films exhibit optical activity and could be useful in optoelectronic applications.

Key words: CdS/PMMA composite films; XRD; UV-Visible absorption; PL spectroscopy.

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Structural optical and electronic properties of $CsSnBr_3$ metal halide perovskite for photovoltaic applications

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Abstract:

The structural and optoelectronic characteristics of the Sn-based inorganic metal halide perovskite CsSnBr3 are calculated using first-principles density functional theory (DFT) and thoroughly described in this work. The Generalised Gradient Approximation GGA-PBEsol(KTB_mBJ) utilising the full-potential linearised augmented plane-wave (FPLAPW) method is employed to optimise the geometric structure of the unit cell and subsequently determine the precise optoelectronic properties of CsSnBr3. The analysis of structural optimisation results indicated that the lattice parameters ($a0$ = 5.8 Å) and unit cell volume of CsSnBr3 are in precise agreement with experimental reports. According to the band structure and density of states analyses, CsSnBr3 is identified as a nonmagnetic semiconductor with an appropriate direct band gap of 0.95 eV at the R symmetry point. Furthermore, the computations of the optical properties of CsSnBr3, including the real part $\varepsilon 1(\omega)$ and imaginary part $\varepsilon 2(\omega)$ of the dielectric function $\varepsilon(\omega)$, the absorption coefficient $\alpha(\omega)$,

reflectivity $R(\omega)$, and refractive index $n(\omega)$, have been conducted within the photonic energy spectrum of 0.0 to 15.0 eV. The findings of this study, which encompass a stable crystal structure and precise optoelectronic properties, including an optimal direct band gap and significant visible light absorption, substantiate the potential application of CsSnBr3 materials in innovative optoelectronic devices such as photovoltaic solar cells, photosensors, photodetectors, photodiodes, and other related technologies.

Keywords: Photovoltaics; peroveskits; Wien2K; FPLAPW; structural properties; optical properties.

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Title: Microstructural Evolution and Predictive Modeling of γ′ Precipitates in IN-738 Turbine Blades after Long-Term Service

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Abstract:

The stability of strengthening γ′ precipitates in the nickel-based superalloy IN-738 under prolonged high-temperature exposure is critical for the lifetime of turbine blades in gas turbine engines. Predictive simulations of γ′ precipitates are therefore essential within integrated computational materials engineering (ICME) to assess microstructural stability and ensure component reliability during service.

This study investigates the microstructural evolution of IN-738 after 45,000 hours of service at 850 °C. Microstructural characterization was performed using digital image analysis of scanning electron micrographs combined with energy-dispersive spectroscopy (EDS). The phase fraction, mean radius of γ′ precipitates, and elemental composition of the different phases were quantified to evaluate microstructural degradation. Complementary microhardness tests were conducted on samples from different blade regions to assess the evolution of mechanical properties during service.

Experimental data were used to calibrate and validate a computational thermodynamics model implemented in the CALPHAD-based software MatCalc. The simulations

successfully reproduced γ′ coarsening, phase redistribution, local chemical compositions, and precipitation strengthening contributions, with good agreement to the service-exposed measurements.

This work demonstrates the synergy between quantitative experimental characterization and computational modeling, confirming the capability of the CALPHAD approach to predict long-term microstructural degradation in IN-738. The results provide a robust framework for remaining life assessment and service life extension of critical high-temperature turbine components.

Key words: nickel-based superalloy, turbine blades, microstructural evolution, CALPHAD, predictive simulation, computational thermodynamics, integrated computational materials engineering (ICME).

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Modeling and Analysis of Modular Multilevel Converter-Based HVDC Systems for Offshore Wind Farm Integration

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Abstract:

Rapid urbanization and industrial growth have intensified global energy demand, increasing reliance on fossil fuels and contributing to higher carbon dioxide emissions, environmental pollution, and energy inefficiencies. To address these challenges, renewable energy has emerged as a sustainable alternative, driving significant investments in transmission infrastructure, particularly high-voltage direct current (HVDC) systems. Offshore wind turbines play a crucial role in this transition by generating large-scale clean energy that can be efficiently transmitted through HVDC links to onshore grids and remote regions.

Among advanced technologies, Modular Multilevel Converter HVDC (MMC-HVDC) offers high efficiency, bidirectional power flow, and enhanced grid stability. Recent advancements include hybrid MMC topologies for optimized offshore performance, diode rectifier-based MMCs to reduce platform mass and weight, and all-DC collection systems to boost efficiency and reliability. Advanced control schemes, such as vector control integrated with hierarchical strategies, ensure precise power management and robust operation under dynamic conditions, including coordinated frequency regulation with offshore wind and energy storage.

This study develops and analyzes an MMC-based voltage source converter (VSC) HVDC symmetrical monopole model in PSCAD/EMTDC, linking an islanded offshore wind farm to an onshore AC grid. The onshore converter regulates DC voltage, while the offshore converter maintaining AC voltage magnitude and frequency. The system features DC cable sections in symmetrical monopole configuration, AC filters for harmonic mitigation, and two wind turbine clusters modeled as separate farms with DFI and PM generators aggregated via scaled current sources. These connect through coupled pi-equivalent transformer sections, with onshore elements including resistive-reactive loads and frequency rate-of-change monitoring.

In this setup, control strategies facilitate stable power transmission and grid synchronization. The onshore converter ensures DC system stability and compensates for power variations, while the offshore unit supports isolated AC network self-sustainment for reliable energy capture. Simulation results validate the hierarchical approach in enhancing resilience, power sharing, and disturbance response, contributing to HVDC-renewable integration.

Key words: Renewable Energy, HVDC Systems, Offshore Wind Farms, Modular Multilevel Converters, Voltage Source Converters.

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Title: **Impact of sulfur substitution on the structural, electronic and optical properties of rock salt MgSe for optoelectronic applications: a first-principles approach**

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Abstract:

This study investigates the electronic, transport and optical properties of (MgS_xSe_{1-x}) ternaries in the rock salt (B1) phase using the full potential linearized augmented plane wave (FP-LAPW) methodology based on density functional theory (DFT) for $0 \leq x \leq 1$. Structural properties were evaluated employing the (PBESol-GGA) functional. Electronic and optical properties were computed via both the local density approach (LDA) and the (TB-mBJ) approaches. The results show that the incorporation of S into MgSe resulted in a decrease in the lattice constant and an increase in the band gap. Finally, the optical properties of MgS_xSe_{1-x} ternaries were calculated and analyzed in detail for the all sulfur compositions ($0 \leq x \leq 1$).

Key words: MgS_xSe_{1-x} ternaries; Wien2k; (TB-mBJ) approach; optical properties; optoelectronic applications;

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Investigation and Analysis of the Instability of Carbon Nanotubes

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Abstract:

Multi-walled carbon nanotubes are distinguished from traditional elastic beams by their hollow multi-layered structure and the Van der Waals intertube forces. In fact, it is evident that the Van der Waals forces between adjacent nanotubes have a significant effect on the mechanical behavior of carbon nanotubes. Since buckling under axial compression is a fundamental mechanical property of carbon nanotubes, the influence of scale effects and temperature changes on the axial buckling of Van der Waals intertube forces is of great interest. Motivated by this, a nonlocal elastic model is presented to study the axial compression buckling of multi-walled carbon nanotubes.

The fundamental approach behind the Euler–Bernoulli bending model is that the beam consists of fibers in a state of uniaxial compression or tension. Given that Hooke's law has a linear form, it is well known that the deflection curve of an elastic carbon nanotube under a constant axial load and a laterally distributed pressure follows this principle.

Key words: Carbon Nanotubes, MWNTs, MMC

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Optimization of Technological Parameters for Enhanced Performance of a Lead-Free Double Perovskite Solar Cell

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Abstract:

Enhancing photovoltaic cell efficiency requires a comprehensive understanding of material properties and a rigorous analysis of the technological parameters governing device performance. In this context, this study focuses on the design and optimization of a lead-free halide double perovskite $Cs_2AgBiBr_6$ solar cell, with particular emphasis on the thickness and doping concentration of the constituent layers. A theoretical analysis is performed to determine the optimal technological parameters for achieving high efficiency. The electrical behavior of the device is simulated using SCAPS software by evaluating current–voltage (J–V) characteristic under AM1.5G solar illumination, along with the spectral response. The influence of technological parameters on key photovoltaic metrics—including open-circuit voltage (V_{OC}), short-circuit current density (J_{SC}), fill factor (FF), and conversion efficiency (η)— is thoroughly investigated. The findings provide valuable insights for guiding the design and development of high-performance, environmentally sustainable perovskite solar cells.

Key words: Solar cell, Perovskite, Technological parameters, Simulation

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Ab Initio Insights into the Mechanical Behavior of Niobate–Tantalate Double Perovskites for Sustainable Energy Technologies

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Abstract:

In this study, the mechanical behavior of the cubic niobate–tantalate double perovskite **Li_2NbTaO_6** was explored using first-principles calculations within the density functional theory (DFT) framework based on the FP-LAPW method. The obtained elastic constants (C_{11}, C_{12}, C_{44}) fulfill Born's stability requirements, confirming the mechanical soundness of the compound. The calculated bulk (B), shear (G), and Young's (E) moduli demonstrate that **Li_2NbTaO_6** possesses a compact and mechanically resilient lattice capable of withstanding both volume and shape deformations. The negative Cauchy pressure and Zener anisotropy factor reveal partial covalent bonding and moderate anisotropic behavior. According to the Pugh's ratio ($B/G \approx 1.48$) and Poisson's ratio ($\nu \approx 0.22$), **Li_2NbTaO_6** can be classified as a

brittle material. The melting temperature, derived from elastic parameters, confirms good thermal endurance, while the Kleinman parameter ($\zeta \approx 0.30$) provides insights into the internal strain flexibility under stress. Overall, the findings highlight the mechanical robustness and thermal reliability of **Li_2NbTaO_6**, underscoring its potential use in high-temperature and energy-related technologies. This theoretical analysis provides a valuable foundation for future experimental and functional optimization of Nb–Ta-based double perovskites.

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Niobate-Tantalate Double Perovskite: First-Principles insights into Its Mechanical Properties for green energy applications

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Abstract:

Double perovskites containing niobium and tantalum are emerging as promising candidates for advanced functional materials due to their structural flexibility and rich physical properties. In this work, we present a comprehensive theoretical investigation of the mechanical behavior of the cubic double perovskite **Na_2NbTaO_6**, employing density functional theory (DFT) within the FP-LAPW framework. The calculated independent elastic constants (C_{11}), (C_{12}), and (C_{44}) confirm the mechanical stability of the compound according to Born's criteria. Derived moduli, including the bulk modulus (B), shear modulus (G), and Young's modulus (E), reveal that **Na_2NbTaO_6** possesses a stiff and robust lattice with high resistance to volume and shape deformations. The negative Cauchy pressure and the Zener anisotropy factor indicate directional bonding and moderate elastic anisotropy. Moreover, the Pugh's ratio ($B/G \approx 1.45$) and Poisson's ratio ($\nu \approx 0.21$) suggest that the compound is brittle in nature. The melting temperature, estimated from elastic data, further supports the thermal stability of the system at high operating conditions. Additional parameters such as the Kleinman parameter ($\zeta \approx 0.32$) provide further insight into internal strain responses under applied stress. These results demonstrate that **Na_2NbTaO_6** combines structural robustness with distinct brittleness, highlighting its potential relevance in high-temperature and

mechanically demanding environments. The outcomes of this study not only reinforce the mechanical reliability of Nb–Ta double perovskites but also pave the way for future experimental validation and application in advanced energy-related technologies.

Keywords Double perovskite oxides, FP-LAPW, Mechanical properties, The melting temperature, Zener anisotropy factor Kleinman parameter.

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Improvement of Seawater Desalination Pretreatment Performance by Replacing Sand with Filtralite® Pure

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Abstract:

In response to the growing scarcity of freshwater resources, seawater desalination has emerged as a strategic solution, particularly in arid regions. Reverse osmosis (RO) is currently considered the leading technology for producing drinking water from seawater. However, its performance heavily depends on the effectiveness of the pretreatment process, which protects RO membranes from fouling. The present study was conducted within the framework of optimizing the pretreatment unit of the seawater desalination process at the SORFERT complex, which faces a critical issue of premature membrane fouling. The research began with an analysis of the sand used in multimedia filters, revealing its inability to retain fine particles responsible for fouling. As an alternative, the use of Filtralite® Pure was evaluated; it demonstrated superior impurity-trapping capabilities and significantly improved the quality of the pretreated water.

Key words: Reverse Osmosis, Advance Pretreatment, Ultrafiltration, Filtration, Sand, Filtralite Pure

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Etude de performance d'énergie solaire face au changement climatique

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Abstract:

This thesis examines the impact of climate change on the performance of photovoltaic installations. It begins with an analysis of various renewable energies, then focuses on solar energy, detailing the types of panels, the functioning of solar cells, and the factors influencing their efficiency. A simulation of a photovoltaic installation is conducted using PVsyst software, evaluating energy production and the effect of future climate scenarios. The thesis concludes that technological innovations and adaptation strategies can mitigate climate impacts, recommending continuous investment in research and development

Keywords :

Solar energy, climate change, solar panels, photovoltaic technology, PVsyst simulation, renewable energies, energy storage, energy transition.

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Exploring the Potential of Zinc Titanium Nitride ($ZnTiN_2$) for Next-Generation Photovoltaics

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Abstract:

The search for earth-abundant and non-toxic absorber materials has intensified in the pursuit of sustainable photovoltaic technologies. Zinc titanium nitride ($ZnTiN_2$) has recently attracted attention due to its direct band gap in the visible range, chemical stability, and compatibility with nitride-based semiconductors. In this work, we present a numerical investigation of $ZnTiN_2$ solar cells, combining optical modeling and electrical simulations to evaluate their potential for thin-film photovoltaics. The optical analysis highlights the strong absorption capability of $ZnTiN_2$ in the visible spectrum, while the device simulations provide insights into the role of absorber thickness, defect density, and interface recombination on overall performance. The study identifies key optimization routes and emphasizes the suitability of $ZnTiN_2$ as a sustainable absorber for future solar cell technologies, paving the way for experimental validation and integration into advanced device architectures.

Key words: $ZnTiN_2$, Thin-film solar cell , Photovoltaics.

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Numerical study of opto-electronic properties of double perovskite Cs_2PtI_6-based solar cell with novel Sb_2Se3 HTL.

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Abstract:

Due to its excellent physical and chemical properties, Cs_2PtI_6 has gained enormous interest. Here in we report a new Cs_2PtI_6 -based solar cell (SC) architecture: FTO/WS_2/ Cs_2PtI_6/Sb_2Se_3/C with Sb_2Se_3 as a hole transport layer (HTL). A high-power conversion efficiency (PCE) of 24.78% was obtained, to make $MoSe_2$ a competitive material to others, like Cu_2O. The effect of electron transport layer (ETL), hole transport layer (HTL) and absorber layer were instigated, also the effect of the FTO thickness. A promising pwer coversion efficiency was obtained 19.53%. The aim of this paper is to show the effect of band diagram engineering, the capacitance, the conductance and the Mott-Schottky characteristics and the generation-recombination rate on the device performance. The simulations were done using SCAPS-1D simulator. The results reveals that the proposed device can serve as an eco-friendly device for photovoltaic applications, since its active layer shows a good stability and low toxicity. The open circuit voltage value (Voc) was 0.54V, the fill factor (FF) was 79.8% and the short circuit current (Jsc) was 44.45 mA/cm². the proposed architecture can be well compared to similar architecture already published.

Keywords: Double perovskite, $MoSe_2$, SCAPS 1-D, perovskite solar cells, Cs_2PtI_6.

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First principles investigations of optoelectronic and magnetic properties of co-doped zinc sulphide by 3*d*-MTs elements

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Abstract:

The full-potential linearized augmented plane wave method (FP-LAPW) with generalized gradient approximation plus Hubbard parameter GGA+*U* as exchange-correlation potential has been applied to investigate the effects of *3d*-Chromium, Cobalt co-doping ZnS on the electronic, magnetic, and optical properties. The calculated lattice parameter of $Zn_{14}Co_2S_{16}$ was in a good argument with the other theoretical calculation, and it was found to be increased by Cr co-doping. The electronic band structures, the total and partial densities of states (TDOS & PDOS) are calculated and represented. The $Zn_{14}Co_2S_{16}$ shows a semiconductor character with a direct band gap. Hence, it saves the semiconductor character by Cr co-doping with some change in the value and the nature of the band gap. It increases by Cr co-doping in the spin-up direction. While, in the spin-down direction, it decreases and it transforms to an indirect band gap. Moreover, the calculation of the energy difference indicating the stability of the $Zn_{14}Co_2S_{16}$ on the ferromagnetic phase (FM) with an interesting magnetic moment. While, the $Zn_{14}Co_1Cr_1S_{16}$ is more stable in the antiferromagnetic phase (AFM). The optical parameters attain it maximum in the near UV-Visible region. This theoretical study intensifies the understanding of the novel performances of Cr and Co co-doped ZnS.

Key words: FP-LAPW, ZnS, Transition metals, GGA+*U*, electronic properties, magnetic properties, optical properties .

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Static and fatigue behaviour of single lap joints with bi-adhesives

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Abstract:

Structures built from several components require some means of joining. In this context, bonding with adhesives has several advantages compared to traditional joining methods, e.g. reduction of stress concentrations, reduced weight penalty and easy manufacturing. Adhesives can be strong and brittle (e.g., Araldite® AV138) or less strong and ductile (e.g., Araldite® 2015). However, one of the primary causes for a decrease in strength in adhesive joints is the presence of stress concentrations at the ends where the overlap occurs, in contrast to the relatively unstressed core. This work presents a numerical analysis of single-lap bi-adhesive joints under cyclic loading using cohesive zone models with four different adhesives. Two adhesives of the same chemical composition (one rigid and one flexible) were used. An optimal arrangement of the rigid and flexible adhesives was designed. The combination of both adhesives in a single lap adhesive joint, with the more rigid adhesive positioned at the core of the joint, resulted in a 37% improvement in joint strength.

Keywords: single lap joint, cohesive zone models, bi-adhesive joint, cyclic loading.

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Finite Element Analysis of Fracture Behavior in Adhesively Bonded Single-Lap Joints Under Shear Loading

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Abstract.

This study develops a finite element model to simulate the fracture behavior of single-lap joints under shear loading. The objective is to provide a reliable numerical tool capable of predicting cases not covered by experimental tests. A cohesive zone model (CZM), based on a bilinear traction–separation law and implemented in Abaqus, was employed to describe crack propagation. The parameters of the cohesive law for the adhesive *Adekit A140* were determined through DCB and ENF fracture tests, while damage initiation and mixed-mode failure criteria were applied to govern crack initiation and growth.

Two numerical configurations were examined: (i) a model with cohesive elements placed along a single adhesive–substrate interface (CZMi), and (ii) a model with cohesive elements along both interfaces (CZMii). Experimental shear tests were performed for validation. Results show that CZMi overestimates the initial stiffness and underestimates resistance to crack propagation. Conversely, CZMii provides force–displacement curves in excellent agreement with experiments, accurately capturing both stiffness and fracture behavior. These results validate the effectiveness of the two-interface cohesive model for simulating shear tests of bonded joints.

Keywords: Single lap joint, Failure, Cohesive zone model, Validation

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First-Principles Investigation of Structural, Elastic, Dynamic, Electronic, and Magnetic Properties of the GdPtSb Half-Heusler Alloy

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Abstract:

Half-Heusler alloys have garnered significant attention for their potential in spintronic applications due to their half-metallic and topological properties. While recent first-principles studies have predicted half-metallicity in various half-Heusler alloys, investigations into those incorporating rare-earth elements remain limited. This study explores the structural, electronic, and magnetic properties of the novel ternary half-Heusler alloy GdPtSb, a promising *f*-type magnetic system, using density functional theory (DFT) with the full-potential linearized augmented plane wave (FP-LAPW) method. We employed GGA-PBE and GGA-PBE + U approximations to examine the alloy in three crystalline phases (α, β, and γ) under non-spin-polarized (NSP) and spin-polarized (SP) configurations. Our results reveal that the ferromagnetic phase is energetically more favorable than the non-magnetic phase across all three phases, with the γ phase identified as the most stable. Dynamically, the half-Heusler alloy GdPtSb shows no negative phonon frequencies in the γ phase. The calculated elastic constants for the γ phase satisfy the Born-Huang stability criteria, confirming the alloy's elastic stability. The total magnetic moment in the γ phase is found to be an integer value of 7 μ_B, primarily contributed by the Gd atom, with minor contributions from Pt and Sb, aligning well with data on other Gd-based half-Heusler alloys. Analysis of the electronic band structure and density of states in the γ phase indicates half-metallic behavior in both spin directions, alongside a negative band gap, establishing GdPtSb as a non-trivial topological material akin to HgTe. These findings highlight the potential of GdPtSb for spintronic applications and underscore the need for further experimental validation.

Key words: Density functional theory; Phase stability; Heusler alloys; Ferromagnetism; Spintronics.

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Chalcogenide Thin Films for Solar Energy: Growth and Properties via Spray Pyrolysis Technique.

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Abstract:

Quaternary multicomponent Cu2BaSnS4 (CBTS) has emerged as a potential absorber material due to its abundant and nontoxic constituents, high absorption coefficient (10−4 cm−1) and suitable bandgap (1.5–2.0 eV) for the solar photovoltaic application. In this study, polycrystalline CBTS thin layers have been deposited by a typical spray pyrolysis technique on glass substrates using different substrate temperatures (Ts = 200, 250, 300 and 350 °C) followed by annealing in a sulfur-rich atmosphere at 550 °C under an argon flow. The (micro-)structural, compositional, and optical properties of both types of films have been studied. Analysis of x-ray diffractogram (XRD) patterns for all acquired films showed the presence of polycrystalline CBTS alongside various secondary phases, including Cu2SnS3 being predominant. Nonetheless, the XRD of the films deposited at 250 °C and annealed at 550 °C showed only the CBTS phase. Raman spectroscopy confirm the formation of the trigonal phase of CBTS. The presence of Cu, Ba, Sn and S in CBTS thin films was confirmed

by X-ray photoelectron spectroscopy and Energy-dispersive X-ray spectroscopy. Scanning electron micrographs show a smooth and dense structure with enhanced crystallinity and improved uniformity. Overall, the physical properties of CBTS thin films were found to be spray deposition temperature dependent. An appropriate optical band gap of 1.6 to 1.8 eV and a compact structure indicate their prospective for solar cell applications.

Key words: spray, CBTS, XPS, Bend gap

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Synthesis and Characterization of Lanthanum-Doped Zinc Oxide Nanostructures

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Abstract:

Undoped and lanthanum (La)-doped ZnO nanostructures (2 at.% and 4 at.%) were synthesized on glass substrates via spray pyrolysis. The effects of La doping on structural, morphological, topographical, and optical properties were examined using XRD, SEM, AFM, EDXS, UV–Vis, and FTIR. XRD confirmed a polycrystalline wurtzite structure, with crystallite size decreasing from 37 nm to 35 nm upon La doping. Surface morphology and roughness were altered, with RMS values increasing significantly. EDXS confirmed the presence of Zn, O, and La. UV–Vis analysis showed high transmittance (80–90%) in the visible range and a slight variation in optical bandgap (3.25–3.27 eV).

Key words: ZnO, La-doped, spray pyrolysis, XRD, FTIR

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Title: DFT-based investigation into the equilibrium properties of BeSe across a range of pressures

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Abstract:

In the present investigation, we analyze the structural and electronic characteristics of the BeSe compound through density functional theory (DFT) computations inside the local density approximation (LDA) framework. The full-potential linearized muffin-tin orbital (FP-LMTO) approach was applied to determine the equilibrium lattice constants, the bulk modulus, and its pressure derivative. Moreover, the electronic band structure of BeSe was explored in detail. All computations were conducted under a range of applied pressure conditions.

Key words: DFT, LDA, BeSe, Pressure

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Title: Cornstarch as a Green Additive for High-Performance and Energy-Efficient Concrete

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Abstract:

This study investigates the effect of adding cornstarch on the mechanical and thermal properties of concrete. The results show that incorporating 0.5%, 1%, and 1.5% starch significantly improves compressive strength, reaching 21.08 MPa at 2 days, 32.58 MPa at 7 days, and up to 37.5 MPa at 28 days for the 1.5% dosage—surpassing the reference concrete (30.8 MPa at 28 days). In parallel, a notable reduction in thermal conductivity was observed, with the lowest value of 0.71 W/m·K at 1.5% starch compared to 0.81 W/m·K for the control sample.

These enhancements are attributed to the internal curing effect of starch and the resulting improvement in concrete microstructure. Biosourced concrete enriched with starch thus presents itself as a sustainable and high-performance alternative, especially suitable for construction applications requiring enhanced energy efficiency and reduced carbon footprint.

Key words: Bio-sourced concrete, Starch, Mechanical strength, Thermal insulation, Durability, Eco-friendly materials

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Title: Theoretical exploration of structural and magnetic features in binary Laves-type systems.

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Abstract:

We present a comprehensive theoretical study of the cubic $MgCu_2$-type binary Laves phases $TbCo_2$ and $TbFe_2$. Calculations were performed within the framework of density functional theory using the full-potential linearized augmented plane wave (FP-LAPW) method. Both the generalized gradient approximation (GGA) and the GGA+U approach were employed to account for exchange–correlation effects and electron correlations. The equilibrium lattice parameter a_0, bulk modulus B, and magnetic moment M were found in good agreement with available experimental data. The site-resolved magnetic moments of Co and Fe were evaluated, revealing higher values for Fe compared to Co, with GGA+U consistently yielding enhanced magnetic moments relative to GGA. To gain deeper insight into the orbital contributions, the projected density of states of the Co-3d and Fe-3d orbitals was analyzed. These findings underline the importance of electron correlation effects in accurately describing the structural and magnetic properties of cubic binary Laves phases.

KEYWORDS : Cubic Laves phases; $MgCu_2$-type structure; $TbCo_2$; $TbFe_2$; DFT; FP-LAPW; GGA+U; magnetic properties.

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$BaSrY_4O_8:Eu^{3+}$ LEDs as a Breakthrough Platform for Sustainable and Reliable VLC

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Abstract:

Visible Light Communication (VLC) stands as a promising pathway for secure, high-speed data transmission, addressing the growing demand for reliable wireless connectivity. This study explores Barium Strontium Yttrium Oxide doped with Europium ($BaSrY_4O_8:Eu^{3+}$) as a novel light-emitting material for VLC applications. Exhibiting a high quantum efficiency (QE) of 83% and strong red emission that generates white light under near-ultraviolet excitation (N-UV), this phosphor also demonstrates excellent thermal and chemical stability, and an environmentally safe profile, making it a sustainable choice for large-scale, eco-friendly VLC deployment. $BaSrY_4O_8:Eu^{3+}$ LED was integrated into a complete VLC system modeled in OptiSystem. The results demonstrate robust and efficient data transmission over link distances reaching 160 meters. To ensure real-world applicability, the system's resilience was assessed under five ambient light levels, including conditions simulating sunlight, office lamps, and other intense illumination sources. The findings reveal that the proposed VLC setup maintains high signal fidelity, minimal Bit-Error-Rate (BER) and an acceptable signal-to-noise ratio (SNR) even under maximum ambient light, underscoring its capability to

deliver reliable communication in challenging indoor and semi-outdoor environments. This work highlights $BaSrY_4O_8:Eu^{3+}$ LEDs as a strong candidate for next-generation, long-range, and ambient light-resilient optical communication systems.

Key words: Visible Light Communication (VLC), $BaSrY_4O_8:Eu^{3+}$ LED, Quantum Efficiency (QE), Ambient Light Resilience, Bit-Error-Rate (BER).

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Nanostructured Coatings for Corrosion Resistance in Marine Environments

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Abstract:

Nanostructured coatings based on ceramic–metal composites have shown great potential to improve corrosion resistance in marine and humid environments. In this work, we investigated the deposition of multilayered coatings using plasma spraying and analyzed their microstructure and electrochemical behavior. Results demonstrate that the gradient architecture of the coating reduces crack propagation and extends service life. Such coatings represent an environmentally friendly alternative to toxic protective paints.

Key words: nanostructured coatings, corrosion resistance, marine environment, plasma spraying

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Title: Quantile Regression and Conditional Mode Estimation for Environmental and Reliability Data

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Abstract:

In this work, we investigate advanced nonparametric statistical tools, including quantile regression and conditional mode estimation, for analyzing complex environmental and reliability datasets. These methods provide robust insights into the distributional characteristics of response variables under random censorship and missing data, common in industrial and environmental monitoring. We establish the asymptotic properties of the proposed estimators, including consistency and asymptotic normality, ensuring reliable inference even in challenging data conditions. Applications include lifetime analysis of materials, degradation modeling, and environmental risk assessment, highlighting the potential of these statistical approaches to support decision-making in industrial and ecological contexts. Our results demonstrate that functional index modeling can capture subtle patterns in time-dependent data, offering a powerful framework for risk evaluation and predictive maintenance.

Key words: Quantile Regression; Conditional Mode Estimation; Random Censorship; Reliability; Environmental Data; Functional Index Model; Asymptotic Normality.

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ANALYZING THE IMPACT OF RENEWABLE ENERGY ON ECONOMIC GROWTH IN ALGERIA: A VAR MODEL APPROACH (2000–2025).

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Abstract:

This study explores the development of renewable energy capacity in Algeria between 2000 to 2025, where Algeria witnessed significant progress in the development of its renewable energy sector, particularly in solar photovoltaic (PV) energy. This study provides a comprehensive analysis of the country's renewable energy capacity expansion during this period, examining policy initiatives, installed capacity growth, investment trends, and institutional frameworks. The findings highlight that while several government-backed programs, such as the national renewable energy and energy efficiency program, aimed to increase capacity to 22 GW by 2030, actual implementation fell short due to administrative delays, financing constraints, and regulatory uncertainties. However, notable milestones include the launch of tenders for large-scale solar projects and increased participation of domestic and foreign investors. The paper also identifies emerging opportunities, such as hybrid energy systems and decentralized solar solutions, which could contribute to Algeria's energy transition goals. Overall, the study underscores the need for coherent policy implementation, improved grid infrastructure, and private sector engagement to accelerate renewable energy deployment in ALGERIA.

Key words: renewable energy, growth, energy efficiency, Algeria

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First-Principles Study of Structural, Magnetic, and Electronic Properties of the Half-Heusler NiFeSb Alloy

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Abstract

The structural, vibrational, elastic, mechanical, thermodynamic, magnetic, and electronic properties of the half-Heusler alloy NiFeSb were investigated across its α, β, and γ configurations using first-principles calculations within spin-polarized density functional theory, employing the generalized gradient approximation (GGA-PBE) for the exchange-correlation energy and potential.

Various phases of the NiFeSb half-Heusler alloy were examined, including cubic ($F\bar{4}3m$), hexagonal ($P\bar{6}2m$, $P6_3mc$, $P6_3mmc$), tetragonal ($P4/nmm$), and orthorhombic ($Pnma$),

incorporating the α, β, and γ configurations. Among these phases, the $\gamma - P4/nmm$) structure emerged as the most structurally stable. Elastic property assessments and phonon spectra for the $\gamma - P4/nmm$ phase confirmed the alloy's elastic and dynamic stability. Band structure and density-of-states analyses revealed ferromagnetic behavior in the $\gamma - P4/nmm$ phase.

Keywords: DFT; Ferromagnetism; Phonon; Heusler; Transition element.

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OPTIMIZATION OF UNDERWATER OPTICAL WIRELESS COMMUNICATION (UWOC) PERFORMANCE

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Abstract:

In this study, we conduct a comprehensive performance evaluation of an underwater optical wireless communication (UOWC) system by integrating optical code division multiple access (OCDMA) with pulse position modulation (PPM) to enhance both transmission range and system capacity. The analysis primarily investigates the bit error rate (BER) in relation to key system parameters, including transmission distance, various modulation schemes such as on-off keying (OOK) and quadrature amplitude modulation (QAM), the number of simultaneous users, and the impact of channel attenuation under different water conditions. Furthermore, we examine the limitations imposed by transmitter power constraints and inclination angles to determine the optimal operational conditions required to achieve a minimum BER of 10−910^{-9}10−9. We also explore the effects of turbulence, scattering, and absorption on signal integrity, providing a more detailed understanding of system behavior in dynamic underwater environments. The findings offer valuable insights into optimizing UOWC systems for enhanced reliability, efficiency, and scalability in practical deployment scenarios

Key words: bit error rate (ber), pulse position modulation (ppm), underwater optical wireless communication (uowc), water type, channel attenuation, ocdma.

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First Principale calculations of structural,elastic,électronic and magnetic propretiesofAg2BGd full Heusler alloy comounds using GGA and GGA+U: FP-LMTO calculations

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Abstract:

A series of full-Heusler based on rare earth Ag_2BSm are studied by liner muffin-tim orbital FP-LMTO method. With imgeneralized gradient approximation GGA and GGA+U in the frame of density functional theory DFT. We have studied the structural, elastic, electronic and magnetic properties. We have found that our three compounds are stable in Al Cu_2 Mn type.

The elastic constants at equilibrium are also determined. We have the bulk and shear modulus(G), young's modulus(E) ,poison'sratio (ν), ratio(B/G) and we have deduced anisotropic parameter (A).

From the parameter's be havior ,it isinferred that these alloys are elastic ally stable and ductile in nature. The magnetic moments of the materials in both cubic phases have been calculated.

Key words: rare earth, DFT, FP-LMTO, GGA, GGA+U, magnetic

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Electronic and Thermoelectric Properties of Thulium Monochalcogenides (TmTe, TmSe, TmS): A First-Principles Study

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Abstract:

Thulium monochalcogenides (TmTe, TmSe, TmS) have attracted significant interest due to their unique electronic structures, narrow band gaps, and potential applications in thermoelectric and optoelectronic devices. In this work, we performed first-principles calculations based on density functional theory (DFT) to investigate the structural, electronic, and thermoelectric properties of these compounds. The results reveal that TmTe and TmSe exhibit narrow-gap semiconducting behavior, while TmS shows a wider band gap with enhanced stability. The calculated band structures and density of states indicate strong hybridization effects between thulium 4f states and chalcogen p states. Furthermore, Boltzmann transport theory was applied to evaluate the thermoelectric performance, showing that TmTe and TmSe possess promising Seebeck coefficients and power factors at elevated temperatures. These findings highlight the potential of thulium monochalcogenides as functional materials for energy conversion and advanced electronic applications.

Figure 1: Band gaps of TmTe, TmSe, and TmS.

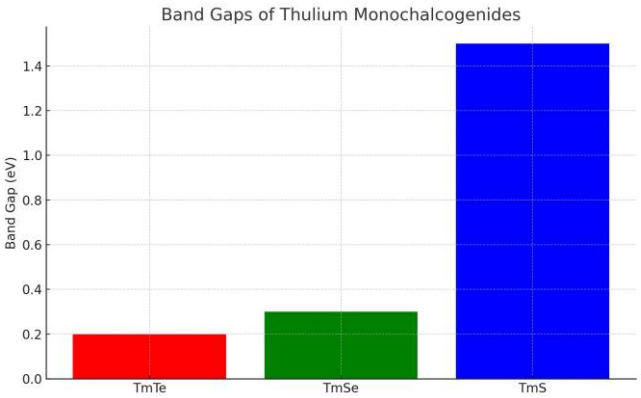


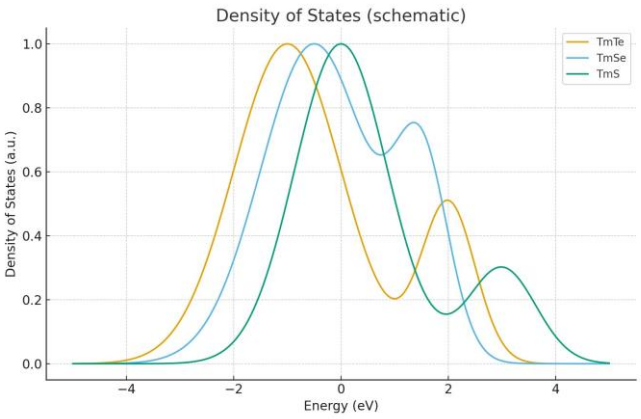
Figure 1: Band gaps of TmTe, TmSe, and TmS

This graph compares the band gaps of the three thulium monochalcogenides.

- **TmTe (~0.2 eV)** and **TmSe (~0.3 eV)** are narrow-gap semiconductors, which favor charge carrier transport.
- **TmS (~1.5 eV)** exhibits a wider band gap, leading to higher stability but lower conductivity.

➢ *Narrow band gaps (TmTe, TmSe) are beneficial for thermoelectric applications.*

Figure 2: Simplified density of states (DOS) for Tm monochalcogenides.

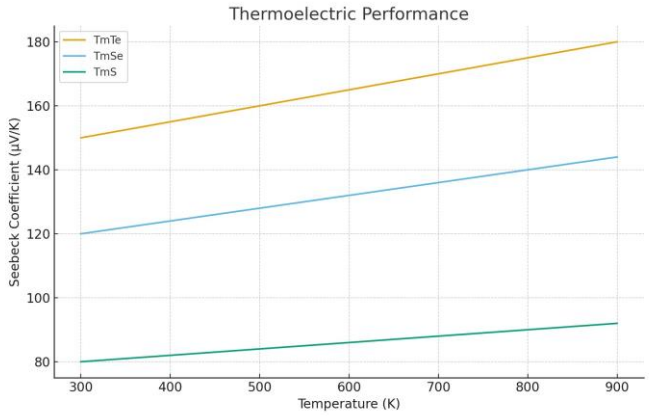


The DOS illustrates the distribution of electronic states as a function of energy.

- Strong **hybridization between thulium 4f states and chalcogen p states** is observed.
- This hybridization plays a key role in carrier transport and thermoelectric properties.

➢ *The DOS explains the enhanced Seebeck effect in TmTe and TmSe.*

Figure 3: Seebeck coefficient as a function of temperature.



The Seebeck coefficient indicates the voltage generated under a temperature gradient.

- **TmTe** shows the highest Seebeck values (> 300 μV/K at high T).
- **TmSe** demonstrates good performance with a balance between electrical and thermal transport.
- **TmS** has a lower Seebeck response due to its wider band gap.

❯ *TmTe and TmSe emerge as promising candidates for thermoelectric energy conversion.*

Key words: thulium monochalcogenides, DFT, thermoelectric properties, electronic structure, energy materials

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Investigation des propriétés structurales de l'alliage ternaire $CdS_{1-x}Se_x$

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Abstract:

L'alliage ternaire $CdS_{1-x}Se_x$ est un très bon semi-conducteur dans le domaine de l'optoélectronique, composé à partir de matériaux CdS et CdSe qui sont des chalcogénures de cadmium appartenant aux composés semi-conducteurs II-VI. Ces remarquables matériaux ont développé la technologie de nombreux systèmes comme les cellules solaires. Ces composés cristallisent dans la structure Zinc blende dans les conditions normales, ils ont une large bande interdite qui leur permet d'être utilisés dans les dispositifs optoélectroniques de haute performance comme les diodes organiques électroluminescentes. Ils sont considérés comme de bons candidats pour le couplage électro-optique et électromécanique car ils ont ionicité élevée.

Le travail réalisé a été effectué grâce à la méthode de premier principe basée sur le formalisme de la théorie de la fonctionnelle de la densité DFT en vue d'étudier les propriétés structurales du matériau considéré. Cette méthode a été codée selon le package WIEN 2k. Le potentiel d'échange et de corrélation est traité par l'approximation du gradient généralisé GGA-PBE et par l'approximation du potentiel modifié de Becke- Johnson mBJ-GGA-PBE.

En premier lieu, nous avons présenté une étude détaillée sur les propriétés structurales et élastiques des deux composés binaires semi-conducteurs parents CdS et CdSe. Ensuite nous avons étudié la stabilité structurale de l'alliage semi-conducteur $CdS_{1-x}Se_x$ pour les différentes concentrations x (x = 0 ; 0.25 ; 0.50 ; 0.75 ; 1) et nous avons déterminé les paramètres de réseau, le module de compressibilité et sa dérivée.

Les résultats obtenus concordent avec les résultats théoriques et expérimentaux disponibles.

Il est clair que les composés binaires CdS et CdSe et leur alliage ternaire sont stables dans la structure zinc-blende. Nos résultats sont en bon accord avec d'autres valeurs théoriques trouvés dans la littérature

Key words: DFT, FP- LAPW, alliage semi-conducteur, optoélectronique, concentration x.

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A Sociological Approach to the Phenomenon of Environmental and Social Risks within the Context of Postmodernity

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Abstract:

In this presentation, we sought to approach the phenomenon of environmental and social risks from the perspective of postmodernity, which itself offers a new understanding of the concept of risk—contrary to what has traditionally been recognized by the scientific community, where risks were defined as natural hazards such as floods and natural disasters. We have moved beyond this classical conception toward a new approach that seeks to understand the forms of risk in which humans are directly involved as a result of their pursuit of modernity, progress, and well-being in various industrial and technological fields, These technological and industrial achievements have produced failures and setbacks at the environmental and social levels through the spread of pollution, chronic diseases, and viruses. In this regard, Ulrich Beck, in his 1986 book *Risk Society*, noted in the introduction that what once seemed exaggerated twenty years earlier had become a tangible and perceptible reality. Among his most significant examples of these new risks is climate change, caused by human activities—particularly industrial production and transportation—that emit large quantities of gases leading to the warming of the planet, Anthony Giddens, in his book *Runaway World*, also defines risks as ventures that are actually assessed in relation to future probabilities, making them the driving force of a society that insists on change, based on the foregoing, the phenomenon of risk is a product of social conditions that have paved the way for several problems emerging at various levels—the most prominent being environmental, security,

economic, and social. All of this resulted from modernity, which directed scientific and technological institutions toward achieving their own triumphs, while society bore the cost of those victories.

Keywords: Modernity, Postmodernity, Environmental Risks.

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Title: $RbNbX_3$ (X = cl, Br, I) lead-free halide perovskites: A DFT study of structural, elastic, electronic, and thermoelectric properties for energy applications

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Abstract:

The search for stable lead-free perovskites has gained significant attention as a promising solution to address thetoxicity and instability challenges of lead-based counterparts. This investigation comprehensively examinesrubidium-based cubic halide perovskites $RbNbX_3$ (X = Cl, Br, I) using first-principles calculations within thedensity functional theory framework. Through the full-potential linearized augmented-plane-wave (FP-LAPW)method implemented in WIEN2k, we systematically analyze the structural, elastic, mechanical, electronic,magnetic, and thermoelectric properties. Structural optimization via the Birch-Murnaghan equation of stateconfirms cubic symmetry with lattice parameters of 5.2049 Å, 5. 4918 Å and 5.8665 Å for RbNbX3 (X = Cl, Br, I),respectively, and reveals a stable ferromagnetic ground state. Electronic structure calculations using the modifiedBecke-Johnson (mBJ) potential demonstrate semiconducting behavior with indirect band gaps of 1.023 eV (Cl),0.866 eV (Br), and 0.710 eV (I), accompanied by a consistent total magnetic moment of ~3 μB predominantlyoriginating from Nb-4d orbitals. Densities of states are

calculated to predict the interaction of orbitals of distinctatoms in the compounds. Mechanical stability is confirmed through elastic constant analysis, with $RbNbCl_3$ and$RbNbBr_3$ exhibiting brittle characteristics while $RbNbI_3$ shows ductile behavior based on Pugh's ratio evaluation.Thermoelectric analysis confirms that $RbNbX_3$ perovskites exhibit excellent potential for energy conversionapplications, demonstrating peak ZT values of 0.99 (100K) for $RbNbI_3$, 0.86 (500 K) for $RbNbBr_3$, and 0.8 (900 K)for $RbNbCl_3$. These high figures of merit arise from their superior Seebeck coefficients (up to 2917 μV/K) and lowthermal conductivity. All these findings establish $RbNbX_3$ perovskites as promising candidates for spintronic andother advanced energy technologies, all within an environmentally friendly framework.

Key words: Density functional theory Lead-free halide perovskites Ferromagnetic Mechanical stability Transport properties

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Title: Growth and Optimization of Spray Coated Ag2BaSnS4 Thin Films for Solar Photovoltaic Application

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Abstract:

Quaternary sulfide semiconductors have emerged as promising alternatives to conventional photovoltaic absorbers owing to their elemental abundance and reduced toxicity. Among them, Ag_2BaSnS_4 (ABTS) is of particular interest due to its kesterite-derived crystal structure and its potential to provide a direct optical band gap in the 1.7–2.0 eV range, suitable for both tandem and optimized single-junction solar cells. In this work, we report the growth of ABTS thin films by solution-based spray deposition followed by controlled sulfurization treatment. The influence of deposition parameters — including substrate temperature, spray rate, and stoichiometric ratios Ag/(Ba+Sn) and Ba/Sn — on crystallinity, morphology, and composition has been systematically investigated. X-ray diffraction and Raman spectroscopy confirm the formation of the quaternary trigonal ABTS phase, while optical measurements reveal a high absorption coefficient ($>10^4$ cm^{-1}) and an adjustable band gap close to 1.8 eV. Optimization strategies, particularly Ag-deficient compositions and high-temperature sulfurization (500–550 °C), improved grain size, suppressed secondary phases, and stabilized p-type conductivity. These results demonstrate that spray deposition offers a simple, scalable, and low-cost pathway for the fabrication of ABTS thin films, paving the way for their integration into environmentally friendly and competitive solar devices.

Key words: Ag2BaSnS4,Spray pyrolysis,Sulfurization,Thin film,X-ray photoelectron, spectroscopy

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The Harmful Impacts of Pesticides on People and Nature

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Abstract:

Pesticides are widely recognized as potential health hazards. Epidemiological research frequently reveals a connection between occupational exposure and an increased risk of diseases in those who use them, as well as in their offspring. Public exposure to pesticides differs from that of users; consumers are exposed through their diet to low doses of pesticide mixtures over extended periods.

This literature review aims to provide an overview of the risk assessment process for pesticides at various levels, encompassing both human health and the environment. Scientific analysis can offer a logical evaluation of potential hazards, prioritize them accordingly, and, in some instances, quantify the level of uncertainty associated with them.

Beyond the basic scientific considerations, research findings have regulatory implications. These regulations must carefully balance the potential risks, the degree of uncertainty, and the anticipated benefits. Furthermore, it's crucial to determine if interactions between different mechanisms of action lead to synergistic, additive, or antagonistic effects. Significant research is still needed in this area, and it presents a challenge that extends beyond the simple toxicity of pesticides.

Keywords:
pesticides, toxicity, environment, human health.

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Multiferroics in Heusler materials

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Abstract:

Multiferroism in Heusler materials represents a promising field of research that aims to couple ferromagnetic and ferroelectric properties in a single material. These metal alloys, already renowned for their exceptional magnetic properties, are engineered to develop electric polarization. This coexistence allows for magnetoelectric coupling, where the magnetization can be controlled by an electric field and vice versa. This effect often arises from structural distortions that break the crystal's symmetry, thus inducing ferroelectricity. The atomic order and strong spin-orbit interactions of Heusler materials make them ideal candidates for observing these phenomena. The main objective is to stabilize these multiferroic properties at room temperature for practical applications. Targeted applications include faster and more efficient non-volatile computer memories, sensors, and spintronics devices. Thus, the study of these materials lies at the border between fundamental materials science and technological innovation, paving the way for next-generation electronics.

Key words: Multiferroism, Heusler, ferroelectricity

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Quantum Insights and Experimental Evidence of Dye Elimination on Kaolinite

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Abstract:

This work presents a theoretical and experimental study of the adsorption of a cationic dye Methylene Blue, on kaolinite surfaces, from aqueous solution under different conditions. Attempts were made to fit the isothermal data using Langmuir and Freundlich equations. The experimental results have demonstrated that the equilibrium data are fitted well by a Langmuir isotherm equation. Thermodynamic parameters such as the changes in enthalpy, entropy, and Gibbs' free energy were determined, showing adsorption to be an endothermic yet spontaneous process. Pseudo-second-order, additionally, the Density Functional Theory (DFT) calculations indicated that CV's narrower HOMO–LUMO gap and higher molecular softness were consistent with its enhanced reactivity and stronger interaction with the adsorbent. Furthermore, the molecular dynamics (MD) simulations confirmed the spontaneous, physically driven nature of the adsorption process. The close agreement between computational predictions and experimental data provides robust validation for the proposed adsorption mechanisms, offering clear mechanistic insights into dye adsorption processes

Keywords: Clay; Adsorption; Molecular dynamics, Isotherms, Kinetics

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The Effect of Printing Angle on the Mechanical Properties of 3D-Printed PA12

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Abstract:

This study examines the influence of the printing angle on the mechanical properties of polyamide 12 (PA12) manufactured by Selective Laser Sintering (SLS). Three printing orientations were tested: 0°, 45°, and 90°. Tensile tests were carried out to determine the Young's modulus corresponding to each orientation. The results show that the printing angle has a significant effect on the mechanical behavior of the material. The 0° orientation demonstrated the best performance, with the highest Young's modulus, indicating greater stiffness and resistance to deformation. These findings highlight the crucial importance of the orientation parameter in optimizing 3D-printed parts for structural applications. They also emphasize the need to control printing parameters to ensure the reliability of parts used in mechanically demanding environments.

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Key words: Polyamide 12, 3D Printing, Selective Laser Sintering (SLS), Printing Angle, Mechanical Properties, Young's Modulus

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Gestion des déchets hospitaliers : un enjeu environnemental et chirurgical

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La gestion des déchets hospitaliers est devenue un défi majeur pour les systèmes de santé. Les blocs opératoires représentent l'une des principales sources de production de déchets médicaux, en raison de l'utilisation intensive de matériel à usage unique, de dispositifs invasifs et de produits chimiques. Au-delà de l'impact environnemental, une mauvaise gestion des déchets peut compromettre la sécurité des patients, du personnel soignant et de la communauté. Le chirurgien, en tant qu'acteur central au bloc opératoire, a un rôle essentiel à jouer dans l'optimisation de ces pratiques.

Méthodes

Une revue narrative de la littérature a été effectuée . Les articles sélectionnés concernaient :

- la typologie des déchets hospitaliers produits en chirurgie,
- les stratégies de tri, de recyclage et de traitement,
- l'évaluation de l'impact écologique et économique,
- les initiatives d'éco-conception et de développement durable en milieu chirurgical.

Résultats

1. Les déchets opératoires représentent jusqu'à 30 % des déchets hospitaliers totaux.
2. Le tri à la source reste insuffisant dans de nombreux hôpitaux, entraînant un surcoût et une pollution accrue.
3. L'introduction de protocoles de réduction, de recyclage et de substitution de certains dispositifs a permis de diminuer significativement le volume de déchets dans plusieurs expériences pilotes.

4. L’implication du chirurgien et des équipes médicales est déterminante pour l’application des bonnes pratiques et la sensibilisation au développement durable.

Discussion – Conclusion

La gestion des déchets hospitaliers constitue à la fois un **enjeu environnemental, sanitaire et économique**. En chirurgie, elle nécessite une stratégie intégrée reposant sur :

- la formation du personnel,
- le tri sélectif rigoureux au bloc opératoire,
- l’innovation technologique et l’éco-conception des dispositifs médicaux,
- une collaboration interdisciplinaire.

Le chirurgien, garant de la qualité et de la sécurité en bloc, devient également un acteur clé de la **transition écologique hospitalière**, conciliant performance chirurgicale et responsabilité environnementale.

Mots-clés : Déchets hospitaliers – Chirurgie – Environnement – Sécurité – Développement durable

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Vitamin D, Pregnancy, and Environmental Issues in Sidi Bel Abbes: Optimizing Supplement Delivery

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Abstract:

Introduction: Vitamin D plays an essential role during pregnancy, for both maternal and fetal health. Despite abundant sunshine in regions such as Sidi Bel Abbes, vitamin D deficiency in pregnant women remains common. This study aims to evaluate vitamin D dispensing practices in pharmacies in this region, focusing on the knowledge and behaviors of pharmacy staff regarding prenatal supplementation. In a context where the increasing use of dietary supplements can have an environmental impact (production, packaging, waste), it becomes relevant to examine these practices from both a public health and sustainability perspective.

Materials and Methods: A descriptive, cross-sectional study was conducted between December 2024 and February 2025 with 201 participants from pharmacies in Sidi Bel Abbes. Data were collected via a self-administered, anonymous, semi-structured questionnaire and analyzed using Excel and SPSS software. Sampling was random.

Results: Among the practices observed, 70% of vitamin D supplements were dispensed on prescription, while 30% were dispensed at the initiative of the pharmacist or patient. The majority of the pregnant women involved were over 30 years old, with a modest socioeconomic status, and 58% had medical conditions requiring supplementation. The most frequently used dosages were 200,000 IU or combinations with calcium, administered daily or weekly. Statistical analysis showed a good match between dosage and administration frequency ($p < 0.001$).

Conclusion: Vitamin D delivery to pregnant women in Sidi Bel Abbes is primarily governed by medical prescriptions. However, to optimize practices and limit the environmental impact of mass supplementation (production, plastic packaging, risks of overconsumption), it is necessary to strengthen coordination between healthcare professionals, update pharmacy knowledge, and promote more personalized prescriptions, particularly through the systematic integration of 25(OH)D biological assays. A more targeted approach would reconcile therapeutic efficacy with the reduction of ecological externalities linked to pharmaceutical consumption.
Keywords: Vitamin D; Maternal health; Delivery practices; Prenatal supplementation; Environmental impact.

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Détermination des temperatures critiques d'un gaz adsorbé sur une surface de graphite.

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Abstract:

Les températures critiques de couches adsorbées ont été déterminées à partir des isothermes d'adsorption pour le système éthylène sur graphite. Les isothermes sont produites dans une gamme de température allant de 50K jusqu'à 170K. Elles reproduisent une caractéristique intéressante observée expérimentalement : à partir d'une certaine température, appelée température critique de couche, ces couches distinctes tendent à disparaître signifiant que l'épaisseur du film augmente en continu.

Les films adsorbés se forment par couches successives. Ce qui se traduit dans les isothermes par une série de marches ou de paliers. Dans un certain domaine de températures, assez basses, les marches sont verticales traduisant la formation de couches distinctes superposées. En augmentant la température, ces marches s'inclinent, s'arrondissent et les parties verticales tendent à disparaître. Ceci indique la disparition des transitions de phase de premier ordre. Ceci s'interprète par une adsorption brusque sans distinction de couches. Autrement dit, les atomes perdent leur individualité et la périodicité du réseau n'est plus respectée. La température au-dessus de laquelle les transitions de 1er ordre ne se produisent plus est dite

critique. Elle est propre à chaque couche n des isothermes d'adsorption des systèmes étudiés et est notée Tc(n).

Key words: adsorption, éthylène, Monte Carlo, température critique.

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Utilisation de la biomasse algale (chlorophycée) dans la dépollution des eaux contaminées par les métaux lourds

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Résumé:

Les activités humaines génèrent de grandes quantités d'eaux usées, qui contiennent divers métaux toxiques. En raison d'un manque de traitement approprié des effluents, ces polluants sont directement rejetés dans l'environnement.

L'élimination des métaux lourds de l'eau contaminée, peut être réalisée par de nombreuses méthodes physico-chimiques. Cependant, ces procédés présentent plusieurs inconvénients. En revanche, les méthodes biologiques telles que l'utilisation de la biomasse d'algue, sont les plus couramment utilisées. Elles sont connues pour éliminer efficacement les éléments métalliques. En effet, les algues marines sont connues par leur capacité à fixer et accumuler les éléments naturellement présents dans l'eau de mer, mais aussi les polluants tels que les métaux lourds.

L'objectif de cette étude vise l'évaluation de la capacité des algues marines à accumuler des métaux lourds en vue d'une éventuelle application à la dépollution des milieux aquatiques contaminés.

Dans ce contexte, le potentiel de bioaccumulation des métaux lourds a été basé sur

l'évaluation des teneurs de certains métaux tels que (As, Cd, Co, Cr et Ni) chez l'algue verte ulva *rigida*, prélevée sur quatre sites d'échantillonnage situés sur le littoral d'Ain Temouchent, nord-ouest de la Méditerranée algérienne durant une année.

Les concentrations des métaux ont été estimées à l'aide de l'ICP Optical Emission Spectrometer, Optima 5300 DV perkin Elmer.

Les analyses ont révélé que les concentrations des éléments, tel que Co, Cr, Ni, Cd et As varient entre (0-0.586) ; (0-2.525) ; (4.659-61.279) ; (0-0.298) et (1.636-22.595) µg/g respectivement.

L'indice de pollution métallique (IPM) a été également évalué pour comparer la teneur totale des éléments métalliques dans l'espèce d'algue, afin d'examiner l'état de la pollution de différentes stations et la capacité des algues à accumuler les métaux lourds.

À l'issue des résultats obtenus, il a été constaté que la biomasse algale joue un rôle crucial dans la décontamination des eaux polluées et l'accumulation de métaux lourds par les algues, est une méthode prometteuse pour la dépollution environnementale.

Mots-clés : algae verte - métaux lourds - accumulation- dépollution- bio-indication.

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Analyse du flambement d'une poutre en nano-composite FG-CNT reposant sur fondation élastique de Winkler–Pasternak–Kerr

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Abstract:

Cette étude porte sur le flambement des poutres composites renforcées par des nanotubes de carbone à gradient fonctionnel (FG-CNT). Elle met en évidence l'effet de la porosité, qu'elle soit uniforme ou non uniforme, ainsi que son interaction avec des modèles de fondations avancés (Winkler, Pasternak et Kerr).

L'originalité de ce travail réside dans l'intégration conjointe de la porosité interne et des modèles de fondations élastiques sophistiqués, ce qui permet une analyse plus réaliste du comportement des structures.Un cadre mathématique rigoureux a été développé pour établir le lien entre les distributions de porosité et les paramètres de fondation, avec validation par des résultats issus de la littérature.

Key words: Nanotubes de carbone, flambement, Porosité, Winkler, Pasternak, Kerr

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Structural, elastic, electronic and optical properties of SrMgZ (Z = Sn, Si) Heusler alloys; ab-initio study

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Abstract:

In this study, the structural, elastic, electronic, and optical properties of SrMgZ (Z = Sn, Si) half-Heusler compounds are predicted using density functional theory within the full-potential linearized augmented plane-wave method, as implemented in the WIEN2k code. These properties are calculated using the Perdew–Burke–Ernzerhof (PBE-GGA) generalized gradient approximation. The structural parameters are in good agreement with the available literature results. The elastic constants indicate that our materials satisfy the stability criteria of the cubic structure. Moreover, the computed electronic structures reveal that both SrMgSn and SrMgSi exhibit a semiconductor behavior with an indirect band gap. Besides, the optical properties obtained in the photon energy range of 0 to 40 eV demonstrate a high absorption coefficient in the ultraviolet region.

Key words: DFT investigation, Half-Heusler, Semi-conductor, Ultra-violet.

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From Lab to Industry: Efficient Extraction of *Eucalyptus globulus* Phenolics Using Pulsed Electric Field

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Abstract:

Pharmaceutical products based on eucalyptus extracts are widely used due to their medicinal properties and high content of secondary metabolites, particularly phenolic compounds. This study aimed to enhance the extraction yield of these compounds and reduce the extraction time by applying a pulsed electric field (PEF) at an intensity of 6 kV/cm. The effects of pulse duration (T), number of pulses (n), and solvent concentration [C] were investigated. Ethanolic extracts were prepared from Eucalyptus globulus leaves, and the contents of total phenolics, total flavonoids, and condensed tannins were determined using spectrophotometric analysis. Results obtained immediately after PEF treatment showed that, under optimal conditions, the total phenolic content doubled and the flavonoid content increased significantly. However, PEF pre-treatment had no noticeable effect on tannin yield. Additionally, process optimization was conducted using a design of experiments (DoE) approach to determine the optimal values of the studied parameters.

Key words: Eucalyptus globulus; pulsed electric field; total phenols; flavonoids; condensed tannins

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Exploring Non-Thermal Methods for plants Bioactive Compound Extraction

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Abstract:

Pharmaceutical products derived from eucalyptus extracts are extensively utilized due to their therapeutic benefits and high levels of secondary metabolites, especially phenolic compounds. This research focused on improving the extraction efficiency of these compounds while shortening the extraction time by employing a pulsed electric field (PEF) treatment at 6 kV/cm intensity. The study examined the impact of pulse duration (T), the number of pulses (n), and solvent concentration ([C]) on extraction outcomes. Ethanolic extracts from Eucalyptus globulus leaves were analyzed for total phenolics, total flavonoids, and condensed tannins using spectrophotometric methods. The findings revealed that immediately following PEF treatment, the total phenolic content doubled, and flavonoid levels increased markedly, whereas tannin extraction remained unaffected.

Key words: Pulsed Electric Field (PEF), phenolic compounds, Eucalyptus globulus, extraction optimization, flavonoids

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The half metallic behavior at high temperature of highly spin-polarized V-based Heusler alloy: DFT calculations

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Abstract:

We have investigated the structural, mechanical, magneto-electronic and thermoelectric properties of Vanadium-based Heusler alloy V2FeGe via the full-potential linearized augmented plane wave (FP-LAPW) method. The calculated equilibrium ground-states of properties reveal that the compound favour the XA-type configuration with a ferromagnetic state. Due to the strong d-electron correlations, we have used the GGA+U approach in order to improve the magneto-electronic properties. The magneto-electronic calculation shows a half metallic behavior with an integer magnetic moment and large band gap in majority spin channel. The calculated elastic properties show that the compound satisfied the criteria stability and the elastic moduli indicated that the studied compound was ductile and anisotropic material. Finally, the thermoelectric responses were computed to explore the potential of this compound and their analysis results are discussed in details.

Key words: FP-LAPW, XA-type GGA+U

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First-Principles Insights into the Electronic, Optoelectronic, and Thermoelectric Properties of Full-Heusler Alloys

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Abstract:

Using the Full Potential Linearized Augmented Plane Wave FP-LAPW, as implemented in the Wien2k package. The structural, electronic and magnetic properties of the full Heusler Ru2NbSb were investigated. The theoretical approach used is the Generalized Gradient Approximation GGA to the Density Functional Theory (DFT)[1], with the Perdew, Burke and Ernzerhof(GGA-PBE)[2,3] and also the modified Becke-Johnson potential (GGA-mBJ). The ground-state properties have shown that Ru2NbSb is stable at the Cu2MnAl structure in the ferromagnetic phase. The electronic properties reveal a metallic character. The total magnetic moment is 1.71 caused by the magnetic moment of the Nb atom. Finally, the negative value of formation energyimplies that Ru2NbSb could be synthesized experimentally.

Keywords: Heusler, DFT,FP-LAPW,GGA, Ferromagnetic.

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Predicting Half-Metallic and Thermoelectric Features in a Novel d⁰ Half-Heusler Material

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Abstract:

In this work, Density Functional Theory (DFT)-based first-principles calculations are performed to investigate the structural, electronic, and thermoelectric characteristics of the sp-type half-Heusler compound RbBaSi. The study employs the Full-Potential Linearized Augmented Plane Wave (FP-LAPW) method as implemented in the WIEN2k code for a detailed examination. Total energy computations suggest that RbBaSi favors a ferromagnetic ground state. The analysis of the electronic band structure reveals complete spin polarization at the Fermi level, confirming the half-metallic nature of the compound. Additionally, thermoelectric property evaluation indicates p-type conduction with high Seebeck coefficients and electrical conductivities. The thermoelectric figure of merit (ZT) approaches unity at 300 K, reflecting promising conversion efficiency. These results provide valuable insights into sp-based half-Heusler materials for thermoelectric applications.

Key words: DFT, Half-Heusler, WIEN2k, Thermoelectric Properties.

OnLine

Communications

ON-001

ICMSE'2025

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Study of the physical properties of half-metallic and/or intermetallic alloys

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Abstract:

From the density functional theory framework **(DFT)** and the pseudo potentials with a plane wave approach, we present first-principles calculations of structural, and elastic properties of cubic **MgCuP** Half Heusler alloy. The exchange correlation potential was treated using the generalized gradient approximation **(GGA-PBE)** and the **(HSE06)** hybrid functional. Features such as lattice constants, bulk modulus, elastic constants, shear modulus, Young's modulus, Poisson's ratio and anisotropy parameter have been calculated and discussed. According to our calculations, **MgCuP** alloy exhibit semiconductor properties, with an indirect band gaps. The obtained results are in agreement with available theoretical data and experimental results.

Key words: *Half-Heusler,MgCuP, hybrid functional, HSE06.*

ON-002

ICMSE'2025

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Title: Central Limit Theorems for Functional Index Models with Missing Data: Applications to Degradation of Materials

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Abstract:

This study develops central limit theorems (CLTs) for conditional estimators in the framework of single functional index models with missing at random (MAR) data. Such statistical settings are particularly relevant in industrial and materials science, where degradation experiments and lifetime studies often produce incomplete or censored datasets. We establish the asymptotic normality of conditional mode estimators under mild regularity assumptions, providing rigorous theoretical foundations for inference in high-dimensional and functional data contexts. The proposed framework offers robust tools for analyzing materials degradation processes, where missing observations and complex dependencies are frequent. Potential applications include predictive maintenance, industrial reliability analysis, and environmental risk assessment, emphasizing the impact of advanced probabilistic methods on engineering and applied sciences.

Keywords: Central Limit Theorem; Functional Index Models; Missing at Random; Conditional Mode; Materials Degradation; Reliability; Asymptotic Theory.

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Title: Valorisation des boues phosphatées comme additifs dans la production de ciments

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Abstract:

Ce travail présente des essais mécanique de la fabrication d'un ciment ordinaire à partir de matières premières telles que le ciment CRS de Biskra (95 % clinker et 5 % de gypse), boues – 45 µm issues de l'opération de débourbage de minerai de phosphate ; obtenus dans la mine de djebel Onk Tébessa. Ce rejet industriel a causé d'importants problèmes sur l'environnement. Après une analyse approfondie de la littérature, il a été possible de vérifier que ce rejet peut être utilisé comme matériaux de construction. Les matières premières ont d'abord été caractérisées par des analyses chimiques au moyen de XRF.

Les essais de résistance à la compression effectués sur les mortiers de ciment à base de boues de phosphate durcis en forme des éprouvettes préparés (à 2, 28 jours) montrent que la résistance dépend de la proportion des boues utilisée (0 % témoin, 5 %, 10 %, 15 %, 20 %... jusqu'à 30 %). Des pressions de 19.93 à 13.13 MPa ont été obtenues en 2 jours, et de 46.38 à 31.26 MPa en 28 jours.

On peut conclure dans ce cas que les matériaux cimentaires produits à partir de boues phosphatées sont techniquement viables et atteignent des performances satisfaisantes dans certains domaines de la construction.

Key words: Djebel Onk, boues phosphatées, caractérisation, ciment, recyclage, environnement.

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ON-004

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Comparative Analysis of Lead-Free Perovskites CsSnI3 and Cs_2TiBr_6 for Photovoltaic Applications: A SCAPS-Based Review

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Abstract:

This paper presents a comparative study of the optoelectronic and photovoltaic properties of CsSnI3 simple perovskite and Cs2TiBr6 double perovskite, two promising lead-free alternatives to traditional lead-based perovskite solar cells (PSCs). Density Functional Theory (DFT) calculations and SCAPS-1D simulations were employed to evaluate the material properties and performance of these materials. CsSnI3 exhibited a direct bandgap of approximately 0.95 eV, demonstrating favorable charge transport properties but facing challenges in device construction and stability due to misalignments in the electron transport layer (ETL) and hole transport layer (HTL). In contrast, Cs2TiBr6 showed excellent stability, a direct bandgap of 1.534 eV, and strong conductivity arising from the 4p states of Br. The theoretical power conversion efficiency (PCE) for Cs2TiBr6 was found to be 24.82%, while CsSnI3 showed promising theoretical efficiency as well, with the ITO/ETL/CsSnI3/CuI/Au configuration achieving optimal results. Both materials were assessed for their potential in large-scale solar applications, with challenges regarding device optimization and material stability. Future research will focus on improving device architecture and stability for the commercialization of both perovskites in photovoltaic applications.

Key words : Perovskite Solar Cells (PSCs),photovoltaic (PV), Electron Transport Layer (ETL), Hole Transport Layer (HTL), Density Functional Theory (DFT).

ON-005

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Analysis of Dimensionless Central Deflection in Functionally Graded Carbon Nanotube-Reinforced PmPV Composite Nanoshells with Agglomeration Effects

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Abstract:

This work analyzed the vibration behavior of PmPV composite shells reinforced with functionally graded (FG) carbon nanotube. The material properties are modeled across two distinct configurations: Hardcore (HC) and Soft-core (SC), in which Five distinct of CNT distribution patterns are examined, including tri-directional (FG-A), bidirectional, and unidirectional patterns. The PmPV composite shells are modeled using higher-order shear deformation theory (HSDT) within the nonlocal strain gradient theory framework and the Galerkin method is employed to establish an analytical solution for the equilibrium equations. This approach is designed to model the effects of agglomeration parameters ζ and ξ on the dimensionless central deflection of spherical CNTs, considering various boundary conditions, CNT volume fractions (V_{cnt}), and power law indexes.

Key words: Carbon nanotubes, agglomeration, dimensionless central deflection, PmPV, HSDT, NSGT.

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Formulation and characterization of Diclofenac sodium loaded hydrogel

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Abstract:

Diclofenac sodium is a nonsteroidal anti-inflammatory drug characterized by a short biological half-life, it was selected as an ideal candidate for sustained release administration. The aim of this study was to formulate and characterize a hydrogel for the sustained release of diclofenac sodium. The hydrogel was prepared using HPMC K4M as gelator. The hydrogel was characterized by determination of pH, viscosity and *in vitro* release in phosphate buffered saline solution (pH = 5.5) at 32°C. The results showed that the hydrogel formulated has a pH of 6.5 , a viscosity of 91.4 Pa.s and only 15.67% of Diclofenac sodium was released after 6hours. Diclofenac sodium hydrogel showed a greatest promise as potential sustained drug delivery systems for treating actinic keratosis.

Key words: Diclofenac sodium, half-life, hydrogel, sustained release.

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Predicting Dielectric Response of Pressboard Under Thermal Ageing with Frequency-Domain Spectroscopy and Neural Networks

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Abstract:

The reliability of power transformers strongly depends on the condition of their solid insulation, with pressboard playing a crucial role in ensuring long-term dielectric performance. As pressboard ages, its dielectric properties—particularly the loss factor (tan δ) and electrical conductivity—undergo significant changes that directly affect transformer efficiency and service life. In this study, two sets of pressboard samples were investigated: one new and one thermally aged under accelerated ageing conditions in an oven. Frequency-domain dielectric spectroscopy (FDS) was then employed to measure these parameters at different temperatures. A portion of the resulting data was used to train artificial neural networks (ANNs) to predict the dielectric parameters of pressboard, focusing on loss factor and conductivity. The ANN demonstrated adequate predictive capability, confirming its effectiveness in estimating these parameters and offering a powerful approach to assess the insulation state of pressboard. These findings highlight the potential of neural networks as non-invasive diagnostic tools for transformer insulation monitoring and life assessment.

Key words: Transformer insulation, Frequency-domain spectroscopy (FDS), Artificial neural networks (ANN), Predictive diagnostics

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Valorization of Dune Sand: Impact of Mineral Additions on the Physicomechanical Performance of High-Performance Concrete.

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Abstract:

Concrete remains the most widely used material in civil engineering today. In recent years, ongoing research has continued to enhance its properties, seeking a balance between cost efficiency and technical performance.

The primary aim of this research is to contribute to an experimental investigation of high-performance concrete (HPC) incorporating local mineral additions. More specifically, the study focuses on the valorization of dune sand from the western erg in southwestern Algeria, while also comparing the effects of different types of mineral additions on the physicomechanical properties of these concretes.

The evaluation centered on short-term mechanical properties, particularly compressive and flexural strength. Initially, an appropriate HPC mix design was developed to ensure ease of implementation. The study then examined the potential of dune sand as a substitute material.

The concretes produced demonstrated remarkable mechanical performance, with compressive strengths reaching up to 75 MPa. The findings confirm that dune sand can be effectively utilized in HPC, and that substituting silica fume with ground dune sand does not compromise the material's properties.

Keywords: high-performance concrete, mineral additions, experimental investigation.

ON-009

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Robust Control for Enhancing Voltage Stability and Power Quality in a PV–Wind Hybrid System

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Abstract:

The growing global energy demand, in tandem with the acute imperative to mitigate environmental impacts, highlights the role of hybrid renewable energy systems (HRES) as sustainable options. By integrating photovoltaic (PV) and wind energy systems, HRES allows for a mutual generation that reduces the use of fossil fuels and enhances grid stability. However, adding such systems within the framework of power networks creates issues related to stability and power quality that demand the application of advanced control strategies. This study implements a robust control strategy in a grid-connected photovoltaic-wind hybrid system based on the Sliding Mode Control (SMC). In the PV system, an SMC-capable DC–DC boost converter ensures accurate Maximum Power Point Tracking (MPPT) in the presence of irradiance variations. In the wind system, a PMSG-based turbine with an SMC-controlled AC–DC converter provides stable torque regulation and smooth power transfer. Simulation results in MATLAB/Simulink are presented as evidence that the introduced methodology achieves effective MPPT tracking, stabilizes DC-bus voltage, and dramatically boosts the quality of the power delivered to the grid. These findings confirm the effectiveness of rugged SMC-based approaches in optimizing the efficiency, reliability, and resilience of hybrid renewable energy configurations so that they can be implemented in future smart grids.

Key words: HRES, Photovoltaic (PV), Wind Energy, Robust Control, MPPT, SMC.

ON-010

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Title: **Slip Trace Analysis of Plastic Deformation Mechanisms in Ti-6Al-4V Alloy**

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Abstract:

In hexagonal close-packed (HCP) materials such as commercially pure titanium, plastic deformation is predominantly accommodated by crystallographic slip and deformation twinning. The incorporation of alloying elements, particularly aluminum, significantly suppresses twinning activity, as observed in the Ti-6Al-4V alloy. In this alloy, plastic strain is primarily accommodated by three crystallographic slip systems: basal ⟨a⟩, prismatic ⟨a⟩ and pyramidal ⟨c+a⟩. Understanding the relative activity of these slip systems is essential to predict the mechanical response of HCP alloys under various loading conditions. This study aims to link the macroscopic behavior of Ti-6Al-4V titanium alloy with the fundamental mechanisms of plastic deformation. The role of various slip systems basal ⟨a⟩, prismatic ⟨a⟩, and pyramidal ⟨c+a⟩ in accommodating plastic strain is analysed. A slip trace analysis technique is developed to identify the contribution of these systems. The results show that plastic deformation is primarily accommodated by the prismatic ⟨a⟩ system, followed by the basal ⟨a⟩ system, and finally, the pyramidal system ⟨c+a⟩.

Key words: Ti-6Al-4V Titanium Alloy, Slip traces Analysis, plastic deformation mechanisms

ON-011

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Assessment of the Mechanical Performance of Stabilized Gargar dam Mud with Mineral Additives for Road Engineering Applications

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Abstract:

Sedimentation poses a serious challenge to the safety and storage capacity of dams, particularly in semi-arid regions affected by severe erosion. At the Gargar Dam, Algeria's third-largest, dredging operations have been undertaken by the National Agency for Dams and Transfers (ANBT) to remove accumulated sludge. In this context, Algerian researchers investigated sustainable strategies for reusing dredged sediments in civil engineering applications. The study involved stabilizing the dredged mud with lime (0–6%), sand (0–20%), and natural pozzolana (0–20%), followed by laboratory tests (Atterberg limits, compaction, CBR, and unconfined compressive strength) to evaluate its mechanical performance. Results show that lime and pozzolana significantly improve the geotechnical properties of the sediments by reducing plasticity, inducing a flocculated structure, and increasing strength. These outcomes highlight the potential of treated Gargar mud as a viable material for road construction.

Key words: Sedimentation, Gargar dam, lime, pozzolana, Compaction.

ON-012

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Automated Bone Fracture Classification in Radiographic Images Using Pre-Trained Deep Learning Models

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Abstract:

Accurate and timely diagnosis of bone fractures is relevant in orthopedics and emergency care. This study presents a comprehensive comparative assessment of five pre-trained convolutional neural network (CNN) models for automatic binary bone fracture classification of X-ray images.

We evaluated the performance of VGG19, ResNet50V2, InceptionV3, MobileNetV2, and EfficientNetB7 models on FracAtlas dataset, which contains 4,083 X-ray images in fractured and non-fractured classes. The dataset was split into 80% training data (3,267 images) and 20% validation data (816 images). All the models were fine-tuned using transfer learning with pre-trained ImageNet weights. Data augmentation techniques like rotation (±20°), width/height shifting (0.2), and horizontal flip were implemented to enhance model generalization. The model was trained on 20 epochs with a batch size of 32 using the Adam optimizer on Kaggle P100 GPUs.

EfficientNetB7 achieved the highest training accuracy of 94.25%, followed by MobileNetV2 (92.01%), InceptionV3 (86.93%), ResNet50V2 (86.87%), and VGG19 (82.43%). Validation accuracies, however, reported varied generalization capabilities:

InceptionV3 had the best validation performance at 81.25%, followed by MobileNetV2 (70.47%), EfficientNetB7 (67.16%), and ResNet50V2 (60.42%). VGG19 suffered training instability with loss convergence issues. The difference between the validation and training accuracies are indicative of overfitting, particularly for EfficientNetB7 (27.09% difference) and MobileNetV2 (21.54% difference), while InceptionV3 was more generalized with only a 5.68% difference.

The comparative analysis here identifies that although architectures with high complexity like EfficientNetB7 provide better training performance, mid-complexity models like InceptionV3 perform better in generalization for medical imaging tasks. The findings indicate the need to balance model complexity and generalization ability in fracture detection systems. The fact that InceptionV3 provides better validation performance suggests it is the most appropriate architecture for clinical deployment among the models tested.

Key words: Bone fracture classification, Convolutional neural networks, Transfer learning, Medical image analysis, FracAtlas dataset

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ON-013

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Transfer Learning Models Analysis with Synthetic Minority Oversampling Technique for Multi-Class Diabetic Retinopathy Classification

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Abstract:

Diabetic retinopathy (DR) is a prevalent complication of diabetes and a leading cause of preventable blindness worldwide. Automated screening using machine learning offers a scalable solution for early detection. This study conducts an analysis of deep learning architectures for the multi-class classification of DR severity from fundus images. We evaluate the performance of three pre-trained convolutional neural networks (CNNs)—VGG16, Inception-V3, and Xception—using transfer learning and fine-tuning. The models were trained and validated on the publicly available APTOS 2019 dataset. A critical challenge addressed is the severe class imbalance inherent in medical datasets. Our preprocessing pipeline included image resizing, normalization, green-channel extraction, and contrast enhancement to improve feature clarity. To combat imbalance, we implemented the Synthetic Minority Oversampling Technique (SMOTE), which generates synthetic samples for the underrepresented classes. The results demonstrate the significant impact of architecture choice and data balancing on classification performance. The Xception model achieved the highest test accuracy of 86%, followed by Inception-V3 (80%) and VGG16 (78%). The application of SMOTE was found to be crucial in improving the models' sensitivity to minority classes. This work underscores the efficacy of transfer learning with advanced CNN architectures, combined with robust data preprocessing and balancing techniques, for building reliable automated DR screening systems.

Key words: diabetic retinopathy, pre-trained models, retinal fundus images, fine-tuning, image classification.

ON-014

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Optimizing Thermal Insulation for Energy Efficiency and Climate Resilience in Hot and Arid Climates: A BIM-Integrated EnergyPlus Analysis

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Abstract:

The building sector represents a critical challenge for both energy security and climate ambitions, particularly in regions with hot and arid climates where cooling demand is increasing. This study investigates the role of optimal thermal insulation thickness in reducing building energy consumption and greenhouse gas (GHG) emissions, while ensuring thermal and moisture comfort. Using the EnergyPlus simulation engine integrated in Building Information Modeling (BIM) workflow, an external concrete wall is modeled in IFC format and analyzed under three insulation scenarios: 0 cm, 2 cm, and 10 cm. A Variable Refrigerant Flow (VRF) system is considered as the Heating, Ventilation, and Air Conditioning (HVAC) solution. Results show that uninsulated walls lead to excessive energy consumption and potential surface condensation risks due to interior temperatures falling below the dew point. While 10 cm of insulation reduces HVAC energy demand by 53%, it creates interstitial condensation risks. The optimal balance is achieved with 2 cm of insulation, reducing energy consumption by 27% while avoiding both surface and interstitial condensation. These findings highlight the importance of targeted insulation strategies to enhance building energy efficiency, reduce GHG emissions, and contribute to national energy security and climate mitigation goals.

Key words: Energy efficiency, Building Information Modeling (BIM), Climate mitigation, HVAC energy consumption.

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Evaluation of Simulation Methods for Structural Behavior of a Pipeline Subjected to Localized Forces

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Abstract:

Pipelines are widely used for transporting fluids such as oil, gas, and water over long distances due to their reliability and cost-effectiveness. Their primary advantages include high transport efficiency, reduced operational and maintenance costs, and a significantly lower environmental impact compared to alternative transportation methods like trucks or rail. Despite these benefits, pipelines are exposed to various mechanical and environmental forces throughout their service life. These forces include internal pressure from the transported fluid, temperature variations causing thermal expansion or contraction, external soil pressure, and dynamic loads such as seismic activity or mechanical impacts. Such forces critically influence the structural integrity and durability of the pipeline, making rigorous structural analysis and robust design approaches essential to ensure safe and continuous operation. In this context, this study focuses on a comparative evaluation of two numerical simulation methodologies implemented in different software platforms. The target model is a cylindrical shell

representing the pipeline subjected to concentrated forces at specific locations. The goal is to understand how each software handles the deformation patterns induced by these loads. To validate and benchmark the numerical results, an analytical solution based on shell theory is used as a reference. This comparison enables the assessment of each simulation tool's accuracy, computational efficiency, and suitability for pipeline structural analysis, highlighting their respective strengths and limitations.

Key words: Pipeline, Loads, Modeling, Analysis, Deformation.

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Contribution to the Modeling and Robust Control of a Wind System based on a Doubly Fed Induction Generator

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Abstract:

The overall objective of this work is to enhance the knowledge needed to contribute to the study and control of a Wind Energy Conversion System(WECS) based on a Doubly Fed Induction Generator (DFIG). After modeling the complete wind energy conversion chain, we proposed the design of a wind system model with speed control, using two methods control of MPPT: the direct method and the indirect method based on two regulators, one PI-type and the other Fuzzy Logic. The control methods are proposed and tested to ensure the closed-loop stability of the turbine-machine assembly and improve the quality of the energy injected into the electrical network.Finally, we demonstrated that a wind system based on a DFIG can effectively contribute to improving electrical power quality by compensating for harmonic currents present in the electrical grid. The simulation results demonstrate the effectiveness and performance of the proposed methods.

Keywords: WECS, DFIG, MPPT, PI, Fuzzy Logic.

ON-017

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Efficient Photocatalytic Removal of Brilliant Green dye from Aqueous Solutions Using CuO Nanoparticles and Response Surface Modeling

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Abstract:

Brilliant Green (BG) is an inexpensive dye widely used in microbiology, paper, cosmetics, and textile industries. Despite its popularity, its discharge into water bodies poses serious environmental and health risks, as BG is toxic, potentially carcinogenic, and resistant to natural degradation.

This study examined the photocatalytic degradation of BG using copper oxide nanoparticles (CuONPs) under ultraviolet–visible light. Response Surface Methodology (RSM) coupled with the Box–Behnken Design (BBD) was used to optimize three parameters—solution pH (4–10), irradiation time (5–25 min), and CuONP dosage (0.5–1.5 g/L)—while maintaining an initial dye concentration of 20 mg/L. The response, expressed as the degradation efficiency of BG (%), was systematically investigated.

The developed two-factor interaction (2FI) model was found to be highly significant ($p < 0.0001$) and demonstrated excellent statistical reliability ($R^2 = 0.9610$, adjusted $R^2 = 0.9317$, predicted $R^2 = 0.8022$). The most influential factors were the linear effects of pH (A) and irradiation time (B), as well as the interaction terms AB and BC. These results indicate that both individual and interactive effects play a crucial role in BG degradation, validating the suitability of the 2FI model. Under optimized conditions—pH 9.7, 24.5 minutes of irradiation, and a CuONP dose of 1.23 g/L—the photocatalytic system achieved a complete (100%) degradation of BG.

These findings highlight the high efficiency and promise of the optimized CuO-based photocatalyst for BG removal under visible-light irradiation, underscoring its potential for sustainable wastewater treatment applications.

Key words: Copper Oxide Nanoparticles, Dye, Brilliant Green, Photocatalysis, Response Surface Methodology, Box-Behnken Design.

ON-018

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Box–Behnken Design optimization of Brilliant Green dye photodegradation using TiO_2 nanoparticles under UV light

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Abstract:

Brilliant Green (BG) is a toxic cationic dye extensively used in various industrial applications. This work focuses on its photocatalytic degradation using titanium dioxide nanoparticles (TiO_2NPs) under UV irradiation, with process optimization carried out via response surface methodology (RSM) employing a Box–Behnken design (BBD). Three independent variables were investigated: TiO_2NPs dose (X_1: 0.5–1.5 g/L), pH (X_2: 4–10), and irradiation time (X_3: 5–25 min). The response variable (Y) was the degradation efficiency (%).

The developed quadratic model was highly significant (p = 0.0006) and exhibited robust statistical performance (R^2 = 0.9832, adjusted R^2 = 0.9530, predicted R^2 = 0.7616). Significant factors included the linear effects of catalyst dose (A), irradiation time (B), and pH (C), the interaction term AB, and the quadratic terms B^2 and C^2. These findings demonstrate the combined influence of individual and interaction effects on BG degradation, validating the use of a quadratic model. Under optimal conditions—TiO_2 NPs dose = 1.5 g/L, pH = 10.00, and irradiation time = 16.26 min—the degradation efficiency reached 98.96% with a desirability of 0.9896. These results confirm the potential of TiO_2NPs-based photocatalysis as an efficient and environmentally sustainable treatment, due to the non-toxic and reusable nature of TiO_2 and the absence of harmful by-products.

Key words: Nanoparticles, Titanium dioxide (TiO_2), Dye, Brilliant Green, Photocatalysis, Optimisation, Box-Behnken Design, UV Irradiation.

ON-019

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Rotating bending fatigue analysis of PMMA specimens weakened by U and V-notched using local Strain Energy Density (SED) method.

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Abstract:

This work is devoted to investigate the effect of notch type on fatigue behavior. A polymethacrylate PMMA specimens weakened by U and V notches were studied using rotating bending tests and based on averaged Strain Energy Density (SED) over control volume method. The notch radius was varied from 0.2 to 2 mm for U notches while the opening of V notch was opted which takes values ranging from 20 to 140 . It has been found that the specimens with narrow notches have less fatigue strength than specimens with wide notches in both U and V, also for the sharp Notch-V, the fatigue strength is lower than for the blunt Notch-U. Moreover, the experimental results show a good agreement with theoretical predictions.

Key words: Brittle failure, Fatigue failure mode, U and V-notches, SED method

ON-020

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Title: Study of the properties of Lanthanum Hydride (LaH10)

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Abstract

In this work, we studied the superconducting material Lanthanum Hydride (LaH10), specifically examining how to determine its properties using ultrasonic waves by relying on the operating principle of an acoustic microscope.

This study was conducted using a liquid medium (water) with this superconducting material to prevent the attenuation of ultrasonic waves at a frequency of 25 MHz. This method allows us to obtain Young's modulus, Shear modulus and poisson's ratio of this material.

Key words: Physical properties, Lanthanum Hydride, ultrasonic waves, Young's modulus, Shear modulus.

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ON-021

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AI-Powered Prediction of Structural and Electronic Properties of Emerging Semiconductor Materials

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Abstract:

The prediction of fundamental physical properties of materials, such as electronic band gap energy and lattice constants, is crucial for accelerating the development of advanced functional materials in energy-related domains like photovoltaics and photocatalysis. Conventional computational methodologies, including density functional theory, often grapple with the trade-offs between computational duration, and predictive accuracy when applied to complex systems such as chalcopyrites and perovskites. To address these issues, this work proposes hybrid artificial intelligence (AI) frameworks that integrate artificial neural networks (ANN), fuzzy logic systems, and advanced metaheuristic optimisation algorithms. For chalcopyrite compounds, we develop an ANN model hybridised with Particle Swarm Optimisation (PSO) to surmount challenges related to local minima entrapment and solution quality, thereby achieving superior convergence and predictive performance for band gap energy of chalcopyrite materials. For simple perovskites ABC_3, optimised ANN and PSO-fuzzy logic models are employed to predict lattice constants. Benchmark evaluations using root mean square error, mean absolute error, and the coefficient of determination

demonstrate the robustness and effectiveness of the proposed approaches. The results highlight the potential of AI- and ML-driven predictive models in accelerating the discovery and design of advanced materials with tailored electronic and structural properties.

Key words: Lattice constant, band gap, perovskites, chalcopyrites, Machine learning, prediction.

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ON-022

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Influence of the pore Wall polarity in structure and dynamic of water in periodic mesoporous silica

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Over the past few years, a family of mesoporous materials with high specific surface area and functionalized surface have received much interest and a great deal of attention because of their wide variety of scientific and technological applications in catalysts, adsorption, sensing, separation, optical devices, drug delivery ….. . Fundamental and applied research dealing with novel silica-based mesoporous materials as MCM-41 and SBA-15 aims to improve template-synthesis strategies, chemical modification of the porosity and surface of mesoporous materials in order to adjust to a more hydrophobic or hydrophilic character….Here, we report the detailed study of the thermodynamic and dynamic properties of water and confined in hybrid functionalized SBA-15 materials, mainly focusing the impact of confinement on the behaviour of water on the surface chemistry of nanapores investigated by spectroscopic and adsorption techniques.

First, the one-pot pathway of co-condensation method, which is characterized by simultaneous condensation of inorganic and organic precursors in a single step, is used to introduce propyl groups in the nanoporous surface of SBA-15. The second modification inner of the surface pore is the trimethylsilylation of the silanols groups through the post-synthesis grafting of TMS groups.

The physicochemical features were characterized by X-ray diffraction, N_2 adsorption/desorption and MAS NMR measurements.

The thermodynamic properties of confined water were done by differential scanning calorimetry (DSC) measurements for hydrated samples in the temperature range from -160°C up to 170°C under nitrogen flow. The NMR magic angle experiments of ^{1}H, ^{31}P, ^{29}Si and ^{13}C were recorded at room temperature.

Adsorption and NMR experiments shows that the surface chemistry of the nanoporous SBA-15 modifies silica nanopore wall properties improving their hydrophobic character.

Key words Nanoporous materials SBA-15, functionalization, hydrophobic nanopore wall.

ON-023

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Impact of the pH bath in the morphology and structure of Ni-Fe alloys

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Abstract:

Magnetic Ni-Fe alloys are the subject of many applications, have been extensively studied in recent years in order to develop materials with optimized magnetic properties, and are used in general in corrosion, wear and electrocatalytic materials. For their realizations, electrochemical method proves to be more adequate and less expensive compared to other methods, the latter depends on several parameters, among these parameters, the effect of the bath additions. In this work, Ni-Fe coatings were deposited on copper substrates. X-ray diffraction (XRD), scanning electron microscopy (SEM) and microhardness analysis are used to study the effects of pH bath on morphology and phase structure,. The experimental results confirm that all Ni-Fe coatings exhibit a uniform, compact structure without cracks and including many globular grains. The contents of Ni and Fe in Ni-Fe deposits vary with the variation of pH used, and confirm that the XRD patterns of the alloy deposits reveal that the pictures a number of sharp peak indicating a good crystalline.

Key words: Ni-Fe alloys , pH ; XRD; SEM; electrochemical method; microhardness; morphology;

ON-024

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Carbon Substitution Enhanced Electronic and Optical Proprties of $MgSiP_2$ Chalcopyrite Through TB-mBJ Approximation

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Abstract:

In this work, we used the first-principles calculation to investigate the effect of carbon substitution on electronic, and optical properties of the $MgSiP_2$ compound. The substitution of the C atoms leads to a reduction of the value of the band-gap to 1.51 eV, 1.47 eV, and 1.30 eV for x = 0.25, 0.5 and, 0.75 respectively. We have calculated also the optical properties and the results show that the average absorption coefficient of $MgSi_{1-x}C_xP_2$ alloys is improved in the visible light region ($\alpha \sim 10^5$ cm^{-1}). Therefore, the band-gap values and the high absorption coefficient ($\alpha \sim 10^5$ cm^{-1}) make $MgSi_{1-x}C_xP_2$ alloys a promising candidate for photovoltaic applications.

Key words: FP-LAPW, Chalcopyrite compound, Structural, Electronic and Optical properties

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ON-025

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X-ray Fluorescence Spectroscopy for Environmental Pollution Assessment

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Abstract:

This study highlights the application of X-ray Fluorescence (XRF) spectroscopy as an analytical method for the assessment of environmental pollution through the investigation of urban dust collected on air filters. The work was conducted within the framework of an international proficiency test coordinated by the International Atomic Energy Agency (IAEA). Major and trace elements (Si, S, Cl, K, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Sr, and Pb) were quantified using a PANalytical Epsilon3 XL spectrometer equipped with a silicon drift detector.

The reliability of the analytical results was evaluated through a rigorous quality assurance and quality control (QA/QC) protocol, including statistical analysis based on z-scores, u-scores, relative bias, and standard deviation index (SDI). These parameters ensured the validation of the produced data and facilitated the identification of potential analytical discrepancies.

The findings confirmed the ability of XRF to provide rapid, accurate, and non-destructive measurements, making it particularly suitable for monitoring atmospheric contamination. Satisfactory performance was obtained for several elements (V, Cr, Cu, Sr, Pb), whereas

significant deviations observed for others (Si, Fe, Zn, Ti, K) indicate the need for methodological improvements.

Overall, this study demonstrates the robustness and relevance of XRF spectroscopy as an effective tool for environmental monitoring, while underscoring the critical role of QA/QC procedures in ensuring the reliability and international comparability of analytical data.

Key words: XRF, Environmental Pollution, Quality Assurance and Quality Control (QA/QC), Trace Metals.

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ON-026

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PZT Thin Films for Direct Environmental Benefit : A Facile Pipette-Deposition Method for Sustainable Sensing Applications

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Abstract:

This work presents a novel, facile, and cost-effective route for synthesizing lead zirconate titanate (PZT) thin films using a simple pipette-deposition technique, demonstrating their direct potential for environmental benefit. Structural and morphological characterization via X-ray Diffraction (XRD) confirmed the successful formation of the perovskite phase with high crystallinity. Scanning Electron Microscopy (SEM) analysis revealed a continuous, homogeneous, and crack-free microstructure, indicating the efficacy of the pipetting method in producing high-quality films. The synthesized PZT thin films were evaluated as active elements for eco-friendly applications. Their excellent piezoelectric response makes them promising candidates for use in self-powered environmental sensors and as vibration energy harvesters. This research validates that high-performance PZT thin films for environmental applications can be produced through a remarkably simple and accessible fabrication process, opening doors for wider adoption and innovation in green electronics.

Key words: PZT, thin films, Pipette, environment.

ON-027

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X-ray Fluorescence Spectroscopy for Environmental Pollution Assessment

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Abstract:

This study highlights the application of X-ray Fluorescence (XRF) spectroscopy as an analytical method for the assessment of environmental pollution through the investigation of urban dust collected on air filters. The work was conducted within the framework of an international proficiency test coordinated by the International Atomic Energy Agency (IAEA). Major and trace elements (Si, S, Cl, K, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Sr, and Pb) were quantified using a PANalytical Epsilon3 XL spectrometer equipped with a silicon drift detector.

The reliability of the analytical results was evaluated through a rigorous quality assurance and quality control (QA/QC) protocol, including statistical analysis based on z-scores, u-scores, relative bias, and standard deviation index (SDI). These parameters ensured the validation of the produced data and facilitated the identification of potential analytical discrepancies.

The findings confirmed the ability of XRF to provide rapid, accurate, and non-destructive measurements, making it particularly suitable for monitoring atmospheric contamination. Satisfactory performance was obtained for several elements (V, Cr, Cu, Sr, Pb), whereas

significant deviations observed for others (Si, Fe, Zn, Ti, K) indicate the need for methodological improvements.

Overall, this study demonstrates the robustness and relevance of XRF spectroscopy as an effective tool for environmental monitoring, while underscoring the critical role of QA/QC procedures in ensuring the reliability and international comparability of analytical data.

Key words: XRF, Environmental Pollution, Quality Assurance and Quality Control (QA/QC), Trace Metals.

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ON-028

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Surface defects in transparent $MgAl_2O_4$ spinel ceramics: detection and quantification

Meziane Rahima[a], Abdelbaki Cherouana[a], Sofiane Bouheroum[a] and Benaissa Salim[a]

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Abstract:

This work presents a transmission moiré interferometry approach for detecting and quantifying surface defects in transparent $MgAl_2O_4$ spinel ceramics. By superimposing a reference grating with the image transmitted through the ceramic under collimated laser illumination, interference fringes are generated, whose distortions reveal local surface irregularities. The method enables the identification of low-contrast defects at the submicron scale, providing both qualitative and quantitative information on the optical and mechanical quality of the ceramics. Its rapid, non-destructive, and high-resolution nature makes it particularly suitable for industrial quality control of transparent spinel ceramics.

Key words: Transparent ceramics, Surface defects, Quantification, Moiré.

ON-029

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A density functional study of structural and electronic properties of Rutile TiO_2.

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Abstract:

The structural and electronic properties of rutile TiO_2 were investigated using density functional theory (DFT) within the full-potential linearized augmented plane wave (FP-LAPW) method as implemented in the WIEN2k code. To improve the description of the electronic structure, we employed the recently developed Tran–Blaha modified Becke–Johnson (TB-mBJ) exchange potential in combination with the generalized gradient approximation (GGA) for the correlation potential. The calculated structural parameters are in good agreement with available experimental data. Our electronic band structure analysis confirms that TiO_2 is a semiconductor with a direct band gap. Furthermore, the density of states (DOS) reveals significant O 2p - Ti 3d hybridization in both the valence and conduction bands, indicating strong interactions between Ti and O atoms in the TiO_2 compound.

Key words: TiO_2, Rutile, DFT, TB-mBJ.

ON-030

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Optical Properties and Energy-Transfer Mechanisms Governing Up-Conversion in Tb^{3+}–Yb^{3+} Co-Doped SiO_2–PbO–PbF_2 Glasses

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Abstract:

Oxyfluoride glasses based on the **SiO_2–PbO–PbF_2** (SPF) system have long been recognized as versatile hosts for rare-earth ions, yet the combined incorporation of Tb^{3+} and Yb^{3+} in this matrix has remained largely unexplored. In this study, we introduce an original co-doping approach designed to exploit the cooperative interactions between Tb^{3+} and Yb^{3+}, thereby enabling highly efficient up-conversion under low-power near-infrared (NIR) excitation. To our knowledge, this constitutes the first systematic report addressing both the energy-transfer dynamics and the rich multicolor luminescence resulting from this specific ion pairing. The synthesized materials were subjected to an extensive spectroscopic investigation, encompassing absorption, excitation, and emission analyses, to unravel their structural and optical characteristics. Particular emphasis was placed on the up-conversion response under 976 nm excitation, complemented by lifetime measurements, and on the excitation power dependence probed with a 940 nm diode laser (300–600 mW). Chromaticity coordinate determination and CIE diagram mapping under 375 nm and 976 nm excitation

further demonstrated the tunable multicolor emission. These findings not only validate the efficiency of the Tb^{3+}/Yb^{3+} co-doping strategy but also underscore the significant promise of these oxyfluoride glasses for advanced photonic technologies, including bioimaging, solar energy harvesting, optical data storage, and solid-state lighting.

Key words: Oxyfluoride glasses, Rare-earth ions, Up-conversion luminescence, Energy-transfer mechanisms.

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On-031

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Enhancing TiO_2 Performance for Smart Technologies Through DFT Doping Strategies

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Abstract:

Titanium dioxide (TiO_2) is a widely studied semiconductor material due to its excellent chemical stability, non-toxicity, and photocatalytic properties. However, its wide bandgap and limited visible-light absorption restrict its applicability in next-generation smart technologies. In this study, Density Functional Theory (DFT) simulations are employed to investigate the structural, electronic, and optical modifications of TiO_2 induced by various dopants, including both metallic and non-metallic elements. The computational models reveal that appropriate doping strategies can effectively tune the bandgap, enhance charge carrier mobility, and introduce mid-gap states, thereby improving TiO_2's responsiveness under visible light and optimizing its properties for use in smart applications such as photocatalysis, self-cleaning surfaces, gas sensors, and solar cells. The findings provide valuable theoretical insights into

dopant selection and mechanism understanding, serving as a guideline for the rational design of doped-TiO_2-based functional materials.

Key words: Titanium dioxyde, DFT, properties calculations, doped system.

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ON-032

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Structural, morphological, and optical properties of MgO and Cu-doped MgO thin films prepared using sol-gel spin coating

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Abstract:

This study investigates the structural, morphological, and optical properties of MgO and Cu-doped MgO thin films with Cu concentrations of 3, 6, and 9 at.%, deposited on glass substrates via the sol–gel spin-coating technique. The films were characterized using scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), and UV–Vis spectrophotometry. Structural analysis revealed a cubic crystal structure with a (200) preferred orientation and no secondary phases. The crystallite size decreased from 31.25 nm to 15.48 nm upon Cu doping. SEM images showed a morphological transition from nanowall structures to rounded grains. Optical characterization indicated a redshift in the absorption edge and a reduction in band gap energy from 3.93 eV to 3.82 eV, based on Tauc plots for direct transitions ($(\alpha h\nu)^2$ vs $h\nu$). These findings demonstrate that Cu doping effectively tunes the optical and catalytic properties of MgO thin films, making them promising candidates for solar-driven environmental remediation and optoelectronic applications.

Key words: Magnesium oxide thin films, sol–gel spin-coating, optical properties, Cu doping.

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ON-033

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Synthesis and characterization of Pr^{3+} doped $LU_xGd_{1-x}Po_4$

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Abstract:

This work concerns a study the structural and optical properties of $LuGdPO_4$ dope with rare earth Pr^{3+}.This material exihibits excellent propertie, incluning high luminous efficiency,fast dacay time .

The material was prepared using the sol-gel method with different concentration of Lu^{3+} (x=10%,20%,30%,40%). the calcination temperature of nano powder are estimated at 1000°C, with a solution pH of 8.

The phase identification of samples was examined using X-ray diffraction (XRD).The morphology of the powder was studied through scanning electron microscopy (SEM).Photoluminscence spectra wer obtained using a PerKin-Elmer(LS-50B) spectrometer.

Key words: Sol-Gel, $LuGdPo_4$,scintillator,Luminescence

ON-034

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Graphene-Based Materials: Physics and Chemistry Approaches for Sustainable Energy and Environmental Applications

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Abstract:

Graphene and its derivatives represent a new class of materials with outstanding physical and chemical properties, including high surface area, excellent charge mobility, and tunable surface chemistry. In this work, we explore the synthesis and functionalization of graphene to enhance its structural, electronic, and environmental performance. Advanced characterization techniques reveal how defects, doping, and chemical modifications influence charge transport and interfacial reactivity.

The study demonstrates that tailored graphene systems can improve energy storage efficiency, support photocatalytic degradation of pollutants, and enable effective water purification. Complementary theoretical modeling provides insights into the role of surface chemistry and defect states in governing material behavior.

By combining physics-based analysis with chemical engineering strategies, this research highlights the potential of graphene as a sustainable material platform for next-generation energy and environmental technologies.

Key words: Graphene, nanomaterials, functionalization, energy, environment.

ON-035

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Performance analysis of solar cell parameters evaluation from I-V curve: Numerical calculation

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Abstract:

photovoltaic (PV) panels are a large part of total power generation. modeling and simulation of photovoltaic cells and modules parameters estimation is a relevant field of research that plays a critical role. A theoretical estimation of solar cell and module parameters from current-voltage data is essential to study the behaviour of the solar cell device and optimize their performance. Herein, a simple, accurate and fast approach is presented to estimate the five parameters of the single diode equivalent solar cell/module using the measured current-voltage data and its derivative (G=dI/dV). These parameters are the photocurrent (I_{ph}), ideality factors (n), saturation current (I_s), series and shunt resistance (R_s, R_{sh}). A nonlinear least-square technique based on the Newton-Raphson and Lumber W-function method under MATLAB Program is applied to different solar cell technologies, including Mono-Si, Poly-Si, and organic solar cell based on TiO_2 Anatase and rutile nanocrystal under different environmental conditions.

Keywords: solar energy, parameter extraction, organic-inorganic SCs, I-V characteristics.

ON-036

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Geometric Optimization of Thermophotovoltaic Systems: Impact of Thermal Emitter and Photovoltaic Cell Thickness on Energy Conversion Efficiency

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Abstract:

Thermophotovoltaic (TPV) systems offer a promising approach for converting thermal radiation into electricity, leveraging advanced materials and photovoltaic principles. This study investigates the geometric optimization of TPV systems by analyzing the influence of thermal emitter and photovoltaic (PV) cell thickness on overall performance. Using COMSOL Multiphysics, we conducted parametric simulations to explore a range of thickness configurations. we explored a wide range of geometric configurations to identify optimal thickness combinations.

Our results demonstrate that optimizing the thickness of the thermal emitter can significantly improve energy conversion efficiency by promoting better absorption of thermal radiation and reducing thermal losses. Similarly, precise adjustment of the PV cell thickness can maximize solar light absorption and electrical current generation, thereby increasing the overall TPV system efficiency.

Key words: Optimal output, Thermophotovoltaic (TPV) system, Emitter thickness; PV cell thickness, efficiency, geometry,Emitter thickness; PV cell thickness.

ON-037

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PbTe-polymorphs Phase Diagram at high P-T Conditions by XtalOpt-Gibbs2 Method

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Abstract:

The ultimate objective of this project is the proposal of new materials with high thermoelectric performance. The success in its achievement is associated with the fulfillment of two other intermediate objectives. The first is of a methodological nature and consists on the combination of prediction models of crystalline structures (XtalOpt [1], USPEX [2], …) with strategies for chemical-quantum calculation of electronic, thermodynamic and transport properties (VASP [3]+newGIBBS [4]).

The second is of an applied nature. It seeks to obtain property-structure correlations from the computational exploration of regions of increasing pressures in the phase diagram of families of compounds with high value of the figure of merit (ZT) (PbTe) and allowing stoichiometric variations. The joint action of the computational tools and techniques along with their application is a unique opportunity to provide a better understanding of the parameters involved in ZT and advance in the rational design of materials that efficiently convert heat into electrical energy.

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ON-038

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Assessing the viability of $Cs_2PbBeBr_6$ halide double perovskite for technological applications

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Abstract:

This research aims to provide a comprehensive understanding of the structural, elastic, electronic, and optical properties of the $Cs_2PbBeBr_6$ halide double perovskite (HDP). In this study, all self-consistent field (SCF) calculations were performed using density functional theory (DFT) within the full-potential linear augmented plane-wave (FP-LAPW) method, as implemented in the Wien2k code. The Perdew-Burke-Ernzerhof (PBE) generalized gradient approximation (GGA) and the Tran−Blaha modified Becke−Johnson (TB-mBJ) methods were employed to accurately describe the exchange-correlation interactions. Our findings indicate that $Cs_2PbBeBr_6$ is stable in a cubic structure (Fm-3m), supported by phase stability analysis, enthalpy of formation, tolerance factor, and elastic constants. The compound exhibits ductile behavior, as assessed by Poisson's and Pugh's ratios. The electronic band structure reveals an indirect band gap of 2.243 eV and 3.248 eV, calculated using the GGA and TB-mBJ methods, respectively. Optical spectra calculations were performed in the energy range of 0 to 13 eV for each of the dielectric functions, extinction coefficient, electron energy loss, refractive index, optical conductivity, reflectivity, and absorption coefficient. The optical properties of $Cs_2PbBeBr_6$ in the visible range are particularly significant, offering strong potential for

applications such as solar energy harvesting. These characteristics make the compound a promising candidate for optoelectronic devices.

Key words: GGA and TB-mBJ, Halide double perovskite, Solar energy, Semiconductor

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ON-039

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Theoretical Insights into the Structural, Elastic, Electronic, and Optical Properties of $Cs_2B'GeF_6$ (B′: Sn, Pb) Halide Double Perovskites

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Abstract:

The present study investigates the structural, elastic, electronic, and optical properties of the halide double perovskites Cs_2SnGeF_6 and Cs_2PbGeF_6. Density functional theory (DFT) calculations have been performed using the generalized gradient approximation (GGA), and spin–orbit coupling (SOC). The investigation reveals that both compounds exhibit mechanical stability. Notably, the studied compounds display weak elastic anisotropy. Electronic properties were further examined, including the electronic band structure and density of states. The compounds show a semiconductor nature with a direct bandgap (Γ-Γ). Additionally, a comprehensive analysis of optical properties was conducted, encompassing the complex dielectric constant, refractive index, reflectivity, extinction coefficient, electron energy loss, absorption coefficient, and optical conductivity function, spanning up to 13.0 eV. These results highlight the potential of Cs_2SnGeF_6 and Cs_2PbGeF_6 for future optoelectronic applications.

Key words: FP-LAPW, Halide double perovskite, Semiconductor, DFT

ON-040

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Optimisation de la maniabilité et des propriétés mécaniques d'un mortier par substitution ternaire de céramique et de brique

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Abstract : L'industrie de la construction est un pilier fondamental du développement économique mondial, mais elle est également l'une des plus grandes consommatrices de ressources naturelles et génératrices de déchets. Dans un contexte d'urgence climatique et de raréfaction des matières premières, la recherche de solutions plus durables est devenue impérative. L'un des défis majeurs réside dans la production de ciment Portland, dont la fabrication est intrinsèquement liée à d'importantes émissions de dioxyde de carbone (CO_2), principal gaz à effet de serre responsable du réchauffement climatique. Environ 5 à 8% des émissions anthropiques globales de CO_2 proviennent de la production de ciment, principalement due à la décarbonatation du calcaire et à la consommation d'énergie fossile nécessaire aux fours. Parallèlement à cette empreinte carbone significative, le secteur du bâtiment est confronté à la gestion volumineuse de ses propres sous-produits et déchets. Parmi ceux-ci, les déchets de briques et les déchets de céramiques provenant des démolitions ou des rejets de fabrication représentent des flux considérables qui, souvent, finissent en décharge, engendrant des problèmes environnementaux. La valorisation de ces matériaux résiduels par leur réintégration dans la chaîne de production de nouveaux matériaux de construction est une voie prometteuse pour réduire l'impact environnemental de l'industrie.

Cette recherche se concentre sur l'utilisation de la poudre de déchet de brique (démolition d'un mur) et de la poudre de céramique (déchets de faïences) en remplacement partiel du

ciment. Nos travaux portent sur la création d'un mortier avec un CEMI de 42,5 et intégrant un taux fixe de 15% de poudre de céramique avec des taux de poudre de déchet de brique (0%, 10%, 20%, 30% ,40% et 50%) en substituant avec le ciment. Les résultats obtenus ont montré que la substitution ternaire a un impact significatif et variable sur les propriétés du matériau, avec la combinaison 15% céramique et 10% brique se distinguant comme la plus performante globalement.

Key words: : Poudre de brique et poudre de céramique, MBE, environnement, rhéologie, comportement mécanique.

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ON-041

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Impact of cement dosage on the physical, mechanical and drainage properties of porous concrete

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Abstract:

Porous concrete is a specific type of concrete with high porosity, accounting for 15 to 35% of its volume. This porous capacity gives it the ability to absorb and drain rainwater and runoff. Its unique structure allows water to flow through it, reducing the risk of accumulation and helping to prevent flooding. This material is a sustainable solution for rainwater management, promoting the natural water cycle. This study aims to investigate the effect of cement dosage on the physical, mechanical and drainage characteristics of porous concrete, keeping all other parameters constant except for the cement dosage. The results show that as the cement dosage increases, the hydraulic permeability and open porosity of the porous concrete decrease, while the abrasion resistance increases. In addition, this increase improves the density in both the

fresh and dry states, as well as the compressive, splitting tensile and flexural strengths. Finally, good correlations were observed between the mechanical properties, density and drainage properties.

Key words: Porous concrete, Cement dosage, Density, Mechanical properties, Drainage properties

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ON-042

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Evaluating adhesion bond strength of repair mortar enhanced with polypropylene fibre and marble waste

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Abstract:

Conventional cementitious repair mortars made using cements and sand are still giving attention due to its good adhesion to the existing concrete structure in terms of engineering and performance properties. Good bond of the combined system (repair/concrete) is the key for a successful repair. This research is aimed to experimentally study the effect of marble waste (MW) on the performance of self-compacting repair mortars (SCRM) reinforced with polypropylene fibres (PPF). Cement was partially replaced by MW at different percentages 0%, 10%, 15%, 20%, 25% and 30%. Then, repair mortar was evaluated on compressive and flexural strength at 7, 28 and 90 days. In addition to adhesion strength on composite specimens (half SCRM/half substrate mortar) at 7, 28 and 90 days. The combined use of PPF and MW showed good mechanical properties of SCRM which fulfilling the requirements of class R4 materials for structural repair products. Adhesion test indicated that 15% of MW is the optimum dosage which provides 20% of gain in adhesion strength.

Key words: Repair mortar, Adhesion bond strength, Polypropylene fibre, Marble waste.

ON-043

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An Experimental Comparative Analysis of Optimal PID Parameters for Robot Manipulators in Real-Time Using Ant Colony Optimization and Genetic Algorithms

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Abstract:

The article conducts a comparative investigation between two established control metaheuristic techniques: Ant Colony Optimization (ACO) and Genetic Algorithms (GA). The two algorithms are employed as tuning mechanisms for PID controllers, generating a hybrid controller with the aim of enhancing the performance of servo control systems and closed-loop processes. The ACO algorithm and GA are utilized to search for PID Controller's optimal gain.

The process of PID tuning revolves around attaining an optimal response from the underlying system, with focal objectives encompassing robustness, swiftness, and precision. A popular application being robot's arm controllers using DC servo motor. This study outlines the

development of a DC Servo PID controller using SISTOOL PID Auto Tuning, and later deployed on an Arduino Mega 2560 via the MATLAB/Simulink interface.

Furthermore, an enhanced controller design using Ant Colony Method (ACO) is proposed, and the simulation's results confirm the outstanding performances and efficiency provided by usage of ACO algorithm for PID tuning.

The objective of this paper is to ascertain the most appropriate metaheuristic paradigm for PID tuning, concurrently showcasing the significant role of parameterization in ensuring the effective operation of both methodologies.

Keywords: PID tuning, Metaheuristic, Ant Colony Optimization, Genetic Algorithms, Sisotool, DC Servo Motor, Arduino.

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ON-044

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Optimization of Methylene Blue dye removal onto Commercial Zinc Oxide Nanoparticles Using Response Surface Methodology.

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Abstract:

Water contamination by colored effluents such as methylene blue (MB) represents a significant environmental and public health concern, requiring the development of efficient, eco-friendly, and cost-effective treatment methods. This study investigates the adsorption performance of commercial zinc oxide nanoparticles (ZnO-NPs) for the removal of MB from textile wastewater. The effects of key operational parameters, including adsorbent dosage (10–50 mg), contact time (10–60 min), and initial dye concentration (20–60 mg/L), were systematically examined. To optimize the process, Response Surface Methodology (RSM) based on the Box-Behnken design was employed, enabling the identification of optimal conditions while minimizing the number of experimental runs. The optimized conditions yielded a maximum removal efficiency of 94.17%, with a high correlation coefficient (R^2 = 99.29%), indicating excellent model accuracy. These findings demonstrate the potential of commercial ZnO-NPs as effective and sustainable adsorbents for the treatment of dye-contaminated industrial wastewater.

Key words: Adsorption, Methylene blue (MB), Commercial zinc oxide nanoparticles (ZnO-NPs), Operational parameters, Optimization.

ON-045

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Sustainable Biocomposites from *Syagrus Romanzoffiana* Fibers Reinforced Bio-Epoxy Resin

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Abstract:

This work explores the fabrication of eco-friendly biocomposites by incorporating natural fibers from *Syagrus Romanzoffiana* (*SrF*) into a bio-epoxy resin. Composites with fiber contents of 10%, 20%, and 30% were produced and evaluated for their mechanical, thermal, morphological, and water absorption behaviors. Mechanical testing revealed that increasing fiber loading enhanced both strength and stiffness, with the 30% *SrF* composite achieving a tensile strength of 83.21 MPa and a flexural strength of 47.54 MPa. Thermogravimetric and derivative thermogravimetry analyses confirmed improved thermal stability, while Gaussian peak deconvolution indicated delayed degradation at higher fiber levels. X-ray diffraction suggested enhanced crystallinity, and FTIR spectra pointed to stronger fiber–matrix interactions. SEM observations highlighted improved dispersion and bonding at moderate fiber fractions. Although higher fiber addition improved performance, it also increased water uptake due to the hydrophilic nature of the fibers. Composites with 10–20% *SrF* provided an optimal balance between mechanical strength and moisture resistance. Overall, these findings demonstrate that *SrF* offers strong potential as a renewable reinforcement for sustainable

biocomposites, supporting the valorization of agricultural residues and advancing environmentally responsible material solutions.

Key words: *Syagrus Romanzoffiana* fibers, Bio-epoxy resin, Sustainable biocomposites, Thermal properties, Mechanical characteristics.

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ON-046

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Contribution to the Optimization of a Two-Stage CMOS Amplifier in 180 nm CMOS Technology

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Abstract:

The optimized design of a traditional two-stage single-ended operational amplifier with a 1.8 V supply that is implemented in 180 nm CMOS technology is presented in this paper. While transistor dimensions were methodically adjusted to satisfy target specifications in terms of DC gain, bandwidth, and phase margin, the amplifier (A2) uses a traditional Miller-compensated two-stage topology to guarantee stability. Additionally, an improved biasing scheme that uses resistive elements increases operating robustness and power efficiency.

The optimized design achieves a DC gain exceeding 60 dB, a gain–bandwidth product exceeding 100 kHz, and a phase margin exceeding 60°, according to post-layout simulation results. The circuit performs consistently at all process corners and temperature variations (0 °C, 27 °C, and 80 °C) and has low total harmonic distortion (THD < 5%).

Compared to the initial baseline design, the optimized amplifier demonstrates a significant reduction in power consumption while preserving a balanced trade-off between linearity and stability. These improvements validate the effectiveness of the adopted design strategy, highlighting the amplifier as a reliable low-power solution for analog applications that demand high gain, robust stability, and wide input operating range.

Key words: Two-stage CMOS amplifier, Miller compensation, low-power design, gain-bandwidth product (GBWP), optimization, bias circuit

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Comparative Study of Single and Dual DFIG Configurations in Small-Scale Wind Turbines

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Abstract:

Small-scale wind energy systems are increasingly considered for residential and distributed generation applications. The doubly-fed induction generator (DFIG) is widely adopted due to its efficiency under variable wind conditions and reduced converter rating. Conventional systems generally employ a single DFIG unit, which may limit both energy capture and reliability. This paper presents a comparative study between single- and dual-DFIG configurations, both driven by the same small-scale wind turbine. In the dual setup, two identical DFIGs operate in parallel on the same turbine shaft. Each machine is modeled in the dq reference frame and controlled by an indirect field-oriented control (IFOC) strategy with PI regulators applied to the rotor-side converter. MATLAB simulations under variable wind profiles highlight the advantages of the dual configuration. The dual-DFIG system achieves an average increase of about 18% in active power output compared to the single-DFIG configuration, with instantaneous gains reaching ~35.5% during transient conditions. Reactive power is effectively regulated near zero, ensuring unity power factor, while torque sharing between the machines reduces mechanical stress and improves dynamic response. These results demonstrate that employing dual DFIGs significantly enhances the overall performance of small-scale wind turbines operated under vector control.

Key words: Wind energy, DFIG, Dual configuration, Vector control, Small-scale wind turbine.

ON-048

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Frequency identification of broken rotor bars and eccentricity faults of squirrel-cage induction motors using spectral analysis

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Abstract:

In recent years, squirrel-cage induction motors have become widely used in electrical drives, mainly due to their durability, high efficiency, and low cost. However, these machines are prone to numerous failures. To detect these failures, we use Fourier transform-based power spectral density (PSD) due to its simplicity and rapid application. However, this method is ineffective against very noisy signals, low- motor slip, or incipient faults.

These limitations are related to the use of truncation windows, which decrease the spectral quality by the generation of negative effects such as side lobes and poor frequency resolution.

In this paper, we examine the effect of window selection on the quality of stator current spectral analysis using Periodogram technique through simulation results highlighting the performance of several weighting windows under different conditions using MATLAB.

Key words: Squirrel-cage induction motors, spectral analysis, signal processing, periodogram technique.

ON-049

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The Impact of Internal Fluid Pressure in a Dashpot Implant on Residual Limb Stress: A Finite Element Study

Presenting Abdelkader Benkhettou[a]

, Omar Khatir[a], Ismail Boudjemaa[b] ,Abderahman Sahli[a], Smail Benbarek[a]

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Abstract:

In this study, a finite element model was employed to examine the effect of internal pressure in a below-knee dashpot implantable prosthetic device on the stress distribution within the residual limb. By varying the internal pressure of the below-knee dashpot implant, we aim to investigate how this pressure influences the stress distribution at the interface between the residual limb and the prosthesis. At a maximal fluid pressure limit of 5 KPa, the Von Mises stress, interface contact pressures, and shear stress decreased by over 18%, 11%, and 10%, respectively. Furthermore, as the pressure increased from 1 KPa to 5 KPa, the stresses in the residual limb were reduced by 8%, 9%, and 9.5%, respectively. The study emphasizes the importance of appropriately calibrated fluid pressure as a critical design element to optimize implant performance.

Key words: Stump–prosthesis interface, Prosthetic, Contact Pressure, Dashpot implant, Prosthesis implant

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HPLC/MS Profiling and *In Vitro* Assessment of the Anti-Inflammatory and Antioxidant Potential of the Chloroform Extract of *Carthamus caeruleus* Rhizome

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Abstract:

This study aimed to evaluate the anti-inflammatory properties of the rhizome of *Carthamus caeruleus* L., a species traditionally used in Algerian medicine. The chloroformic rhizome extract (CHL-R) was characterized by preliminary phytochemical screening to identify major secondary metabolite classes and further analyzed by HPLC/MS.

In vitro assays were conducted to assess its anti-inflammatory potential. These included the nitric oxide (NO) inhibition assay in LPS-stimulated RAW 264.7 macrophages, the human red blood cell (HRBC) membrane stabilization assay, and a modified bovine serum albumin (BSA) protein denaturation assay. Antioxidant activity was also evaluated using the lipid peroxidation inhibition assay and the cellular antioxidant activity (CAA) assay.

Phytochemical analysis revealed the presence of tannins, flavonoids, anthocyanins, and polyphenols, while alkaloids were absent. Chromatographic profiling identified seven compounds, including dihydro-*p*-coumaric acid glucoside, apigenin-7-*O*-glucoside, and epicatechin glucoside. CHL-R inhibited NO production (199.80 ± 0.21 µg/mL), reduced

erythrocyte hemolysis (79.76 ± 0.78%), and prevented protein denaturation (60.00 ± 1.09%) at 500 µg/mL. Moreover, the extract demonstrated moderate lipid peroxidation inhibition (IC_{50} = 1.88 ± 0.15 mg/mL) but exhibited relatively weak CAA (4.09 ± 0.36%).

In conclusion, the chloroformic rhizome extract of *C. caeruleus* displayed promising *in vitro* anti-inflammatory activity and moderate antioxidant potential. Further investigations, particularly *in vivo* studies, are warranted to confirm its pharmacological efficacy and elucidate the underlying mechanisms of action.

Key words: *Carthamus caeruleus*, chloroformic extract, anti-inflammatory activity, nitric oxide inhibition, antioxidant activity, HPLC/MS.

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Modeling Urban Flood Dynamics in Biskra (Northeastern Algeria): An Advanced Approach

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Abstract:

Text of the abstract This study presents an integrated hydrological-hydraulic modeling approach to assess flood hazards in the Oued Biskra watershed (southeastern Algeria), where extreme events are amplified by climate variability and anthropogenic pressures.

The hydrological phase, simulated using HEC-HMS, quantifies runoff responses to rainfall events by incorporating key parameters (precipitation, infiltration, and basin characteristics). Subsequently, HEC-RAS-based hydraulic modeling evaluates channel dynamics under varying discharge scenarios, enabling precise floodplain delineation.

Geospatial integration (GIS) synthesizes these outputs into high-resolution flood risk maps, pinpointing vulnerable zones. The findings offer actionable insights for resilient urban planning and emergency preparedness, addressing a critical gap in arid-region flood management.

Key words: Keywords: modeling, flood, oued Biskra, HEC HMS, HEC RAS, modeling.

ON-052

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Adsorption of Basic yellow 28 Dye onto a Natural Bioadsorbent: Experimental Study, Kinetics and Machine Learning Modeling

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Abstract:

In this work, mandarin peel, considered as an agri-food residue, was used as a raw material for preparing a bioadsorbent aimed at eliminating basic yellow 28 dye from water. A series of experiments was carried out to assess the influence of different operating conditions and to determine the most favorable ones. The adsorption behavior was interpreted using isotherm, kinetic, and thermodynamic models, while predictive tools based on machine learning were also applied. Kinetic analysis revealed that the adsorption process is consistent with the pseudo-second-order model. Furthermore, the effect of the investigated parameters on dye elimination was explored through artificial intelligence modeling.

Key words: Adsorption, Basic yellow 28, Bioadsorbent, ANN Modelling, Valorization

ON-053

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Phytochemical Composition and Antioxidant Activity of *Rosmarinus officinalis L.* Leaf Extracts

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Abstract:

Targeting oxidative stress with natural antioxidants is a central strategy in preventive and therapeutic research. Medicinal plants represent an important source of bioactive compounds, which not only protect plants from oxidative damage but also confer significant health benefits in humans. *Rosmarinus officinalis* L., widely used in phytotherapy, is traditionally recognized for its antioxidant potential. This study aimed to evaluate the antioxidant activity of *R. officinalis* leaves and to characterize their phytochemical profile. Leaves were extracted by hydro-ethanolic maceration (30:70, v/v) for 48 h, and the crude extract was fractionated with ethyl acetate. Phytochemical screening revealed the presence of flavonoids, tannins, free quinones, and coumarins in both extracts, while alkaloids and terpenoids were detected only in the hydro-ethanolic extract. Tests for anthraquinones and saponins were negative. However, quantitative analyses indicated that the hydro-ethanolic extract contained 229.7 ± 0.069 µg GAE/mg and 297.2 ± 0.039 µg CE/mg, whereas the ethyl acetate fraction showed slightly higher values (236.2 ± 0.06 µg GAE/mg; 317.2 ± 0.076 µg CE/mg). Antioxidant evaluation using DPPH and total antioxidant capacity (CAT) assays confirmed the superior activity of the ethyl acetate fraction, with IC_{50} = 1.06 ± 0.04 µg/mL and 155.3 ± 0.082 µg ascorbic acid equivalents/mg extract, compared to the hydro-ethanolic extract (IC_{50} = 2.53 ±

0.1 µg/mL; 129.7 ± 0.0049 µg ascorbic acid equivalents/mg extract). Overall, these findings highlight *R. officinalis* leaves as a promising source of natural antioxidants, with the ethyl acetate fraction representing a particularly rich reservoir of bioactive compounds for managing oxidative stress and supporting phytotherapeutic applications.

Keywords: *Rosmarinus officinalis*, antioxidant activity, polyphenols, flavonoids, phytotherapy, oxidative stress

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Targeted Lipid-Based Delivery of Nicotinamide for Protecting Pancreatic β-Cells from Mitochondrial Oxidative Stress and Dysfunction

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Abstract:

The dysfunction of pancreatic β-cells is the major issue in the development of type 1 diabetes, and mitochondrial oxidative stress being one of the initial leading to this functional failure. Under stress, the mitochondria produce in excess reactive oxygen species (ROS), free radicals that disrupt the mitochondrial membrane potential (Δψm), affect mitochondria health and activate apoptotic pathways. Nicotinamide, a precursor of NAD+, promotes the preservation of mitochondrial activity and cellular homeostasis. However, it is a water-soluble molecule with low permeability, making it difficult to cross cell membranes, and its efficacy often requires high doses that may cause adverse effects. To overcome these limitations, we designed a lipid-based carrier system encapsulating nicotinamide, to ensure sustained intracellular delivery in β-cells under oxidative stress. In vitro studies on pancreatic β-cells pre-treated with nicotinamide-loaded lipid carriers at concentrations of 30 µM and 60 µM were assessed using JC-1 dye fluorescence staining. Both concentrations found significantly

improved Δψm and β-cell viability compared to free nicotinamide ($p \leq 0.01$), with the 30 μM dose providing greater protection than 60 μM. These results suggest that delivery of nicotinamide through a lipid carrier provide significant mitochondrial protection and improves β-cell resilience to oxidative stress.

Key words: Mitochondrial oxidative stress, Nicotinamide, Liposomes, Pancreatic β-cells, mitochondrial membrane potential.

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Bioactive Compounds of Medicinal Plants for Biotechnology and Human Health: Focus on Oral and Periodontal Diseases

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Abstract:

Oral and periodontal diseases remain a major global health concern, strongly influenced by microbial dysbiosis and host inflammatory responses. In this context, medicinal plants are recognized as promising reservoirs of bioactive compounds with potential applications in biotechnology and human health. The aim of this study is to highlight the role of three major classes of plant-derived bioactives—polyphenols, alkaloids, and terpenoids—in the prevention and management of periodontal diseases. A comprehensive review of recent literature was conducted, emphasizing biochemical characterization and reported biological activities. The collected evidence indicates that these compounds exert antimicrobial, antioxidant, and anti-inflammatory effects, thereby reducing periodontal tissue damage and improving oral health outcomes. Moreover, their multifunctional properties suggest valuable applications in sustainable therapeutic approaches. In conclusion, beyond their biological effects, the valorization of these compounds in innovative galenic formulations such as oral rinses, gels, or biodegradable films may provide effective and accessible alternatives for oral healthcare, reinforcing the role of medicinal plants as a bridge between traditional knowledge and modern biotechnology.

Key words: Bioactive Compounds, Oral Health, Periodontal Diseases, Biotechnology.

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UHPLC-DAD-ESI-MS^n analysis, radical scavenging and cytotoxic activity of Salvia algeriensis (Desf.) underground part extract

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Abstract:

The genus *Salvia* is widely recognized for its diverse therapeutic properties; however, the phytochemical and pharmacological characteristics of several species, including *Salvia algeriensis* (Desf.), remain insufficiently investigated. This study aimed to provide a comprehensive assessment of the phenolic composition and biological activities of hydromethanolic extracts obtained from the roots of *S. algeriensis* (Desf.). Total phenolic content (TPC) and flavonoid content (FC) were quantified, while phytochemical profiling was conducted via liquid chromatography coupled with mass spectrometry (UHPLC-DAD-ESI-MS^n). Biological potential was evaluated using antioxidant assays (ABTS$^{\bullet+}$, TBARS, and H_2O_2), cytotoxicity screening via the sulforhodamine B (SRB) assay against tumor cell lines. Root extracts exhibited high phenolic (114.01 ± 2.52 µg GAE/mg extract) and flavonoid (11.31 ± 0.66 µg QE/mg extract) contents. A total of 19 phenolic compounds were identified, with rosmarinic acid and salvianolic acid K being the major constituents in the roots. Additional key compounds included caffeic acid, salvianolic acid B isomers, and luteolin-*O*-hexoside. Root extracts exhibited strong lipid peroxidation inhibition (10.42 ± 3.36 µg/mL)

and promising cytotoxic effects especially against Caco-2, AGS, and HeLa cells. Overall, *S. algeriensis* shows considerable potential as antioxidants and anticancer agents.

Key words: *Salvia algeriensis* (Desf.), High-performance liquid chromatography-mass spectrometry, Antioxidants, Tumor cell lines.

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Incorporation d'extrait phénolique dans du PLA un polymére biodégradable

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Abstract:

La dégradation des aliments par les microorganismes sont devenues un problème croissant. Ainsi, pour préserver l'environnement et la qualité des aliments, il est important de choisir des matériaux issus des technologies d'emballage innovantes offrant une protection active libérant en permanence des composés actifs tels que des antioxydants, issus de plante tel que le thé vert *(Camellia sinensis)* qui constitue une source importante d'antioxydants et aux propriétés antimicrobiennes. Notre travail consiste a essayer d'introduire des extraits aqueux de thé vert dans un polymére biodégradable qui est le PLA (Polyacide Lactique) .Le pouvoir antioxydant d'extrait de the vert a été évalué par deux tests , le premier étant la capacité de piégeage du radical DPPH , et le second est le pouvoir de réduction du fer ferique en fer ferreux.Le potentiel antibactérien des extraits du thé vert a été détérminé par la methode des antibiogramme .

Les résultats obtenus, indiquent que la plus grande activité est obtenue avec l'extrait de Thé vert avec un pouvoir réducteur de (0.64) et de piégeage de DPPH de (56.401%). Ces activités peuvent être attribuées à la richesse de thé vert en composés phénoliques.

D'après l'analyse des résultats obtenus, seule *Pseudomonas.qerugenos (ATCC27853)* a montré une faible sensibilité envers les extraits de thé vert de diamètre 7±1 mm. Les trois

autres souches étudiées se sont révélées sensible avec des diamètres d'inhibition variant de de 9 ± 0.00 à 9,8 ± 0,3 mm pour *S.aureus*(ATTCC43300) et *Salmonelle .sp* respectivement. Par contre *Escherichia Coli* (ATTCC25922) est très sensible puisque le diamètre de son inhibition est de t 15±1 mm.

Ces résultats ouvre une nouvelle alternative de valoriser les plantes et les sous produits végétaux dans la fabrication d'emballage alimentaire actifs

Mots clés: Camellia sinensis ; antioxydant ; antimicrobien, DPPH; Pouvoir réducteur, PLA

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Fenugreek Sprouts as a Natural Reservoir of Bioactive Compounds: In Vivo Evidence of Anti-Inflammatory and Antioxidant Activities

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Abstract:

Germination enhances the bioactive profile of seeds through natural biotechnological processes. Fenugreek (*Trigonella foenum-graecum* L.) is a traditional medicinal and nutritional plant, recognized as a rich source of phenolic compounds with potential health-promoting effects. In this context, the present study investigates the methanolic extract of fenugreek sprouts for its antioxidant and anti-inflammatory potential. Extraction was performed by maceration using 80% methanol.The total polyphenol content was measured using the Folin–Ciocalteu method, yielding 649.36 mg GAE/100 gDW. Total flavonoid content, determined via the aluminum chloride colorimetric assay, was 96.94 mg QE/100 gDW . Antioxidant activity assessed through the DPPH radical scavenging method revealed a significant free radical inhibition capacity, confirming the extract's strong antioxidant profile. Furthermore, in vivo anti-inflammatory activity was evaluated in a formalin-induced paw edema model in Wistar rats. The extract showed dose-dependent inhibition of inflammation, achieving 50.10% and 70% inhibition at 100 mg/kg and 200 mg/kg, respectively. Notably, the

higher dose outperformed Diclofenac (60.50% inhibition at 50 mg/kg .These results highlight the rich composition and dual bioactivity of fenugreek sprouts, supporting their potential application in natural product chemistry and the development of nutraceuticals.

Key words: : Fenugreek sprouts , Anti-inflammatory activity, Antioxidant activity , Bioactive compounds.

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Valorization of Local Plant By-Products to Enhance Poultry Meat Quality: A Biotechnology Approach for Human Health

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Abstract:

Improving the nutritional quality of chicken meat represents a major challenge in biotechnology and human health, particularly through the sustainable use of local plant by-products. In this context, our study evaluated the effect of incorporating pea residues and prickly pear cladodes into broiler chicken diets. The raw materials were characterized through basic chemical analyses: peas showed high levels of crude protein (17.40 % ± 0.35), crude fat (2.92 % ± 0.5) and crude fiber (15.31 % ± 0.4), while prickly pear cladodes were distinguished by their richness in starch, crude ash, fiber fractions (ADF and NDF), as well as essential amino acids such as alanine (0.42 % m/m), aspartic acid (0.67 % m/m),and glutamic acid (1.62 % m/m). These by-products were incorporated into an experimental feed formulation and provided to broiler chickens to assess their impact on meat composition. Biochemical and spectroscopic (FTIR) analyses of the obtained meat revealed a significant improvement in nutritional value, with increased contents of proteins, polysaccharides, starch, vitamins and minerals. These results confirm that the valorization of pea and prickly pear residues can contribute to the production of chicken meat with enhanced nutritional quality, thus providing direct benefits for human health while supporting a sustainable and circular approach to food production.

Key words: Biotechnology, Human health, Poultry nutrition, Plant by-products, Meat quality.

ON-060

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Qualité nutritionnelle et stabilité microbiologique des pleurotes (*Pleurotus ostreatus*) cultivés sur substrats alternatifs

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Résumé:

L'essor des champignons comestibles s'inscrit dans une logique d'économie circulaire, notamment à travers leur culture sur substrats issus de biomasses résiduelles. Dans ce travail, des pleurotes (*Pleurotus ostreatus*) ont été cultivés sur sciure de bois et marc de café afin d'évaluer à la fois leur valeur nutritionnelle et leur aptitude à la conservation. Les analyses physicochimiques ont révélé une forte teneur en humidité (91 %), une richesse minérale confirmée par une teneur en cendres de 6,6 %, ainsi que 2,3 % de protéines et 7,35 % de sucres totaux, attestant du potentiel nutritionnel de cette espèce. Les essais de stabilité ont montré un pH globalement stable (variation < 0,5 unité après incubation à 37 et 55 °C), confirmant l'efficacité du traitement thermique appliqué. Sur le plan microbiologique, l'absence d'anaérobies sulfito-réducteurs (ASR) et de coliformes après 30 et 60 jours de conservation démontre une bonne maîtrise sanitaire. Toutefois, une charge microbienne croissante en flore mésophile aérobie totale (jusqu'à 1,3 × 10^5 UFC/g) et en levures-moisissures (jusqu'à 5,1 × 10^5 UFC/g) a été observée, dépassant les limites fixées par la

norme NF V08-059. Cette contamination secondaire est attribuée à l'absence de sertissage hermétique, soulignant le rôle critique du conditionnement dans la qualité finale du produit. Ces résultats mettent en évidence d'une part, l'intérêt nutritionnel et durable de la culture de pleurotes sur substrats alternatifs et d'autre part, la nécessité d'optimiser les procédés de conservation afin d'assurer leur stabilité microbiologique et leur valorisation à plus large échelle.

Mots-clés : *Pleurotus ostreatus*, substrats alternatifs, valeur nutritionnelle, stabilité microbiologique, conservation.

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ON-061

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Chemical and Biological Activities of Essential Oils of Few Land Plants of The West of Algeria

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Abstract:

Introduction : Exploiting the therapeutic potential of plants for human well-being is the goal of the research of medicinal plant valorization. Its foundation is the centuries-old usage of plants with therapeutic and prophylactic qualities.This field seeks to improve knowledge of medicinal plants, extract their active components, and apply them successfully in a variety of contexts, including traditional medicine, the pharmaceutical sector, and cosmetics.
Objectives:-Plants with therapeutic value are valued.
The identification of the chemical components of essential oils from certain aromatic and therapeutic plants that are widely utilized by Mediterranean Basin residents.
Methods: One can access hydro distillation in the University of Tiaret laboratory after collecting species, washing, drying, and allowing light and air to enter in compliance with a clearly established methodology. Chromatography in phase gazeuze coupled to mass spectrometry was used to examine these hydro-distilled essential oils.
Results:
In fact, the hydro distillation process yields a considerable amount of essential oil from *mentha spicata*, with an extraction yield of 1.13%. Nineteen (19) chemicals are found by CPG/MS chromatographic analysis, with pulegone accounting for 42.32% of the total. Monoterpenes and sesquiterpenes make up the rest.
Conclusion: improving medicinal plants contributes to the preservation of customary wisdom and ancestors' methods of treatment. In an attempt to strengthen Algeria's economy and increase the value of its bioresources, it also promotes the production and marketing of these plants, which helps the economies of areas with high biodiversity.

Key words: Essential oil, *Mentha spicata*, hydro distillation, Tiaret, and antibacterial action.

ON-062

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Valorization of *Moringa oleifera* leaf powder: Study of its hepatoprotective effects in Wistar rats fed a high-calorie diet

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Abstract:

The objective of this study is to examine the protective effect of *Moringa oleifera* leaf powder on the liver of Wistar rats induced by a high-calorie diet, in order to promote this medicinal plant in the prevention of lifestyle-related liver diseases.

Male Wistar rats are subjected to a high-calorie diet for 14 days (adaptation phase). After this phase, the rats were divided into two homogeneous groups: the first group (HL/HS) consumed a high-calorie diet for 30 days and served as a control, while the second group consumed a high-calorie diet with 5% *Moringa oleifera* leaf powder added (HC-M5%).

The results obtained show that after one month of experimentation, the incorporation of *Moringa oleifera* leaf powder into the high-calorie diet controlled body weight gain. In addition, serum total cholesterol (TC) and triglyceride (TG) levels were significantly reduced (-69%, -32% respectively) in the treated group compared to the control group. Serum and liver TBARS levels decreased in the HC-M5% group compared to the control group (-20%, -10%, respectively). In addition, aspartate aminotransferase (AST) and alanine

aminotransferase (ALT) activity were reduced (-24% and -13%, respectively) in the HC-M5% group compared to the HL/HS group.

In conclusion, *Moringa oleifera* leaves, rich in natural antioxidants, exert a significant hepatoprotective effect in rats fed a high-calorie diet. This medicinal plant deserves to be promoted because of its remarkable therapeutic properties.

Key words: Moringa oleifera, rat, high-calorie diet, hepatoprotective, oxidative stress.

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Spatial distribution of heavy metals and their impact on water chemistry in the Sidi Kamber mining area (NE Algeria)

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Abstract:

Mining activities generate large amounts of waste that often remain untreated after mine closure, constituting a long-term source of environmental contamination. The abandoned Sidi Kamber mine (Zn–Pb), located in Skikda (Northeast Algeria), represents a typical case where several million tons of residues have been left exposed to weathering. The leaching of these wastes can release potentially toxic elements into surrounding aquatic systems, altering their hydrochemical balance. This study investigates the spatial distribution of heavy metals in both surface and groundwater around the Sidi Kamber site, particularly in Oued Essouk and the Guenitra Dam. A total of 17 water samples were collected and analyzed. Physicochemical parameters (pH, electrical conductivity, dissolved oxygen, total dissolved solids, turbidity, etc.) were determined in situ and in the laboratory, while heavy metals were analyzed using standard techniques. Water quality and pollution indices were applied to assess the relationship between hydrochemical conditions and metal mobility. Preliminary results suggest that Oued Essouk is strongly impacted by mine drainage processes, with acidic conditions and high salinity favoring metal release, whereas the Guenitra Dam shows lower levels of alteration but remains vulnerable. These findings emphasize the need to integrate hydrochemistry with metal distribution patterns to better understand the environmental risks associated with abandoned mines in Algeria.

Key words: Water chemistry, Heavy metals, Spatial distribution, Mine waste.

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Valorization of *Melissa officinalis* leaves extract: phytochemical investigation, anti-inflammatory and antioxidant effects on experimental animals

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Abstract:

Melissa officinalis is one of the lemon-scent aromatic herbs widely used in traditional medicine due to its calming, sedative, and anti-arrhythmic effects. In this study, the leaf extract of the medicinal plant *Melissa officinalis* was analyzed for its phenolic and flavonoids contents. The anti-inflammatory activity was evaluated using carrageenan induced paw edema method on Swiss albinos mice. Furthermore, the inflammation induced effect on redox status was assessed. The phytochemical analysis revealed the richness of extract in phenolic compounds with contents of 342.27 ± 0.56 mg GAE / g CE, and 87.63 ± 0.75 mg QE / g CE, for total polyphenols and flavonoids respectively. For the anti-inflammatory activity, the highest percentage of carrageenan-induced edema inhibition was 82.14% after 4 h at dose of 600 mg/kg. The result on oxidative stress revealed significant increases ($p < 0.05$) in the activities of catalase (CAT), superoxide dismutase (SOD), glutathione (GSH), and significant decreases in the malondialdehyde (MDA) level activity in hepatocytes of mice after carrageenan injection, in comparison with the inflammatory group. These data suggest that *Melissa officinalis* extract could be tested as drug candidates against oxidative and inflammation-related pathological processes in medicinal chemistry studies.

Key words: *Melissa officinalis*, Polyphenols, Anti-inflammatory activity, Oxidative stress.

ON-065

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Towards Sustainable Nanotechnology: Extremophilic Microorganisms as Agents for Nanoparticle Biosynthesis

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Abstract:

The green synthesis of metallic nanoparticles is gaining attention as an eco-friendly, sustainable, and cost-effective alternative to traditional chemical methods, which are often energy-intensive and environmentally harmful. This approach utilizes biological systems—such as plant extracts, algae, fungi, and bacteria—to reduce metal ions into stable nanoparticles with controlled size and morphology.

Among these systems, extremophilic microorganisms are particularly promising due to their unique metabolic capabilities. Thriving in extreme environments (high temperature, salinity, acidity, or pressure), these organisms can tolerate and convert toxic metal ions through specific enzymatic pathways, notably involving reductases.

The experimental approaches aim to demonstrate the biosynthesis process, including microbial cultivation, addition of a metal precursor, visual confirmation of nanoparticle formation (typically via color change), and subsequent purification and characterization using spectroscopic and microscopic techniques.

The use of extremophiles in nanoparticle biosynthesis opens new avenues for sustainable nanotechnology applications, including environmental remediation, antimicrobial coatings, and nanomedicine.

Key words: biosynthesis, metallic nanoparticles, extremophiles, characterization.

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Fixed bed adsorption of cationic dye by cross-linked chitosan-epichlorohydrin/ bentonite

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Abstract:

The adsorption of methylene blue from aqueous solution onto bentonite–chitosan beads was investigated in a fixed-bed column. The effects of key operating parameters, including initial dye concentration, flow rate, bed height, and temperature, were systematically studied. Breakthrough curve analysis demonstrated that the adsorption capacity increased with higher initial concentrations, greater bed height, and elevated temperature, whereas it decreased with increasing flow rate. Kinetic modeling using the Thomas and Yoon–Nelson models provided a good fit to the experimental data and offered insights into the mass transfer dynamics of the process. These findings highlight the potential of bentonite–chitosan composites as efficient bio-adsorbents for dye removal from wastewater in continuous treatment systems.

Key words: fixed bed column, breakthrough curves, adsorption of cationic dye.

ON-067

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Nanoparticles as an innovative alternative to antibiotics: a promising approach against multi-resistant bacteria

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Abstract:

Bacterial resistance to antibiotics now represents a major threat to global public health. The rapid emergence of multidrug-resistant bacteria (MDR) significantly limits the effectiveness of conventional treatments and calls for the search for new therapeutic alternatives. In this context, tests conducted on silver nanoparticles (AgNPs) on various multi-resistant bacterial strains have shown that AgNPs exert significant inhibitory activity, even against bacteria insensitive to conventional antibiotics. The AgNPs reduced the growth of the tested bacteria in a dose-dependent manner. A complete inhibition was observed at relatively low concentrations, confirming their antimicrobial potency. AgNPs, thanks to their nanometric size and large specific surface area, offer an effective approach against pathogenic bacteria resistant to multiple antibiotics. Thus, AgNPs are emerging as a promising alternative to overcome the current crisis of antimicrobial resistance and open new perspectives in the biomedical field. The results obtained confirm that silver nanoparticles can represent a credible alternative solution to antimicrobial resistance and pave the way for new therapeutic strategies combining nanotechnology and antibiotic therapy.

Key words: Multidrug-resistant bacteria, Antibiotics, Nanoparticles, Antibacterial.

ON-068

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Vulnérabilité hydrochimique en zone aride : Étude de cas de l'aquifère du Complexe Terminal de la Vallée de Oued Souf (Sud-Est Algérien)

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Abstract:

La région d'Oued Souf (Sud-Est de l'Algérie) se caractérise par la superposition de trois couches aquifères, de haut en bas : l'aquifère superficiel, l'aquifère du Complexe Terminal (CT) et l'aquifère Continental Intercalaire (CI).

L'aquifère du Complexe Terminal constitue la principale ressource en eau destinée à l'alimentation en eau potable et aux usages agricoles. L'étude de la qualité chimique de ces eaux révèle qu'elles ne sont pas potables, fortement minéralisées, et que leurs éléments majeurs (sodium, magnésium, sulfate, chlorure et calcium) dépassent les normes recommandées par l'OMS ainsi que les normes algériennes applicables à l'eau potable, ce qui constitue un obstacle à leur utilisation.

Afin de mettre en évidence les origines de cette minéralisation, nous avons utilisé l'outil hydrochimique. Ainsi, les analyses chimiques à notre disposition ont été traitées à l'aide du logiciel « Statistica », ce qui nous a permis de réaliser une analyse en composantes principales (ACP). Cette dernière a révélé une compétition entre des eaux chlorurées sodiques ou magnésiennes et des eaux bicarbonatées calciques, riches en potassium. La simulation thermodynamique réalisée a montré une variation des indices de saturation, qui n'excèdent

pas zéro pour les eaux des complexes CT, indiquant ainsi une sous-saturation des eaux par rapport aux minéraux. La minéralisation débute par la dissolution des évaporites (gypse et halite) et les échanges de bases. Cela démontre l'influence des formations affleurantes sur la qualité des eaux.

Les eaux de l'aquifère du Complexe Terminal sont de mauvaise qualité pour l'irrigation, car leur représentation sur le diagramme de Richards montre qu'elles se répartissent selon deux classes, C4S2 et C4S3, et doivent être traitées (désalinisées) avant d'être distribuées aux consommateurs.

Key words : Hydrochimique, Complexe Terminal, Minéralisation, Zones arides, Oued Souf.

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ON-069

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Early-Life Exposure to Lead and Cadmium through Drinking Water: Biomonitoring Evidence from Children and Newborns in Jijel, Algeria"

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Abstract:

Groundwater is the primary source of drinking water for many communities in Jijel (Algeria). However, elevated levels of lead (Pb) and cadmium (Cd) have been detected in several boreholes and hand-dug wells, raising major concerns for vulnerable populations. Among these, children and newborns represent the most sensitive groups due to their higher absorption rates and limited detoxification capacity.This study investigated Pb and Cd contamination in groundwater sources and assessed human exposure among children and newborns. Drinking water samples were collected from boreholes, wells, and springs supplying local households. Chemical analysis of water was performed using Flame Atomic

Absorption Spectroscopy (FAAS). Biological monitoring included the determination of Pb and Cd in venous blood, umbilical cord blood, urine, and placental tissue of newborns and children residing in the affected area. Results demonstrated that Pb and Cd concentrations in water exceeded World Health Organization (WHO) guidelines for safe drinking water. Correspondingly, alarming levels of Pb and Cd were detected in umbilical and venous blood, as well as in placental tissue, reflecting active maternal-fetal transfer. These findings provide strong evidence of early-life exposure to toxic metals through drinking water, which may contribute to long-term neurodevelopmental and metabolic risks. The study underscores the urgent need for biomonitoring programs in Algeria and highlights the importance of preventive measures to protect children and newborns from chronic exposure to heavy metals.

Key words: Lead, cadmium, drinking water, children, newborns.

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ON-070

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Therapeutic Potential Of Olive Leaf For Managing Oxidative Stress And Inflammation

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Abstract:

Agricultural wastes pose the environment, despite they are rich in bioactive components, therefore valorizing these wastes in many applications will maximize their usage in many applications. Many by-products are produced during the processing of olives.

This study is interested in the research of the anti-inflammatory and antioxidant effect *In vitro* of the aqueous extract of olive leaf extract.

The aqueous extract of olive leaf extract showed significant anti-inflammatory activity with an IC50 of 42 ± 1.02 µg/ml, very close to that of sodium diclofenac (IC50 of 47.02 ± 2.90 µg/ml). Biochemical characterization shows that the aqueous extract of olive leafs has a high content of total polyphenols (164.53 ± 0.37 mg EAG/g ES), a high content of flavonoids (3.57

± 0.01 mg EQ/g ES), and condensed tannins (4.65 ± 0.63 mg EC/g ES). On the other hand, the antioxidant effect of olive leaf extract was evaluated using DPPH test and reducing power test. The aqueous extract showed a significant scavenger effect towards the DPPH radical with an IC50 of 42 ± 1.50 µg/ml. This value is compared to that of the standard antioxidant (Vit C) which showed an IC50 of 4.3 ± 0.65 µg/ml. The studied extract also has a reducing power of 0.92 ± 0.05. Ascorbic acid has a better reducing capacity (3.17 ± 0.09).
These findings highlight the therapeutic potential of olive leaf for managing oxidative stress and inflammation, supporting its use in dietary supplements and functional foods.

Key words: Anti-inflammatory, Antioxidant, olive, leaf, polyphenols.

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ON-071

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Anti-inflammatory and antioxidant activities of aqueous extracts from carob (ceratonia siliqua) seeds: implications for the development of dietary supplements and nutraceutical products)

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Abstract:

The carob is an edible pod with a sweet and chocolate taste, derived from the Mediterranean carob tree, used both as food, traditional remedy and industrial raw material. This study is interested in the research of the anti-inflammatory and antioxidant effect *In vitro* of the aqueous extract of carob seeds. The aqueous extract of carob seeds showed significant anti-inflammatory activity with an IC50 of 42 ± 1.02 µg/ml, very close to that of sodium diclofenac (IC50 of 47.02 ± 2.90 µg/ml). Biochemical characterization shows that the aqueous extract of carob seeds has a high content of total polyphenols (20.66 ± 0.56 mg EAG/g ES), a high content of flavonoids (1.52 ± 0.10 mg EQ/g ES), and condensed tannins (3.8 ± 0.56 mg EC/g ES). On the other hand, the antioxidant effect of carob seed extracts was evaluated using DPPH test and reducing power test. The aqueous extract showed a significant scavenger effect towards the DPPH radical with an IC50 of 181 ± 2.50 µg/ml. This value is compared to that of the standard antioxidant (Vit C) which showed an IC50 of 4.3 ± 0.65 µg/ml. The studied extract also has a reducing power of 0.31 ± 0.02. Ascorbic acid has a better reducing

capacity (3.17 ± 0.09). In conclusion, carob seed extracts have significant anti-inflammatory and antioxidant properties, thus demonstrating an important pharmacological potential that justifies its integration into dietary supplements, functional products and neutraceutical formulations.

Key words: Anti-inflammatory, Antioxidant, Carob, polyphenols.

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ON-072

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Anti-inflammatory and antimicrobial activities of hydro-alcoolic and essential oil of *Teucrium polium* L.

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Abstract:

The aim of this study is to evaluate the therapeutic potential of *Teucrium polium*, a medicinal plant from the Djelfa region belonging to the Lamiaceae family. Two extraction techniques were empoyed: hydrodistillation and maceration. The anti-inflammatory activity was assessed using the bovine serum albumin (BSA) denaturation inhibition test, while antimicrobial activity was evaluated through the aromatogram method. The results showed that the percentage of SBA denaturation inhibition ranged from 2 to 22%. The hydro-alccolic extract exhibited significant antibacterial activity, with inhibition zones ranging from 17 mm to 20 mm against the tested bacterial strains. Notably, *Escherichia coli* showed sensitivity to the essential oil, with inhibition zones of 16 mm and 14 mm, while *Proteus mirabilis* exhibited zones of 13 mm and 11 mm, indicating a measurable antimicrobial effect. However, it was observed that dilutions of the essential oil and hydro-alcoholic extract (1/2, 1/4, and 1/10) did not display any inhibitory effects on the tested strains. These findings highlight the potential of *Teucrium polium* as a source of bioactive compounds, reinforcing the value of traditional medicinal plants in modern pharmaceutical research.

Key words: *Teucrium polium*, extract, anti-inflammatory, antimicrobial.

ON-073

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New Material Explored For Water Quality Treatment

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Abstract:

A wide variety of plants in Algeria are valorized to produce oils, materials, adsorbents, and for energy uses. The abundance and the low cost of this resource are the main objectives for researchers to explore new sustainable materials. The quality of water is the issue of this century, and the treatment of waste water is indispensable for aquatic life, and environment. This aim of this work was to valorize a biomass to use it for adsorption of copper ions in aqueous solution. The material issued from the biomass was characterized by determining the porosity by the BET method, iodine number, and the thermogravimetry analysis. The removal of copper ions was carried out by adsorption process by studying the effect of the mass of adsorbent, the concentration of adsorbate solution, the influence of pH, the kinetic, the isotherm and the modelization to identify the available mechanism for adsorption.

Key words: Water, Material, Environment, Biomass.

ON-074

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Pumpkin seeds oil protects sodium nitrate induced oxidative stress and heart toxicity in wistar rats

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Abstract:

Nitrate is the most common chemical contaminant in groundwater aquifers around the world. The aim of the present study was to evaluate the effect of sodium nitrate (NaNO3) administration on some biochemical and oxidative stress parameters and to explore the protective role of pumpkin seeds oil (PSO) to minimize the deleterious effects of sodium nitrate. Rats are divided into four groups of 10 animals each. Group one (G1) was the control group is orally given distilled water for 4 weeks. Group two (G2) is given NaNO3 in drinking water at a rate of 200 mg/kg body weight (BW) for 4 weeks. Group three (G3) PSO administered rats at rate of 4 ml/kg BW by gavage for 4 weeks. Group four (G4) received the combination PSO/NaNO3 in the same way and doses, as described in the above in G2 and G3 for 4weeks. Phytochemical analyses of PSO in vitro, showed the presence of phenolic, flavonoid and tannins compounds. Ingestion of NaNO3 caused a significant rise in serum total cholesterol and triglycerides with a significant increase in heart malondialdehyde (MDA) level with concomitant decrease in reduced glutathione content (GSH) and the antioxidant

enzyme activities such as catalase (CAT), glutathione peroxidase (GPx) and glutathione-S-transferase (GST). However, HTO supplementation produced a detectable decrease in MDA levels and significant amelioration of antioxidant enzymes activities in heart tissues. The present results demonstrated that PSO supplementation is effective in reducing sodium nitrate toxicity and improve Heart functions by normalizing levels of serum biochemical parameters, oxidative and antioxidant status in rats.

Key words: Sodium Nitrate, PSO, Oxidative Stress, Heart, Rats.

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ON-075

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Groundwater Hydrochemistry and Quality Assessment in arid environments: Adrar region study case

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Abstract:

In the context of increasing environmental pressures on water resources, the physicochemical characteristics of groundwater in the Algerian Sahara (Southwest Algeria) were analyzed to assess its quality and suitability for both drinking and agricultural applications. A total of 15 groundwater samples were collected and examined for major physicochemical parameters using standard laboratory methods.The results revealed that pH, electrical conductivity, sodium, bicarbonate, and Chloride values were within the permissible limits recommended by the World Health Organization (WHO). Magnesium concentrations varied between 30 and 66 mg·L^{-1}, with an average of 36 mg·L^{-1}; all of the samples recorded levels below the WHO guideline value of 74 mg·L^{-1}. Conversely, potassium concentrations exceeded WHO standards in nearly 70% of the samples. Nitrate (NO_3^-) levels were generally low across the study area; however, elevated concentrations observed in some samples indicate potential health risks. Overall, the groundwater analyzed was deemed suitable for drinking purposes, except for a limited number of samples. These findings highlight the importance of continuous hydrochemical monitoring to ensure safe and sustainable use of groundwater resources in arid and semi-arid environments.

Key words: Groundwater, Hydrochemistry, Quality, Adrar

ON-076

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Biochemical Profiling, Antinociceptive and Antiinflammatory Effects of *Beta vulgaris* L. Roots Extract

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Abstract:

Beta vulgaris L. (beetroot) is recognized for its nutritional value and medicinal potential, attributed mainly to its abundance of bioactive molecules. This study examined the biochemical composition and biological effects of *Beta vulgaris* L. (beetroot) root extract. The extract was first analyzed for its phytochemical content, with special focus on polyphenols and flavonoids. Its pharmacological activities were then investigated through experimental models. Antinociceptive activity was evaluated using the acetic acid–induced writhing test in mice, while anti-inflammatory activity was assessed by the carrageenan-induced paw edema method. Antioxidant capacity was determined by measuring

malondialdehyde (MDA), reduced glutathione (GSH), catalase (CAT), and superoxide dismutase (SOD) levels. The biochemical analysis revealed that the extract was rich in polyphenols and flavonoids. *In vivo* experiments showed a significant reduction in acetic acid–induced abdominal writhing, demonstrating an antinociceptive effect. The extract also inhibited carrageenan-induced paw edema in a dose-dependent manner, indicating strong anti-inflammatory activity. Antioxidant assays confirmed its capacity to modulate oxidative stress: MDA levels were reduced, while GSH, CAT, and SOD activities increased compared to controls. These combined effects highlight the therapeutic potential of beetroot extract. Overall, the findings suggest that *Beta vulgaris* root extract exerts notable antinociceptive, anti-inflammatory, and antioxidant properties, mainly linked to its high polyphenol and flavonoid content. It may represent a valuable natural candidate for managing pain, inflammation, and oxidative stress.

Key words: Antinociceptive, paw edema, stress, *Polyphenols, Beta Vulgaris.*

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ON-077

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Nanomaterials from Forest Waste: Valorization of Biomass for Pollutant Removal

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Abstract:

The increasing discharge of synthetic dyes into aquatic ecosystems poses serious environmental and health threats, necessitating the development of efficient, low-cost, and eco-friendly materials for wastewater treatment. In this study, a novel **MnO_2–cedar cone bio-nanocomposite** was synthesized for the **adsorptive and oxidative degradation of dye pollutants** from contaminated water. Cedar cone, an abundant forest waste, was valorized as a natural biomass substrate due to its porous structure, surface functionality, and biodegradability. MnO_2, known for its strong redox activity and high adsorption potential, was incorporated via in-situ deposition onto the cedar cone surface, forming **a hybrid nanocomposite** with enhanced pollutant removal capacity. The incorporation of MnO_2 nanoparticles onto the biomass matrix significantly increased the material's surface area and introduced reactive sites that facilitated both physical adsorption and oxidative degradation of dye molecules, particularly methylene blue used as a model contaminant. Characterization techniques including Scanning Electron Microscope (SEM), Fourier transform infrared spectroscopy FTIR and X-ray diffraction (XRD) confirmed the successful formation of the

nanocomposite and revealed favorable surface morphology and functional group interaction. The Nano-material demonstrated high efficiency in dye removal under mild operating conditions, with excellent performance (99.93%) at neutral pH and ambient temperature.

Moreover, the MnO_2–cedar nanocomposite showed reusability over multiple cycles with minimal loss in activity, highlighting its potential as a sustainable and scalable material for industrial wastewater treatment. This work not only contributes to the field of bio-nanocomposites for environmental applications, but also presents a promising strategy for resource recovery from forest waste, aligning with circular economy and green chemistry principles.

Key words: bio-nanocomposite, Cedar Cone, adsorption, wastewater.

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ON-078

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Effects of plant extracts used as bio-pesticides (Eucalyptus globulus) on haematological parameters

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Abstract:

Chemical pesticides have long been considered the most effective means of controlling crop pests. Although their effectiveness is obvious, their negative impact on the environment is increasingly debated. Biopesticides, on the other hand, have the advantage of being of natural origin, biodegradable, more or less selective and harmless to non-target organisms. In this context, the aim of this study was to assess the possible adverse effects of vegetable oils used as biopesticides (Eucalyptus globulus), by measuring a number of haematological markers. 30 adult male rats (Rattus rattus) (238g ±) were used in this study. The rats were divided into four equal groups: control group (T), group (E): treated with aqueous eucalyptus globulus extract (100 mg/kg bw) diluted in water and group (EM): treated with methanolic eucalyptus globulus extract (100 mg/kg bw). The latter were treated by gavage over a 28-day period. Analysis of the biochemical parameters showed a non-significant increase in white blood cells in the groups treated with aqueous extract of the plant, compared with the control groups. As regards red blood cells, haemoglobin and platelets, the results obtained showed a decrease in the groups treated with aqueous extract of eucalyptus, compared with the control groups.

Key words: biopesticides, rats, eucalyptus, hematological.

ON-079

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Structural Insights into Fresh vs. Dried (45 °C) Strawberry Extraction Residues Using FTIR Spectroscopy

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Abstract:

Strawberries (Fragaria × ananassa) are rich in polysaccharides, proteins, lipids, and phenolic compounds, many of which remain in the extraction residues. The structural and chemical integrity of these residues is crucial for evaluating the effects of processing. In this study, FTIR spectroscopy was used to compare extraction residues from fresh strawberries and from strawberries dried at 45 °C prior to extraction. The FTIR spectra revealed absorption bands corresponding to polysaccharides, proteins, and phenolic compounds. Dried residues showed markedly reduced intensities for hydroxyl and amide bands, indicating dehydration, protein denaturation, and partial disruption of hydrogen-bonding networks. Furthermore, changes in carbohydrate-related peaks suggest rearrangements or breakdown of polysaccharide structures. These findings support that thermal drying, even at a moderate temperature (45 °C), induces significant molecular rearrangements in strawberry residues. Understanding these changes contributes to the valorization of extraction residues in food and bioactive applications.

Key words: Strawberry, Extraction residue, Drying at 45 °C, FTIR, Macromolecules.

ON-080

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Experimental and Numerical Assessment of a Forced Earth–Air Heat Exchanger for Cooling and Ventilation in Stone and Brick Rooms under Hot-Arid Summer Conditions in Ouargla

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Abstract:

This study experimentally evaluates the cooling and ventilation performance of a forced earth–air heat exchanger (EAHE) serving two test rooms constructed from different materials (local stone and fired brick) under hot-arid summer conditions in Ouargla. In the local stone room, the forced EAHE reduced indoor air temperature by 13.2 °C and achieved 127 air changes per day, indicating strong preconditioning of supply air and robust turnover. Daily heat removal by the forced EAHE reached 2331 kJ, corresponding to 47.9% of the heat removal associated with the natural-ventilation benchmark in the brick room. At a volumetric flow setting reported as 75.23 m³/s, the forced-convection performance attained 66.9% of the natural-ventilation reference; at peak operation reported as 121.52 m³/s, the material selection effects on EAHE performance were approximately 2.5%. Numerical simulations (FLUENT), driven by experimentally measured temperatures, reproduced the temperature and velocity fields in the conditioned space with excellent agreement to measurements. A parametric analysis then yielded an optimal design range for an air–soil exchanger tailored to Ouargla's

summer conditions. Note: the reported flow rates appear unusually large for EAHE applications; if intended as m^3/h rather than m^3/s, values should be corrected consistently before submission, and derived performance ratios rechecked accordingly.

Key words: Earth–air heat exchanger (EAHE); Geothermal air tube; Forced convection; Passive–hybrid cooling; Natural ventilation benchmark; Building material effect (stone vs brick); CFD validation (FLUENT); Hot-arid climate; Ouargla; Parametric optimization.

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ON-081

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Deep Learning-Based Segmentation of Plant Diseases: YOLOv8 versus YOLOv11

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Abstract:

In precision agriculture, the early detection and monitoring of plant diseases play a crucial role in ensuring crop protection and sustainable farming. This study evaluates and compares the performance of two advanced deep learning models, YOLOv8 and YOLOv11, for the segmentation of diseased plant regions. The models were trained on a curated dataset of affected leaves, and their performance was assessed using loss, precision, recall, and F1-score. Results reveal that YOLOv8 achieved a lower training loss (0.5978), higher recall (0.9010), and the best F1-score (0.9104), highlighting its balanced performance in detecting diseased areas. Conversely, YOLOv11 demonstrated slightly higher precision (0.9414), but at the expense of reduced recall (0.8812) and a marginally lower F1-score (0.9010). These findings underline the robustness of YOLOv8 for practical agricultural applications where minimizing missed detections is critical. This work contributes to developing intelligent decision-support systems for sustainable and environmentally friendly agriculture.

Key words: Deep learning, YOLO, Plant disease segmentation, Precision agriculture, Sustainability

ON-082

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Reducing environmental impact through the use of Recycled plastic in plaster-based mortars

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Abstract:

This research addresses the urgent need for sustainable construction methods by proposing an innovative approach aimed at reducing the environmental impact associated with the disposal of polyvinyl chloride (PVC) waste. It offers a dual opportunity: effective plastic waste management and the conservation of natural resources, by reusing PVC as aggregate in plaster-based composite mortars (PCM).

The objective of the study is to evaluate the effect of replacing natural aggregates with PVC waste—recovered from water pipe systems—on the properties of PCM. Four composite mortar formulations with varying PVC content were developed. Physical properties (density, ultrasonic pulse velocity – UPV, surface hardness, capillary water absorption, and total water immersion) and thermal performance (thermal conductivity) were analyzed as a function of the plastic incorporation rate.

The results show that adding PVC reduces the composite's density, making it particularly suitable for applications requiring lightweight materials. Additionally, the low porosity of PVC limits capillary absorption, enhancing moisture resistance and long-term durability. Notably, replacing 60% of natural sand with PVC leads to a thermal insulation improvement of up to 48% compared to the reference mortar. However, increasing the PVC content significantly decreases mechanical strength.

This study supports the valorization of PVC waste as a substitute for natural aggregates in composite mortars, thereby contributing to environmental impact reduction and promoting circular economy practices in the construction sector.

Key words: Construction plasters, Plastic waste, Physico-mechanical properties, Thermal properties

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ON-083

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Controlled Synthesis and Optical Characterization of Silver Nanoparticle-Doped Soda-Lime Silicate Glass

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Abstract:

The incorporation of silver nanoparticles into soda-lime silicate glass matrices enables precise tuning of optical properties through localized surface plasmon resonance (LSPR), presenting promising opportunities for advanced photonic applications including optical sensors, wavelength-selective filters, and nonlinear optical devices. However, the realization of reproducible and controllable optical responses necessitates systematic methodological approaches, as the resulting properties exhibit strong sensitivity to nanoparticle characteristics—specifically size distribution, morphology, and oxidation state—which are intrinsically governed by processing parameters including ion-exchange duration, thermal treatment profiles, and post-exchange annealing protocols.

This investigation establishes comprehensive experimental and analytical frameworks for the controlled fabrication, systematic monitoring, and rigorous characterization of optical responses in silver-doped glass systems. Silver-functionalized glass specimens were synthesized via Ag^{+}/Na^{+} ion exchange followed by controlled thermal treatments. The resulting nanocomposite structures were systematically characterized employing a multimodal

analytical approach: scanning electron microscopy coupled (SEM/EDS) for spatial distribution analysis of nanoparticles, (UV–Vis) spectroscopy for absorption spectra and plasmon resonance characterization, and photoluminescence (PL) spectroscopy for oxidation state determination. Nanoparticle size estimation through Mie theory analysis yielded dimensions ranging from 1.8 to 2.4 nm.

Key words: soda-lime silicate glas, Silver nanoparticles, Mie theory, plasmon resonance.

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ON-084

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Stability behaviors of FG sandwich plates containing metallic foam cores resting on various boundary conditions and elastic foundation

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Abstract:

The main objective of this paper is to study the effect of foam cells distribution on the buckling behavior of functionally graded sandwich plate resting on various boundary conditions under different in plane loads. The formulation is made for a newly developed sandwich plate using a functional gradient material based on a modified power law function. metal foam is considered in this study on this model of sandwich which containing metal foam core and FGM face sheets. New quasi 3D high shear deformation theory is used here for this investigate; the present kinematic model introduces only six variables with stretching effect by adopting a new indeterminate integral variable in the displacement field. The stability equations are obtained by Hamilton's principle then solved by generalized solution. The impact of different parameters: foam cells distribution, boundary conditions, elastic foundation, power law index, ratio aspect, side to thickness ratio and different in plane axial loads on the variation of the buckling behavior are demonstrated.

Key words: buckling behavior, functionally graded materials, metal foam, sandwich plate

ON-085

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Title: Thermal effects on the Modal Behavior of Aluminum Honeycomb Panels

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Abstract:

The aim of this paper is to perform a study on how the elevated temperature affects the natural frequencies of aluminum honeycomb plate. This study is carried out for temperature range between -55ºC (218 K) and 200ºC (473 K. The obtained results show that the effect of the temperature is noticeable. From low temperature (-55 ºC) to high temperature (200 ºC) the natural frequency decreased by approximately 5.6%, which means that the effect of the temperature on the natural frequencies is not negligible. High temperature makes the material suffers from weak rigidity, which furthermore contribute to high decrease of all the frequencies. The effect of the temperature on the selected adhesive for honeycomb panels is an important parameter to consider in the structural design. The adhesive must operate over the mission range of temperature without degradation.

Key words: honeycomb panel, aluminum, natural frequency, finite element method, temperature.

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Optimizing POMC Machining Using MOORA: Enhancing Surface Quality and Reducing Environmental Impact

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Abstract:

aterials exhibit different behaviors during machining, leading to variations in surface quality. Recent advancements in polymer development, particularly Polyoxymethylene Copolymer (POMC), have enabled the creation of materials with enhanced mechanical and thermal properties. This study focuses on optimizing machining conditions for POMC to achieve superior surface quality while reducing operating temperature. By minimizing both surface roughness and cutting temperature, the research aims to improve product quality, reduce energy consumption, and protect machining tools from heat-induced wear, ultimately lowering production costs. Additionally, optimizing these parameters enhances machining efficiency and reduces environmental impact by minimizing waste, energy consumption, and tool wear, thereby promoting a more sustainable manufacturing process. In this study, the key machining parameters—cutting speed (V_c), depth of cut (ap), and feed rate (V_f)—were varied at three levels. The Central Composite Design (CCD) was used to design the experimental plan with the following levels: (100, 130, 160 m/min) for V_c, (1, 1.5, 2 mm) for ap, and (0.05,

0.1, 0.15 mm/rev) for V_f. This design resulted in 17 turning experiments. For each POMC turning test, surface roughness was measured using a roughness tester and cutting temperature was recorded with an infrared camera. Multi-Objective Optimization based on Ratio Analysis (MOORA) was applied to optimize both surface roughness and cutting temperature simultaneously. The results clearly indicate that some tests outperformed others, with the MOORA method helping to select the most appropriate solution to minimize both surface roughness and cutting temperature. The application of this method showed that Test No. 9 achieved the lowest Ra and a relatively low Tc. The MOORA ranking effectively guides experimental decisions to attain optimal surface quality and the lowest possible cutting temperature.

Key words: Cutting parameters, MOORA, CCD, turning, POMC.

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ON-087

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Study of the Structural, Electronic, and Thermoelectric Properties of Oxide and Sulfide Perovskites using First Principles for Thermoelectric Energy Conversion.

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Abstract:

This study employed first-principles calculations utilizing density functional theory (DFT) and the pseudopotential-plane wave (PP-PW) method to study the structural, electrical, and thermoelectric properties of the oxide perovskite $SrMnO_3$ and the sulfide perovskite $SrMnS_3$. Our findings reveal that the electronic band structure is significantly influenced by atomic subtitution, resulting in a halfmetallic ferromagnetic character for the perovskite $SrMnO_3$, with total magnetic moment of value $3.00\mu_B$ per unit cell, and a metallic ferromagnetic behaviour for the perovskite $SrMnS_3$ with total magnetic moment of $3.55\mu_B$ per unit cell, both at the same Hubbard correction U=6 eV. Furthermore, the asymmetrical density of states curves for both spin up and spin down channels indicate the halfmetallic and metallic properties of these materials. We also thoroughly examined $SrMnO_3$'s thermoelectric characteristics. $SrMnS_3$ and $SrMnO_3$ are identified in our investigation as viable possibilities for thermoelectric energy and data storage applications.

Key words: halfmetal, spinelectronic, DFT, $SrMnS_3$, $SrMnO_3$, ferromagnetic.

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Comparative Study of Hole Transport Layers in $MAPbI_3$ Perovskite Solar Cells: Effect of Defects, Thickness, and Temperature

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Abstract:

This study presents a comparative investigation of perovskite solar cells (PSCs) where the photoactive layer (PAL) is $MAPbI_3$, the electron transport layer (ETL) is ZnO, and different hole transport layers (HTLs), NiOx, Spiro-OMeTAD, and P3HT. The analysis focused on the effect of the density of defects (Nt), active layer thickness, and operating temperature, on device performance. Numerical simulations were carried out to evaluate how these factors affect the open-circuit voltage (Voc), short-circuit current density (Jsc), fill factor (FF), and power conversion efficiency (PCE). Results demonstrate that the choice of HTL significantly affects charge extraction, defect tolerance, and thermal stability. In particular, NiOx-based devices showed enhanced stability under elevated temperatures, while Spiro-OMeTAD offered superior efficiency but higher sensitivity to defect density. P3HT provided moderate performance with potential as a low-cost alternative. This comparative study highlights the importance of optimizing material selection and device parameters to achieve efficient and stable perovskite solar cells.

Key words: Perovskite solar cells, $MAPbI_3$, ZnO, NiOx, Spiro-OMeTAD, P3HT, thickness, temperature, stability, efficiency.

ON-090

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Ab-initio study of the physical properties of Mg_3BiCl_3

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Abstract:

The CASTEP code's implementation of Density Functional Theory (DFT) is used in this study to examine the properties of the halide perovskite Mg_3BiCl_3. Both the local density approximation (LDA) and the generalized gradient approximation (GGA) were used to compute the exchange-correlation energy. The calculated lattice constant, bulk modulus, and elastic constants agree very well with existing theoretical data in structural optimization. Our calculations reveal a direct band gap of 1.25 eV for LDA and 1.178 eV for GGA at the Γ point. Additionally, we have calculated the total density of states (DOS). Furthermore, our results suggest that Mg_3BiCl_3 compound is suitable for electronic and optoelectronic applications.

Key words: CASTEP code, Band gap, halide perovskite

ON-090

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Title: Power Regulation of a Wind Turbine Utilizing a Doubly-Fed Induction Machine

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Abstract:

The aim of this study is to model and control a variable-speed wind turbine system using a doubly fed induction machine (DFIM) combined with a PWM rectifier. To mitigate the impact of parameter sensitivity, control strategies have been developed that estimate active and reactive power based solely on electrical measurements obtained from the rotor. Among these strategies, Direct Power Control (DPC) has demonstrated notable effectiveness and competitiveness. Traditionally, Field-Oriented Control (FOC) is implemented using conventional Proportional-Integral (PI) controllers. In contrast, the proposed DPC method offers a fast and robust response in power regulation. Simulation results comparing the performance of the proposed DPC strategy with the conventional FOC scheme under various step changes in active and reactive power are presented.

Key words: Wind system; Doubly Fed Induction Machine (DFIM); Field Oriented Control (FOC); Direct Power Control (DPC).

ON-091

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GGA-PBE and Koller-mBJ study of anti-perovskite Li_3OCl as a solid state electrolyte for next-generation batteries

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Abstract:

A comprehensive theoretical investigation of the electronic properties of the cubic anti-perovskite compound Li_3OCl was performed using first-principles calculations within the framework of density functional theory (DFT). The full potential linearized augmented plane wave (FP-LAPW) method, as implemented in the Wien2k package, was employed. Structural optimization was conducted using the Perdew–Burke–Ernzerhof generalized gradient approximation (GGA-PBE), while the electronic band structure and density of states were evaluated using both GGA-PBE and the modified Becke–Johnson exchange potential (Koller-mBJ). The optimized structural parameters confirm the stability of Li_3OCl in its cubic phase, in agreement with previous reports. The comparative electronic analysis highlights the systematic underestimation of the bandgap by GGA-PBE, which predicts an indirect gap of 4.99 eV, whereas the Koller-mBJ functional provides a more accurate value of 4.86 eV, consistent with earlier theoretical and experimental findings. This study underlines the critical role of exchange–correlation functionals in accurately describing the electronic structure of wide-bandgap anti-perovskites. The results establish a solid theoretical foundation for future

investigations into the electronic behavior of Li_3OCl and its potential application as a solid-state electrolyte in advanced lithium-ion batteries.

Key words: Li3OCl, Anti-perovskite, Solid-State electrolyte, Band-gap.

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Effect of Growth Temperature (80–90 °C) on the Crystallization of ZnS Thin Films Prepared by Chemical Bath Deposition (CBD), with Hexagonal Wurtzite Phase

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Abstract:

In this study, ZnS thin films were synthesized by chemical bath deposition (CBD) at two different growth temperatures, 80 °C and 90°C, with a deposition time of 6 h. The structural properties of the samples were analyzed using X-ray diffraction (XRD), UV-Visible spectroscopy, and infrared (IR) spectroscopy. The film deposited at 80°C exhibits an amorphous nature, indicating insufficient crystallization, although weak traces of the hexagonal wurtzite structure can be detected. In contrast, the film prepared at 90°C shows well-defined diffraction peaks, confirming full crystallization of the sample and the complete hexagonal wurtzite phase. These findings highlight the significant role of growth temperature in promoting the crystallization of ZnS thin films, which is a key factor for improving their structural quality and potential applications in optoelectronic devices.

Key words: ZnS, Thin films , CBD, XRD, Crystallization.

ON-093

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Shared Solar PV and Battery Storage in a residential Microgrid: A case study of two houses

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Abstract:

Microgrids based on renewable energy are cleaner than conventional electricity systems since they diminish the use of fossil fuels and, consequently, greenhouse gas emissions significantly. These networks integrate renewable resources, storage devices, and local loads, and may run either in connection with the main power grid or in islanded mode. The current study considers a grid-connected residential microgrid. This study investigates a collective self-consumption community comprising two households, a shared 10Kwh PV generator and a common battery (20Kwh). Each house has a different energy demand.

The core challenge in microgrid energy management is to optimally distribute power among various sources over a daily horizon, ensuring an uninterrupted supply. Renewable energy sources are prioritized. The battery is discharged only to ensure the continuity of load supply when photovoltaic generation is insufficient, down to a minimum state of charge of 25% (with no possibility of selling the stored energy). It is recharged exclusively from the renewable source, whenever available, up to a maximum state of charge of 90%. If the battery-PV combination is insufficient to meet the energy demand of homes, the management algorithm compensates for the residual power through the main power grid. The simulation results demonstrate the effectiveness of the proposed energy management system.

Key words: Energy Management, Energy allocation, Microgrid.

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ON-094

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Etude théorique des propriétés structurelles, électroniques et élastiques du TMAl (TM=Fe,Ni)

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Abstract:

Le but de notre travail est de calculer les propriétés structurales, électroniques et élastiques du composé intermétallique TMAl (TM = Fe,Ni) dans la structure B2, donnant des états ferromagnétiques (FM) et non ferromagnétiques (NM). Dans le cadre générale de la théorie de la fonctionnelle de la densité (DFT) et par la méthode linéaire des ondes planes augmentées de potentiel total (FP-LAPW) en utilisant l'approximation gradient généralisé (GGA), implémentées dans le code wien2k. D'après les calculs, les résultats concernant les constantes du réseaux (a), le module de compressibilité (B) et son dérivé (B ') sont en bon accord avec les résultats expérimentaux et les autres résultats théoriques disponibles. Nous avons aussi calculé les propriétés électroniques, ceci nous montre que notre composé à un caractère métallique. Les constantes élastiques (C11, C12 et C44) et les propriétés mécaniques telles que le coefficient de Poisson (ν), le module de Young (E), le module de cisaillement (GH), le facteur anisotrope (A) sont également calculés et sont en bon accord avec les résultats expérimentaux et théoriques. La ductilité de ces composés a été analysée par

la règle de Pugh (rapport B/GH) et la pression de Cauchy (C12 - C44). Nos résultats calculés révèlent que le NiAl est le plus ductile par pour FeAl.

However, this integration is fraught with challenges. The study identifies several key barriers, including the high capital costs of fuel cell systems and electrolyzers, the need for a comprehensive hydrogen distribution and refueling network, a skills gap in advanced energy technologies, and the need for strong policy and regulatory frameworks to encourage private investment.

Key words: Fuel cells, green hydrogen, renewable energy integration, energy transition, SOFC, Energy Policy.

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ON-095

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Impact of the Hubbard U Correction on the Electronic and Structural Properties of a Strongly Correlated Transition Metal Oxide: A DFT Study Using ELK code.

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Abstract:

Transition metal oxides represent a key class of functional materials in materials science and engineering because of their diverse structural, electronic, and catalytic properties. However, their localized d-electrons give rise to strong electron–electron correlations that are poorly captured by standard density functional theory (DFT) methods. classic functionals such as GGA, LDA and LSDA typically underestimate the bandgaps and fail to correctly describe the electronic structure of this type of systems. To solve these shortcomings, the DFT+U method introduces the Hubbard (U) term that improves orbital localization and better accounts for electron correlation effects.

In this work, we investigate the influence of the Hubbard U parameter on the structural and electronic properties of copper oxide (CuO), a representative strongly correlated oxide. Using the full-potential linearized augmented plane wave (FP-LAPW) method implemented in the ELK code, A detailed comparative analysis is carried out for the three approximations LDA, LSDA, GGA, and their respective +U extensions. Our results show that standard functionals significantly underestimate the bandgap, often predicting metallic behavior, On

the other hand, the inclusion of U yields a semiconducting ground state consistent with experimental observations. The +U correction also modifies the density of states (DOS), enhances d-state separation, and slightly alters structural parameters such as Cu–O bond lengths.

These findings highlight the necessity of incorporating DFT+U methods when modeling strongly correlated oxides in order to obtain accurate predictions of their structure–property relationships. Such insights are crucial for advancing the design and application of transition metal oxides in materials science and engineering.

Key words: DFT, Hubbard U Correction, ELK Code, Band-gap, DOS, Copper Oxide.

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Tribological behavior of Composite material based on PU and date pits powder

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Abstract:

This paper deals with tribological behavior of composite materials based on Polyurethane (PU) Matrix and Date Pit (DP) Particles reinforcements. Two filler content were studied: 30% and 50% in volume were used to obtain PU/DP Composites developed by modeling technique.

The investigation of the morphology and microstructure using optical microscopy reveals a microporous structure with relatively continuous interface between matrix and reinforcements. FTIR analyses indicated the presence of new chemical groups, suggesting a chemical interaction between PU and cellulose of DP.

The tribological ~~test~~ results show that the lowest friction coefficients are obtained for samples containing 30 vol.% DP under loads of 5 and 7 N. However, under higher load, namely 10 N, the lowest friction coefficient is achieved with 50 vol.% DP.

Key words: Date Pit Powder (DP), PU, Friction coefficient, composite material.

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Title: Intelligent Control Strategies for Doubly-Fed Induction Generator (DFIG) in Variable-Speed Wind Turbine Generation Systems

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Abstract:

In the context of electricity generation, power quality is a critical parameter that encompasses aspects such as waveform integrity, harmonic distortion, and the continuity of power supply. When interfacing with an electrical grid, it is essential that the power delivered meets optimal operational standards in terms of both stability and efficiency. To address the challenges posed by sensitivity to parametric variations within the system, advanced control strategies have been developed. Specifically, this study proposes techniques that estimate active and reactive power based solely on electrical quantities measurable at the rotor level, eliminating the need for full-state measurements. Among the methods investigated, the Neural Network-based Direct Power Control (NN-DPC) has demonstrated superior performance. Unlike conventional Direct Power Control (C-DPC), which typically relies on a pre-defined switching table for its operation, the NN-DPC approach leverages intelligent control to achieve a faster and more robust dynamic response. A comparative analysis is conducted through simulation, evaluating the performance of both C-DPC and NN-DPC under various step changes in active and reactive power demands. Furthermore, to ensure consistent contribution to primary frequency control irrespective of wind speed fluctuations, a Maximum

Power Point Tracking (MPPT) strategy is integrated. This MPPT algorithm is based on a Proportional-Integral (PI) controller, designed to optimize the amount of power extracted from wind energy. The entire control framework is implemented and simulated on a 1.5 MW Doubly-Fed Induction Generator (DFIG)-based Wind Energy Conversion System (WECS). The effectiveness and robustness of the proposed NN-DPC control strategy are assessed under diverse operational scenarios to validate its applicability in real-world grid-connected wind energy systems.

Key words: Wind Energy Conversion System (WECS), Doubly Fed Induction Generator (DFIG), Direct Torque Control (DTC), Conventional Direct Power Control (C-DPC), Neuronal Network Direct Power Control (NN-DPC)

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The structural and electronic properties of rare earth-based alloy HoPdBi.

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Abstract:

Using the density functional theory (DFT) based on the full potential linearized augmented plane wave (FP-LAPW) implemented in WIEN2k code, we investigated the structural and electronic properties of two rare earth-based alloy HoPdBi. The optimized cell parameters found for our both alloys were in the antiferromagnetic type II along the [1 1 1] direction, the structural properties achieved used the generalized gradient approximation GGA-PBE. For the electronic properties, we used the Hybrid-GGA approximation thanks to the heavy elements in our both alloys, also we included the spin-Orbit effect (SOC) in the plot of band structure and density of state in which, we remarked an important effect of the SOC to clear the topological behavior of our both alloys. These results confirmed also by the total and partial density of states where the trivial semi metallic behavior appeared. These important properties lead to more uses of our alloys in the technologic fields.

Key words: DFT, Topological semi metal, Antiferromagnetic alloys, FP-LAPW

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Beyond Conventional Liquid-Liquid Extraction: Advancing Diesel Desulfurization through a Sulfonation-Assisted Strategy

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Abstract:

Diesel desulfurization is a critical step in reducing sulfur dioxide (SO_2) emissions, which result from the combustion of sulfur compounds. Although hydrodesulfurization (HDS) remains the main industrial approach, it presents major limitations such as high costs, harsh operating conditions, and environmental concerns. Consequently, alternative methods especially liquid-liquid extraction and extractive-oxidative processes are being increasingly investigated as milder, more selective, and cost-effective solutions. In this study, two approaches were investigated. The initial experiments focused on the direct extraction of untreated diesel with different polar solvents (acetonitrile, methanol, dimethylformamide, and acetone) in order to assess their efficiency in solubilizing and removing sulfur compounds. The results revealed a limited desulfurization efficiency, with a maximum sulfur removal of 39.32% achieved using acetonitrile. The second series of experiments employed a two-step combined process. The first step consisted of a mild sulfonation by adding concentrated sulfuric acid to diesel under stirring. This oxidation step converts sulfur compounds into sulfonated derivatives. After phases separation, the oxidized diesel was treated and subjected to liquid-liquid extraction using the same polar solvents, aiming to remove the formed sulfones. This integrated approach led to a substantial improvement in sulfur removal efficiency, achieving up to 87.57% with acetonitrile. The study underscores the limitations of simple extraction for diesel desulfurization and confirms the superior efficiency of the oxidation-extraction approach, positioning it as a promising, cost-effective, and environmentally sustainable strategy for deep desulfurization of middle distillates.

Key words: Desulfurization, Liquid-liquid extraction, Sulfur compounds, Polar solvents.

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Green Synthesis, Characterization, DFT Calculations and Molecular Docking of Cocrystal of a Eutectic Mixture of Celecoxib

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Abstract:

This study investigates the enhancement of the physicochemical properties of celecoxib, a poorly soluble non-steroidal anti-inflammatory drug, through the formation of eutectic mixture with cinnamic acid. Phase diagrams obtained by differential scanning calorimetry (DSC) revealed the presence of a simple eutectic system, characterized by a melting point significantly lower than those of the pure components. The eutectic solid phase was further characterized by powder X-ray diffraction (PXRD) and Fourier-transform infrared spectroscopy (FTIR), confirming the formation of stable eutectic mixture stabilized by cohesive intermolecular interactions, without the emergence of new crystalline phase as observed in cocrystals. In addition, drug repositioning studies highlighted the antimicrobial potential of the mixture, particularly against *Staphylococcus aureus*. Complementary computational analyses, including density functional theory (DFT) and molecular docking on COX-2, demonstrated increased chemical reactivity and a strong binding affinity toward the enzymatic target. Overall, these findings underscore the potential of eutectic mixtures as an innovative strategy to improve the solubility, dissolution, and pharmacological performance of celecoxib, while simultaneously offering new perspectives for therapeutic repositioning.

Key words: Eutectic mixture, DFT, Celecoxib, DSC, Molecular Interactions.

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The effects of kaolin content mechanical properties of polypropylene

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Abstract:

The incorporation of layered silicates has proven to be a very effective strategy to improve the mechanical properties of polymer matrices. The improvement in material performance is achieved without increasing the polymer density, and without changing its optical properties or recycling potential. The tensile test was carried out to evaluate the properties at break and yield point of the different samples studied after the introduction of rigid kaolin particles into the polymer matrix. Impact resistance characterizes the energy absorbed during the rupture of a smooth or notched bar under the action of a given striker and sufficient kinetic energy. The impact resistance test therefore results from the application of mechanical stress at high percussion speed with high energy, causing the rupture of a specimen in a fraction of a second. It makes it possible to deduce, under given experimental conditions, the fragility or ductility of the material.

The objective addressed in our work is the production by melt mixing and characterization of the mechanical properties of hybrid systems based on a thermoplastic matrix, polypropylene, and a lamellar clay, kaolinite. the tensile characteristics of the hompolymer and its composites, namely, the stress and the elongation at yielding and at break (σy and εy) and (σr

and εr), respectively, measurements were performed according to the norm ASTM D638, at a cross-head speed

It appears that kaolinite incorporation to the thermoplastic matrix causes a marked decrease of its impact strength. This result is explained by the fact that the introduction of the mineral filler engenders an increase of rigidity and causes a high local stress concentration at the interface filler/matrix, attributed especially to aggregates formation which weakens the strength of all the material.

The composite's yielding behavior is essentially governed by the PP matrix due to the low rate of the incorporated mineral filler. However, it seems important to note that the values of the yielding strain of all the composites are higher than those of the matrix, probably because of the rigidity of the clay.

The behavior at break of the composites has been markedly affected by the incorporation of the mineral filler. Thus, the strain noticeable decrease occurred from 600% for the nonfilled PP to a value of 60% for the composites with 5 phr of kaolin. The decrease of the strain at break at this filler loading might be due to the decreased deformability at the interface the filler/matrix.

Key words: Polypropylene, kaolinite, The mechanical tests, hybrid systems.

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Zeolite Based Catalysts for the Liquid Phase Oxidation of Organic Compounds

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Abstract:

The development of functional catalytic materials remains a key objective in materials science and engineering. In this study, zeolite based catalysts were investigated for the liquid phase oxidation of phenolic compounds under mild conditions. Green oxidants, including hydrogen peroxide (H_2O_2), sodium percarbonate (SPC), and sodium perborate (SPB), were employed to promote efficient oxidation pathways. Structural and surface analyses confirmed the stability of the zeolite framework and the presence of well dispersed active sites. Catalytic tests performed at 80 °C and atmospheric pressure showed high activity, with phenol and p-cresol effectively converted into valuable products such as hydroquinone, catechol, and benzoquinone. The use of solid peroxides demonstrated superior efficiency compared to aqueous hydrogen peroxide, offering cleaner and more selective oxidation routes. These results highlight the promise of zeolite based catalysts as sustainable materials for advanced oxidation processes, combining stability, efficiency, and environmental compatibility for wastewater treatment and related applications.

Key words: Catalysis, Peroxides, Organic Oxidation, Advanced Oxidation Processes.

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Characterization and antibacterial activity of silver exchanged NaY zeolite

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Abstract:

In this study, we prepared silver-exchanged adsorbent materials from NaY zeolite at exchange loading rates of 50 and 100 w.t%. The cationic exchanges of the based zeolite were carried out by adopting the aqueous solution protocol. The prepared samples are investigated by physicochemical, and antibacterial characterizations. The atomic absorption spectroscopy (AAS) and flame photometer shows the effectiveness of the cation-exchange protocols applied to the NaY based zeolite. The structural and textural characterizations of our samples were performed using X-ray diffraction (XRD) and N_2 adsorption-desorption at 77K. The obtained results show that the crystalline structure of NaY zeolite is preserved after silver exchange and porous volumes, specific surface areas are affected. Furthermore, exchange zeolites adsorbents have significant antibacterial activity against *Escherichia Coli Staphylococcus aureus*.

Key words: Silver-exchange, NaY zeolite, Adsorption, Antibacterial activity.

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Heterogeneous Photocatalytic Degradation of methyl violet 2B Using a titanium-based catalyst

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Abstract:

Advanced Oxidation Processes (AOPs) are among the most effective methods for treating wastewater, generating highly reactive hydroxyl radicals (·OH) through processes like photolysis and photocatalysis. This study explores the heterogeneous photocatalytic degradation of methyl violet 2B (MV2B), a persistent synthetic dye, using a manganese titanate ($MnTiO_3$) catalyst. The catalyst was synthesized using an eco-friendly method with a fruit extract and characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and infrared (IR) spectroscopy. The aim of this work was to evaluate the catalytic efficiency of the synthesized $MnTiO_3$ for the methyl violet 2B degradation.

The photocatalytic activity of $MnTiO_3$ was at fisrt tested under different pH conditions. The results showed that MV2B degradation was most efficient at natural pH, reaching 100% removal within 90 minutes. This is due to favorable electrostatic interactions between the dye molecules and the catalyst surface. Additionally, increasing the catalyst dosage improved the degradation rate, reaching an optimal concentration of 0.25 g/L. This improvement can be attributed to the increased number of active sites available for the photocatalytic reaction.

In conclusion, these results demonstrate the potential of green-synthesized $MnTiO_3$ as an effective photocatalytic material for removing persistent organic pollutants such as MV2B.

Key words: Advanced oxidation processes, photocatalysis, methyl violet 2B, degradation, $MnTiO_3$.

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Evaluation of a Thiosemicarbazone-Based Ligand for the Selective Complexation of Heavy Metals in Aqueous Solution

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Abstract:

Heavy metal contamination in aquatic environments continues to raise critical concerns due to the toxic, persistent, and bioaccumulative nature of these pollutants. Even at trace levels, metals such as Cu(II), Pb(II), and Cd(II) pose serious risks to ecosystems and public health, largely because they are not biodegradable and tend to accumulate through trophic levels.

This study investigates the complexation-based removal of heavy metals from aqueous solutions using a novel thiosemicarbazone-derived Schiff base ligand (DHCT). The ligand was synthesized via conventional organic synthesis and characterized by Fourier-transform infrared spectroscopy (IR), proton nuclear magnetic resonance (^{1}H NMR), and single-crystal X-ray diffraction (XRD), confirming the intended structure.

The ligand demonstrated a strong capacity to selectively bind target metal ions through coordination, suggesting its promising application in water decontamination. The efficiency, selectivity, and potential low environmental impact of this approach underscore the relevance of Schiff base chemistry in the development of advanced metal-removal strategies for contaminated water treatment.

Key words: Water treatment, Heavy metals, Complexation, Thiosemicarbazone.

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Optimizing Scaffold Architecture for Tissue Regeneration: Geometry, Porosity, and 3D Printing

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Abstract:

Scaffold architecture is a key factor in tissue engineering, as it directly affects cell behavior and the success of regenerative therapies. Advances in Computer-Aided Design/Manufacturing and 3D printing now allow precise control over scaffold geometry and pore distribution, enabling the creation of biomimetic structures that replicate the extracellular matrix. These designs promote cell adhesion, proliferation, and tissue formation. Layer-by-layer additive manufacturing ensures reproducibility and well-defined microarchitecture with appropriate porosity, both crucial for efficient tissue regeneration. In summary, the design of scaffolds is a key factor in the success of tissue engineering, and the combination of design and manufacturing software with three-dimensional printing opens up vast possibilities for personalized therapeutic solutions and ground breaking advances in the field of tissue regeneration.

Key words: Tissue Engineering, Scaffold Design, Geometry; Porosity, 3D Printing, Additive Manufacturing

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Synthesis and physicochemical properties of composite films adsorbents based on polyvinyl alcohol and nanocellulose extracted from wood waste

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Abstract:

In recent years, significant progress has been made in developing composite materials derived from waste sources. These materials offer a sustainable approach to waste valorization while effectively removing dye pollutants from wastewater.

This study focuses on producing composite film adsorbents using polyvinyl alcohol (PVA), glycerol and nanocellulose (NC) which was extracted from wood waste. The nanocellulose (NC) was obtained via a two-step process: first, an alkaline treatment was used to remove non-cellulosic components; then, acid hydrolysis was applied to break down the purified cellulose into nanoscale particles. Subsequently, PVA/NC composite film adsorbents containing various amounts of NC (0.5, 1.5, 2.5, 3.5, 4.5 and 5.5 wt%) were produced using the solvent casting technique.

The resulting adsorbents were analyzed using the following parameters: density, solubility, swelling ratio and compound group analysis using a Fourier-transform infrared spectrometer (FTIR). Their morphological properties were also examined using an optical microscope.

Optical microscopy showed that the composite films exhibited a uniform distribution of nanocellulose particles at the optimal NC content of 3.5 wt%. However, increasing the NC content further to 4.5 and 5.5 wt% resulted in a noticeable increase in the thickness of the film samples accompanied by slight signs of particle agglomeration.

Under optimal conditions (pH 8, 3.5 wt% nanocellulose (NC) content and a contact time of 120 minutes at room temperature), the maximum adsorption capacities of the composite film adsorbents were found to be 57.6 and 41.4 mg/g for methylene blue (MB) and crystal violet (CV), respectively. The adsorption kinetics of both cationic dyes (MB and CV) were well described by the pseudo-second-order (PSO) model, indicating that chemisorption governs the process.

Key words: Nanocellulose, Polyvinyl alcohol, Composite films, Adsorption

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DFT Theoretical Investigation of Quinoxaline Derivatives having Efficient Photovoltaic Properties for Organic Solar Cells

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Abstract:

This work describes the design of a new NFAs for OSCs using density functional theory. By adding functional groups to reference molecule diphenyl-pyrazolo[3,4-b]quinoxaline, the designed molecules QNX1-QNX8 are developed. B3LYP and TD-CAM-B3LYP methods with the 6-31G(d,p) basis set were used to evaluate the photophysical and optoelectronic properties of designed molecules. The obtained results show that all the newly developed molecules exhibit large dipole moment, reduced band gap, high bathochromic shifted absorption bands in THF as well as in gas phase, low exciton bonding energy, small reorganization energy values and moderate V_{oc}, which demonstrate that they can be utilized as photovoltaic materials. QNX6 is considered to be promising acceptor molecule with highest λ_{max} (794nm), narrow band gap (1.37eV), lowest λ_h value (0.00410) and high open-circuit voltage (1.32eV) which eventually increase the power conversion efficiency of the OSC devices.

Key words: Organic photovoltaic, Non-fullerene acceptor, Density Functional Theory, optoelectronic properties

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HPLC-Based Phytochemical Characterization and Antioxidant Evaluation of Phenolic Extracts from Pea (*Pisum sativum* L.)

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Abstract:

This study explores the phenolic composition and antioxidant activity of pea (Pisum sativum L.) extracts, a legume widely consumed for its nutritional properties and bioactive compounds. Polyphenols were extracted using hydroalcoholic solvents, followed by quantification of total polyphenol content using the Folin-Ciocalteu method. Individual compounds were analyzed by HPLC, enabling the identification of molecules such as chlorogenic acid, ferulic acid, catechin, and quercetin. The antioxidant activity of the extracts was assessed using DPPH and ABTS assays, revealing significant radical scavenging capacity. A positive correlation was observed between polyphenol content and antioxidant efficiency. The results highlight the potential of green peas as a natural source of antioxidant compounds, with possible applications in the fields of health, functional nutrition, and plant-based pharmacology. This study confirms the importance of analytical techniques such as HPLC in the accurate characterization of plant-derived secondary metabolites.

Key words: *Pisum sativum*, Phenolic extracts, Antioxidant activity, HPLC.

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Impact of Water pH on Kaolinite Transport and Deposition in Fractured Chalk

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Abstract:

Water chemistry plays a significant role in the mobility of contaminants in subsurface systems. Groundwater pH is assumed to be neutral; however, the relevance of acidic and alkaline groundwaters has been documented worldwide. The current study examines the pH variation on the migration of particles in saturated aquifers. A set of transport experiments was conducted across a range of pH values from acidic to alkaline values at low salinity. Kaolinite P300 was selected as a suspension to migrate in saturated fractured chalk. FTIR results confirmed the presence of hydroxyl groups in kaolinite ($Al_2Si_2O_5(OH)_4$) and carbonate groups in chalk ($CaCO_3$). Zeta potential measurements across the studied pH range revealed that both kaolinite and chalk maintained negative surface charges. The transport parameters were derived using experimental results and extended DLVO calculations combined with a numerical transport model. The overall behavior of kaolinite particles through fractured chalk was shown to be pH-dependent, where acidic conditions favour the particle retention and deposition due to dominant van der Waals forces originating from protonation of hydroxyl

groups at low pH, leading to enhanced attraction and irreversible trapping in the primary minimum. The findings are directly applicable to predicting colloid-facilitated contaminant transport in carbonate aquifers and optimizing groundwater remediation strategies.
Key words: pH variation, kaolinite, fractured medium, deposition.

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Elaboration of a novel samarium (III)-based coordination polymer with remarkable antenna effect-driven emission

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Abstract:

Coordination polymers are crystalline materials composed of metal ions connected by multidentate ligands into one-, two-, or three-dimensional frameworks [1]. Their structural diversity arises from the choice of metal centers and ligands, which allows for the design of compounds with specific properties [2][3].

In this work, we investigated the synthesis and characterization of a new coordination polymer based on samarium (Sm^{3+}) coordinated to fumarate and phenanthroline as ligands. The compound was characterized by X-ray diffractions and Infrared spectroscopy analysis, confirming the formation of an original extended framework. Optical properties were investigated by photoluminescence spectroscopy, revealing that the luminescent behavior arises from the antenna effect of the phenanthroline ligand, leading to well-defined emission signatures. These results highlight the potential of fumarate-phenanthroline coordination polymers for optoelectronic and sensing applications.

Key words: coordination polymers, samarium, fumarate, phenanthroline, photoluminescence

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Cloud Point Extraction of Orange II Using Neutral Micelles Dehydol LT7

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Abstract:

Text of the abstract Synthetic dyes are widely used in printing, textile industries food, cosmetic, clinical, metal coloring, photography (sensitization), biology (staining of microscopic preparations), color indicators and medical care therapy (antiseptic). The research work carried out on these dyes, has shown that these chemical compounds have carcinogenic effects for humans and animals. Both, the coloured untreated or partially treated discharges in the ecosystem cause a dramatic source of pollution, eutrophication, inhibition of photosynthesis in aquatic plants by reducing the penetration of light .

Orange II is an acid ,used as a dyes in cytology, for laboratory and textile industries. The degradation of such dyes often requires a physico-chemical process and also a biological treatment chain ensuring the elimination of the various pollutants in successive stages. The physico-chemical treatments commonly utilized include adsorption, coagulation , flocculation, precipitation, ozonation, membrane processes

ultrafiltration and nanofiltration, filtration with coagulation, ozonation with coagulation. Although, they are successfully used for the treatment of the industrial effluents, these separation methods have proven to be ineffective given the standards required for these discharges. As a matter of fact, the cloud point extraction treatment is proposed in this work as an efficient and reliable alternative.

The present work concerns the extraction of the problem point (PCE) of the dye, and it has been observed that this method simultaneously includes the problem point and the phenomenon of solubilization of the medium of nonionic surfactants. Besides, most polyethoxylated nonionic surfactants in aqueous solution form two phases above the cloud point (T,): a rich-surfactant phase (coacervate) and a dilute phase in which the concentration of the surfactant is close to its critical micelle concentration. Therefore, due to the micellar solubilizing property of surfactants, the hydrophobic, amphiphilic or even ionic solutes can be extracted into the coacervate after increasing the temperature above Tc. EPCs using micelles or mixed micelles. It is a promising method for setting up a new large-scale process in which the aqueous phase is used. The small volume of the rich phase in biodegradable surfactants obtained by the cloud point method makes it possible to design an extraction strategy requiring low cost, extraction efficiency and good efficiency more than those using organic solvents. This fact is particularly interesting, as the concept of "green chemistry" is obyed. This novel process called liquid-coacervate extraction or cloud point extraction (CPE), was first time applied to the separation of metal ions in the presence of a chelating agent. It has been largely utilized to remove organic. Really, surfactants suitable for the cloud point extraction process should be poorly soluble in water (to limit the loss of surfactants in the dilute phase), have a low cloud point (to reduce the need for heating), solubilize pollutants, form low toxicity and of course biodegradable.

The objective of this work is the extraction by coacervate of Orange II. Its extraction has been achieved in aqueous solution by using the extractant dehydol LT7 which is easily and rapidly biodegradable. The experimental results of the extraction, as a function of the concentration of the surfactant and the temperature, are expressed by the following three quantities: percentage of dye extracted (E), residual concentration of dye in the phase dilute (Xs, w) and volume fraction of the coacervate (Φc) at equilibrium. The results obtained for each parameter are represented on three-dimensional diagrams by using the empirical smoothing method. In optimal conditions Orange II concentration in the effluent was reduced to about 227 times.

Keywords: cloud point, non ionic surfactant, cloud point extraction

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In Vitro Investigation: 1-amidoalkyl -2-naphthol Derivatives as Cholinesterase Inhibitors

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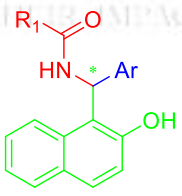
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Abstract:

Alzheimer's disease (AD) is a crucial neurodegenerative disorder recognised by cognitive dysfunction and irreversible memory loss. Researchers aim to develop drugs with Cholinesterase (ChE) inhibition properties exactly for AChE and BChE enzymes. This strategy is one of the major strategies in AD treatment. 1-amidoalkyl-2-Naphthol are synthetic compounds with good biological activities including antioxidant, antidiabetic anticholinesterase. They are good candidates for Alzheimer's disease treatment.

In the present study, a series of fifteen 1-amidoalkyl -2-naphthol derivatives has been synthesized via Betti reaction. Compounds were evaluated for anticholinesterase inhibitory activity using both enzymes acetylcholinesterase (AChE) and butyrlcholinesterase (BChE) by Elman's method. Results revealed moderate to good compounds inhibition potency against AChE and BChE.

Keywords: 1-Amidoalkyl-2-Naphthol, Cholinesterase ,AChE, BChE, Alzheimer's disease.



R_1= CH_3, C_6H_5

Figure. General Structure of 1-amidoalkyl-2- naphthols

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Hydrometallurgical Separation of Lanthanum(III) by Cloud Point Extraction Using $C_{13}E_{10}$ Surfactant

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Abstract:

Hydrometallurgy offers an effective approach for the recovery of rare earth metals (REMs), particularly lanthanum (La), which plays a vital role in advanced structural materials and metallurgical applications due to its exceptional physical and chemical properties. The demand for lanthanum is increasing in sectors such as astronavigation, luminescence, nuclear energy, and alloy production. While hydrometallurgical techniques remain central to the recovery of La from leach solutions, conventional methods including solvent extraction, precipitation, ion exchange, and adsorption often face operational, economic, or environmental limitations.

To overcome these limitations, Cloud Point Extraction (CPE) has emerged as a promising alternative. This technique employs non-ionic surfactants that, upon reaching a specific temperature known as the cloud point undergo phase separation, forming a surfactant-rich coacervate phase and a dilute aqueous phase. Metal ions such as La(III) can be selectively extracted into the coacervate phase through interactions with micellar aggregates, allowing for both separation and preconcentration in one step. In this study, CPE was applied using the non-ionic surfactant $C_{13}E_{10}$, and the extraction parameters were optimized via the classical one-variable-at-a-time method. The process achieved a La(III) extraction efficiency of 61.77%, and a stripping rate of 90.26% using 10^{-1} M nitric acid, demonstrating CPE's potential as an efficient, selective, and environmentally friendly hydrometallurgical technique.

Key words: Metallurgical processing, Cloud point technique (CPE), Lanthanum(III), non-ionic surfactant $C_{13}E_{10}$.

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Phase Behavior and Electro-Optical Response of Systems Composed of Recycled Nematic Liquid Crystals and Poly (2-ethylhexylacrylate)

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Abstract:

This work focuses on the development and characterization of polymer-dispersed liquid crystals (PDLCs) incorporating recycled liquid crystals (RLCs) obtained from end-of-life LCD screens. These hybrid systems combine the mechanical properties of polymers with the optical responsiveness of liquid crystals, offering promising applications in smart materials and electro-optical devices. The use of RLCs contributes to the valorization of complex electronic waste while preserving key optical features such as birefringence and the nematic–isotropic transition.

Two types of polymer matrices were studied: polymethylphenylsiloxane (PMPS 40000) and poly(2-ethylhexyl acrylate), both mixed with RLCs in varying compositions. The PDLCs were prepared using the thermally induced phase separation (TIPS) method. Characterization was carried out using polarized optical microscopy (POM), Fourier transform infrared spectroscopy (FTIR), and differential scanning calorimetry (DSC), in order to analyze the structural organization, thermal behavior, and optical properties of the materials.

The results highlight the influence of composition on phase transitions and electro-optical performance, contributing to a better understanding of PDLC systems using recycled liquid crystal components.

***Keywords*:** PDLC, recycled liquid crystals, thermal phase separation, FTIR, DSC, POM, electro-optical materials

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(Bouriche et al., 2018)

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Design, Spectral Analysis, Molecular Docking and ADMET Evaluation of a New Sulfur-Containing Vanillin Derivative

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Abstract:

Vanillin is a bioactive oxygenated aromatic compound that has been widely modified to enhance its biological properties [1–3]. Among organic molecules, heterocyclic compounds particularly sulfur-containing derivatives are of great interest due to their notable activity in both natural and synthetic structures [4].

In this study, a novel vanillin derivative bearing a 5,6-dihydro-4H-cyclopenta[d][1,3]dithiole-2-yl group was synthesized through the condensation of vanillin with a selenone in a trialkylphosphite medium under ultrasonic irradiation. The compound's structure was confirmed using infrared spectroscopy, ^{1}H NMR, and ^{13}C NMR .

Furthermore, the compound was evaluated in silico for ADMET properties and binding affinity through molecular docking against three key target proteins: gyrase B (S. aureus), MurE (E. coli), and bromodomain BD2 (C. albicans). The docking results were compared with the standard ligands B48, SZN, and 8HZ, highlighting the potential biological relevance of this new sulfur-containing vanillin derivative.

Key words: Vanillin, 1.3-dithiol-2-selenone, Functionalization, ADMET properties

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Dye Removal via Biosorption Using a Biobased Nanocomposite

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Abstract:

Synthetic dyes pose a significant environmental threat due to their toxicity, persistence, and resistance to biodegradation, making their removal from aquatic systems particularly challenging. Among the available techniques, adsorption stands out as an efficient and cost-effective method for dye remediation.

In this study, we developed hydrogel beads composed of carboxymethyl cellulose (CMC), a biopolymer rich in hydroxyl and carboxyl functional groups, to act as biosorbents for the removal of industrial cationic dyes. To enhance their adsorption capacity, montmorillonite (MMt) clay was incorporated into the CMC matrix, resulting in modified CMC beads (CMCbds).

The biosorbents were characterized using Fourier Transform Infrared Spectroscopy (FTIR) to identify functional groups, X-ray Diffraction (XRD) to evaluate crystallinity, and pH sensitivity tests to assess solubility behavior. Initial adsorption experiments revealed that unmodified CMCbds achieved a dye uptake of 30 mg/g. Upon integration of MMt, the adsorption capacity increased significantly to approximately 100 mg/g, with a removal efficiency nearing 100%.

These results highlight the potential of CMC-MMt nanocomposite beads as a sustainable, low-cost alternative to conventional adsorbents for the treatment of dye-contaminated wastewater.

Keywords: Adsorption, Biosorbents, Carboxymethyl Cellulose, Clays, Montmorillonite.

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Ab initio modeling of elastic behavior of piracetam polymorphs

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Abstract :

In last decades, the importance of polymorphism has a continuous grow within the scientific community and the pharmaceutical industry. Different crystal structures exibit different physical and chemical properties such as the mechanical properties, melting point, solubility and a dissolution rate which have a direct impact on the stability, bioavailability and performance of the active pharmaceutical ingredient (API) [1]. The success of manufacturing processes of API such as milling, compressibility, granulation, depend largely on its mechanical properties (elastic properties, plastic properties, hardness, brittleness.). These are also important for designing new crystals APIs with desired mechanical properties in order to improve their solubility and bioavailability. Consequently, understanding the relationship between structure and mechanical properties is fundamental in API crystal engineering [2].

Computer atomistic simulation were carried out to investigate the structural and elastic properties of piracetam ($C_6H_{10}N_2O$) polymorphs; a pioneering notropic active pharmaceutical ingredient that has revolutionized the pharmaceutical industry field since its development in the 1960 [3]. It is marketed as Nootropil intended for enhancement of cognitive functions, this synthetic derivative of the neurotransmitter γ-aminobutyric acid (GABA) represents the

prototypical member of racetam family, characterized by its distinctive 2-pyrrolidone nucleus [4]. The prediction of elastic properties is crucial for stability, stress and strain consideration, also in order to rationalize the manufacturing process of an active pharmaceutical ingredient in term of tablet compression. Moreover, simulation methods offer an opportunity to understand the mechanical behaviour at the atomic scale that nanoindentation techniques sometimes fail to explain [5]. Our atomistic simulations are performed by using density functional theory, as implemented in the SIESTA code, while employing the VDW-DF approach. This accurately describes van der Waals interactions and Hydrogen bonds which are crucial for the cohesion of molecular crystals.

Key words: polymorphism, atomistic simulation, piracetam, DFT, VDW-DF

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MOLECULAR DOCKING AND ADMET STUDIES: SCHIFF BASE AND ITS ZINC (II) COMPLEX

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Abstract:

Metal complexes have emerged as a promising class of compounds with wide-ranging applications. These complexes exhibit enhanced antibacterial, antifungal, antioxidant, anticancer, and other biological properties. Their ability to target multiple pathways in microbial cells contributes to their effectiveness. Importantly, compared to traditional organic drugs, metal complexes often exhibit lower toxicity towards human cells while maintaining high potency against pathogens. This makes them a potential alternative in overcoming drug-resistant infections.

In this study, we focus on the synthesis and characterization of Schiff base-metal complex. The complex is formed through the condensation of primary amine with an aldehyde, followed by coordination with zinc ion. The resulting ligand and zinc complex were then characterized using UV-visible and FT-IR spectroscopic techniques. DFT/B3LYP

quantum calculations were used to identify the most stable configurations. Moreover, molecular docking simulations were performed to evaluate the binding affinity and biological potential of the ligand and its complex against Staphylococcus aureus (1AD4) and Escherichia coli (1AJ0). The pharmacokinetic properties and drug-likeness of the synthesized compounds were predicted to evaluate their potential as therapeutic agents.

KEYWORDS: Schiff base, Zinc (II) complex, DFT calculations, molecular docking, ADMET prediction.

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Molecular Docking Study of (E)-1-[-2-(4-fluorophenyl) diazen-1-ylidene] naphthalen-2(1H)-one (4-FPDN)

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Abstract:

(E)-1-[-2-(4-fluorophenyl) diazen-1-ylidene] naphthalen-2(1H)-one (4-FPDN) is a fluorinated azo compound derived from the naphthalene scaffold, which is known for its broad spectrum of biological activities. In this study, molecular target prediction was performed using the SwissTargetPrediction web server, which identified 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1) as a probable target. This enzyme plays a key role in glucocorticoid activation and is associated with metabolic disorders, making it a relevant therapeutic target.

To validate the docking protocol, redocking of the native ligand into the 11β-HSD1 active site was performed. The root-mean-square deviation (RMSD) between the crystallographic pose and the redocked conformation was calculated using the RMSD web server, yielding a value within the acceptable threshold (<2 Å), confirming the accuracy and reliability of the docking procedure.

Molecular docking simulations were subsequently conducted to evaluate the potential inhibitory activity of 4-FPDN against 11β-HSD1. The docking results revealed stable binding interactions, including hydrogen bonding and hydrophobic contacts with key residues within

the enzyme's active site. These findings suggest that 4-FPDN may serve as a promising inhibitor of 11β-HSD1.

Key words: Azo, RMSD, 11β-HSD1, Docking.

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Fabrication and Evaluation of SnO_2 Thin Films: A Cost-Effective Wet Chemical Method

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Abstract:

Tin dioxide (SnO_2) is a material belonging to the transparent conductive oxide (TCO) family. Its nontoxic and abundant composition on Earth makes it an ideal candidate for transparent electrical contacts for electronic, optical, and catalytic applications. SnO_2 exhibits a good compromise between transparency in the visible range and high electrical conductivity .

In the present work, we propose a straightforward chemical method for the preparation of SnO_2 thin films. The method has many advantages.

Key words: SnO_2; Spin coating; Sol-Gel; Thin films

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Semi-Empirical Determination of the L_3-Subshell Jump Factor for Selected High-Z Elements

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Abstract:

This study develops an analytical model for the computation of L_3-subshell jump factor (J_{L_3}) for elements with atomic numbers ranging from 79 to 83, employing an interpolation-based approach. The model utilizes a commonly adopted analytical expression of the form $f(Z)\sum_{i=0}^{n} a_i Z^i$, wherein interpolation techniques are applied to determine the coefficients a_i as functions of the atomic number Z. The model's performance is evaluated through comparison with theoretical, experimental, and semi-empirical datasets. The predicted values demonstrate excellent concordance with experimental measurements, exhibiting deviations within the range of 0% to 4%. These results affirm the model's validity and its capacity to serve as a reliable analytical framework for investigating jump factor in atomic systems. Moreover, the study highlights the critical role of jump ratio parameters in elucidating atomic behavior. The strong correlation between the present model's outcomes and existing literature further substantiates its accuracy and applicability in the field of atomic physics.

Key words: L_3-subshell jump factor, analytical function, semi-empirical calculation.

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Study of Pb(II) extraction using the emulsified liquid membrane (ELM) technique: process optimisation

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Abstract:

The extraction of lead (II) ions, with nitrate ions as counter-ions, was investigated using the emulsion liquid membrane (ELM) technique, optimizing one experimental parameter at a time.

The results demonstrated that Pb(II) ions were completely extracted (100%) using a quaternary amine extractant (Aliquat 336) and a non-ionic surfactant (Span 80), commonly employed to stabilize water-in-oil (W/O) emulsions due to its low HLB value of approximately 4,3.

The most influential experimental factors such as extractant concentration, surfactant concentration, solution pH, and the nature and concentration of both internal and external phases were systematically studied.

Key words: Extraction, Emulsion Liquid Membrane (ELM), Lead, Span 80, Aliquat 336.

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First principles investigation of Structural, Elastic, Electronic and Optical properties of the ternary phosphides LiSrP

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Abstract :

Ab- initio calculations have been performed on the structural, electronic, elastic and optical properties of the ternary phosphides compound LiSrP using the formalism of the density functional theory (DFT). The exchange-correlation potential has been treated by the generalized gradient approximation (GGA) based on the Perdew-Burke-Ernzerhof function (PBE) implemented in the Vienna Ab initio Simulation Package (VASP). The calculated equilibrium structural parameters are in good agreement with the available experimental and theoretical data. The electronic properties of the LiSrP had been reported and proven that the LiSrP had an indirect band gap semiconductor. Moreover, the elastic constants of the compound such as Shear modulus, Young's modulus, Pugh ratio, Posisson ratios and anisotropic index had been also estimated and the results obtained verify the stability criteria. The dielctric function, refractive index, reflectivity, optical conductivity, absorption spectra, extinction coefficient, and energy_loss spectrum are predicted for an incident radiation in an energy range up to 15 eV, and the origins of the main peaks in the optical spectra are discussed in terms of the calculated electronic band structure.

Key words: Ternary phosphides, Semiconductor, Electronic properties, Optical properties

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Impact of the composition of a composite material based on natural fibers on mechanical characteristics

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Abstract:

This study is part of an effort to promote the use of renewable natural resources, focusing on the use of raw plant waste, particularly dry fronds, as a raw material for the manufacture of composite materials. Particular attention was paid to the physical and mechanical description of this waste, with the aim of better understanding its potential as a natural reinforcement in a polymer matrix. The fibers extracted from the fronds were then incorporated into an epoxy resin to produce several types of composites.

The mechanical characterization of the materials obtained was carried out mainly through flexural tests to evaluate their structural behavior. The tests were performed by varying the fiber reinforcement percentages to 4%, 10%, and 16%. The results obtained show a gradual improvement in mechanical properties as the fiber content increases. However, the flexural curves also reveal significant differences between the different incorporation rates, indicating that the amount of fibers has a direct nonlinear influence on the stiffness and strength of the composite.

These observations suggest that optimizing the fiber percentage is crucial to achieving a good compromise between mechanical performance and processability. The study thus opens up interesting prospects for the development of environmentally friendly, high-performance materials based on plant fibers, while contributing to the reduction of organic waste

Key words: Mechanical characterization, Plant fibers, Composite materials, Epoxy resin

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Advanced Cool Materials for Sustainable Urban Pavement Systems: A Comprehensive Review of Thermal Management Technologies

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Abstract:

Advanced cool materials for sustainable urban pavement systems represent a critical innovation to address the increasing challenges of urban heat islands and climate change. This comprehensive review critically examines the state-of-the-art thermal management technologies incorporated into pavement design to enhance urban sustainability. The paper explores various categories of advanced cool materials, including reflective coatings, permeable pavements, phase change materials, and thermally conductive composites. Each material type is analyzed for its effectiveness in reducing surface temperatures, mitigating heat absorption, and improving overall thermal comfort in urban environments.

The review discusses the underlying mechanisms by which these materials control thermal behaviour, such as high solar reflectance, enhanced evaporative cooling, and efficient heat dissipation. Extensive evaluation criteria including durability, environmental impact, and installation feasibility are considered to provide a balanced understanding of current

technologies. Additionally, the paper highlights recent advancements in nano-engineered materials and smart pavements that adapt dynamically to temperature fluctuations.

Case studies from global cities demonstrate real-world applications and quantify the benefits in terms of temperature reduction, energy savings, and improvements in air quality. Challenges related to material aging, maintenance, and integration with existing infrastructure are also addressed, proposing potential solutions and future research directions.

Overall, this review underlines the importance of adopting multi-faceted thermal management strategies using advanced cool materials to create resilient, energy-efficient, and climate-adaptive urban pavement systems. It aims to guide researchers, urban planners in selecting and implementing appropriate technologies that contribute to sustainable urban development and enhance the quality of life in rapidly urbanizing regions.

Key words: Cool materials, cool pavement, urban heat island, thermal management, sustainable infrastructure, reflective materials, phase change materials, thermal emittance, solar reflectance, urban sustainability

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Integration of Nanomaterials in Cool Pavement Systems for Urban Heat Island Mitigation: A Systematic Review of Mechanisms and Performance

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Abstract:

The intensification of the Urban Heat Island (UHI) effect, driven by rapid urbanization and the pervasive use of traditional, heat-absorbing pavements, presents a significant challenge to urban sustainability. This systematic literature review synthesizes global research on the integration of advanced nanomaterials into cool pavement systems as a high-potential mitigation strategy. The review methodology involved a comprehensive analysis of different studies to evaluate the thermal regulation mechanisms and performance characteristics of various nanomaterial categories. The findings identify four primary material classes: Titanium dioxide (TiO_2) nanoparticles, which demonstrate enhanced solar reflectance and photocatalytic properties, leading to surface temperature reductions of 5–15°C ; Phase Change Material (PCM) nanocapsules, which provide superior thermal energy storage to mitigate diurnal temperature fluctuations ; reflective nano-oxides (e.g., ZnO, Al_2O_3) that form durable, high-albedo coatings ; and carbon-based nanomaterials (e.g., graphene, nanotubes), which enhance thermal conductivity . Performance assessments indicate that nanomaterials can improve the Solar Reflectance Index (SRI) by 20-40% and significantly enhance mechanical

durability and resistance to weathering. Despite this promise, challenges regarding long-term performance stability, cost-effectiveness, and environmental health impacts remain critical barriers. The study concludes that nanomaterials represent a transformative approach to cool pavement technology, with TiO_2-based solutions showing immediate commercial viability. Future research must prioritize standardized performance metrics, large-scale longitudinal studies, and comprehensive lifecycle assessments to validate the sustainable application of nanotechnology in urban cooling.

Key words: Urban Heat Island (UHI), Cool Pavements, Nanomaterials, Thermal Reflectance, Phase Change Materials (PCMs), Titanium Dioxide (TiO_2), Sustainable Infrastructure

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Quantum Insights and Experimental Evidence of Dye Elimination on Kaolinite

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Abstract:

This work presents a theoretical and experimental study of the adsorption of a cationic dye Methylene Blue, on kaolinite surfaces, from aqueous solution under different conditions. Attempts were made to fit the isothermal data using Langmuir and Freundlich equations. The experimental results have demonstrated that the equilibrium data are fitted well by a Langmuir isotherm equation. Thermodynamic parameters such as the changes in enthalpy, entropy, and Gibbs' free energy were determined, showing adsorption to be an endothermic yet spontaneous process. Pseudo-second-order, additionally, the Density Functional Theory (DFT) calculations indicated that CV's narrower HOMO–LUMO gap and higher molecular softness were consistent with its enhanced reactivity and stronger interaction with the adsorbent. Furthermore, the molecular dynamics (MD) simulations confirmed the spontaneous, physically driven nature of the adsorption process. The close agreement between computational predictions and experimental data provides robust validation for the proposed adsorption mechanisms, offering clear mechanistic insights into dye adsorption processes

Keywords: Clay; Adsorption; Molecular dynamics, Isotherms, Kinetics

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Effect of Hydrothermal Aging on the Mechanical Properties of Biodegradable Composites based on polylactic reinforced with natural reinforcements

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Abstract:

This dissertation aims to characterize composites based on acid polylactide (PLA) reinforced with Alfa plant fiber. The effect of hydrothermal aging on the mechanical and thermal properties of these composites is considered. In order to study this aging phenomenon, biodegradable PLA/Alfa and PLA /Cloisite composites were immersed in distilled water at different temperatures. Rheological analysis shows a change in the behavior of aged composites, which is confirmed by DSC and FTIR.

Key words: PLA, Alfa fibers, biocomposites, hydrothermal aging…

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Enhanced Deep Learning Model with Transfer Learning and Data Augmentation for Plant Disease Detection and Environmental Protection

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Abstract:

The early detection of plant diseases is essential to ensure food security and protect the environment through sustainable agricultural practices. Traditional diagnostic methods are often time-consuming, costly, and dependent on human expertise, which limits their scalability. In this work, we present an enhanced version of the Plant Doctor system, based on deep learning, for automatic disease identification from plant leaf images.

Our approach leverages transfer learning by fine-tuning a pre-trained convolutional neural network (ResNet50) on the PlantVillage dataset (38 classes, >50,000 images). To improve robustness and prevent overfitting, several data augmentation techniques (rotation, zoom, brightness adjustment, and flipping) were applied. In addition, hyperparameter optimization was performed, tuning the learning rate, batch size, number of epochs, and dropout rate.

The enhanced model achieved an accuracy of 97.8%, surpassing conventional CNN approaches and demonstrating strong generalization across diverse conditions. Designed for potential integration into a mobile application, the system provides farmers with a practical decision-support tool that enables early intervention, reduces crop losses, and minimizes pesticide overuse. By linking artificial intelligence with sustainable agriculture, this work

contributes to technological development (Topic 07) and the protection of natural resources and the environment (Topic 11).

Key words: Artificial Intelligence, Deep Learning, Transfer Learning, Data Augmentation, Plant Disease Detection, Environmental Protection

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Synergetic control of DFIG applied in a wind energy conversion system

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Abstract:

This study presents the application of synergetic control to a doubly-fed induction generator (DFIG) integrated in a wind turbine system. The proposed strategy ensures the independent control of active and reactive powers, This technique is validated by simulation in the MATLAB/SIMULINK software. The simulation results clearly demonstrate the effectiveness of this control strategie for decoupling the DFIG's stator active and reactive power. They perfectly follow their reference values, with high dynamic and static performances and satisfactory disturbance rejection. thereby improving the effectiveness of this control strategie in the presence of parametric variations, A robustness test was done when the mutual inductance Lm was reduced of its nominal value the obtained results shows that the synergetic control partially loses its control performance.

Key words:

Wind energy, Doubly-fed induction generator, synergetic control, Robustness.

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Kinetic Study of the Adsorption Process of a Pharmaceutical Residue onto Two Adsorbents in a Batch System

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Abstract:

The adsorption of the ibuprofen molecule onto two adsorbents granular activated carbon and an (α, β, γ)-cyclodextrin-based polymer, was studied in a closed, stirred system at room temperature. Characterization of the two adsorbents revealed that activated carbon is hydrophobic and mesoporous, with a porosity of approximately 69.5%. The Boehm method showed that its surface functions are of an acidic type. The cyclodextrin-based polymer is hydrophilic with a high swelling capacity and can be considered a hydrogel.

The kinetic study revealed that the initial concentration of the ibuprofen solution has a significant influence on the adsorption capacity of both adsorbents, with the amount adsorbed increasing with ibuprofen concentration.

The Langmuir model provides the best fit for the adsorption equilibrium data of ibuprofen on both adsorbents, indicating that ibuprofen molecules are adsorbed in monolayers. The Langmuir constants reveal that the ibuprofen molecule has a higher affinity for the cyclodextrin-based polymer, likely due to the simultaneous presence of interstitial spaces and hydrophobic cavities.

The kinetic data showed that the adsorption process for both adsorbents follows the pseudo-first-order model.

The adsorption results demonstrate that these two materials are promising candidates for the removal of this type of pollutant, particularly at trace levels, as evidenced by high adsorption rates reaching up to 99%.

Key words: Activated carbon, cyclodextrin-based polymer, ibuprofen, characterization, adsorption.

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Optimisation de la maniabilité et des propriétés mécaniques d'un mortier par substitution ternaire de céramique et de brique

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Abstract : L'industrie de la construction est un pilier fondamental du développement économique mondial, mais elle est également l'une des plus grandes consommatrices de ressources naturelles et génératrices de déchets. Dans un contexte d'urgence climatique et de raréfaction des matières premières, la recherche de solutions plus durables est devenue impérative. L'un des défis majeurs réside dans la production de ciment Portland, dont la fabrication est intrinsèquement liée à d'importantes émissions de dioxyde de carbone (CO_2), principal gaz à effet de serre responsable du réchauffement climatique. Environ 5 à 8% des émissions anthropiques globales de CO_2 proviennent de la production de ciment, principalement due à la décarbonatation du calcaire et à la consommation d'énergie fossile nécessaire aux fours. Parallèlement à cette empreinte carbone significative, le secteur du bâtiment est confronté à la gestion volumineuse de ses propres sous-produits et déchets. Parmi ceux-ci, les déchets de briques et les déchets de céramiques provenant des démolitions ou des rejets de fabrication représentent des flux considérables qui, souvent, finissent en décharge, engendrant des problèmes environnementaux. La valorisation de ces matériaux résiduels par leur réintégration dans la chaîne de production de nouveaux matériaux de construction est une voie prometteuse pour réduire l'impact environnemental de l'industrie.
Cette recherche se concentre sur l'utilisation de la poudre de déchet de brique (démolition d'un mur) et de la poudre de céramique (déchets de faïences) en remplacement partiel du ciment. Nos travaux portent sur la création d'un mortier avec un CEMI de 42,5 et intégrant un taux fixe de 15% de poudre de céramique avec des taux de poudre de déchet de brique (0%, 10%, 20%, 30% ,40% et 50%) en substituant avec le ciment. Les résultats obtenus ont montré que la substitution ternaire a un impact significatif et variable sur les propriétés du matériau, avec la combinaison 15% céramique et 10% brique se distinguant comme la plus performante globalement.

Key words: : Poudre de brique et poudre de céramique, MBE, environnement, rhéologie, comportement mécanique.

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A Predictive Model for Boride Layer growth on a Tool Steel: application and validation

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Abstract:

This study presents a kinetic model for the growth of dual-phase boride layers (FeB + Fe_2B) on a tool steel. The model is founded on solving the mass balance equations at the advancing diffusion fronts to describe the boron diffusion process. It was employed to determine two dimensionless parameters governing the growth kinetics at a given temperature. The diffusion coefficients of boron in both the FeB and Fe_2B phases were calculated for the temperature range of 900–1000°C, also the corresponding activation energies for diffusion were determined.

Key words: boronizing, iron borides, kinetic, bilayer model, activation energy

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Effect of FRP Properties on the Structural Response of RC Beams: A Numerical Approach

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Abstract:

Fiber-reinforced polymers (*FRP*) are widely used to strengthen reinforced concrete (*RC*) structures due to their high efficiency in improving strength and durability. Nevertheless, the performance of FRP-strengthened beams can be influenced by different parameters related to the FRP itself, such as its type and dimensions. In this work, previously published experimental results were considered, and a numerical study was carried out using a cohesive zone model (*CZM*) to investigate the flexural behavior of *RC* beams externally strengthened with *FRP* plates. The analysis highlights the effect of *FRP* properties on the global response of the beams. The results show good agreement with experimental observations and confirm the significant role of *FRP* characteristics in enhancing the flexural performance of *RC* beams.

Key words: FRP, RC beams, Finite element analysis, CZM

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Structural and photoluminescence properties of GdYAG: Ce^{3+} nanoparticles in polystyrene nanocomposite films

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Abstract:

The scientific community has recently taken a significant interest in inorganic-polymer nanocomposites. Thanks to their affordable manufacturing costs, as well as their well-known physical and chemical properties, polymer materials can be used in various geometric shapes. The luminescent nanocomposite films GdYAG:Ce^{3+} /polystyrene were successfully prepared by the direct mixing in solution method, consisting of combining nanoscale luminescent nanoparticles with polystyrene granules. To characterize these samples, several techniques were used including X-ray diffraction (XRD), SEM, differential scanning calorimetry (DSC), photoluminescence spectroscopy (PL).

Key words: GdYAG:Ce^{3+}, polystyrene (PS), films nanocomposites, photoluminescence (PL).

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Development and characterization of an alternative cement made from industrial wastes

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Abstract:

The aim of this study is to synthesize a belitic sulfoaluminate cement (BYF) as an eco-friendly alternative to Portland cement (PC). This cement will be obtained at low temperature from a mixture of industrial wastes, using hydrothermal treatment. One of the main minerals in this cement is calcium sulfoaluminate, which is highly reactive. The high reactivity of this mineral is responsible for the hydraulic performance of sulfoaluminate cement. This cement also contains belite, which contributes to high mechanical strength and low porosity at older ages. The mineralogical composition of the clinker produced was identified using XRD analysis. The hydraulic reactivity of this cement will be studied and estimated using the Rietveld method, quantifying the mineralogical composition as a function of time. This will provide an indication of the cement's hydraulic reactivity, enabling us to predict its mechanical performance. The mortar compressive strength of the developed cement was determined by mechanical testing. The results show that the obtained cement is highly reactive, developing a compressive strength in excess of 42 MPa after 28 days of curing.

Key words: Alternative cement, sulfoaluminate cement, industrial wastes, hydraulic properties.

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Theoretical Calculation of the Structural, Electronic, and Magnetic Properties of a New Rare-Earth Based Full Heusler Alloys

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Abstract:

In this work, we investigated the structural, electronic and magnetic properties of the full Heusler rare earth- based alloys Pr2CoZ (Z = Al and Ga), our calculations were by density functional theory (DFT) based on full potential linearized augmented plane wave (FP-LAPW) implemented in WIEN2k code. We used the generalized gradient approximation (GGA) to achieve all properties. The electronic and magnetic properties calculated based on the optimized cell parameter in the ferromagnetic Hg2CuTi type with space group 216. The obtained results confirm the half metallicity behavior of our both alloys and they have important magnetic moment equal to 4 µB, these results lead them candidates for spintronics and storage applications.

Key words: DFT, Full Heusler, Rare earth,Spintronics

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Comparative Evolution of Antioxidant Effect of Spirulina (Arthrospira platensis) Aqueous Extract Obtained by Two Extraction Techniques: Conventional maceration and Innovant Microwaves-Assisted Extraction

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Abstract:

Spirulina (Arthrospira platensis), a cyanobacterium rich in proteins, pigments, and secondary metabolites, has been extensively studied for its biological properties, particularly its antioxidant potential. The effectiveness of the extracts is closely linked to the extraction method applied, which influences the nature, quantity, and stability of the recovered biomolecules. In this work, we propose a comparative evaluation of the antioxidant activity of spirulina obtained through two distinct approaches: aqueous maceration, a conventional method, and microwave-assisted extraction, considered an innovative and more efficient technique. The extracts were characterized based on their antioxidant capacity using standard assays, DPPH and Reducing Pawer. In the first approach, maceration was performed by immersing Spirulina powder in distilled water under controlled conditions, allowing passive diffusion of bioactive compounds. In contrast, microwave-assisted extraction was carried out using an ordinary microwave to enhance solvent penetration and improve the recovery of

antioxidant molecules. Preliminary results indicate that maceration significantly improves the efficiency of antioxidant activity by both DPPH and Reducing Power compared to microwave assisted extraction. This enhancement can be attributed to the heat energy induced by microwave irradiation, leading to the degradation of phenolic compounds and pigments**.** These findings highlight the importance of selecting appropriate extraction techniques for maximizing the bioactive potential of bioresources. Microwave-assisted extraction represent an efficient and environmentally friendly alternative to traditional techniques, though it can sometimes lead to diminished bioactivities in sensitive biomolecules.

Key words: bioactive molecules, conventional extraction, innovative extraction, biologic activity.

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First-Principles Investigation of Half-Heusler Alloys for Photovoltaic Applications

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Abstract:

The Half-Heusler LiAlC alloy has been investigated using Density Functional Theory (DFT) calculations within the GGA-PBE and mBJ-GGA approximations. The results indicate that this alloy is most stable in the cubic type-I structure with a non-magnetic configuration. Density of states analysis confirms its semiconducting behavior, while mechanical and elastic analyses demonstrate its mechanical stability. Moreover, the optical properties reveal a remarkable ability to absorb electromagnetic radiation within the visible spectrum. These findings highlight the great potential of LiAlC as a promising candidate for photovoltaic and optoelectronic applications, contributing to the development of new materials for renewable solar energy technologies.

Keywords: DFT, Half-Heusler, optical properties, photovoltaics

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Assessing The Efficacy of Permeable Pavement as a Low Impact Development (LID) Solution for Enhancing Urban Resilience and Groundwater Recharge

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Abstract:

Urbanization has profoundly transformed landscapes globally, increasing impervious surfaces that disrupt natural water infiltration. This results in heightened surface runoff, urban flooding, diminished groundwater recharge, and water pollution. Traditional stormwater management systems, primarily reliant on piped drainage networks, often fall short in addressing these issues, thereby exacerbating flooding, hindering groundwater replenishment, and reducing urban resilience to climate variability. This underscores the urgent need for sustainable stormwater strategies to mitigate these environmental impacts. In this context, Low Impact Development (LID) emerges as a vital approach within sustainable urban planning, emphasizing the preservation and mimicking of natural hydrological processes. Specifically, LID practices —such as green roofs, rain gardens, bio-retention cells, and permeable pavements—manage stormwater at its source, reducing runoff, improving water quality, and enhancing groundwater recharge. By adopting a holistic approach, LID fosters resilient urban ecosystems capable of adapting to climate change impacts.

Permeable pavement, as a key component of LID practices, is distinguished by its ability to allow water to infiltrate through the surface, thereby reducing runoff and facilitating groundwater recharge. By utilizing porous materials such as pervious concrete, porous asphalt, or interlocking pavers, permeable pavements offer numerous advantages. These include alleviating surface water accumulation, reducing stormwater runoff volume, and filtering pollutants before they reach groundwater systems. Importantly, permeable pavements play a vital role in enhancing groundwater recharge by enabling stormwater to percolate through the surface and into underlying soil layers, which naturally filter and replenish aquifers. This process helps restore the natural hydrological cycle disrupted by urban development, ensuring a sustainable supply of groundwater for ecological and human needs.

Furthermore, permeable pavements play a crucial role in enhancing urban resilience by supporting adaptation to climate change and extreme weather events. They manage stormwater sustainably, reducing urban flooding and protecting infrastructure and communities from water-related disasters. As a result, they lessen the burden on conventional drainage systems and improve cities' capacity to handle heavy rainfall. Additionally, permeable pavements decrease surface temperatures, mitigate the urban heat island effect, and improve environmental quality. Collectively, these benefits promote more sustainable and resilient urban environments capable of withstanding growing climate challenges.

This research underscores the importance of permeable pavement as a pivotal Low Impact Development (LID) practice that addresses pressing water management challenges. To this end, a comprehensive review of recent journal papers is conducted to evaluate its effectiveness in groundwater recharge and the enhancement of urban resilience, promoting for its broader application in sustainable urban planning.

Key words: Permeable Pavement, Low impact Development (LID), Groundwater Recharge, Urban Resilience.

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Structural Insights into Fresh vs. Dried (45 °C) Strawberry Extraction Residues Using FTIR Spectroscopy

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Abstract:

Strawberries (Fragaria × ananassa) are rich in polysaccharides, proteins, lipids, and phenolic compounds, many of which remain in the extraction residues. The structural and chemical integrity of these residues is crucial for evaluating the effects of processing. In this study, FTIR spectroscopy was used to compare extraction residues from fresh strawberries and from strawberries dried at 45 °C prior to extraction. The FTIR spectra revealed absorption bands corresponding to polysaccharides, proteins, and phenolic compounds. Dried residues showed markedly reduced intensities for hydroxyl and amide bands, indicating dehydration, protein denaturation, and partial disruption of hydrogen-bonding networks. Furthermore, changes in carbohydrate-related peaks suggest rearrangements or breakdown of polysaccharide structures. These findings support that thermal drying, even at a moderate temperature (45 °C), induces significant molecular rearrangements in strawberry residues. Understanding these changes contributes to the valorization of extraction residues in food and bioactive applications.

Key words: Strawberry, Extraction residue, Drying at 45 °C, FTIR, Macromolecules.

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Assessing The Efficacy of Permeable Pavement as a Low Impact Development (LID) Solution for Enhancing Urban Resilience and Groundwater Recharge

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Abstract:

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Thymus algeriensis: When Aroma Turns into Remedy

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Abstract:

In this study, a medicinal plant (*Thymus algeriensis*) was investigated through the extraction of its essential oil using a Clevenger-type apparatus. GC-MS analysis allowed the identification of its major constituents. Biological assays revealed a notable antimicrobial activity against *Escherichia coli* as well as a significant antioxidant potential evaluated by the DPPH assay. Furthermore, molecular docking was performed on the compound cis-verbenol in interaction with DNA gyrase B, showing a strong binding affinity (−7.3 kcal/mol). Overall, these findings suggest that this plant represents a promising source of bioactive molecules with pharmaceutical potential.

Key words: *Thymus algeriensis*, GC-MS, DPPH, DNA gyrase B.

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Title: Investigation of Gamma-Ray Shielding Properties of transparent glass Using PHITS Monte Carlo code

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Abstract:

This study investigates the gamma-ray shielding properties of transparent glass materials using the PHITS Monte Carlo code. Transparent glasses, particularly with high-density components, have emerged as promising alternatives to traditional shielding materials due to their lightweight, versatile, and aesthetic characteristics. The simulation setup involved modeling various type of transparent glass to evaluate their mass attenuation coefficients (MAC), half-value layers (HVL), and effective atomic numbers (Zeff) across a range of gamma-ray energies. Results highlight the significant influence of glass composition, particularly the incorporation of high-Z elements, on shielding performance. The findings demonstrate the potential of optimized glass systems for use in radiation protection applications, such as medical diagnostics, nuclear facilities, and industrial processes. Further research is recommended to explore the practical feasibility and long-term stability of these materials in real-world conditions.

Key words: Transparent glasses, gamma shielding, Monte Carlo simulation

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Criblage des bactéries métallorésistantes à partir de sols agricoles

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Abstract:

La contamination des sols agricoles par le nickel (Ni) représente une menace importante pour la fertilité des sols, la croissance des plantes et la santé environnementale. Cette étude a pour objectif d'isoler et de caractériser des bactéries rhizosphériques capables de résister et de détoxifier le nickel. Des isolats ont été obtenus à partir de sols contaminés et évalués pour leur tolérance à différentes concentrations de Ni. Deux souches ont présenté une résistance élevée et un fort potentiel de réduction. Leur identification a été confirmée par des analyses morphologiques, biochimiques et moléculaires. Ces résultats démontrent leur potentiel comme agents de bioremédiation in situ, offrant une solution durable pour restaurer les sols pollués par le nickel et améliorer la productivité agricole.

Key words: Nickel, .Bactérie, Bioremediation, Sol

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Les propriétés conservatrice des extraites de Pistacia lenticus et Pistacia atlantica dans un produit cosmétiques (crème)

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Résumé

La présente étude visait à examiner la composition des extraite des fruits de P. lenticus et P.atlantica et son éventuelle utilisation comme conservateur cosmétique naturel. Les extraits a été extraite par soxlet et sa composition a été déterminée par screening phytochimique, en utilisant les techniques usuelles, a permis de mettre en évidence l'existence d'alcaloïdes, flavonoïdes, stérols et triterpénes, les composés réducteurs, anthocyanes, de tanins. L'activité antioxydant a été estimée par le test du 2,2-diphényl-1-picrylhydrazyl (DPPH) . Ces méthodes ont révélé une inhibition du DPPH de 50 % à 3,94 mg/mL . L'activité antibactérienne et l'efficacité antibactérienne de P.lenticus et P.atlantica ont été évaluées contre trois souches bactériennes fréquemment présentes dans les cosmétiques, et étudiées dans un modèle de crème pendant 28 jours d'incubation. Toutes les souches bactériennes se sont montrées sensibles à le deux epeces, mais la plus sensible était Staphylococcus aureus (concentration minimale d'inhibition = 0,68 mg/mL). Globalement, les résultats obtenus suggèrent que Pistacia lentiscus et Pistacia atlantica peut être utilisé dans les cosmétiques comme conservateur antibactérien et antioxydant.

Mots clés : Pistacia lentiscus, Pistacia atlantica, DPPH, conservateur cosmétique naturel.

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Deep Learning Approaches for Free Space Optical (FSO) Communication: Toward Sustainable and Energy-Efficient Networks

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Abstract:

The growing demand for high-capacity, low-carbon communication infrastructures has positioned Free Space Optical (FSO) communication as a promising green alternative to conventional radio frequency and fiber systems. FSO enables rapid deployment with minimal environmental disruption, but its performance is severely limited by atmospheric turbulence, scattering, and alignment instability.

To address these challenges, this work proposes a hybrid deep learning framework based on Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks for real-time signal recovery and channel prediction in FSO systems. The CNN component extracts spatial features from distorted optical intensity patterns, while the LSTM module captures temporal variations in turbulence, enabling accurate channel state estimation and adaptive modulation. Simulation results demonstrate that the CNN-LSTM model reduces bit error rate, enhances link stability, and minimizes retransmission requirements compared to traditional equalization methods.

From an environmental perspective, AI-enhanced FSO communication reduces energy consumption and avoids the ecological footprint of large-scale fiber deployment, contributing to sustainable and eco-friendly network infrastructures. This integration of optical communication and intelligent neural architectures offers a pathway toward reliable, energy-efficient, and environmentally responsible next-generation communication systems.

Key words: FSO, CNN, LSTM, environment.

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Solar-driven photocatalytic degradation of emerging contaminants in aquatic environments using bismuth oxide/titanium dioxide heterojunctions: performance, stability, and environmental relevance

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Abstract:

The occurrence of pharmaceutical residues in aquatic systems has become a major environmental concern. In this study, bismuth oxide/titanium dioxide heterojunction photocatalysts were synthesized via a hydrothermal route and tested under simulated solar irradiation for the degradation of cetirizine dihydrochloride, an antihistamine frequently detected in water bodies. The optimized photocatalyst showed rapid removal efficiency and maintained excellent stability over successive reuse cycles, confirming its potential for practical application. Performance was further assessed in different aqueous matrices, including tap, spring, and seawater, demonstrating the robustness of the system under realistic environmental conditions. The contribution of reactive oxygen species was examined, and transformation products were identified, providing insights into the degradation pathway. These findings highlight the promise of bismuth oxide/titanium dioxide heterojunctions as efficient solar-active materials for mitigating pharmaceutical pollution and advancing sustainable water purification technologies.

Key words: Bismuth oxide/titanium dioxide heterojunctions, Emerging contaminants, Solar irradiation, Water treatment.

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Neural Network–Driven Control of a Thirteen-Level Cascaded H-Bridge Inverter for Photovoltaic Energy Conversion with Intelligent MPPT

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Abstract:

The rapid expansion of renewable energy integration into modern power networks has intensified the need for reliable, efficient, and intelligent conversion systems. Photovoltaic (PV) sources, in particular, require robust power electronics interfaces capable of addressing the variability of solar irradiation and temperature while maintaining high-quality output performance. In this study, a thirteen-level cascaded H-bridge multilevel inverter (CHB-MLI) is developed and controlled using neural network–based strategies. The system architecture combines two intelligent layers of control: on the DC side, a boost converter driven by a neural network maximum power point tracking (MPPT) controller ensures maximum energy extraction from the PV array, while on the AC side, a neural network regulator supervises the pulse width modulation (PWM) switching of the multilevel inverter. This dual approach enables the system to dynamically adapt to environmental fluctuations and load variations while minimizing harmonic distortion and improving conversion efficiency.

The choice of a thirteen-level inverter topology allows for enhanced voltage synthesis with lower total harmonic distortion (THD) compared to traditional lower-level structures, yet its complexity is alleviated through the use of artificial intelligence.

The proposed configuration is modeled and simulated in MATLAB/Simulink to evaluate performance under different operating conditions. Key metrics such as output voltage stability, inverter efficiency, harmonic profile, and dynamic tracking capability are analyzed. Simulation outcomes demonstrate that the integration of neural intelligence significantly reduces THD, enhances system efficiency, and delivers near-sinusoidal waveforms with reduced switching effort.

Unlike existing works primarily focused on nine- or eleven-level inverters, this study extends neural-based regulation to a thirteen-level topology, providing new insights into the synergy between advanced power electronics and artificial intelligence. The results highlight the potential of neural network–controlled multilevel inverters to serve as adaptive, scalable, and high-performance solutions for future renewable energy systems.

Key words: Multilevel Inverter, Photovoltaic System, Neural Network Control, Maximum Power Point Tracking (MPPT)

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Green Synthesis of Nanoparticles Using Biomolecules *from Azolla pinnata*

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Abstract:

Azolla pinnata is an aquatic fern recognized as a rich source of bioactive compounds with diverse industrial relevance. Owing to its biochemical composition, it has traditionally been employed as a natural fertilizer and as a protein supplement. Beyond these uses, its bioactive molecules highlight its potential for broader applications in aquaculture, as well as in the food and pharmaceutical industries. The valorization of *Azolla pinnata* therefore represents a promising avenue for sustainable biotechnological and industrial development.

This study investigated the extraction of bioactive compounds from the aquatic fern *Azolla pinnata* with the aim of enhancing their potential applications. Different drying methods, extraction techniques, and solvents were compared to evaluate their efficiency. The focus was placed on key biomolecules such as carbohydrates, pigments, polyphenols, and flavonoids, known for their biological activities. Antioxidant potential was assessed using standard assays, highlighting the value of *Azolla pinnata* as a promising natural resource for future applications in various fields.

Silver nanoparticles were synthesized from the aqueous extract rich in bioactive compounds and characterized using UV-Visible spectroscopy, infrared (IR) spectroscopy, X-ray diffraction (XRD), and scanning electron microscopy (SEM). The findings revealed that 80% acetone was particularly effective for extracting pigments, while the combination of 90% acetone with reflux extraction and oven drying yielded the highest levels of polyphenols and flavonoids. The synthesized silver nanoparticles exhibited an absorption peak at 450 nm, functional groups involved in Ag^{+} reduction were identified, and a face-centered cubic (FCC) crystalline structure was confirmed.

Our study highlighted that *Azolla pinnata* extracts provided notable levels of pigments, polyphenols, and flavonoids, depending on the extraction conditions. Furthermore, characterization analyses validated the successful biosynthesis of silver nanoparticles from the obtained extracts.

Key words: *Azolla pinnata*, Biomolecules, Biological activity, Biosynthesis, nanoparticles.

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Comparative Evaluation of Antioxidant Activity and Phenolic Content in Two Extra Virgin Olive Oils Using the FRAP Assay

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Abstract:

Extra virgin olive oil (EVOO) is a key component of the Mediterranean diet, known for its richness in phenolic compounds, which play a crucial role in preventing oxidative stress and are recognized for their beneficial effects on human health. This study focused on a comparison between two EVOO varieties: *Chemlal* (Algerian) and *Arbequina* (Spanish). Olives were harvested in the same region (El Aouana, Jijel, Algeria) and processed under identical conditions, allowing the assessment of the varietal effect independently of production factors. Phenolic compounds were extracted using a methanol/water mixture (80:20, v/v), and their total content was determined by the Folin–Ciocalteu colorimetric method. Antioxidant activity was evaluated using the FRAP assay (Ferric Reducing Antioxidant Power), which measures the reducing capacity of extracts against the ferric-tripyridyltriazine complex. Results showed that both oils exhibited notable antioxidant activity. However, the *Chemlal* variety displayed a higher phenolic content and greater reducing capacity, highlighting a marked functional potential. These findings confirm the

importance of the varietal factor and emphasize the value of *Chemlal* as a promising Algerian resource for promoting olive oils as a source of bioactive molecules with high added value.
Key words: Extra virgin olive oil, Polyphenols, FRAP, Antioxidant activity, *Chemlal*, *Arbequina*.

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Environmentally Friendly Oxidation Process Using Periodate Activation for Water Purification

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Abstract:

The presence of synthetic dyes in aquatic environments is a major environmental concern due to their stability, toxicity, and resistance to conventional treatment methods. In this study, we investigated a new oxidation process based on the activation of periodate by a manganese catalyst. The system displayed outstanding efficiency, achieving more than 97% removal of a representative toxic dye within two hours under mild conditions close to neutrality. The process remained effective across a slightly acidic to neutral pH range and showed very low energy demand, with an activation energy of 7.16 kJ·mol^{-1}. Comparative evaluation indicated that this approach outperforms several conventional oxidation processes, offering higher efficiency and stability. Furthermore, validation tests carried out with different real water samples, including tap water, groundwater, and seawater, confirmed its robustness and practical applicability. These findings highlight periodate activation by manganese as a promising and sustainable solution for the treatment of dye-contaminated waters.

Key words: Oxidation, Periodate, Manganese catalyst, Real water samples

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Separation of Isobutanol-Water heterogeneous azeotrope: process intensification for sustainable development

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Abstract:

The separation of heterogeneous azeotropic mixtures represents a major challenge for the chemical industry, particularly in the case of the Isobutanol–Water system. Isobutanol, recognized as a next-generation biofuel, exhibits higher energy performance than Ethanol and is attracting increasing attention both as an alternative fuel and as a bio-based solvent. However, the formation of a heterogeneous azeotrope with Water significantly restricts the efficiency of conventional distillation, thus requiring the exploration of alternative separation processes. In this context, the present study investigates a parametric analysis of Isobutanol–Water separation using a configuration that combines distillation columns with liquid–liquid decanters. Simulations were carried out with the Aspen Plus software, allowing the evaluation of different operating conditions and process architectures. The results indicate that a configuration consisting of a ten-stage distillation column coupled with a decanter operating at 80 °C provides a satisfactory compromise between product purity and energy consumption. Moreover, the assessment of more complex configurations demonstrated that increasing the degree of coupling significantly enhances overall performance, with an Isobutanol recovery rate reaching 94.58% in the case of a double-coupled process. These findings highlight the potential of distillation–decantation coupling as an efficient and adaptable solution to industrial requirements, supporting energy transition and sustainable development objectives.

Key words: Biofuel purification, Isobutanol recovery, Azeotropic separation, Energy efficiency.

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Optimization of the Electrodeposition of a Zn-Mg-Al Alloy on E24 Steel

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Abstract:

Zn-Mg-Al alloys are attracting increasing interest for the corrosion protection of steels due to their excellent adhesion, corrosion resistance, and improved mechanical properties compared to pure zinc-based coatings. This work focuses on the study of the electrodeposition of such an alloy on mild steel. Initially, a formulation study was conducted to determine the optimal composition of the alloy. The optimal volumes of the metal solutions were obtained using a mixture design: VZn^{2+} = 46 mL, VMg^{2+} = 30 mL, and VAl^{3+} = 24 mL. Subsequently, the optimization of the operating conditions was carried out using a Box-Behnken design. The optimal conditions identified for achieving a high-performance coating are: a current density of 1.5 A/dm², a bath temperature of 20 °C, and no agitation. Under these conditions, a theoretical hardness of 691.26 HV was predicted, with an experimental value very close to 688.9 HV, thus confirming the reliability of the model. These results demonstrate the potential of the Zn-Mg-Al alloy as an innovative protective coating for industrial applications.

Key words: Optimization, electrodeposition, Zn-Mg-Al ternary alloy, experimental design.

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Synthesis and characterization of the Eutectic mixture of Celecoxib.

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Abstract:

Celecoxib, a selective cyclooxygenase-2 (COX-2) inhibitor, is a non-steroidal anti-inflammatory agent widely used to treat rheumatoid arthritis, osteoarthritis, and inflammation. In addition, celecoxib is known for its anticancer, analgesic, and antipyretic activity. However, despite its significant therapeutic effects, it falls into category II of the biopharmaceutical classification system, characterized by low solubility and high permeability, limiting its dissolution and affecting its bioavailability. To improve its physicochemical properties, such as solubility, dissolution rate, and, consequently, bioavailability, several strategies have been explored, such as co-crystallization, micro- and nanoparticles formation, salt formation, inclusion complex formation, and eutectic mixtures, which are the subject of this work. Therefore, this study aims to synthesize the eutectic mixture of celecoxib/maleic acid using the solvent-assisted grinding technique. To determine the coordinates of this eutectic mixture, we prepared binary celecoxib/maleic acid mixtures in a range of celecoxib mole fractions from 0.1 to 0.9. The mixtures obtained were analyzed by differential scanning calorimetry. The thermograms obtained enabled us to plot the binary

liquid-solid equilibrium diagram, characterized by a single eutectic with a mole fraction of 0.3 and a temperature of 111°C. The solid phase of the eutectic mixture was characterized by SEM, PXRD and FTIR. The results obtained are in agreement with those of the calorimetric thermal analysis.

Keywords*: : Celecoxib; Liquid-solid equilibrium; Co-crystallization; Differential scanning calorimetry; XRD.*

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From Experimental Complexity to Modeling: The Role of Design- Expert in The Adsorption of Emerging Micropollutants

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Abstract:

The adsorption of emerging pharmaceutical micropollutants represents a major challenge in water treatment. In this study, three model compounds (paracetamol, amoxicillin, and diclofenac) were selected to evaluate the performance of activated carbon. To translate experimental complexity into a robust predictive model, a Response Surface Methodology (RSM) based on a Central Composite Design (CCD) was applied using *Design-Expert 7.0*. A total of 30 experimental runs, including six replicates at the central point, were conducted to investigate the influence of four key factors: solution pH, pollutant concentration, contact time, and activated carbon dose. The results demonstrated that a second-order polynomial model accurately describes both the individual effects and the interactions among these variables. This statistical approach highlights the relevance of *Design-Expert* as an optimization tool to enhance adsorption efficiency and to support the development of advanced water treatment processes.

Key words: Adsorption, Design-Expert, Response Surface Methodology, Micropollutants.

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Enhancing of CdS/ Sb_2Se_3 hetro-junction with Cu_2O as BSF

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Abstract:

Antmony selenide (Sb_2Se_3) is a semiconductor compound that gained a lot of interest this few years as a potential absorber for thin films photovoltaic. This material exhibits several advantageous characteristics, including its non-toxicity, abundance, and low cost. Additionally, it has a favorable band gap (1.1-1 .3 eV) and a high absorption coefficient (>10^4 cm^{-1})[1-2]. Despite notable developments over the past decade, Sb_2Se_3-based thin film solar cells need improvements; several experimental and computational research work have been done in order to optimize their photovoltaic parameters[3-4]. Adding a back surface field layer enhances the Sb_2Se_3 based solar cells [5-6]

In the present work, a ZnO/CdS/ Sb_2Se_3/Cu_2O structure is numerically analyzed, using the one-dimensional SCAPS-1D simulator. We evaluate the effect of Cu_2O parameters (thickness and doping concentration) as back surface field on electrical solar cell's parameters, such as open circuit voltage (Voc), short circuit density (Jsc), fill factor (FF), and

power conversion (PCE). The optimal thickness of the absorber layer is also studied. The results show that the conversion efficiency is enhanced for a thin Cu_2O and Sb_2Se layers of 10 nm and 700 nm respectively. A maximum conversion efficiency of about 26% is achieved

Key words: Solar cell, efficiency, Sb_2Se, Cu_2O

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Investigating the effect of using clay in construction on the thermal loads of desert houses

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Abstract:

This article analyzes the impact of building materials used in the Adrar region on buildings' thermal loads. The study focuses on a housing unit for university professors with an area of 90 m^3. The thermal loads of the building were calculated according to the ASHRAE method, considering the dimensions of the building and the characteristics of the wall and roof materials, as well as the changes in outdoor temperature, on the hottest day for cooling loads and the coldest day for heating loads. The results obtained showed that the roof thermal loads represent 45% of the total cooling needs and 48% of the total heating needs and using clay instead of the air gap in the walls reduced the cooling heat load by 43% and the heating heat load by 32%. In addition, the introduction of clay material in the components of the roofs reduces the thermal loads for cooling by 38% and the thermal loads for heating by 31%.

Key words: Building materials, cooling loads, heating loads, ASHRAE method, Adrar region.

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Simulation-based analysis of tool dimensions impact on heat generation during the butt-joint friction stir welding (FSW)

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Abstract:

The welding tool in Friction Stir Welding (FSW) is a key element responsible for generating frictional heat, softening the material, mixing it to form a solid-state joint without filler metal, and consolidating the weld under pressure. It typically consists of two parts: the shoulder and the pin (or probe). Tool design and material are adapted to the application and the workpiece, making proper selection essential for weld quality and tool life. The shoulder, usually flat or concave, contacts the surface to generate heat, contain the plasticized material, and apply downward force for consolidation, while the pin, which penetrates the workpiece, stirs and mixes the material to create the bond. Its geometry (length, shape, profile) varies with material thickness and joint design, with options such as cylindrical, conical, polygonal, or threaded forms. Pin design strongly influences the joint's microstructure and mechanical properties.

This study examines the influence of shoulder diameter, pin diameter, and pin height on heat generation in AZ31B magnesium alloys using an SS304 tool. Finite Element Method (FEM) simulations performed in ALTAIR software aim to clarify parameter interactions and optimize FSW conditions for improved weld quality.

Key words: Friction Stir Welding, Tool dimensions, Heat generation, Numerical study and magnesium alloys.

Graphical abstract

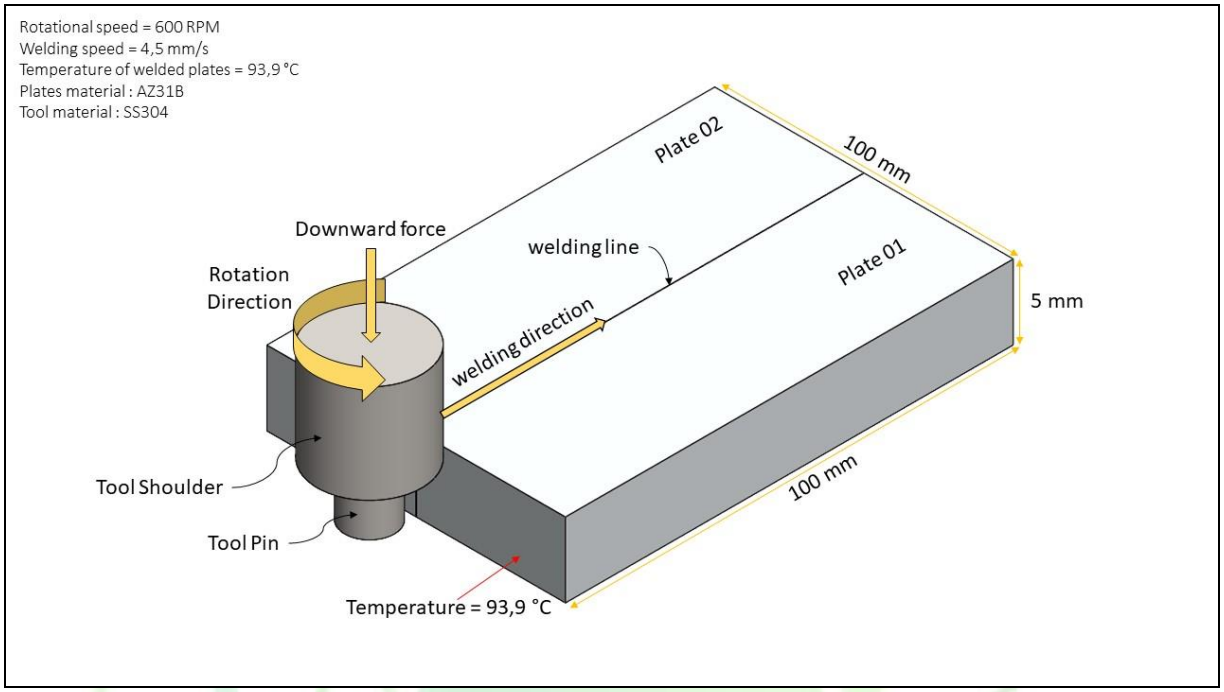
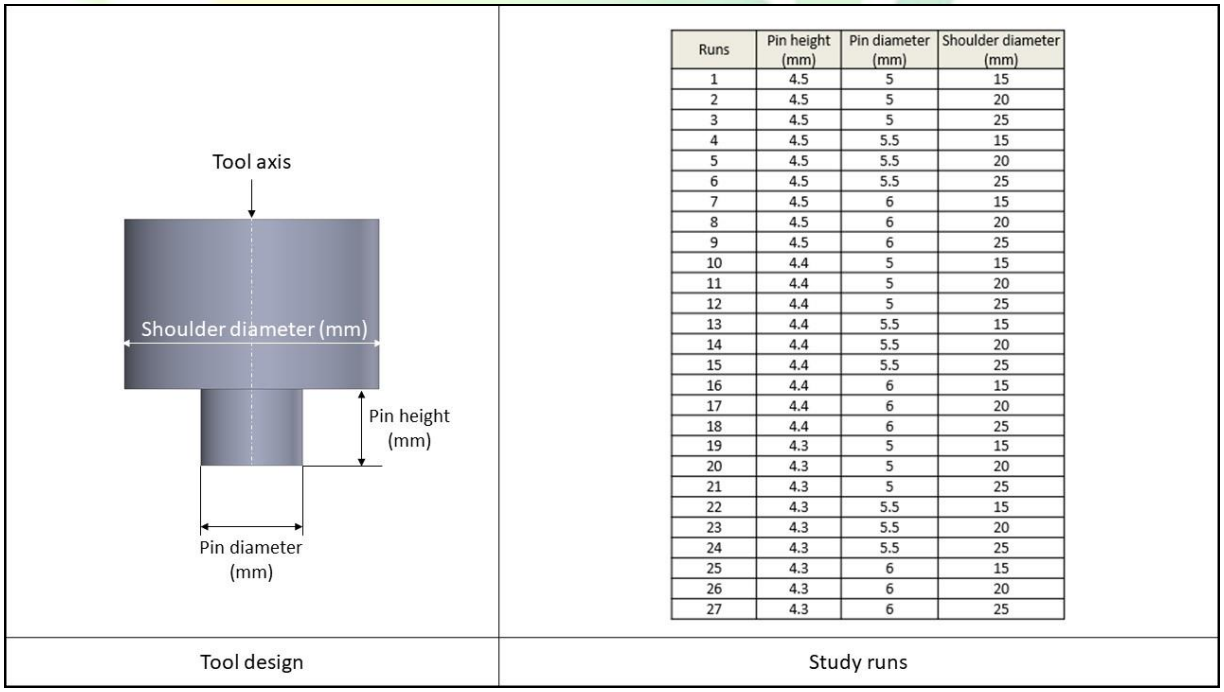


Figure 1 : FSW process with the applied parameters during the study.



Runs	Pin height (mm)	Pin diameter (mm)	Shoulder diameter (mm)
1	4.5	5	15
2	4.5	5	20
3	4.5	5	25
4	4.5	5.5	15
5	4.5	5.5	20
6	4.5	5.5	25
7	4.5	6	15
8	4.5	6	20
9	4.5	6	25
10	4.4	5	15
11	4.4	5	20
12	4.4	5	25
13	4.4	5.5	15
14	4.4	5.5	20
15	4.4	5.5	25
16	4.4	6	15
17	4.4	6	20
18	4.4	6	25
19	4.3	5	15
20	4.3	5	20
21	4.3	5	25
22	4.3	5.5	15
23	4.3	5.5	20
24	4.3	5.5	25
25	4.3	6	15
26	4.3	6	20
27	4.3	6	25

Tool design | Study runs

Figure 2 : Tool design and configurations used in the study.

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Removal of Non-Steroidal Anti-Inflammatory Drugs from Water Using Chitosan–Montmorillonite Beads

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Abstract:

The adsorption performance of chitosan–montmorillonite (CH–MMT) beads was investigated for the removal of acetylsalicylic acid (ASA) from aqueous solutions. The beads were produced via a straightforward gelation method and analysed using FTIR, XRD, and laser granulometry, confirming successful composite formation and an average particle size of 756 µm. Batch experiments were conducted under optimized conditions ([ASA] = 100 ppm, pH = 3, T = 25 °C). The composite beads exhibited a high adsorption capacity of 18.76 mg/g, which agreed well with the theoretical value (21.33 mg/g). Kinetic analysis showed that the process followed a pseudo-second-order model (R^2 = 0.99728), suggesting chemisorption as the controlling mechanism. The enhanced adsorption efficiency is attributed to the synergistic effect between the layered structure of montmorillonite and the active amine and hydroxyl groups of

chitosan, which provide abundant adsorption sites. These results demonstrate that CH–MMT beads are promising, eco-friendly, and low-cost materials for removing pharmaceutical pollutants from wastewater.

Key words: Adsorption; Acetylsalicylic acid; Chitosan–Montmorillonite; Pharmaceutical pollutants; Kinetics

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Assay of phenolic compounds and determination of antioxidant activity of methanolic extracts of Periploca Laevigata from the Bechar region

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Abstract:
In this work, we were interested in the study of phenolic compounds and antioxidant activities of *Periploca Laevigata* from the Bechar region. The first part of this study concerns the quantification of total polyphenols, flavonoids and condensed tannins by the Folin-Ciocaleu reagent, by aluminum trichloride and by the vanillin test respectively. The second part is the study of the antioxidant activities of methanolic extract of this plant using the DPPH radical scavenging test.

Key words: *Periploca Laevigata,* activité antioxydante, polyphénols, DPPH,

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Enhancement of PHBV Biocomposites Using Chemical Treatments Spanish Broom Fibres

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Abstract:

Several researchers have investigated various types of natural fibre for use as possible reinforcements in polymer composites. However, there are also some drawbacks to consider, including their hydrophilic nature with hydrophobic polymeric matrix. In order to overcome these problems and improve the compatibility between natural fibres and polymer matrix, a range of surface modification processes are employed, including alkali treatment, silane treatment and acetylation... etc. In this study, a novel biocomposite was developed, utilising poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) as a matrix, with the addition of both untreated and treated Spanish broom fibres (SBF) for reinforcement. The aim of this study is to determine the impact of different chemical treatments on Spanish broom fibres, and their effect on the chemical structure, water absorption, thermal and mechanical properties of biocomposites. The findings demonstrated thermal stability and enhancement of the biocomposite's mechanical properties with treated fibres.

Key words: PHBV, Biocomposites, Chemical treatments, Natural fibre

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Structure, Microstructure, Morphology and Magnetic Properties of Nanostructured Fe – (Ni, Cu, S) Powders Synthesized by mechanical alloying Process

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Abstract:

Fe – (Ni, Cu, S) nanocrystalline powders were synthesized by mechanical alloying (MA) for various periods, in order to investigate the evolution of their structural, morphological and magnetic properties as a function of milling time. A comprehensive characterization of the synthesized powders was performed using scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction (XRD) with Rietveld refinement and Mössbauer spectroscopy (MS). SEM analysis revealed significant morphological evolution, transitioning from coarse, irregular particles to near-spherical agglomerates with increasing milling time. In the case of $Fe_{50}Ni_{50}$ alloys X-ray diffraction and Mössbauer spectroscopy proved that during mechanical alloying process the Fe-Ni solid solution with FCC lattice was formed. XRD phase analysis results revealed that the $Fe_{50}Cu_{50}$ alloys was formed with a

single FCC phase and for a FeS_2 (pyrite) typically adopts a cubic crystal structure. The average crystallite size can be estimated from XRD data using the Scherrer equation, often ranging from a few nanometers to tens of nanometers. The synthesized $Fe_{50}Cu_{50}$ alloys exhibited ferromagnetic properties at room temperature with a high saturation magnetization and higher coercivity as compared to the other alloy compositions. The magnetic properties of $Fe_{50}Ni_{50}$ alloys were investigated by using vibrating sample magnetometer at room temperature. The effect of milling time on saturation magnetization (*Ms*) and the coercivity (*Hc*) of all the samples are discussed.

Key words: Nanostructure, Mechanical Alloying, X-ray diffraction, Soft Magnetic Character

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Activated Biochar in Cementitious Materials: Chromium Removal and Mechanical Property Enhancement

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Abstract:

This study investigates the dual-purpose application of activated coconut shell biochar: the removal of trivalent chromium (Cr(III)) from water and the enhancement of cement-based construction materials. Chromium, particularly from the leather tanning industry, is a toxic heavy metal that poses serious environmental and health hazards. The activated biochar used in this work exhibits an excellent surface area (850 m^2/g) and iodine value of 800 mg/g, which indicates good adsorption capacity. The biochar effectively adsorbs Cr(III) from water solutions, indicating the potential it has as a cheap, environment-friendly material for water treatment. In addition, upon incorporation into cement mortar mixes, the biochar improved its mechanical properties with a compressive strength of 53.3 MPa after 28 days, above the 51.6 MPa obtained in control samples with no biochar addition. Characterization techniques such as Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM/EDS) confirmed that the biochar chemically interacts with cement hydration products, greatly enhancing the formation of calcium silicate hydrate (C-S-H), which is vital for structural durability. The findings demonstrate the value of biochar as a multifunctional material beneficial not only in environmental remediation but also in infrastructure construction. Future research needs to investigate the long-term stability, scalability, and economy of the use of biochar in real-life applications.

Key words: trivalent chromium, activated biochar, cementitious materials, strengths

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Valorisation of xylan from Algerian eucalyptus

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Abstract:

The main objective of this work is to evaluate the efficiency of extracting methylglucuronoxylans (xylans) from Eucalyptus, with a focus on producing fractions of optimal molecular mass and high yield suitable for applications in coatings and packaging films. Achieving this balance represents a major challenge for the extraction processes, which are prone to thermal and chemical degradation. A factorial set of experiments was carried out at three temperatures and five extraction times in order to optimize conditions. The weight-average molar masses (Mw) were determined by high-performance size exclusion chromatography (HP-SEC). Carbohydrate composition was assessed by GC, and free monomers were additionally identified by GC. Lignin content in the water extracts was determined spectrophotometrically (UV), and acetic acid was quantified using HPLC. The influence of extraction time and temperature on yield, purity, and molecular weight distribution was systematically investigated.

Key words: HPLC, extraction, Mw, TDS, Xylans

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Chemical Composition, Metabolic Disruption, and Toxicity of *Ruta* Essential Oil Mixtures Against a Mosquito Vector

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Abstract:

The exploration of plant-based bioinsecticides has opened new avenues for combating mosquito vectors in an environmentally responsible way. Rather than relying on single-plant extracts, combining essential oils from different botanical sources may generate enhanced bioactivity through synergistic interactions. In this context, the present study investigated the larvicidal potential of binary mixtures of *Ruta graveolens* and *Ruta montana* essential oils against *Culiseta longiareolata*. Three mixture ratios were tested, and the results revealed that the 1:1 (50:50) blend exhibited the highest larvicidal potency compared with the other proportions and with the single oils. Gas chromatography–mass spectrometry (GC–MS) analysis confirmed distinct chemical fingerprints in each oil and identified ten compounds in the optimized 1:1 mixture. Beyond mortality, biochemical assays demonstrated that larvae exposed to the oils experienced profound metabolic stress. Catalase (CAT) and glutathione S-transferase (GST) activities were significantly elevated, reflecting oxidative stress responses, while major biochemical reserves, including proteins, lipids, and carbohydrates, were markedly reduced. The 1:1 *Ruta* essential oil blend showed the strongest larvicidal activity,

triggering oxidative stress and depleting key energy reserves. This multi-target action underscores its potential as an eco-friendly alternative to conventional insecticides for sustainable mosquito control.

Key words: *Ruta* essential oils, GC-MS , Larvicidal activity, Metabolic disruption.

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High-Fidelity Simulation and Smart Optimization of Next-Generation Silicon PV Devices

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Abstract:

This work introduces a refined physical modeling approach for next-generation silicon photovoltaic (PV) devices using the two-diode model. The framework accurately describes carrier recombination and diffusion phenomena in monocrystalline silicon cells, surpassing the limitations of classical single-diode formulations. Temperature and irradiance dependencies are explicitly integrated to assess intrinsic parameters such as saturation currents, ideality factors, and resistances. A complementary optimization stage employing intelligent algorithms refines parameter extraction and aligns simulated results with experimental trends. The findings confirm the strong interplay between physical parameters and electrical performance, underscoring the relevance of dual-diode modeling for precise PV characterization and the design of efficient next-generation solar devices.

Key words: Photovoltaic cell, Two-diode model, Silicon, Physical modeling, Electrical characterization, Temperature effect, Intelligent algorithms

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Valorization of Shrimp By-products into Biopolymers: A Step Toward Sustainable Marine Resource Management

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Abstract:

Fisheries and seafood processing industries generate large amounts of by-products (heads, shells, viscera) each year, which are often underutilized or discarded, leading to marine pollution and the waste of valuable biological resources. In the context of protecting and sustainably developing natural resources, the valorization of these by-products represents a promising pathway for the blue bioeconomy.

This study focuses on the extraction of chitin and its derivative, chitosan, from shrimp by-products. A total of 160 g of shrimp residues was subjected to successive chemical treatments involving demineralization, deproteinization, and deacetylation. The process yielded 32.7 g of chitosan, corresponding to an overall yield of 20.4%.

These results highlight the potential of shrimp by-products as a renewable source of high-value biopolymers, contributing to waste reduction and the sustainable management of marine resources.

Key words: chitin, chitosan, shrimp by-products, valorization, marine resources

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Synthesis and application of a new composite heterojunction supported on modified clay in the photodegradation of cefazolin under visible light irradiation.

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Abstract :

The pharmaceutical industry produces substantial volumes of wastewater containing a diverse array of contaminants, including antibiotics, anti-inflammatory drugs, and antihistamines. This study investigates the synthesis of a new composite heterojunction supported on modified clay and its application in the photocatalytic degradation of pharmaceutical compounds under visible light irradiation. The synthesized materials were prepared using three sources of metals with different molar percentages (10, 20, 30%) (B_$M_{10\%}$_Y_clay, B_$M_{20\%}$_Y_clay, and B_$M_{30\%}$_Y_clay). Among these, B_$M_{20\%}$_Y_clay exhibited the highest photocatalytic activity and was subsequently calcined at different temperatures (NC, 500, 550, and 600°C) for two hours. The optimal photocatalytic performance was observed with B_$M_{20\%}$_Y_clay un-calcined, achieving complete degradation of cefazolin under visible light. A photodegradation rate of 90.70 % was attained for a 10 mg/L cefazolin solution after 165 minutes of irradiation.

Key words: Composite, heterojunction, photo degradation, Cefazolin, Pharmaceutical Product, Clay.

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Hypolipidemic and hypoglycemic effects of the Magnesium supplementation in rats with Type 2 Diabetes

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Abstract:

The objective of this study was to explore the hypolipemic and anti-inflammatory effects of magnesium supplementation in Wistar rats with type 2 diabetes. Diabetes is induced by the ingestion of a high-calorie (HL) diet, followed by a low-dose injection of streptozotocin (STZ).

The T2D rats were divided into two groups, each consuming the HL diet supplemented with magnesium (DT2-Mg) at a dose of 50 mg/kg rat/day or unsupplemented (DT2).

After one month of experimentation, a significant decrease in body weight (-10%), blood glucose (42%). The enzymatic activities of aspartate aminotransferase (-37%) and alanine aminotransferase (-33%), total lipids and triacylglycerols (TG) of liver (-18%, -35%), and serum lipids (-50%), total cholesterol (-58%), unesterified cholesterol (-56%) and cholesteryl esters (-38%) was noted in DT2-Mg group compared to DT2. Mg also reduces blood glucose (1.3-fold), HbA1c (2-fold) as well as CRP, albumin and lactate dehydrogenase (LDH) activity (-220%, -18%, -18 %). In contrast, the cholesterol content of anti-atherogenic lipoproteins,

the activity of lecithin: cholesterol acyltransferase and the antioxidant capacity (CAox) were high (+36%; +42%; +10%).

Key words: Magnesium, DT2, Rats, Cholesterol, Lipids

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Optimization of Rodhamine B Removal from Aqueous Solution by Green Emulsion Liquid Membrane Prepared by Clove oil

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Abstract:

This study focuses on the treatment of an aqueous solution containing Rhodamine B (Rh-B) using a green emulsified liquid membrane (GELM). The membrane system is composed of Span80 as a surfactant, vinegar as the internal phase, and clove oil as the diluent. To identify the most influential factors affecting extraction efficiency, a Plackett-Burman screening design was first employed. Subsequently, a Box-Behnken experimental design was applied to optimize the operating conditions.

The optimization targeted three key variables: the mass percentage of Span80, the concentration of the internal phase, and the volume ratio between the external phase and the membrane (V_{ext}/V_{em}), while keeping all other parameters constant.

Under optimal conditions: 34.45% Span80 by mass, 0.1 M internal phase concentration, and a V_{ext}/V_{em} ratio of 10 an extraction yield of 96.18% was achieved.

Keywords: Optimization, Plackett–Burman design, Box–Behnken design, green emulsified liquid membrane.

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Title: Study of the Antioxidant and Aromatic Properties of Pomegranate Bark and Lemon Zest in Infusion

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Abstract:

The pomegranate is a fruit native to Persia, whose Latin name means "apple with many seeds." This fruit, about the size of an apple, has a thin skin lined with a white membrane that divides it into several cells, each containing numerous seeds encased in juicy pulp. When ripe, the skin of the most popular varieties is pink to dark red. The pomegranate is well-suited to the hot, dry climate of the Southwest and contains a wide range of bioactive substances.

The aim of our study is to evaluate the effect of a tea made from pomegranate bark, as well as its organoleptic impact.

To achieve this objective, we assessed the pH and moisture content of the tea. Additionally, we conducted a sensory evaluation with 30 participants. We also performed sensory tests (triangular test and sensory profiling) to determine the level of acceptance of the tea among participants, as well as the average satisfaction of the samples.

According to our results:

- The tea has a pH of 5.2 and a moisture content of 20%.

- The sensory evaluation revealed that the infusion was largely well-received by participants, with an acceptance rate of 80% for its appearance, 76% for its aroma, 72% for its taste, 78% for the overall impression, and 70% regarding the intention to consume it in the future.
- During the triangular test, 60% of participants successfully identified the distinguishing sample, highlighting notable differences among the samples.
- According to the sensory profile, Sample A received the highest ratings in terms of aroma, taste, flavor, and texture compared to Samples B and C.
- The hedonic analysis showed that Sample A is the most favored, with an average rating of 8.5 out of 9, while Sample B received 6.2 and Sample C 5.8.

Conclusion

Our results indicate that the tea prepared from pomegranate bark, lemon zest, and mint shows promising effectiveness against overweight and obesity. Furthermore, this infusion was particularly appreciated by participants, highlighting its commercial potential.

Key words: Herbal tea – Pomegranate peel – Lemon zest – Sensory analysis – Hedonic profile – Obesity – Antioxydant activity – Acceptability.

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Isolement, Activité Antimicrobienne et Identification Moléculaire des Actinobactéries du Genre *Streptomyces*

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Abstract:

Compte tenu de la résistance croissante des pathogènes aux antibiotiques conventionnels, la recherche de nouvelles molécules antimicrobiennes s'est intensifiée. Dans ce contexte, quarante-cinq (45) isolats d'actinobactéries ont été obtenus à partir de cinq échantillons de sol collectés dans différentes régions d'Algérie. L'activité antibactérienne de ces isolats a été évaluée par la méthode du cylindre sur agar contre deux bactéries à Gram positif (Micrococcus lutteuse ; S .aureus) et quatre bactéries à Gram négatif(Pseudomonas aeruginosa , Escherichia coli Klebsiella pneumoniae ,et Yersinia enterocolitica). Les résultats ont révélé que 20 souches présentaient une activité contre au moins une des bactéries testées. Parmi celles-ci, 15 souches montrant une forte activité antibactérienne ont été sélectionnées pour une identification moléculaire. Cette identification, basée sur l'analyse de la séquence de l'ARNr 16S, a révélé que ces isolats appartiennent au genre Streptomyces, reconnu pour sa capacité à produire des antibiotiques naturels, des pesticides, des herbicides

et des immunosuppresseurs. Cette étude met en évidence la richesse du sol algérien en métabolites secondaires à fort potentiel.

Key words: .. Isolement, Algérie, Actinomycètes, Antimicrobien, résistance ; l'ARNr 16S .

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Prescribed Performance Network Control for Fractional-Order Nonlinear chaotic Systems

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Abstract:

This paper proposes a novel control strategy for fractional-order nonlinear systems, integrating Neural Networks (NNs) to approximate unknown nonlinear functions within the control framework. An innovative neural network-based adaptive control approach is specifically designed for fractional-order chaotic systems. The core concept involves transforming the original constrained system into an equivalent form using a carefully defined output error transformation, which enables adaptive compensation for system uncertainties. A fractional-order controller is subsequently developed to ensure precise trajectory tracking while maintaining adherence to predefined performance specifications. The effectiveness and robustness of the proposed methodology are validated through comprehensive simulation studies.

Key words: prescribed performance, Adaptive Control, Lyapunov stability, fractional order.

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Etude expérimentale des nanoparticules Au/CeO2 et Ag/CeO2

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Abstract:

This work studies the gold and silver anchored on Ceria oxides, in the aim to observe Their antibacterial action tested against Escherichia coli (E.coli), Staphylococcus aureus (S. aureus), Bacillus spizizenii and pseudomonas. The assay results have shown that the nanoparticles has an activity against these bacteria.

The radiolysis is one of the most effective methods for the metal reduction, giving the possibility of synthesis of aggregates of atoms. It is a powerful process making it possible to control the size of the particles, their localization on the surface or in the bulk. This study work studies silver and gold catalysts supported on cerium oxide synthesized by radiolytic method. In a first stage, the conditions of fixing of the metal precursor on cerium oxide are optimized. In a second stage, the samples are irradiated or calcined at various temperatures (T=250, 350, 500°C).

Several experimental techniques are used for the characterization of the samples at the various stages of their elaboration (MEB, DRX, FTIR, and U Visible). A change of morphology of the oxide cerium grains was observed by Scanning Electron Microscope. The

X-rays diffraction made it possible to evidence the formations of 7 nm sized Au-Ce in the case of $AuCeO_2$

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Biodegradable PLA-diss fiber Composite material processed via Powder Technology

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Abstract:

A composite material with a PLA matrix and diss fiber reinforcement was developed using powder metallurgy techniques. PLA, previously converted into powder, was mixed with 10% diss fibers and compacted under a pressure of 10 MPa at 180 °C for 5 minutes. Microstructural characterizations performed by SEM coupled with EDS revealed that the PLA particles exhibit irregular shapes with micrometer-scale dimensions, while the diss fibers show the presence of trichomes on their surface.

After processing, the diss fibers were well embedded within the PLA matrix, forming a continuous interfacial network. FTIR analyses indicated the presence of new chemical groups, suggesting a good chemical interaction between the PLA macromolecules and those of the diss fibers.

Tensile tests highlighted the good mechanical properties of the developed composites: the Young's modulus can reach up to 3.4 GPa for the PLA–diss fiber composite. SEM–EDS observations also revealed appreciable amounts of silicon within the diss fibers, which is believed to contribute to the good mechanical strength of these reinforcements.

Key words: diss fiber, PLA polymer, SEM-DXS, FTIR

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Prediction of optoelectronic properties for $Be_{0.750}Cd_{0.250}Se$ ternary alloy with (TB-m BJ) approach for photovoltaic applications

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Abstract:

The reliability and long-term performance of photovoltaic (PV) modules are critical for ensuring the sustainability and cost-effectiveness of solar energy, particularly in harsh environments such as the Algerian Sahara. This study focuses on the experimental assessment of the degradation of two types of crystalline silicon PV modules UDTS-50 and PHOTOWATT PWX 500 after 25 years of exposure to extreme desert conditions at the Research Unit for Renewable Energies in the Saharan Medium (URER-MS), Adrar. Current–voltage (I–V) measurements were conducted to evaluate the extent of electrical performance degradation. After 25 years of continuous operation, UDTS-50 modules exhibited up to 13% power loss, while PWX 500 modules exhibited up to 10% loss compared to their initial performance. Both types showed visible defects such as cracked cells, encapsulant yellowing, delamination, and other physical deterioration. The degradation mechanisms are primarily driven by environmental stressors such as high irradiance, temperature fluctuations, sand abrasion, and prolonged UV exposure. The study highlights the importance of identifying failure modes and degradation pathways to improve the design and durability of PV systems in desert climates. These findings contribute to the development of more reliable solar

installations and maintenance strategies aimed at extending system lifetimes and reducing the levelized cost of electricity (LCOE) in arid regions.

Keywords: Photovoltaic modules; Performance evaluation; Power losses; Degradation and failure modes; Reliability; Desert climate

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Removal of Cationic Malachite Green with Adsorption on Agricultural Waste.

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Abstract:

Removal of the cationic malachite green (CMG) dye by adsorption onto bio-waste (BW) was studied. The (BW) has an acidic character, with a pH _PZC of 4.44. A series of experiments was conducted to evaluate the adsorptive capacity of the BW. Parameters such as the amount of adsorbent, contact time, concentration, pH, temperature, and ionic strength were examined. The overall results show that the maximum adsorption capacity is 18.48 mg/g under the following conditions: contact time t_C = 40 minutes, T = 293 K, natural pH of the CMG solution, and agitation speed of 50 rpm. The kinetics of MG adsorption on BW are well described by the second-order model. The Langmuir and the Freundlich models satisfactorily explain the adsorption isotherm of the BW/CMG system. Thermodynamic studies indicate that the adsorption of CMG dye onto BW is a physical, spontaneous, and endothermic process.

Key words: Bio-Waste, Cationic Malachite Green, Adsorption.

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Development and study of the electrochemical properties of nanocomposite metal oxide-based for energy storage application

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Abstract:

$LiNiVO_4$ (LNVO) is a high-voltage lithium intercalation compound with an inverse spinel structure, space group $Fd\bar{3}m$, a lattice parameter a = 8.2150 Å, and an average crystallite size of 41 nm. This material was synthesized at temperatures below 500°C using the aqueous citric acid combustion method. The phase purity of the synthesized product was confirmed by X-ray diffraction. Scanning electron microscopy (SEM) characterization showed that the synthesized particles are porous and visible under different magnifications, with pore diameters ranging from 0.025 to 1.4 µm. Fourier-transform infrared spectroscopy (FTIR) revealed characteristic metal–oxygen bond bands specific to the VO_4^{3-} and NiO groups. X-ray photoelectron spectroscopy (XPS) confirmed the oxidation states of the present elements (Ni^{2+}/Ni^{3+} and V^{5+}), highlighting the possible coexistence of multiple nickel oxidation states—a key factor in the redox mechanisms in batteries. Thermogravimetric analysis (TGA) was used to study the thermal stability of the material and to ensure the complete elimination of organic residues and carbonates resulting from the synthesis. The electrochemical

performance of the material was tested using coin-type Li/LNVO cells. Performances evaluation was conducted in two types of three-electrode cells and in a Swagelok-type battery system. The electrochemical studies (CV, GCD, and EIS) confirmed that the developed materials exhibited promising structural and electrochemical properties for long-term lithium-ion battery applications. However, the discharge capacity of LNVO remains relatively low, which may be attributed to structural limitations and poor lithium-ion diffusion. These limitations result in insufficient performance for practical applications. Further research is needed to optimize synthesis parameters, improve the materials morphology, and enhance its electrochemical properties.

Keywords: $LiNiVO_4$, Cathode, Li-Ion batteries, Electrochemical performance of lithium storage.

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Structural, Elastic, Electronic, and Magnetic investigations of Full-Heusler Compound Fe_2OsIn: FP-LAPW Method

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Abstract:

In this work we undertook a study on the structural, elastic, electronic, magnetic and thermodynamic properties of full – Heusler alloy Fe_2OsIn by using the first principles calculations. E have used: the generalized gradient approximation Perdew, Burke and Ernzerhof GGA-PBE for electron exchange and correlation. We could observe that the full-Heusler Fe_2OsIn compound exist in Cu_2MnAl-type structure and that its mechanical stability is verified at zero temperature and pressure. The electronic structure calculations show that this being metallic ferrimagnets in nature.

Key words: : Full-Heusler alloy; DFT, magnetic properties

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Natural bond orbitals and molecular electrostatic potential analysis of heteropolyoxoniobates

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Abstract:

Polyoxoniobates (PONbs), a class of polyoxometalates composed of niobium and oxygen atoms, have gained significant attention in recent years due to their intriguing structural diversity and versatile applications in catalysis, materials science and medicine.

In order to get clear insight on how molecular structure can influence the reactivity of these compounds, theoretical study on four distinct heteropolyoxoniobates, namely P_2Nb_4, As_2Nb_4, P_4Nb_6, $P_2Se_2Nb_6$, comprising the same addenda niobium atom and different heteroatoms (Se, P, As) is carried out using Density Functional Theory (DFT) :

Natural Bond Orbital (NBO) analysis is an efficient method for interactions among bonds. It is performed to describe the charge transfer in molecular systems.

Molecular Electrostatic Potential (MEP) can be used to to find what region of molecule is electron rich or poor to have an interpretation what side of molecule is apt for nucleophilic or electrophilic attack.

Key words: Polyoxoniobates, DFT, NBO, MEP.

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Wastewater Treatment and Agricultural Reuse: Examining the Process, Benefits, and Potential Problems

Rachid OUHIB, Samira BELKHOUANE, Zahira Amel BOUYAKOUB, Lynda-Amel Chaabane, Djamila HARRACHE.

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Abstract:

Given the scarcity of water in Algeria, any further investment aimed at capturing and making water accessible to various economic sectors is warranted, taking into consideration its quality and potential application. Reclaiming wastewater after treatment is a key element of the nation's plan to increase and enhance its water resources. The primary goal is to explore the viability of wastewater reuse, while also assessing the environmental and public health consequences of irrigation using treated wastewater from diverse treatment facilities.

Keywords :

Irrigation, wastewater, agriculture, economy, impact environment and society.

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investigates CZTS-based materials and their related structures for use in solar energy applications.

Samira BELKHOUANE, Rachid OUHIB, Zahira Amel BOUYAKOUB, Djamila HARRACHE, Lynda-Amel Chaabane.

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Abstract:

Zirconium-based alloys are promising materials for use as absorber layers in solar cells. Our research focused on identifying, understanding, and addressing key challenges that limit the photovoltaic performance of CZTS-based thin-film solar cells. We conducted a theoretical investigation into the structural, elastic, electronic, and magnetic properties of these materials. This study employed the full-potential linearized augmented plane wave (FP-LAPW) method within the framework of density functional theory (DFT), as implemented in the Wien2k code.

Keywords :

Photovoltaic cells, CZTS, Cu2ZnSnS4, and FP-LAPW.

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Design, optimization and management of renewable energy sources in a micro-grid

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Abstract:

This paper analyzes the possibility t0 devel0p the simple micro-grid model in optimizing the utilization of local renewable energy for on-grid area. The proposed micro-grid model integrates the power plants driven by renewable energy sources employing micr0 hydro (MHP) and photovoltaic system (PV) which is connected to grid system. This model is analyzed using HOMER and MATLAB software. Based on the load profiles and the availability of water resources, the H0MER simulates the proposed micro-grid model with three options of MHP capacity. The simulation results show that the micro-grid model with the largest capacity MHP produced the lowest energy cost, greatest reduction of $C0_2$ emission, and largest fraction of renewable energy. However, these result required the expensive initial capital cost. In addition, the PV power generation was always recommended with a minimum capacity. Hence, MATLAB results show the performances of the power plants with renewable energy sources were used maximally.

Key words: Micro-grid Micro Hydro Photovoltaic Cost of Energy Carbon Emission.

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Evaluation of minerals composition of two orange varieties (*Citrus Sinensis L and Citrus clementina*) by X-ray fluorescence (XRF) spectra

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Abstract:

Natural plant extracts contain different minerals compounds and biological activities. Our study compares extracts from two mandarin varieties, *(Citrus Sinensis)* and (*Citrus clementina*). We chose this farm to evaluate minerals by X-ray fluorescence (XRF) spectra allowed us to measure mineral elements through this analysis on samples of the peel of two citrus varieties. The elements detected in majority in the peels varieties include essential macro-elements (Ca, K, S, P), important trace elements (Fe, Zn), and rare metals (Rh, Pd). The intensity of the lines in the XRF spectra is associated with the energy intensity, meaning that the radiation is more intense for the higher lines.

According to the mineral analysis results, clementine flavedos contain a high amount of K+, while orange albedos contain a high amount of NA+, with a content of 3.5 mg/ml. In Citrus Clementina (C) the potassium (K) is substantially greater shows that the Clémentine type absorbs nutrients more effectively might encourages improved tolerance to drought and water

stress, could affect the fruit's texture and flavor. In TM, calcium (Ca) is more prevalent.contributes much to the peels' structural stability. May suggest improved post-harvest preservation and mechanical resistance. Offers citrus sinensis (T) peels more stiffness than citrus clementoena peels, possibly Influence of macro-elements on peel properties. The Potassium (K) is significantly higher in C Indicates more efficient nutrient absorption by the Clémentine variety. May promote better resistance to water stress and drought. Could influence the taste and texture of the fruit. The Calcium (Ca) is more abundant in TM plays a key role in the structural stab stability of the peelsn, May indicate better mechanical resistance and post-harvest preservation. In the light of the results, it appears that potassium and calcium is the predominant constituent in the chemical composition in the two citrus where both varieties are rich in these mineral elements.

Key words: Citrus, Varieties, chemical Composition, X-ray fluorescence (XRF) spectra

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Copper(II) coordination polymer: synthesis, structural characterization, and catalytic performance in 4-nitrophenol reduction

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Abstract:

The use of porous coordination polymers as catalyst supports has attracted considerable attention in heterogeneous catalysis. However, studies on the structure–activity relationship within such confined catalytic systems remain relatively scarce. In this context, the catalytic performance of a copper-based coordination polymer (Cu(II)-CP) was investigated. The polymer was synthesized at room temperature using malonic acid as the ligand and copper nitrate as the precursor, under normal atmospheric conditions with stirring. The coordination polymer was characterized by various physicochemical techniques. The catalytic performance of copper malonate was examined for the catalytic reduction of 4-nitrophenol (4-NP). The Cu(II)-CP exhibited significant catalytic activity, achieving a 4-nitrophenol reduction efficiency greater than 90% after 10 minutes. Furthermore, the possible catalytic mechanism of Cu(II)-CP was discussed based on reaction kinetics analysis.

Key words: Cu-CPs, Copper malonate, 4-Nitrophenol, Heterogeneous catalysis, Reduction.

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Morphological and Optical Optimization of Silicon Nanowire Arrays for Enhanced Photovoltaics

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Abstract:

Silicon nanowire (SiNW) arrays offer a compelling alternative for photovoltaic applications, primarily due to their ability to efficiently trap light across their length and significantly reduce the distance for electron collection. This study focuses on the fabrication of SiNW arrays via Metal-Assisted Chemical Etching (MACE), using silver (Ag) as a catalyst, and investigates the influence of etching time on the resultant SiNW morphology and optical reflection in the visible spectrum. SEM plan-view observations confirm the successful creation of highly aligned SiNW arrays perpendicular to the Si wafer surface. Critically, increasing the etching time leads to a decrease in SiNW density while simultaneously increasing the nanowire length. After a short etching time of 30 s, the SiNW length reached approximately 1.4 µm, resulting in a drastic reduction in light reflectance from 40% (for a polished wafer) to less than 10% across the 300 nm to 1000 nm range. Further increasing the etching time to 1 minute (reaching ≈3 µm in length) showed no significant further change in reflectivity. This saturation is attributed to the formation of SiNW bundles, which compromises uniformity and increases the presence of void spaces. Nevertheless, the sample with 3 µm achieved the highest degree of light trapping, owing to the balance between increased SiNW length and sufficiently dense distribution before severe bundling occurred.

Keywords: Silicon Nanowires (SiNW), MACE, Etching Time, Reflectance.

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Central Limit Theorems for Functional Index Models with Missing Data: Applications to Degradation of Materials

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Abstract:

This study develops central limit theorems (CLTs) for conditional estimators in the framework of single functional index models with missing at random (MAR) data. Such statistical settings are particularly relevant in industrial and materials science, where degradation experiments and lifetime studies often produce incomplete or censored datasets. We establish the asymptotic normality of conditional mode estimators under mild regularity assumptions, providing rigorous theoretical foundations for inference in high-dimensional and functional data contexts. The proposed framework offers robust tools for analyzing materials degradation processes, where missing observations and complex dependencies are frequent. Potential applications include predictive maintenance, industrial reliability analysis, and environmental risk assessment, emphasizing the impact of advanced probabilistic methods on engineering and applied sciences.

Keywords: Central Limit Theorem; Functional Index Models; Missing at Random; Conditional Mode; Materials Degradation; Reliability; Asymptotic Theory.

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DFT studies of the physical properties of perovskite hydride materials ABH3 (A = K, Li ; B = Ca)

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Abstract:

In recent years, Perovskite hydrides materialshave been extensively studied. This has been motivated by their possible applications for hydrogen storage devices .Motivated by the Perovskite hydridesmaterials and in the objective to enrich literature by new materials for hydrogen storage devices, we want to investigate the physical properties of ABH_3 (A = K, Li, Rb; B = Ca, Sr) compounds using the DFT calculations.

Key words: hydrogen storage devices; Perovskite hydrides; DFT; FP-LAPW.

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Geographical Conditioning and Traditional Hybrid Wall Systems: The Case of the Ziban Region, Algeria

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Abstract:

In arid and pre-Saharan regions, constructive traditions reflect a deep dialogue between environment and culture. The Ziban region of southeastern Algeria offers a remarkable case where builders developed hybrid wall combining earth, stone, and palm stipes.

these systems represent an adaptive response to vulnerability to floods and seismic activity. This study explores the relationship between geographical conditioning factors and the evolution of such hybrid walls, emphasizing their role as preventive strategies deeply embedded in local culture. Far from being obsolete, these vernacular systems suggest pathways for sustainable construction that remain relevant in contemporary architectural debates on resilience and ecological design.

Key words: hybrid walls, resilience, ziban region, geographical conditioning.

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Etude et réalisation d'une chambre de stérilisation à l'ozone des accessoires médicaux en milieu hospitalier

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Abstract:

This experimental study presents a novel sterilization method using gaseous ozone generated directly inside an aluminum enclosure, through ceramic plate-based ozone modules. The system reaches an ozone concentration of 1800 ppm within one minute. The sterilization protocol consists of two consecutive phases: a 5-minute ozonation step, followed by a 20-minute ozone destruction step using heating resistors, raising the internal temperature to approximately 60 °C.

The microbiological efficacy of the process was evaluated on resistant spore forms, specifically *Penicillium*, *Clostridium*, and *Bacillus* species. Prior to treatment, samples contained an average of 7 CFU (Colony Forming Units). After the complete sterilization cycle, no microbial growth was detected, indicating a sterilization efficiency greater than 99.99%. The thermal phase played a crucial role in ensuring complete ozone breakdown while enhancing microbial inactivation, particularly for resistant spores.

The results demonstrate that this high-concentration ozone technique, combined with controlled heating, offers a fast, effective, and residue-free alternative for the sterilization of

medical and surgical devices, including those contaminated with highly resistant microorganisms such as spores.

Keywords: Ozone sterilization, spores, medical devices, thermal inactivation, *Clostridium*, *Bacillus*, *Penicillium*

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Legal Protection of Water Resources from the Risks of Advanced Chemical Industries.

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Abstract:

Water resources are vital assets increasingly threatened by the rise of advanced chemical industries and their polluting waste. National and international laws aim to protect water through the principles of prevention and sustainable development, yet implementation still suffers from weak oversight and enforcement. There is a need to update legislation to include new chemical substances and strengthen coordination among relevant authorities. Promoting the use of clean technologies is also essential to ensure the sustainability of water resources for future generations

Keywords:

Legal protection – Water resources – Advanced chemical industries – Industrial pollution – Sustainable development

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Natural Alternatives to NSAIDs: Anti-Inflammatory Potential of Citrus Peel Extracts

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Abstract:

In comparison to diclofenac sodium, a common non-steroidal anti-inflammatory medicine (NSAID) . This study investigates the in vitro anti-inflammatory activity of methanolic extracts from two different Citrus varieties, compared to diclofenac sodium . The extracts were obtained from dried peels by macerating them in methanol. The anti-inflammatory activity was then evaluated using the albumin denaturation inhibition assay, which is a reliable method of assessing the stabilising effects of proteins under inflammatory conditions. Both extracts demonstrated significant concentration-dependent inhibition of protein denaturation. The first extract, obtained from Citrus reticulata, exhibited an IC_{50} value of 49.6 µg/mL, where as the second extract, obtained from Citrus limon, demonstrated slightly lower activity with an IC_{50} value of 58.3 µg/mL. By comparison, diclofenac sodium exhibited a stronger effect, with an IC_{50} value of 12.1 µg/mL. While less potent than the reference drug, both extracts displayed notable anti-inflammatory potential, likely due to the presence of

flavonoids and polyphenolic compounds, which are known for their biological activity. These findings support the potential use of Citrus peel extracts as natural alternatives or complementary agents in anti-inflammatory therapies. Further studies are underway to isolate active compounds and explore possible mechanisms of action.

Key words: Citrus peels , Anti-inflammatory activity , IC50 , Diclofenac comparison , Methanolic extracts

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Artificial Intelligence for Physics

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Abstract:

The integration of artificial intelligence (AI) is currently revolutionizing physics research, introducing new paradigms for analysis and experimentation. Starting with a consideration of the diversity of human intelligences and their function in the scientific method, this conference offers a cross-disciplinary perspective on AI in the service of physics.

A technical overview of machine learning (ML), deep learning (DL), and physics-informed neural networks (PINN) will be presented, demonstrating how these methods revolutionize the modeling, simulation, and investigation of intricate physics phenomena. While DL enables the capture of large-scale nonlinear relationships, PINN incorporates the fundamental laws of physics as explicit constraints, opening the door for significant advancements in the resolution of differential equations or inverse optimization, whereas ML primarily depends on the exploitation of experimental data. The presentation will also address the concept of Large Language Models (LLM) and prompt engineering techniques, which expand reasoning, explanation, and hypothesis generation capabilities from natural language. Finally, concrete examples from the theoretical physics laboratory will illustrate the real impact of these methods in physics, whether in weather forecasting, the search for HSE electronic bandgaps

or the optimization of interaction potentials in molecular dynamics. Thus, this presentation proposes a dialogue between cognitive diversity, advanced numerical methods, and new forms of intelligence.

Key words: Artificial Intelligence, Machine Learning, Deep Learning, Physics-Informed Neural Networks, Physical Prediction

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