The Third International Conference on Materials, Energy & Environment

(MEE'2025)

El Oued – Algeria

April 21-22, 2025

PROCEEDING ABSTRACT

M E E 3

El Oued – Algeria

MEE'2025

April 21-22, 2025

جامعة الشهيد حمه لخضر - الوادي TEL/+213-32-12-07-41/40 . Adresse/PO Box 789 EL-OUED - ALGERIE

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The Third International Conference on
Materials, Energy & Environment
(MEE'2025)
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PREFACE

The Third International Conference on Materials, Energy and Environment will be held at El Oued University on April 21-22, 2025. It goal is to bring together researchers, professors and industrialists concerned by technological and scientific advances in the Materials, Energy and Environment sciences. This first international edition is intended to be open to industrial concerns and the transfer of technology between universities and industries. This is why applied themes are programmed to better meet the needs of the industrial community.

TOPICS

TOPIC 1: ENERGY

- Renewable Energy and Environment
- Phase Change, Flows and Energy Transfer Processes
- Optimization of Energy Systems
- Fuel Cells
- Drying and Porous Media
- Energy Storage
- Thermal and Mass Transfers
- Energy Management.

TOPIC 2: MATERIALS

- Material Modeling
- Material Valuation
- Material Characterization and Behavior
- Nanotechnology
- Materials for Energy
- Biomaterials and the Environment
- Energy Storage and Conversion

TOPIC 3: ENVIRONMENT

- Air pollution and treatment
- Biofuels
- Desalination
- Environmental Protection
- Environmental Sustainability and Development
- Greenhouse Effect, Global Warming, and Climate Change
- Groundwater Issues

- Soil Pollution and Treatment
- Wastewater Management and Treatment
- Water Pollution and Treatment

TOPIC 4: MATHEMATICS IN PHYSICS

- Application of Quantum Mechanics on Materials
- Numerical Methods and Simulations Applied in Technology
- Theory of Operators and Their Applications in Science
- Mathematical Physics and Limit Problems
- Plasma Physics

SCIENTIFIC COMMITTEE

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Pr. Nourredine BELGHAR (Biskra University, Algeria)

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Mr. Zoubir BESR (El Oued University, Algeria)

PLENARY

SPEAKERS

Plenary Speakers & Subjects

Plenary	Speaker	Subject
Plenary 1	Pr. Paulo Nobre Balbis dos Reis (Coimbra University, Portugal)	Benefits of fiber and nano-reinforcements hybridization on the fatigue response of composite laminates
Plenary 2	Pr. Zied Driss (Sfax University, Tunisia)	Study and growth of hydroponic greenhouse systems
Plenary 3	Pr. Essebti DHAHRI (Sfax University, Tunisia)	Effect of the synthesis method on the physical properties of metal oxides for their use in different applications
Plenary 4	Pr. Abderrezak BEZAZI (Guelma University, Algeria)	The advantages of employing composite materials in the design of structures, pipelines, and tanks

SEQUENCE PROGRAM

MATERIALS ENERGY ENVIRONMENT 3rd Conference

THE THIRD INTERNATIONAL CONFERENCE ON MATERIALS, ENERGY & ENVIRONMENT (MEE-2025)

General Program Schedule

Event				Sunday April 20th, 2025
Registration fees (14h00) (With Accommodation) (El Oued Hotel – El Oued, Algeria)				
First Day				Monday April 21st, 2025
Registration fees (08h00) (Without Accommodation) (Mediatech Lecture Hall – Front to Faculty of Techno – University El Oued, Algeria)				
09.00 – 09.30 Mediatech Lecture Hall – Front to Faculty of Techno				Opening Ceremony
09.30 – 10.00	Plenary 1 Pr. Paulo Nobre Balbis dos Reis (Coimbra University, Portugal) "Benefits of fiber and nano-reinforcements hybridization on the fatigue response of composite laminates"	President(s)		Pr. Ridha Ennetta Pr. Linda Aissani
10.00 – 10.30	Plenary 2 Pr. Zied Driss (Sfax University, Tunisia) " Study and growth of hydroponic greenhouse systems"	President(s)		Pr. Erdem Cuce Pr. Mourad Mimouni
10.30 – 11.00	Poster Sessions + Coffee Break	President(s)	Mat.	Pr. Azzeddine Beggas Pr. Fatma Bouzenna
			Env/Ene	Pr. Mohammed Ali Hadj Ammar Pr. Samir Hameurlaine Pr. Fadhila Khelfaoui
			Math-Phy	Pr. Fethi Leteim Pr. Khiari Leila
11.00 – 12.30	Oral Sessions	President(s)	Mat.	Pr. Mabrouk Chaabane Pr. Ghani Rihia
			Env/ Ene	Pr. Abdallah BOUABIDI Pr. Nourredine Belghar
			Math-Phy	Pr. Mosbah Dhif Allah Pr. Bedida Nacira
13.00 – 14.00	Lunch			
15.00	Excursion			

MATERIALS
ENERGY
ENVIRONMENT
3rd Conference

جامعة الشهيد حمه لخضر - الوادي
UNIVERSITY OF EL OUED

THE THIRD INTERNATIONAL CONFERENCE ON MATERIALS, ENERGY & ENVIRONMENT (MEE-2025)

<table>
<tr><td colspan="2">Second Day</td><td colspan="3">Tuesday April 22nd, 2025</td></tr>
<tr><td colspan="5">Registration fees (08h00) (Without Accommodation)
(Mediatech Lecture Hall– Front to Faculty of Techno – University El Oued, Algeria)</td></tr>
<tr><td rowspan="2">09.00 – 09.45</td><td rowspan="2">Plenary 3
Pr. Essebti DHAHRI
(Sfax University, Tunisia)
" Effect of the synthesis method on the physical properties of metal oxides for their use in different applications "</td><td rowspan="2">President(s)</td><td colspan="2">Pr. Mohammed Sadok Mahboub</td></tr>
<tr><td colspan="2">Pr. Soria Zeroual</td></tr>
<tr><td rowspan="2">09.45 – 10.30</td><td rowspan="2">Plenary 4
Pr. Abderrezak BEZAZI
(Guelma University, Algeria)
" The advantages of employing composite materials in the design of structures, pipelines, and tanks "</td><td rowspan="2">President(s)</td><td colspan="2">Pr. Erdem Cuce</td></tr>
<tr><td colspan="2">Pr. Nabil Mahamdioua</td></tr>
<tr><td rowspan="2">10.30 – 11.00</td><td rowspan="2">Poster Sessions + Coffee Break</td><td rowspan="2">President(s)</td><td>Mat.</td><td>Pr. Nassima Mefteh
Pr. Abdelouahab Gahtar</td></tr>
<tr><td>Env/Ene</td><td>Pr. Nawal Houmri
Pr. Fethi Leteim</td></tr>
<tr><td rowspan="2">11.00 – 12.00</td><td rowspan="2">Oral Sessions</td><td rowspan="2">President(s)</td><td>Mat.</td><td>Pr. Abderrazek OUESLATI
Pr. Mebrouk Ghougali</td></tr>
<tr><td>Env/Ene</td><td>Pr. Larbi Haddad
Pr. Belhi Guerira</td></tr>
<tr><td>12.00 – 12.30</td><td colspan="4">Closing Ceremony
(Mediatech Lecture Hall– Front to Faculty of Techno)</td></tr>
<tr><td>13.00 – 14.00</td><td colspan="4">Lunch</td></tr>
</table>

Poster & Oral Sessions Locations: Material: Room 09 (1st Floor – Faculty of Exact Sciences)

Env/Ene: Lecture Hall – Madiatech

Math-Phys: Room 06 (Ground Floor – Faculty of Exact Sciences)

Coffee Break Location: Mediatech Hall (Front to Faculty of Techno)

WELCOME TO EL OUED

PROCESS OF PARTICIPATION

MATERIALS
ENERGY
ENVIRONMENT
3rd Conference

THE THIRD INTERNATIONAL CONFERENCE ON MATERIALS, ENERGY & ENVIRONMENT (MEE-2025)

Process of participation

First Day

Materials				Energy			Environment			Math & physics	
Mat-O-01	Mat-P-1	Mat-P-29	Mat-P-56	Ene-O-01	Ene-P-1	Ene-P-29	Env-O-01	Env-P-1	Env-P-27	MPh-O-01	MPh-P-01
Mat-O-02	Mat-P-2	Mat-P-30	Mat-P-57	Ene-O-02	Ene-P-2	Ene-P-30	Env-O-02	Env-P-2	Env-P-28	MPh-O-02	MPh-P-02
Mat-O-03	Mat-P-3	Mat-P-31	Mat-P-58	Ene-O-03	Ene-P-3	Ene-P-31	Env-O-03	Env-P-3	Env-P-29	MPh-O-03	MPh-P-03
Mat-O-04	Mat-P-4	Mat-P-32	Mat-P-59	Ene-O-04	Ene-P-4	Ene-P-32	Env-O-05	Env-P-4	Env-P-30	MPh-O-04	MPh-P-04
Mat-O-05	Mat-P-5	Mat-P-33	Mat-P-60	Ene-O-05	Ene-P-5	Ene-P-33	Env-O-06	Env-P-5	Env-P-31	MPh-O-05	MPh-P-05
Mat-O-06	Mat-P-6	Mat-P-34	Mat-P-61		Ene-P-6		Env-O-07	Env-P-6	Env-P-32		MPh-P-06
Mat-O-07	Mat-P-7	Mat-P-35	Mat-P-62		Ene-P-7			Env-P-7	Env-P-33		MPh-P-07
Mat-O-08	Mat-P-8	Mat-P-36	Mat-P-63		Ene-P-8			Env-P-8	Env-P-34		MPh-P-08
Mat-O-09	Mat-P-9	Mat-P-37	Mat-P-64		Ene-P-9			Env-P-9	Env-P-35		MPh-P-09
Mat-O-10	Mat-P-10	Mat-P-38	Mat-P-65		Ene-P-10			Env-P-10	Env-P-36		MPh-P-10
	Mat-P-11	Mat-P-39	Mat-P-67		Ene-P-11			Env-P-11	Env-P-37		MPh-P-11
	Mat-P-12	Mat-P-40	Mat-P-68		Ene-P-12			Env-P-12	Env-P-38		MPh-P-12
	Mat-P-13	Mat-P-41	Mat-P-69		Ene-P-13			Env-P-13	Env-P-39		MPh-P-13
	Mat-P-14	Mat-P-42	Mat-P-70		Ene-P-14			Env-P-14			MPh-P-14
	Mat-P-15	Mat-P-43	Mat-P-71		Ene-P-15			Env-P-15			MPh-P-15
	Mat-P-16	Mat-P-44	Mat-P-72		Ene-P-16			Env-P-16			MPh-P-16
	Mat-P-17	Mat-P-45	Mat-P-73		Ene-P-17			Env-P-17			MPh-P-17
	Mat-P-18	Mat-P-46	Mat-P-74		Ene-P-18			Env-P-18			MPh-P-18
	Mat-P-19	Mat-P-47	Mat-P-75		Ene-P-19			Env-P-19			MPh-P-19
	Mat-P-20	Mat-P-48	Mat-P-76		Ene-P-20			Env-P-20			MPh-P-20
	Mat-P-21	Mat-P-49	Mat-P-77		Ene-P-21			Env-P-21			MPh-P-21
	Mat-P-22	Mat-P-50	Mat-P-78		Ene-P-22			Env-P-22			MPh-P-22
	Mat-P-24	Mat-P-51	Mat-P-79		Ene-P-23			Env-P-23			MPh-P-23
	Mat-P-26	Mat-P-52	Mat-P-80		Ene-P-25			Env-P-24			MPh-P-24
	Mat-P-27	Mat-P-53	Mat-P-81		Ene-P-27			Env-P-25			MPh-P-25
	Mat-P-28	Mat-P-54	Mat-P-82		Ene-P-28			Env-P-26		MPh-P-28	MPh-P-26
		Mat-P-55	Mat-P-83							MPh-P-29	MPh-P-27

THE THIRD INTERNATIONAL CONFERENCE ON MATERIALS, ENERGY & ENVIRONMENT (MEE-2025)

MATERIALS ENERGY ENVIRONMENT 3rd Conference

Second Day

Materials				Energy			Environment		
Mat-O-11	Mat-P-84	Mat-P-113	Mat-P-140	Ene-O-06	Ene-P-34	Ene-P-61	Env-O-08	Env-P-40	Env-P-68
Mat-O-12	Mat-P-85	Mat-P-114	Mat-P-141	Ene-O-07	Ene-P-35	Ene-P-62	Env-O-09	Env-P-41	Env-P-69
Mat-O-13	Mat-P-86	Mat-P-115	Mat-P-142	Ene-O-08	Ene-P-36	Ene-P-63	Env-O-10	Env-P-42	Env-P-70
Mat-O-14	Mat-P-87	Mat-P-116	Mat-P-143	Ene-O-09	Ene-P-37	Ene-P-64	Env-O-11	Env-P-43	Env-P-71
Mat-O-15	Mat-P-88	Mat-P-117	Mat-P-144	Ene-O-10	Ene-P-38	Ene-P-65		Env-P-44	Env-P-72
Mat-O-16	Mat-P-89	Mat-P-118	Mat-P-145		Ene-P-39	Ene-P-66		Env-P-45	Env-P-73
	Mat-P-90	Mat-P-119	Mat-P-146		Ene-P-40	Ene-P-67		Env-P-46	Env-P-74
	Mat-P-91	Mat-P-120	Mat-P-147		Ene-P-41	Ene-P-68		Env-P-47	Env-P-75
	Mat-P-92	Mat-P-121	Mat-P-148		Ene-P-42	Ene-P-69		Env-P-49	Env-P-76
	Mat-P-93	Mat-P-122	Mat-P-149		Ene-P-43			Env-P-50	Env-P-77
	Mat-P-94	Mat-P-123	Mat-P-150		Ene-P-44			Env-P-51	Env-P-78
	Mat-P-95	Mat-P-124	Mat-P-151		Ene-P-45			Env-P-52	Env-P-79
	Mat-P-96	Mat-P-125	Mat-P-152		Ene-P-46			Env-P-53	Env-P-80
	Mat-P-97	Mat-P-126	Mat-P-153		Ene-P-47			Env-P-54	Env-P-81
	Mat-P-98	Mat-P-127	Mat-P-154		Ene-P-48			Env-P-55	Env-P-82
	Mat-P-99	Mat-P-128	Mat-P-155		Ene-P-49			Env-P-56	Env-P-83
	Mat-P-100	Mat-P-129	Mat-P-156		Ene-P-50			Env-P-57	Env-P-84
	Mat-P-101	Mat-P-130	Mat-P-157		Ene-P-51			Env-P-58	Env-P-85
	Mat-P-102	Mat-P-131	Mat-P-158		Ene-P-52			Env-P-59	Env-P-86
	Mat-P-105	Mat-P-132	Mat-P-159		Ene-P-53			Env-P-60	Env-P-87
	Mat-P-106	Mat-P-133	Mat-P-160		Ene-P-54			Env-P-61	
	Mat-P-107	Mat-P-134	Mat-P-161		Ene-P-55			Env-P-62	
	Mat-P-108	Mat-P-135	Mat-P-162		Ene-P-56			Env-P-63	
	Mat-P-109	Mat-P-136	Mat-P-163		Ene-P-57			Env-P-64	
	Mat-P-110	Mat-P-137	Mat-P-164		Ene-P-58			Env-P-65	
	Mat-P-111	Mat-P-138	Mat-P-165		Ene-P-59			Env-P-66	
	Mat-P-112	Mat-P-139	Mat-P-166		Ene-P-60			Env-P-67	

GLOBAL PARTICIPATIONS

GLOBAL PARTICIPATIONS LISTING

ID	Participant	Title
Ene-O-1	bentria djelloul	Application of Discrete Kirchhoff-Mindlin Quadrilateral (DKMQ) Element for Flutter Analysis
Ene-O-2	Hacene Kadi	Buildings energy saving by editing HVAC systems terminal units and its impact on airflow characteristics to optimize indoor occupant's thermal comfort
Ene-O-3	Mohammed Bouladame	Design and simulation investigations on charge transport layers-free in the triple active layer perovskite solar cell
Ene-O-4	Salheddine Rahmani Bouzina	Transient Analysis of a Helical Coil Steam Generator in a 600 MW High-Temperature Gas-Cooled Reactor
Ene-O-5	Emre Alvur	Towards Net-Zero: The Synergistic Role of Insulation Plasters and Bio-based Additives for Next-Generation Energy-Efficient Construction
Ene-O-6	Hayat Arbouz	Computational Study of FASn(1-x)Ge(x)I3 Hybrid Perovskite as a High-Efficiency Wide Bandgap Absorber for Enhanced Dual-Junction Solar Cell Performance
Ene-O-7	Farid Saadaoui	Minimization of Hydrogen Consumption of a Hybrid System (PV/PEMFC/Lithium-Ion Battery) intended for isolated urban areas of southern Algeria
Ene-O-8	Athmane BEN RABAH	Drying Chamomile Flowers Using an Indirect Hybrid Solar Dryer
Ene-O-9	Okba Bouaichaoui	Enhancing Refrigerator Efficiency Using Solar Energy
Ene-O-10	Nour Elislam DJEDAA	Modelling Algeria's Energy System using OSeMOSYS: Assessing the Alternative Scenarios of Energy Transition
Ene-P-1	Belgherbi Ouafia	Nickel-modified polyaniline nanocomposites for direct methanol fuel cells
Ene-P-2	Mebrouk Ghougali	Improving the productivity of a solar still by integrating it with a heat collector supported by a reflective mirror
Ene-P-3	chadouli rachid	Impact of contact parameters of contact solids on the Thermal Contact Resistance #TCR#
Ene-P-4	CHEHDA Rabeh	Contribution à la commande vectorielle et la commande directe du couple appliquées à un moteur asynchrone à double alimentation
Ene-P-5	Djedid TALOUB	Design and evaluation of an indirect dehydrator integrated with a PV/T hybrid solar collector system for drying agricultural produce
Ene-P-6	DJOURNI Youcef	ANN-Enhanced Backstepping Control for Fractional-Order Converters in Energy Conversion Systems
Ene-P-7	Benzeghda Sabah	Efficiency enhancement of amorphous silicon thin film solar cell
Ene-P-8	Feguir Abdelmadjid	Numerical Investigation of Drag Reduction Using Energy Promoter Rings in Turbulent Newtonian Pipe Flow
Ene-P-9	LAMIRI Leila	High-performance of polypyrrole/cobalt–silver bimetallic nanohybrid for electrochemical hydrogen peroxide reduction in fuel cell applications
Ene-P-10	Merazi Sayah	Analyse de l'énergie interne totale dans une torche à cathode/plasma couplée par induction
Ene-P-11	Oubouzid nacima	Assessing the Influence of Current Sensor Quality on Total Harmonic Distortion Across Varied Operating Conditions in Electrical Metering Systems
Ene-P-12	Salah MARIH	Etude et simulation d'un moteur asynchrone alimenté par un onduleur de tension multiniveaux
Ene-P-13	Salah MARIH	Study of wind energy efficiency in the western coastal region of Algeria
Ene-P-14	Salah MARIH	Study and evaluation of wind resources in the highlands for the contribution to energy transition: Ksar Chellala region

Ene-P-15	Belhi GUERIRA	Investigation of the temperature changes in a solar chimney
Ene-P-16	Cherif Boulebbina	Thermodynamic Analysis and Investigation of the COP Improvement of Conventional Cooling System by the Use of a Two-phase Ejector: Application of Fourth Generation Refrigerants
Ene-P-17	DJEDAI Hayette	Three-dimensional Numerical Investigation of Corner Stall Blowing in an Axial Compressor Cascade
Ene-P-18	Fekih Abdellali	Comparison of daily global solar irradiance from ground-based and reanalysis datasets. A case study over Adrar (South Algeria)
Ene-P-19	Abdelmalek Abdelmalek	Analysis of the impact of temperature on the vibration of the shaft line of a gas turbine
Ene-P-20	MAHDAB SALIM	Practical Implementation of an MPPT Algorithm for a DC-DC BOOST Converter Using Arduino UNO in Photovoltaic Systems
Ene-P-21	chadouli rachid	Numerical study of the effect of the seal placed between two solids in contact on the heat transfer coefficient
Ene-P-22	hamza mehdaoui	Numerical analysis of mixed convection in an open square cavity using a nanofluid
Ene-P-23	Anfal Benrezkallah	Study of thermophysical properties of nanofluids
Ene-P-24	Salah Medguedem	Analyse CFD de l'effet de la rugosité artificielle des parois sur la résistance hydraulique d'un écoulement turbulent
Ene-P-25	HADJADJI Narimane	Energy-Efficient Optical Fiber Networks Enabled by AI-Driven Distortion Mitigation
Ene-P-27	Chadi Kamel	Analysis of the Impact of Obstacle Angle in a Divergent-Convergent Minichannel on Sound Pressure Levels
Ene-P-28	Haddad Zakaria	The effect of suction and injection on the stability of thin fluid film
Ene-P-29	Bentchikou Ibrahim	Contribution of the technique of predictive control fed by an inverter seven level applied to a permanent magnetique synchronous machine
Ene-P-30	BENYEKHLEF Ahmed	Application of artificial neural network (ANN) for the prediction of fouling resistance in heat exchanger
Ene-P-31	toumi djaafar	implementation of MPPT with P&O, I_C and PSO algorithm for photovoltaic systems in Arduino
Ene-P-32	M. BOUDJELOUD	Production d'hydrogène via la réaction de vaporeformage du méthane (VRM) en présence de catalyseurs Ni/Al, Ni-La/Al et Ni-Fe/Al
Ene-P-33	hamza ramdani	Enhanced Performance of a Photovoltaic Thermal Collector with a Copper Metal Foam Air Channel
Ene-P-34	Zine Labidine MAHRI	A Study of the Impact of Ventilation on Thermal Comfort and on the Energy Consumption for Heating and Air Conditioning
Ene-P-35	Abdelkader Boukaroura	Bald Eagle Search Optimization Algorithm for optimal DG Allocation in Distribution Network with Seasonal Load Variations
Ene-P-36	Riyadh bekkai	Enhancing Small Rotor Performance with Winglets
Ene-P-37	LEHTIHET Mohammed Cherif	LE VEGETAL URBAIN COMME OUTIL D'ADAPTATION AUX DEFIS CLIMATIQUES ET UNE MEILLEURE EFFICIENCE ENERGETIQUE DES CONSTRUCTIONS . CAS DE LA VILLE DE JIJEL
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ABSTRACTS

ID: Ene-O-1

Application of Discrete Kirchhoff-Mindlin Quadrilateral (DKMQ) Element for Flutter Analysis

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Abstract: This paper presents a flutter analysis of non-rectangular Plates using a quadrilat-eral element called DKMQ (Discrete Kirchhoff Mindlin Quadrilateral) with three degrees of freedom (DOFs) per node. This element is suitable for analyzing plates with varying thicknesses, from thin to thick. The aerodynamic forces induced by airflow are modeled using linearized first-order piston theory. Results obtained from a developed in-house Finite Element Method (FEM) code demonstrate the robust convergence properties of the proposed approach.

Keywords: finite element method; Flutter analysis; DKMQ element; Piston theory; Supersonic airflow.

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Buildings energy saving by editing HVAC systems terminal units and its impact on airflow characteristics to optimize indoor occupant's thermal comfort.

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Abstract: Nowadays buildings design focus on the occupants' satisfaction by the optimization of their thermal comfort in indoor environment. Heating, ventilation and air conditioning (HVAC) systems are the most energy consuming devices in buildings, which also play an important role for achieving occupants' thermal comfort and better air homogenization in indoor environment. In this study, numerical investigation of the air flow behavior generated from round ceiling air diffuser, solving the governing equations and the phenomenon capture using the computational fluid dynamics (CFD) simulation, employing the commercial ANSYS Fluent software, examining the impact of employing symmetry and mesh study for obtaining accurate results and less computational costs.

Keywords: Thermal comfort; Heating, ventilation, and air conditioning (HVAC); Energy; Airflow; Indoor environment; Symmetry

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Design and simulation investigations on charge transport layers-free in the triple active layer perovskite solar cell.

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Abstract: The multiple absorber layer perovskite solar cells (PSCs) with charge transport layers-free (CTLs-free) have drawn widespread research interest due to their simplified architecture and promising photoelectric characteristics. Under the circumstances, the novel design of CTLs-free inversion PSCs with stable and three absorber layers as optical harvesters has been numerically simulated by utilizing Silvaco Tcad simulation software and achieved high power conversion efficiency (PCE). To overcome this problem, the attention of the research community is diverted from methyl ammonium based perovskite solar cells to formadininum (FA) based perovskite solar cells. To enhance the efficiency of PSCs further, effective absorption of solar-spectrum by the multi-layer will allow the maximum utilization of spectrum, and in turn, it will increase the efficiency of the resulting Perovskite Solar Cell (PSC). Here, we have analyzed the efficiencies of single, double, and triple absorber layers PSCs. Initially, we simulated and studied the performance of three FAPbI3, FAPbIBr2, and FAPbBr3-based single-junction perovskite solar cells. Then, we simulated a PSC with FAPbIBr2 and FAPbBr3 as the two absorber layers and optimized the performance of the bilayer solar cell. Finally, we simulated a triple-layer PSC that used the combination of FAPbIBr2, FAPbBr3, and FAPbI3 as absorber layers. The bilayer and triple layer PSCs are optimized concerning different variables, i.e., absorber layer thickness, defect density, and interface defect density in all three PSCs. In this study, we achieved a remarkable efficiency of 31.92%, 27.62%, and 23.44% efficiency in the case of triple-layer solar cells, in the case of bilayer solar cells, and in the case of single-junction PSC, respectively. This is owing to the innovative architecture of PSCs, which favors efficient transport and extraction of more holes, and the slender band gap FAPbI3 extends the absorption spectrum to the near-infrared periphery compared with the two absorber layers architecture of PSCs. Thus, well aligned multiple absorber layers in PSC will provide the future pathways for highly efficient PSCs.

Keywords: Perovskite solar cell, Triple absorber layer, Charge Transport layer, Silvaco-TcaD

ID: Ene-O-4

Transient Analysis of a Helical Coil Steam Generator in a 600 MW High-Temperature Gas-Cooled Reactor

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Abstract: High-temperature gas-cooled reactors (HTGRs) offer a safe and sustainable solution for nuclear energy, using helium coolant and ceramic-coated fuel particles to minimize meltdown risks and radiation release. Their ability to operate at 750–950°C ensures high efficiency in electricity generation and supports industrial heat applications essential for decarbonization. This study analyzes the thermal performance and safety aspects of a 600 MW thermal HTGR, focusing on its helical coil steam generator, which transfers heat from the reactor core to the secondary power cycle and plays a key role in fourth-generation reactor designs. A numerical model of the steam generator was developed using the RELAP5 system code and validated with analytical calculations and benchmark data. Simulations under steady-state and transient conditions, including loss of flow accident (LOFA), show that without safety system intervention, helical coil tube temperatures can rise to 658°C, and can leading to thermal stress and potential structural failure. Activating the safety system enables controlled pressure reduction, enhancing passive heat dissipation and reducing peak temperatures by 36% to approximately 421°C, preventing thermal shock and maintaining structural integrity. These results highlight the necessity of advanced safety mechanisms for ensuring the reliable operation of next-generation HTGRs.

Keywords: High-temperature; HTGR; helium; helical coil; steam generator;RELAP5; LOFA.

ID: Ene-O-5

Towards Net-Zero: The Synergistic Role of Insulation Plasters and Bio-based Additives for Next-Generation Energy-Efficient Construction

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Abstract: Buildings account for approximately 40% of global energy consumption, with a significant portion of this loss occurring through façades. This is predominantly due to the low thermal resistance of structural components, which permits high rates of heat transfer. Considering the environmental costs of fossil fuel-based energy production, the need for cost-effective and environmentally friendly solutions to reduce energy loss through the building envelope has become increasingly critical. This study aims to highlight the potential of insulation plasters not merely as complementary elements, but as standalone thermal solutions in the current architectural context. A series of real-scale experimental applications were carried out under actual building conditions, involving four different configurations, each coated with 2 cm internal and 2 cm external plaster: (i) traditionally plastered conventional briquette (4.41 W/m²K), (ii) traditionally plastered briquette with 6% bamboo addition (2.46 W/m²K), (iii) insulated plaster on conventional briquette (2.05 W/m²K), and (iv) insulated plaster on 6% bamboo-enhanced briquette (1.96 W/m²K). The results demonstrate that both the incorporation of sustainable materials like bamboo and the use of novel insulation plasters significantly improve thermal performance. Particularly in structural elements with high thermal conductivity, such solutions offer up to 55.6% improvement, marking a striking advancement in energy efficiency. This study thus confirms that substantial energy savings can be achieved through low-cost, practical means and underscores the strategic importance of sustainable construction materials in achieving the carbon-neutral building goals set for 2030–2050.

Keywords: Low-carbon buildings; Energy-efficient construction; Thermal insulation plaster; Bamboo fibre-reinforced briquette; Thermal resistance enhancement

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Minimization of Hydrogen Consumption of a Hybrid System (PV/PEMFC/Lithium-Ion Battery) intended for isolated urban areas of southern Algeria

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Abstract: This study focuses on the electrical energy management of a hybrid autonomous system that mainly produces solar energy, associated with a hydrogen fuel cell and a storage device (lithium battery). This energy coupling dynamic is implemented under different operating conditions, ensuring the uniqueness of the use of the energy generated to provide electricity to remote areas and isolated urban regions in southern Algeria. This hybrid mechanism is managed by an energy management strategy based on a continuous bus charged to the variable load via a DC/DC converter. It allows to control the energy flow between different energy sources to reduce the use of the hydrogen fuel cell and thus minimize hydrogen consumption.

Keywords: HES; RES; PV; PEMFC; Li-Ion Battery; hydrogen consumption.

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Drying Chamomile Flowers Using an Indirect Hybrid Solar Dryer.

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Abstract: In this research study, experiments were carried out on the drying of chamomile flowers (Matricaria chamomilla L.), a medicinal and aromatic plant of great importance in the food and pharmaceutical industries. To preserve the quality of its active compounds, such as flavonoids and essential oils, drying is a critical post-harvest step. An indirect solar dryer, combining solar and electrical energy, was used for the drying process. The experiments were carried out on sunny days in March and April in the province of Aïn Defla, Algeria, under drying conditions with air temperatures ranging from 40°C to 60°C and relative humidity between 6% and 30%. The results showed that indirect solar drying effectively preserves the color, taste and overall appearance of the dried flowers, making this technique an alternative solution to other traditional dryers.

Keywords: Chamomile flowers1 ; indirect solar drying 2; Hot-air 3;

ID: Ene-O-9

Enhancing Refrigerator Efficiency Using Solar Energy

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Abstract: Conventional cooling systems, which rely on fossil fuels, generate significant greenhouse gas emissions. In light of the climate crisis, decarbonizing cooling systems by utilizing renewable energy sources has become imperative. While these systems offer clear advantages in reducing carbon dioxide emissions and enhancing energy independence, challenges remain, particularly regarding investment costs and energy intermittency. Further advancements are needed to improve the efficiency and reliability of these promising solutions. Despite these obstacles, integrating renewable energy into cooling systems appears to be a crucial step toward sustainable refrigeration. With this objective in mind, this work aims to reduce carbon emissions and dependence on fossil fuels by providing an environmentally friendly alternative to conventional cooling methods. Simulation results demonstrate the feasibility and effectiveness of the proposed approach through optimal solar system selection, confirming its potential for applications in food preservation and rural areas.

Keywords: Renewable Energy1 ; Refrigerator 2; Energy Optimization3

ID: Ene-O-10

Modelling Algeria's Energy System using OSeMOSYS: Assessing the Alternative Scenarios of Energy Transition.

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Abstract: Low-carbon energy transition plays a crucial role in mollifying the climate system's warming; shifting from high-carbon to low-carbon energy systems will minimize the environmental impact of fossil fuel usage. The main aim behind this paper is to prospect Algeria's opportunities and potential towards a sustainable energy transition between 2023-2070 using a linear programming model to minimize the total energy system costs and satisfy future energy needs. To do so, we have explored three main scenarios: Fossil Fuel Scenario (FF), Net-Zero by 2050 (NZ 50), and National Renewable Programme of 15 GW by 2035 (NRP35). This paper's insights emphasize maintaining energy security and renewable energy deployment and achieving the appropriate energy mix transition for the Algerian Context.

Keywords: Energy-System; Energy Security; Energy Transition

ID: Ene-P-1

Nickel-modified polyaniline nanocomposites for direct methanol fuel cells

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Abstract: A metal–organic composite thin film composed of polyaniline (PANI) and Ni was prepared and characterized for methanol electrooxidation reaction. First, PANI thin films were electrodeposited on a fluorine-doped tin oxide (FTO) coated glass support in an aqueous acidic solution. Subsequently, the polymer film was modified with Ni particles (FTO/PANI-Ni) by chronoamperometric (CA) technique. The composite film was characterized by structural, morphological and electrocatalytic analyses. X-ray diffraction (XRD) results confirmed the crystallization of Ni according to the cubic structure. Scanning electron microscopy (SEM) images showed that the Ni nanoparticles were uniformly dispersed on the PANI surface. The electrocatalytic performance of the FTO/PANI-Ni composite electrode for the methanol electrooxidation reaction was investigated in 0.5 M KOH solution containing methanol using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and chronoamperometry (CA) techniques. The effects of temperature and methanol concentration on the methanol electrooxidation performance were also studied. The modified composite catalyst exhibited an electrochemically active surface area of 0.5235 cm2. The presence of Ni nanoparticles on the polymer surface promoted the adsorption of methanol molecules and facilitated the oxidation process, leading to higher current densities and better overall performance. The maximum current density was 14 mA cm-2 and the electrode maintain 68 % of its initial activity even after 200 cycles, indicating that the FTO/PANI-Ni electrode exhibited good stability. The high methanol oxidation performance of the composite electrode was associated with large real surface area, a possible synergistic effect between the polymer moleucles and Ni particles as well as high intrinsic activity of Ni for this process.

Keywords: Polyaniline ;Ni particles; Composite electrode; Methanol electrooxidation; Direct methanol fuel cells

ID: Ene-P-2

Improving the productivity of a solar still by integrating it with a heat collector supported by a reflective mirror

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Abstract: The increasing problem of scarcity of potable water, especially in remote areas, has prompted many researchers to pay attention to this issue in order to find effective solutions. One of the most important of these solutions is the distillation of salt water, which is what prompted us to exploit solar distillation technology for water desalination. An experimental study was carried out in order to improve the performance of the simple solar distiller by integrating it with a thermal collector that helps raise the temperature of the water in the still basin, where a heat exchanger was installed. (A copper tube with a diameter of 1.5 cm) at the bottom of the still and the distiller basin integrated with it, which leads to an increase in the water temperature in the distiller basin. This increases the amount of steam that condenses and drips later, thus improving the productivity of distilled water. The yield of the built-in distiller was improved by 22.4% compared to its reference counterpart.

Keywords: solar distillation, simple solar still, solar collector, heat exchanger, distilled water.

ID: Ene-P-3

Impact of contact parameters of contact solids on the Thermal Contact Resistance #TCR#

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Abstract:

a numerical simulation by the computer code ABAQUS (6.14) was conducted to study the influence of the thermal conductivity, the interstitial fluid convection coefficient and surface roughness on the thermal contact resistance "TCR" to improve the heat transfer between the materials in contact. In our study, the pairs specimens involved have a thermal conductivity k ranging between 20 w/m.K to 390 w/m.K. The diameter of specimen d is 2cm, the height L is 8cm, and the surface roughness Ra is in the range of 5 to 20µm. Results indicated that the surface roughness and thermal conductivity present a power law relationship with thermal contact resistance between solids in contact. Moreover, the interstitial fluid convection coefficient influences weakly the variation in the thermal contact resistance. The TCR magnitude decrease more rapidly with decrease of the specimen's surface roughness when the latters have high thermal conductivity than when they have low thermal conductivity.

Keywords: thermal contact resistance; interstitial fluid; convection coefficient; roughness

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ID: Ene-P-4

Contribution à la commande vectorielle et la commande directe du couple appliquées à un moteur asynchrone à double alimentation

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Abstract: Cet article présente une étude de la commande vectorielle par orientation du flux et la commande directe du couple de la machines Asynchrone à Double Alimentation MADA. Le contrôle direct du couple présente de nombreux avantages par rapport à la structure classique de commande vectorielle par orientation du flux (FOC). Cette technique permet de calculer les grandeurs de contrôle que sont le flux statorique et le couple électromagnétique à partir des mesures des courants statoriques. Des simulations sont effectuées pour valider chaque commande. Les résultats obtenus de la commande par DTC de la machine se traduisent par de meilleures performances dynamiques du couple et du flux.

Keywords: Machine asynchrone à double alimentation (MADA), Commande par orientation du flux, Contrôle direct du couple.

ID: Ene-P-5

Design and evaluation of an indirect dehydrator integrated with a PV/T hybrid solar collector system for drying agricultural produce

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Abstract: In this paper, a project proposal is put forward for a hybrid solar dryer that uses a hybrid solar panel to produce heat and electricity at the same time, as we know that a traditional photovoltaic panel produces three times as much heat as electricity. The new aspect of this research is to recover this thermal energy by heating or drying. Previous dryers worked with thermal collectors thanks to the greenhouse effect, which only gives off heat. So a hybrid solar panel (thermal and photoelectric) was developed and used, which supplies electricity to the fans to circulate the air and speed up the drying process, and also gives off heat, which is responsible for the drying process. Hot air is used for drying, as it reduces and absorbs the moisture in agricultural produce. A thermal collector has also been added to support the hybrid solar panel in case we need to increase the temperature. A battery was also added to store electrical energy and use it when the sun goes down to operate the lamp in the drying chamber, which provides heat inside the drying chamber. As a result, drying is continuous and fast, as the drying time is very short compared with previous dryers, while preserving the nutritional value of the product and good quality.

Keywords: Design; Solar drying; PV/T hybrid system; Indirect dehydrator; Drying performance

ID: Ene-P-6

ANN-Enhanced Backstepping Control for Fractional-Order Converters in Energy Conversion Systems.

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Abstract: The main goal of this paper is to establish an innovative design of photovoltaic (PV) system employing fractional calculus.. In order to enhance the efficiency and robustness of the maximum power point tracking (MPPT) approach, a fractional-order (FO) DC-DC boost converter is suggested for a PV system. To address the nonlinearity of the PV module, an artificial neural network (ANN) loop is utilized to consistently generate an optimal reference voltage. Ultimately, a nonlinear backstepping controller (BSC) is integrated to track the maximum power point under extreme atmospheric conditions and load changes.. In this context, the asymptotic stability is guaranteed via Lyapunov function. According to Grünwald-Letnikov fractional definition, the FO dynamic equations of the proposed converter have been derived using the principle of the average method, and the FO components of the converter are successfully approximated via Oustaloup recursive approximation method (ORA). MATLAB/Simulink has been used to confirm the validity and the accuracy of the constructed model. The results have proved that the efficiency of the extracted maximum power has been improved in comparison with the conventional DC-DC converter.

Keywords: An artificial neural network; DC-DC boost converter; Factional calculus.

ID: Ene-P-7

Efficiency enhancement of amorphous silicon thin film solar cell

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Abstract: In this work, a novel solar cell concepts are explored, categorized into three contributions. First, how to develop the most used commercial type of amorphous silicon solar cell that's currently has the highest efficiency with an affordable cost on the market demonstrating response from the material, and evaluating the feasibility of improving it efficiency further with concentrator cells. Additionally, a new structure is proposed in perspective, aiming to enhance the performance and adaptability of multi-junction solar PV systems. Second, how to develop a mechanically-stacked multi-junction solar cell enabled by a GaAs tunnel junction. Third, two analytic model cells are built using Silavco TCAD to rapidly investigate the efficiency difference between the two concept of solar cell architectures with a clear win for the multijunction and concentrator cells technologies.

Keywords: ATLAS, Multi-junction solar cell, Efficiency, Single junction.

ID: Ene-P-8

Numerical Investigation of Drag Reduction Using Energy Promoter Rings in Turbulent Newtonian Pipe Flow

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Abstract: The oil and gas industry incurs substantial costs in crude oil transportation due to pressure losses caused by frictional resistance along pipeline walls. A promising solution to this challenge is the use of energy promoters—devices strategically installed within pipelines to modify flow dynamics and reduce drag. These promoters work by disrupting turbulent flow, thereby minimizing frictional losses and improving flow efficiency. Their performance is critically influenced by design parameters such as geometry, size, spacing, and placement. This study employs computational fluid dynamics (CFD) to investigate drag reduction in turbulent Newtonian flow, focusing on the impact of energy promoter design and the distance between rings. A grid independence study is conducted to validate the accuracy of the numerical simulations. Using ANSYS Fluent, the flow behavior within a pipeline section equipped with energy promoters is analyzed, providing insights into their effectiveness and optimization for enhanced pipeline performance. The findings aim to contribute to the development of more efficient and cost-effective crude oil transportation systems.

Keywords: numerical simulation; drag reduction; energy Promoter; Newtonian fluid; turbulent flow;

ID: Ene-P-9

High-performance of polypyrrole/cobalt–silver bimetallic nanohybrid for electrochemical hydrogen peroxide reduction in fuel cell applications

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Abstract: Hydrogen peroxide (H2O2) is a practical importance in health care in food security, environmental protection .etc... In this investigation, our primary focus was on the electrochemical fabrication of hydrogen peroxide (H2O2) sensors utilizing a bimetallic composition of polypyrrole/Co@Ag. Through chronoamperometry and pulsed electrodeposition techniques, we successfully synthesized composite hybrid materials comprising Co@Ag/PPy/ITO. The obtained electrode (Co@Ag/PPy/ITO) were studied using scanning electron microscopy, ultraviolet-visible and cyclic voltammetry techniques, through scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX) revealed the presence of silver and cobalt nanoparticles distributed on the PPy surface, forming fern-like structures. The electrochemical properties of the bimetallic composition were investigated by means of cyclic voltammetry (CV), chronoamperometry (CA) and electrochemical impedance spectroscopy (EIS). The electrochemical detection of H2O2 was carried out using amperometric method as well as cyclic voltammetry (CV). The H2O2 sensor demonstrated an enhanced amperometry response, exhibiting a higher sensitivity of 3.664 mA mM-1cm-2 within a linear range spanning 0.12–3.6 mM. Notably, the sensor achieved a low detection limit of 4.078 mM (S/N=3). Additionally, the nanocomposite hybrids displayed superior stability, repeatability, and reproducibility, making this sensor applicable for long-term use in fuel cell.

Keywords: Polypyrrole; Silver Nanoparticles; cobalt Nanoparticles, Hydrogen Peroxide, fuel cell

ID: Ene-P-10

Analyse de l'énergie interne totale dans une torche à cathode/plasma couplée par induction

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Abstract: L'analyse de l'énergie interne totale dans une torche à plasma couplée inductivement (ICP), notamment dans une configuration cathode/plasma, est essentielle pour comprendre les mécanismes énergétiques et optimiser les performances de ces dispositifs dans des applications industrielles et de recherche. Ces torches sont largement utilisées dans des processus tels que la fabrication de matériaux et le traitement de surface. Une étude approfondie de l'énergie interne permet de mieux appréhender l'équilibre thermodynamique et la dynamique du plasma. Cette recherche aborde plusieurs problématiques clés, telles que la distribution de l'énergie interne dans le plasma, l'impact du régime de Local Thermodynamic Equilibrium (LTE) sur les échanges thermiques, ainsi que l'utilisation des simulations numériques pour modéliser ces processus. Les résultats indiquent que l'énergie interne varie en fonction de la densité de courant, de la géométrie de la cathode et de la pression atmosphérique. En mode LTE, l'énergie est principalement concentrée dans les électrons et l'ionisation, tandis que les processus de recombinaison et de dé-excitation jouent un rôle crucial dans l'équilibre énergétique. Les simulations révèlent que l'optimisation de la fréquence de couplage inductif et de la géométrie de l'électrode peut améliorer l'efficacité énergétique et la stabilité du plasma. Enfin, la pression atmosphérique influence significativement l'énergie interne et la dynamique du plasma, avec des effets plus marqués à des pressions élevées.

Keywords: Torche à plasma inductivement couplée, énergie interne totale, cathode/plasma, Local Thermodynamic Equilibrium (LTE), simulation numérique, pression atmosphérique, dynamique du plasma.

ID: Ene-P-11

Assessing the Impact of Sensor Accuracy on Power Quality Monitoring in Smart Grids

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Abstract: In the realm of sensor technology, accuracy is a paramount factor that directly impacts reliability and effectiveness in various applications. As sensors are ubiquitous in modern life, from industrial automation to consumer electronics, choosing the right sensor for a specific task is critical. One of the most significant considerations is the level of accuracy it can provide. High accuracy sensors, which measure target parameters with utmost precision, come at a higher cost. On the other hand, low accuracy sensors, while more affordable, may compromise on precision. This article delves into the differences between high and low accuracy sensors, examining their advantages, limitations, and the scenarios in which each type excels. We will explore whether the extra cost of high accuracy sensors is justified, and help determine the optimal choice for smart economic meters.

Keywords: Sensor; accuracy economic; meter.

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Etude et simulation d’un moteur asynchrone alimenté par un onduleur de tension multiniveaux

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Abstract: Ce travail est consacré à l'étude de l'association entre la machine asynchrone et l'onduleur à structure NPC à deux et à trois niveaux. Le modèle mathématique de la machine asynchrone sera établi sous les hypothèses simplificatrices en utilisant la transformation de Park. Les stratégies de commande MLI seront choisies de telles manières pour que les tensions obtenues soient de plus en plus proches de celles de référence.

Keywords: machine asynchrone; l'onduleur à structure NPC ; onduleur de tension multiniveaux; commande MLI

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ID: Ene-P-13

Study of wind energy efficiency in the western coastal region of Algeria

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Abstract: This work presents a study of wind energy efficiency in the western coastal region of Algeria, case study Oran, Arzew. By studying the wind potential in the industrial region of Arzew, located in northwest Algeria, to improve the quality of service of the electricity grid and increase Algeria's participation in the use of renewable energy. The hourly wind data over 10 years (2005-2015) corresponding to the wind potential of the site were analyzed, such as: dominant wind directions, probability distribution, Weibull parameters, mean wind speed, and power potential. The site has a promising annual average wind speed for wind installations and enough space to locate the wind turbines. The estimation of the energy produced using the WAsP software for wind turbines was confirmed. Finally, this work provides a good indicator for the construction of wind installations in the western region of Algeria.

Keywords: Wind resource assessment; Weibull distribution; Wind speed; Wind turbine; Power density; WAsP.

ID: Ene-P-14

Study and evaluation of wind resources in the highlands for the contribution to energy transition: Ksar Chellala region

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Abstract: In this study, we examine the wind potential and the design methodology of a 5.2 MW wind farm in the industrial region of Kasr Chellala, located southeast of TIARET. The objective is to improve the quality of the electrical grid service and encourage Algeria to engage in the use of renewable energies. We examined hourly wind information over 4 years corresponding to the wind potential of the site, such as dominant wind directions, probability distribution, Weibull parameters, average wind speed, and power potential. The wind reaches an average annual speed of 3.3 m/s at a height of 10 m, and there is enough space to place the wind turbines. Finally, this work provides a good indicator for the construction of a wind farm in Ksar Chellala.

Keywords: Wind resource; Wind potential; Wind farm; Wind energy; Ksar Chellala; power potential

ID: Ene-P-15

Investigation of the temperature changes in a solar chimney

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Abstract: Solar chimneys are innovative systems that harness solar energy. As a sustainable solution, they provide a clean and environmentally friendly means of addressing energy needs, particularly in regions with abundant sunlight. These systems do not rely on fossil fuels, emit minimal greenhouse gases, and play a significant role in the global energy transition by offering a viable alternative to traditional energy sources. This study undertook an experimental investigation to examine the influence of mean absorber and collector temperatures on the average air and chimney temperatures. Conducted in the arid climate (Biskra University), the experiments were performed in a solar chimney prototype characterized by a collector radius of 0.50 m, a collector height of 10 cm, a chimney radius of 10 cm, and a chimney height of 1 m. Four temperature sensors are positioned on the absorber, four on the collector, and an additional four on the chimney. Temperature measurements at various study locations were conducted utilizing temperature measurement systems. The experimental findings indicate that the temperatures of the absorber, collector, and air exhibit a consistent pattern. Similarly, the temperature within the chimney also follows this pattern, demonstrating a linear decline relative to its position. The average temperature of the absorber increases in correspondence with the rise in the average temperature of the collector, adhering to a linear relationship characterized by a coefficient of determination (R^2) of 0.94. The average air temperature increases concurrently with the average temperatures of both the absorber and collector, as indicated by a model adhering to an exponential law (R^2=0.84). Furthermore, the average temperature of the chimney also rises in correlation with the mean temperatures of the absorber and collector, based on a mathematical model that follows a polynomial law (R^2=0.87). Consequently, the temperature of the absorber emerges as a critical parameter influencing the performance of the solar chimney.

Keywords: Solar Chimneys, Environmentally, Friendly Experimental investigation , Arid climate

ID: Ene-P-16

Thermodynamic Analysis and Investigation of the COP Improvement of Conventional Cooling System by the Use of a Two-phase Ejector: Application of Fourth Generation Refrigerants

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Abstract: This study presents a theoretical analysis and investigation of an operating cycle of standard refrigeration machine improved with a two-phase ejector using the HFO refrigerants as working fluids. The refrigerants considered in this study are: R1234yf, R1234ze(E) and R1216. A numerical simulation was carried out in MATLAB to evaluate and compare the energy parameters of those fluids in particular the determination of the coefficient of performance. The comparison was made for evaporating temperatures ranging from (-10 to 10 °C) and condensing temperatures ranging from (30 to 55 °C). The results obtained show in particular that the basic refrigeration system improved with a two-phase ejector allows an increase in the coefficient of performance compared to that of the basic refrigeration system and that the performances obtained with the HFO working fluid R1234ze(E) offers the maximum values compared to the two working fluids R1234yf and R1216 in the both refrigeration systems studied.

Keywords: HFO refrigerants; Low-GWP; Basic cooling cycle; Two-phase ejector; COP

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Three-dimensional Numerical Investigation of Corner Stall Blowing in an Axial Compressor Cascade

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Abstract: The aerodynamic performances in three-dimensional compressor cascade are mainly influenced by the secondary flow, like the cross flow on the side wall as well as the corner separation. Often, these secondary flows can produce a blockage and losses in the blade passage. In this paper a numerical investigation has been carried out to control three dimensional boundary layer stall in a linear compressor cascade by applying an active flow control by means of end wall or suction side tangential blowing. This work has been conducted for steady, turbulent and incompressible flow field using Reynolds Averaged Navier Stokes simulations with Realizable k-ε turbulence model. Many controlled configurations were studied. A detailed topology analysis gives us knowledge of the flow structure and the separation zone behavior. Based on this topological method, it was found that the effective blowing slot on the end wall should be located at dual nature critical point which represents the origin of separation line emission at about 9% axial chord from the blade leading edge front, which an enhancement of static pressure and total losses was possible.

Keywords: Axial compressor; Three-dimensional separation; Flow control; Boundary layer blowing; Flow topology.

ID: Ene-P-18

Comparison of daily global solar irradiance from ground-based and reanalysis datasets. A case study over Adrar (South Algeria)

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Abstract: Accurate solar resource assessment is crucial for successful solar photovoltaic (PV) projects, especially in regions like the Sahara with high solar potential but limited ground measurements. Reanalysis datasets like ERA5 and MERRA2 provide valuable spatial and temporal coverage of solar data, bridging this gap. This study compared three years (2014-2016) of daily Global Horizontal Irradiance (GHI) measurements from Adrar, Algeria, with ERA5 and MERRA2 reanalysis data using statistical metrics such as Mean Bias Error (MBE), correlation coefficient (R), Root Mean square Error (RMSE) and Mean Absolute Percentage Error(MAPE). The high correlation (R=0.90) between measurements and reanalysis underscores the reliability of ERA5 and MERRA2 in estimating solar radiation levels. With a mean daily GHI of around 6 Kwh/m2, with a relative error under 2.5 %. Seasonal analysis revealed better performance during winter months with correlations exceeding 0.9, while lower correlations were noted in summer, particularly in July (0.35 for ERA5 and 0.44 for MERRA2). These reanalysis datasets can significantly enhance the planning and implementation of solar energy projects in the Sahara, where ground measurements are limited. This makes them valuable tools for solar energy applications in data-scarce regions.

Keywords: Global Horizontal Irradiation; Reanalysis; ERA5; MERRA2; Adrar

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ID: Ene-P-19

Analysis of the impact of temperature on the vibration of the shaft line of a gas turbine

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Abstract: As part of our study, we examine the vibrational response of a gas turbine in relation to the effects of ambient temperature. Our innovative methodologies include evaluating the condition of the machine in operation, defining intervention parameters and focusing on vibration analysis to ensure accurate diagnosis and fault detection. The current project concerns vibration analysis at various ambient temperatures, with the objective of diagnosing mechanical defects in shaft bearings. The study aims to assess the impact of summer temperatures on the vibration of gas turbines in the context of power plants. This analysis focuses on two specific aspects: the vibration behaviour of gas turbines, the results of this study show that temperature variations in hot zones can be used to evaluate the effectiveness of vibration analysis for diagnostic purposes and identify potential indicators of failure.

Keywords: measurement; vibration; temperature; gaz turbine, effect.

ID: Ene-P-20

Practical Implementation of an MPPT Algorithm for a DC-DC BOOST Converter Using Arduino UNO in Photovoltaic Systems

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Abstract: The performance of a photovoltaic module is affected by several factors, including solar irradiation intensity, temperature, and load conditions. To enhance the efficiency of photovoltaic systems, it is essential to employ a Maximum Power Point Tracking (MPPT) algorithm, which ensures the extraction of the maximum available energy from the solar panels. This study focuses on the practical implementation of an MPPT algorithm to regulate a DC-DC BOOST converter. The Arduino UNO microcontroller was utilized as the control platform for this implementation. The experimental work was conducted in the laboratory at the University of Khemis Miliana.

Keywords: Photovoltaic module ;Maximum Power Point Tracking (MPPT) ;DC-DC BOOST converter ;Arduino UNO

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Numerical study of the effect of the seal placed between two solids in contact on the heat transfer coefficient

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Abstract: At the interface between two solids, contact is never perfect and occurs only at discrete points. This imperfect contact limits heat transfer by conduction between the two materials, creating a resistance to heat flow from material 1 to material 2. The imperfection of the solid-solid contact depends primarily on the surface conditions of the materials, as well as their mechanical and thermal properties. To enhance heat transfer at the contact zone, we propose the installation of a seal and aim to determine its optimal thickness and thermal conductivity to achieve efficient heat transfer. The Abaqus simulation software is used to calculate the heat transfer coefficient based on the characteristics of the seal placed between the contacting solids.

Keywords: seal; heat transfer; interface; thickness; thermal conductivity; optimal

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Numerical analysis of mixed convection in an open square cavity using a nanofluid

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Abstract:

A numerical study of a steady and laminar mixed convection through a horizontal channelcontaining an alveolus, where three fins are mounted. The finite volumemethod has been used to discretize the governing equations (continuity, momentum, and energyequations). Dynamic and thermal fields are obtained for different values of the Reynolds numberranging from 50 to 200, for different values of the solid volume fraction (0, 0.01, 0.03 and 0.05) andfor different nanofluids (Ag-Water, Cu-Water, Al2O3-Water). Analyses of temperature evolution,velocity and Nusselt number have been realized .The results obtained show that heat transfer increaseswith the increase of the solid volume fraction and the Reynolds number. They show also that the heattransfer increases using a nanofluid, and it is more important corresponding to the one which contains nanoparticles of Ag.

Keywords: Mixed convection, heat transfer, alveolus, nanofluids, finite volume method.

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Study of thermophysical properties of nanofluids

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Abstract: The thermophysical properties of nanofluids represent a modern and significant field of research in thermal engineering. Nanofluids are fluids that contain nanoparticles (smaller than 100 nanometers) suspended in base fluids such as water or oils. In this paper, the thermal conductivity, specific heat capacity, and viscosity of metal oxide nanofluids (CuO, SiO2, Al2O3, TiO2) based on Therminol VP-1™ at a 4% volume concentration were studied as heat transfer fluids. A model was developed to simulate various theoretical models of the thermal properties of nanofluids, as proposed by numerous researchers, to identify the model that best aligns with and simulates the behavior of nanofluids.

Keywords: Nanofluids ; Thermophysical properties ; Numerical simulation

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Analyse CFD de l'effet de la rugosité artificielle des parois sur la résistance hydraulique d'un écoulement turbulent

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Abstract: Cette étude numérique porte sur l'analyse des écoulements turbulents tridimensionnels dans des conduites, en considérant des parois lisses ainsi que des rugosités de formes rectangulaires avec des intervalles de nombre de Reynolds (de 10^3 à 10^6), nous avons développé et validé une nouvelle méthode de calcul du coefficient de la résistance hydraulique pour des canaux annulaires et à rugosité artificielle.

Les calculs ont été effectués à l'aide du logiciel ANSYS Fluent. Les modèles de turbulence k-ε et k-ω SST ont été utilisés pour résoudre numériquement les équations de Navier-Stokes moyennées par Reynolds. Nous nous sommes particulièrement intéressés à la deuxième constante du profil de vitesse logarithmique, un paramètre clé caractérisant l'interaction fluide-paroi dans les écoulements turbulents sur des surfaces rugueuses. Les résultats obtenus sont ensuite comparés entre eux, ainsi qu'avec des résultats théoriques et de simulations issus de la littérature, ce qui a révélé une excellente concordance.

Keywords: Simulation numérique, rugosité, résistance hydraulique, vitesse logarithmique, ANSYS Fluent, modèles de turbulence.

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Energy-Efficient Optical Fiber Networks Enabled by AI-Driven Distortion Mitigation

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Abstract: Distortion in optical fibers is one serious problem that impacts the quality of communication systems at high speed. The main distortions are nonlinear effects, chromatic dispersion, amplified spontaneous emission noise, and polarization mode dispersion. Complex mitigation strategies will be required for these distortions in applications involving dense wavelength division multiplexing, high data rates, and longer distances.

Artificial intelligence (AI) and machine learning (ML) are helping to predict and compensate for distortions caused by photonic components in optical networks. To model the nonlinear distortions without an explicit model of the channel, for instance, deep learning models such as convolutional neural networks (CNNs) and long short-term memory (LSTM) networks can be used. Reinforcement learning (RL) algorithms are used to optimize dynamic power allocation and dispersion management to alleviate CD and PMD while minimizing power consumption.

Digital signal processing (DSP) methods powered by AI, like equalizers based on neural networks, do better than traditional methods in addressing complicated distortions in coherent optical systems. Also, optical networks use AI to create digital twins that predict distortion effects and maintain the system.

This research shows how AI can help reduce optical fiber distortions and create a strong, energy-efficient, and high-capacity network communication system.

Keywords: Signal Distortion Mitigation; Nonlinear Effects; Artificial Intelligence (AI); Machine Learning (ML); Energy Efficiency; Optical Fiber Networks.

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Analysis of the Impact of Obstacle Angle in a Divergent-Convergent Minichannel on Sound Pressure Levels

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Abstract: This study aims to analyze the effect of the obstacle angle position within a minichannel on the sound pressure level. The research investigates three different obstacle configurations in a water-filled minichannel, with water chosen as the medium for sound propagation. Harmonic analysis was used to evaluate the results.

The study considers three different cases:

The first case consists of a divergent-convergent channel with a length of 40 mm, containing a rectangular obstacle positioned at an angle of 0° to the horizontal axis.

The second case features an obstacle positioned perpendicular to the horizontal axis, forming a 90°.

The third case includes an obstacle inclined at a 45° to the horizontal axis.

The analysis was conducted using wavelengths ranging from 1000 to 4000 Hz. The results indicate that sound pressure distribution varies with wavelength. At a frequency of 4000 Hz, the third case exhibits the highest sound pressure level variation, reaching 82.24 dB, compared to 79.5 dB in both the first and second models, which showed similar values.

Additionally, this study examined the impact of sound pressure level on the overall deformation of the minichannel, revealing that the third case is more affected than the other two. Furthermore, findings suggest that sound transmission loss within the channel decreases with increasing frequency in the first and second models. However, in the third case, transmission loss fluctuates with frequency but remains lower than in the other two cases.

Keywords: Divergent-Convergent minichannel; obstacle Angle; sound pressure level; Harmonic acoustics.

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The effect of suction and injection on the stability of thin fluid film

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Abstract: Our study focuses on the stability of a flow of a viscous fluid film subjected to the action of an injection and suction all over an inclined plane. An accurate model is obtained in terms of a system of simplified differential equations that describe the spatial and temporal evolution of the two fundamental variables, which are the interface and the local flow rate. All the important physically effects are contained. A linear flow stability study was carried out to investigate the influence of the different parameters of the problem on the growth rate of the perturbations in the physical problem. Within this framework, we determined the critical conditions at the threshold of instability.

Keywords: instability ; injection ;suction; linear stability; interface

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Contribution of the technique of predictive control fed by an inverter seven level applied to a permanent magnetique synchronous machine

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Abstract: The increasing demand for high-performance electrical drives has led to the development of advanced control strategies that enhance efficiency, precision, and robustness. In this context, Model Predictive Control (MPC) has emerged as a powerful technique for controlling electrical machines due to its ability to handle multiple constraints and optimize control actions in real-time. This paper presents a predictive control technique applied to a Permanent Magnet Synchronous Machine (PMSM) fed by a seven-level inverter. The proposed control strategy aims to improve system performance in terms of torque response, reduced harmonics, and increased efficiency. Multilevel inverters have gained significant attention in power electronics due to their ability to generate high-quality output waveforms with lower harmonic distortion. The seven-level inverter, in particular, offers superior voltage resolution and improved power conversion efficiency compared to conventional two- or three-level inverters. By integrating a seven-level inverter with predictive control, this study demonstrates the advantages of advanced control techniques in high-performance motor drive applications.

The predictive control approach relies on a model-based optimization process that predicts future states of the system and selects the optimal switching states to minimize a predefined cost function. This method provides fast dynamic response, eliminates the need for complex proportional-integral (PI) controllers, and allows for direct control of machine variables. The predictive model considers the electrical and mechanical dynamics of the PMSM, ensuring accurate tracking of reference signals while minimizing torque and flux ripples.

Simulation and experimental results confirm the effectiveness of the proposed predictive control strategy in improving the overall performance of the PMSM drive. Compared to conventional control techniques, such as field-oriented control (FOC) or direct torque control (DTC), the predictive control method exhibits superior transient and steady-state performance. The integration of a seven-level inverter further enhances the power quality by reducing total harmonic distortion (THD), leading to improved efficiency and extended motor lifespan. Additionally, the study explores the impact of different prediction horizons, switching frequencies, and computational complexities on system performance. The results demonstrate that the predictive control method, when optimized properly, ensures smooth torque operation, reduced current distortions, and minimal switching losses. Furthermore, the seven-level inverter structure contributes to lower voltage stress on power semiconductors, improving system reliability and efficiency.

Keywords: predictive control; inverter seven level; PMSM

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Application of artificial neural network (ANN) for the prediction of fouling resistance in heat exchanger

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Abstract: In this work an artificial neural network model was developed with the aim of predicting fouling resistance, the network was designed and trained by means of 200 experimental data points that were selected from the literature of a countercurrent double-pipe heat exchanger operating with water and milk has been used to build the ANN model. This data points contains 9 inputs, including logarithmic mean temperature difference, Reynolds number and Prandtl number of entering and leaving fluids (hot, cold), and dimensionless fouling resistance as an output. The experimental data are used for training, testing and validation the ANN using multiple layer perceptron (MLP). The comparison of statistical criteria of different networks shows that the optimal structure for predicting the fouling resistance of entering and leaving fluids is the MLP network with 9 hidden neurons, which has been trained with Levenberg–Marquardt (LM) algorithm. The accuracy of the model was assessed based on three known statistical metrics including root mean square error (RMSE), mean absolute percentage error (MAPE) and coefficient of determination (R2). The obtained model was found with the performance of {RMSE=2.4893×10-4, MAPE=0.0222% and R2=0.99999} for the training stage, {RMSE=8.1077×10-4, MAPE=0.0625 % and R2=0.99992} for the test stage and {RMSE=5.9164×10-4, MAPE=0.0584 % and R2= 0.99988} for the validation stage.

Keywords: Heat Exchanger, Fouling, Modeling, Artificial Neural Networks

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implementation of MPPT with P&O, I_C and PSO algorithm for photovoltaic systems in Arduino

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Abstract: To maximize the electricity output of a photovoltaic generator (PVG), maximum power point (MPPT) detection methods are most commonly used in photovoltaic systems. The principle of these techniques is to operate the PVG at maximum power (MPP), which depends on environmental factors, such as solar radiation and ambient temperature, and ensures optimal power transfer between the PVG and the load. In this article, we present the implementation of digital MPPT commands using the Arduino Mega type. The two proposed MPPT controls are based on the perturb and observe algorithm (P&O), InC, Fuzzy logic, PID based on PSO. The simulation results show that the Fuzzy logic controller provides good results and is the most efficient compared to the P&O, InC and PSO based PID algorithm. As the experimental results show, the P&O and InC algorithm give good results

Keywords: MPPT, controls, perturb and observe algorithm (P&O), InC, Fuzzy logic, PID based on PSO, PV

ID: Ene-P-32

Production d'hydrogène via la réaction de vaporeformage du méthane (VRM) en présence de catalyseurs Ni/Al, Ni-La/Al et Ni-Fe/Al

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Abstract: Les conséquences de la consommation abusive des énergies fossiles sur le système écologique sont désastreuses. De ce fait l'orientation vers l'utilisation des énergies renouvelables s'impose. L'hydrogène vecteur énergétique propre semble être la solution de substitution. En effet son impact carbone est très intéressant car sa combustion génère uniquement de l'eau et produit 3 fois plus d'énergie comparé aux carburants d'origine fossile. L'hydrogène intervient dans de multiples secteurs industriels; tels que la chimie et le raffinage ,dans le secteur du transport et dans la production d'électricité .95% de l'hydrogène est actuellement produit industriellement par vaporeformage du méthane [1].Ce procédé est généralement réalisés en présence de matériaux catalytiques à base de nickel [2].Cependant bien que ces systèmes catalytiques soient actifs ils présentent un inconvénient majeur lié à leur rapide désactivation par des phénomènes de frittage et ou de dépôt de carbone. Afin de palier à ces désagréments l'ajout de promoteur tel que le lanthane ou le césium ,ou l'incorporation d'éléments de transition dans des structures bien définies tels que a spinelle semble prometteur[3]. Dans cette optique nous nous sommes intéressés à des systèmes bimétalliques nickel lanthane et nickel fer, supportés sur alumine alpha (Ni-La/α -Al2O3 et Ni-Fe/α -Al2O3),afin de créer un effet de synergie entre les matériaux et minimiser la désactivation des catalyseurs à travers la formation de particules de petite taille bien dispersées en forte interactions avec le support. Les matériaux ont été préparés par la méthode d'imprégnation humide et caractérisés par différentes techniques DRX, BET et RTP. Leurs performances catalytiques ont été testés dans la réaction de vaporeformage du méthane .

Keywords: hydrogène; vaporeformage; méthane; nickel; lanthane; fer.

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Enhanced Performance of a Photovoltaic Thermal Collector with a Copper Metal Foam Air Channel

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Abstract: This numerical investigation aims to study the effect of Cu/air porous-fluid and pure air as working fluids on the thermal energy, electrical energy and exergy efficiencies as well as entropy generation of a photovoltaic thermal system (PV/T). For this purpose, the effect of various porous on the performance efficiency of PV/T system performance efficiency was investigated first. The effect of operating parameters (inlet temperature and inlet velocity) for each porosity on the thermal and electrical energy efficiencies as well as exergy and entropy of the PV/T system was then investigated. The results indicated that the increasing the porosity from 1 to 0.89, increases the thermal energy, electrical energy and exergy efficiencies from 44.50% to 67.01%, 10.64% to 11.54% and 12.01% to 13.19%, respectively. Furthermore, the entropy generation decreases from 1.3116 W to 1.2942 W. The results also indicated that the application of porous in the cooling channel provided better performance than the pure air when increasing the inlet temperature from 30℃ to 50℃ and increasing the solar radiation from 200 W/m2 to 1000 W/m2. In addition to that, the optimum thickness of the cooling channel was cm for porosity 0.93.

Keywords: Metal foam; cooling; exergy; entropy; thermal performance; photovoltaic

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A Study of the Impact of Ventilation on Thermal Comfort and on the Energy Consumption for Heating and Air Conditioning

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Abstract: The objective of this study is to improve the energy efficiency of buildings by analyzing the thermal behavior of a building, aimingto ensure a maximum thermal comfort of the occupants, while minimizing the energy consumption of heating and air conditioning. This study aims to demonstrate the effect of ventilation on thermal comfort and on energy consumption for heating and air conditioning, using a numerical sımulatıon. This simulation is carried out for two cites having distinct weather conditions, namely: Bechar and Constantine. The city of Bechar is located in the south west of Algeria (having a desert climate) while the city of Constantine is located in the north east of Algeria (having a Mediterranean climate). The main focus of this work is the analysis of passive air conditioning, since it plays an important role in improving energy efficiency for buildings. The specificity of this work lies in the fact that it performs a comparative analysis of the energy performance of a building, in two regions of different climates in Algeria. In addition, it studies the effect of ventilation speed on passive and active air conditioning. The approach used in this work is a numerical simulationusing the TRNSYS software.

A FORTRAN program was implemented in order to process the results obtained by this simulation (by reading the output files of this simulation). The result of this processing has allowed the calculation of the annual and seasonal durations of comfort for each site and each speed of ventilation, as well as the total annual and seasonal energetic consumption for heating and air conditioning.

The optimal ventilation speed, which gives the minimum of energy consumption in heating and air conditioning, for the two cities, is estimated at 0.2 vol/h; except during the spring season in Béchar, where this speed is estimated at 0.5 vol/h.

As a general conclusion, this simulation has allowed the estimation of optimal ventilation speed, for passive and active air conditioning.

Keywords: Thermal engineering; thermal comfort; numerical simulation; TRNSYS software.

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Bald Eagle Search Optimization Algorithm for optimal DG Allocation in Distribution Network with Seasonal Load Variations

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Abstract: Optimal allocation is critical for effective planning of distribution network connected distributed generators (DGs) subject to efficient optimization methods. This paper present the optimal placement and sizing of renewable distributed generators in distribution network with technical objective like minimization of total active power losses using the Bald Eagle Search method (BES) considering seasonal voltage dependence. Practical voltage dependency load model, that are not, completely residential, industrial, and commercial, a mixed load model is considered which comprises only these three load types in which every bus of the system has a mixture of these load types connected to it.

The effectiveness and feasibility of the BES are evaluated on the IEEE 69-bus distribution network. The results show the effectiveness of the proposed algorithm.

Keywords: Distributed Generators; Distribution Network; Bald Eagle Search Algorithm; Seasonal Load Models.

ID: Ene-P-36

Enhancing Small Rotor Performance with Winglets

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Abstract:

Computational Fluid Dynamics (CFD) is a powerful and reliable tool for evaluating and optimizing rotor performance. One effective flow control strategy for enhancing rotor efficiency is the integration of winglets, which have been widely applied across various engineering fields. This study investigates the aerodynamic benefits of winglets, focusing on their role in mitigating tip vortex effects and improving overall rotor performance. By implementing a winglet with a cant angle of 30° and a length of 7% of the tip radius (R_tip) in the pressure direction, the rotor demonstrated a 10% performance enhancement. The study provides a detailed flow analysis using advanced CFD techniques, offering insights into the physical mechanisms driving these improvements.

Keywords: CFD ; Winglet; Vortex tip ; Flow control

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LE VEGETAL URBAIN COMME OUTIL D'ADAPTATION AUX DEFIS CLIMATIQUES ET UNE MEILLEURE EFFICIENCE ENERGETIQUE DES CONSTRUCTIONS . CAS DE LA VILLE DE JIJEL.

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Abstract: Les changements climatiques engendrent un réchauffement global de la planète particulièrement pour la région Afrique du nord ce qui entraine des situations d'inconfort pour les usagers des espaces urbains ainsi que des surcouts dus à la consommation énergétique qui devient une préoccupation majeure au niveau de nos villes. Le végétal urbain au niveau des espaces urbains sous forme d'arbres de pelouses et de toitures végétalisées peut être une technique optimale pour atténuer l'impact des phénomènes météorologiques extrêmes sur la santé humaine et la préservation des infrastructures par l'adoucissement des ambiances microclimatiques et l'absorption des eaux de pluies en période de tranches pluviométriques élevées. L'efficience énergétique des bâtiments est un sujet crucial dans les zones climatiques méditerranéennes en raison des températures élevées et des conditions climatiques souvent extrêmes. Les bâtiments économes en énergie sont essentiels pour réduire la consommation d'énergie, les émissions de gaz à effet de serre et les coûts de fonctionnement des bâtiments. En plus de lutter contre les nuisances urbaines les zones végétalisées atténuent l'effet ilot de chaleur urbain, diminuent notre dépendance aux énergies fossiles émettrices des gaz à effet de serre, réduisant ainsi significativement l'impact des phénomènes extrêmes dus aux changements climatiques. L'objectif du présent travail est de mettre en évidence les effets quantifiés de la couverture végétale sur la régulation thermique des microclimats urbains à l'échelle d'un quartier dans un contexte climatique régional méditerranéen. Les outils développés à l'occasion consistent en l'étude de l'apport des corridors écologiques et ce à travers la présentation des résultats du travail expérimental réalisé et consistant en deux campagnes de mesures in situ, des paramètres de température de l'air, humidité relative et vitesse du vent, sur deux zones urbaines contradictoires de la ville de Jijel. Les résultats de ces mesures permettent de démontrer l'amélioration des conditions climatiques de la zone végétalisée d'une moyenne de 23 % pour la température de l'air, de 62% pour le taux d'humidité et une réduction de 45 % pour la vitesse du vent. Ce qui contribue à adoucir les ambiances microclimatiques des villes améliorant l'efficience énergétique des bâtiments par des procédés passifs de rafraichissement contribuant ainsi à atténuer les effets des changements climatiques comme solutions durables pour une meilleure efficience énergétique des constructions renforçant la résilience des villes face à ces impacts.

Keywords: Changement climatique. Effet de serre. Efficience énergétique. Couverture végétale. Résilience environnementale.

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Performance analysis of two end-side-end solar laser pumping systems: RAC-RAC vs. RAC-Parabolic mirror configurations.

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Abstract: Solar laser systems are a promising technology for the direct conversion of the sun's energy into high-power laser beams and have potential applications in communications, industry, and numerous other areas. In this study, the performance of two solar concentration systems as laser pumpers is compared in terms of their absorbed power efficiency and thermal distribution in the active medium. The first system (RAC-RAC) employs two ring array concentrators, and the second system employs a ring array concentrator and a parabolic mirror. Both systems share the same dimensions: a 1.5 m concentrator and a 20 mm length and 5.5 mm diameter laser rod (active medium). Numerical simulations were conducted on Zemax software with an input solar power of 254.1 W. The results showed the RAC-RAC system delivered more total power absorbed, at 184.5 W (72.6% of input) compared to 180 W (70:8%) of the hybrid system. Notably, the RAC-RAC configuration saw an evenly divided power output towards the ends of the laser rod: 96.2 W at the front and 89.5 W at the back (front-to-back ratio: 1.07:1), lowering the thermal gradients and attendant stress danger. In comparison to this, the secomd system showed gross imbalance, taking in 73.2 W at the front and 106.2 W at the rear (ratio: 1.45:1), worsening concentration of thermal loads and weakening structural integrity of the rod. This study categorically confirms that the parabolic ring array (RAC) is optimal for end-side-end solar laser pumping. Its ability to deliver high absorbed power with a constant heat profile ensures enhanced operating stability and active medium longevity, which makes it the most suitable for sustainable solar laser systems. While the RAC-RAC has improved performance for end-side-end solar laser pumping, consider that this system is more complex in design compared to the comparatively less complex second system.

Keywords: Solar-pumped laser; end-side-end system; laser rod; RAC concentrator; laser head; solar power.

ID: Ene-P-39

Kinetic Modeling of Lemon Slices Drying in a Direct Solar Dryer

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Abstract: This work presents the results of research on the drying process of lemon. The drying device used is a new direct solar dryer with forced convection. The study focuses on modeling the drying kinetics of lemon slices. It estimates the effective diffusivity of moisture and analyzes the drying kinetics of the samples using Fick's diffusion model to explain moisture transfer. Statistical parameters such as the coefficient of determination (R^2), the root mean square error (RMSE), and the reduced chi-square (χ^2) have been used to compare the predicted and observed moisture rates. The results indicate that the Midilli-Kucuk model is successful in describing the drying kinetics of lemon slices.

Keywords: forced solar dryer ; lemon ; drying kinetics ; effective moisture diffusivity

ID: Ene-P-40

A Fractional Calculus Based on the Grey Wolf Optimizer in Drying Research

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Abstract: In this study, A comparison has been carried out between analytical and fractional solution of the Fick's first and second-order of diffusion to model the drying process of different products and dryers and under different operational parameters. The solution to the function with two parameters has been obtained by using Laplace and Laplace's inverse transform. The order index n and the fractional time index α of the above Fick's law and theirs parameters have been non-linearly optimized using a grey wolf optimisation (GWO) algorithm. The findings demonstrated that the fractional-order model best explains the anomalous diffusion phenomenon that occurs during the drying process.

Keywords: Moisture ratio, fractional calculus, drying, modelling, grey wolf optimizer,

ID: Ene-P-41

Absorption system with thermal energy storage

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Abstract: The absorption system is an efficient method for storing thermal energy, utilizing the principles of sorption to capture and release heat as needed. This system involves a working pair, lithium bromide and water, where one component absorbs or desorbs the other in response to temperature changes. During the charging phase, thermal energy from sources like solar collectors or waste heat is used to separate the sorbent and refrigerant, storing energy in the form of a chemical potential. When heat is required, the components recombine, releasing the stored thermal energy. This technology is particularly valuable for applications in cooling, heating, and refrigeration, offering an energy-efficient and sustainable alternative to conventional storage methods. this study was completed using variable operating temperatures to change climatic conditions, in this article shows How the absorption cooling system works, which linked the relationship on how to store thermal energy extracted from the sun for exploitation in the absorption cooling system.

Keywords: Absorption/storage /energy

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Amélioration de la Réaction d'Évolution de l'Hydrogène (HER) avec des électrodes Ni-Al activées chimiquement et fabriquées par chauffage par induction

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Abstract: Cette étude présente une investigation approfondie sur la préparation, la caractérisation structurelle et l'amélioration des performances des électrodes de composés inter-métalliques Ni-Al (50 % en poids de Ni) pour la Réaction d'Évolution de l'Hydrogène (HER). Les électrodes ont été synthétisées par chauffage par induction, une technique rapide et économique qui a produit des phases inter-métalliques homogènes NiAl avec des tailles de cristallites de 60,36 nm et 67,38 nm, respectivement, comme confirmé par diffraction des rayons X (XRD) et raffinement de Rietveld. L'alliage Ni-Al a été chimiquement activé par lixiviation sélective dans une solution de NaOH (1,0 M) à 353 K pendant 72 heures, augmentant significativement la porosité et la rugosité de surface. La profilométrie optique a révélé une augmentation des paramètres de rugosité, y compris le facteur de rugosité, qui est passé de 28,49 à 63,77, et une amélioration marquée de la surface disponible pour l'activité électrochimique. La transformation de la morphologie de surface, confirmée par la Microscopie Électronique à Balayage (MEB), a été accompagnée d'une réduction partielle de la teneur en aluminium (de 49,57 % à 36,22 %) et d'un enrichissement correspondant en nickel, favorisant ainsi l'activité catalytique. Les tests de performance électrochimique dans KOH (1,0 M) à 298 K ont démontré une augmentation de 66,67 % de la production d'hydrogène (98 mL contre 63 mL pour les électrodes non activées) et une réduction significative du surpotentiel, attribuée à l'augmentation de la densité des sites actifs et à l'amélioration de l'efficacité du transport de masse. Les électrodes activées ont maintenu une stabilité à long terme, avec une dégradation minimale des performances observée sur des périodes d'essai prolongées. Dans l'ensemble, la combinaison du chauffage par induction et de l'activation chimique s'est avérée être une stratégie efficace et évolutive pour fabriquer des électrodes Ni-Al performantes et durables. Les propriétés électrocatalytiques améliorées, la production de hydrogène accrue et la durée de vie opérationnelle prolongée font de ces électrodes des candidates prometteuses pour la production de hydrogène vert à grande échelle et à moindre coût, répondant ainsi au besoin mondial de solutions énergétiques durables.

Keywords: Activité électrocatalytique ; Énergie verte ; Réaction d’évolution de l’hydrogène (HER) ; Composé intermétallique NiAl; Nickel de type Raney ; Électrolyse de l’eau ; Diffraction des rayons X (XRD)."

ID: Ene-P-43

An Enhanced Hybrid GWO-PSO Algorithm for High-Efficiency MPPT in Photovoltaic Systems

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Abstract: Maximum Power Point Tracking (MPPT) is a critical factor in optimizing photovoltaic (PV) system efficiency, yet traditional methods suffer from slow convergence and susceptibility to local optima, particularly in the presence of multi-peak power curves. To address these challenges, this study proposes a novel hybrid MPPT strategy integrating **Grey Wolf Optimizer (GWO) and Particle Swarm Optimization (PSO). The proposed approach enhances global exploration through a cosine adaptive factor, improves search diversity using circle chaotic mapping and cross-variance mechanisms, and incorporates a **cooperative search strategy to strengthen local exploitation and accelerate convergence. The algorithm's effectiveness is validated using IEEE benchmark functions, demonstrating superior convergence speed and accuracy compared to conventional AOA, TSO, and PSO methods. When applied to MPPT control in PV systems, simulation results confirm faster tracking response, improved stability, and higher energy extraction efficiency**, making this hybrid GWO-PSO approach a promising solution for enhancing PV system performance in dynamic environments.

Keywords: Maximum Power Point Tracking (MPPT), Renewable Energy Optimization, Grey Wolf Optimizer (GWO), Particle Swarm Optimization (PSO).

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ANFIS-Based DC Bus Voltage Regulation for DFIG Wind Systems Under Real Wind Profiles and Grid Faults

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Abstract: This study investigates the regulation of DC bus voltage V bus in the grid-side converter of a Doubly Fed Induction Generator (DFIG)-based wind energy system using an Adaptive Neuro-Fuzzy Inference System (ANFIS) controller. The proposed ANFIS-based control strategy is integrated into a vector control scheme and evaluated against a conventional Proportional-Integral (PI) controller. The system is modeled and simulated in MATLAB/Simulink using a real wind speed profile measured and recorded at the Research Unit for Renewable Energies in the Saharan Environment in ADRAR, ALGERIA. Additionally, the controller's performance is tested under actual grid fault conditions to assess its response in maintaining V bus stability. Simulation results demonstrate that the ANFIS controller achieves superior voltage regulation compared to the PI controller, effectively enhancing power quality and improving grid stability under varying wind conditions and fault scenarios.

Keywords: DFIG ; wind turbine ; ANFIS ; vector control ; grid side ; grid fault ; real wind speed profil

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Application of solar collectors in poultry houses

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Abstract: Despite the significant potential of global renewable energy resources, the poultry industry continues to rely heavily on conventional energy sources. Recent advancements in industrial poultry farming have reignited interest in enhancing heating systems. Many poultry farmers face challenges in maintaining optimal temperature and humidity levels while also minimizing harmful emissions of carbon dioxide and ammonia, which can lead to increased chicken mortality. This study explores the feasibility of utilizing a solar collector to heat a prototype poultry house under various conditions, including top- or bottom-drawing configurations and different tube counts. Conducted in Algeria's arid region, the analyses revealed that the top-drawing method yielded the most effective temperature increases. Notably, configurations A (one tube from the top of the collector) and H (three tubes from the top) achieved indoor temperatures of 41°C and 37°C, respectively.

Keywords: Solar collectors ; Poultry house ; Eco ; friendly practices ; Environmental impact ; Heating systems.

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Artificial Recurrent Neural Control of a Six-phase Induction Generator Used in Wind Energy Conversion System

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Abstract: In this paper a field-oriented control (FOC) of a six-phase induction generator (6PH-IG) used in a grid-connected wind turbine system is presented. Currently, the six-phase induction machine (6PH-IM) is the most used among multiphase machines. This machine has two windings-set, sharing the same stator and shifted by an electrical angle of 30° and fed by two parallel converters. In the first step a maximum power point tracking (MPPT) is presented , in order to extract a maximum of power under fluctuating wind speed. In a second step, vector control of th 6PH-IG with FOC is described. Finally, voltage oriented control (VOC) is used to ensure the power factor unity on the network side. The main contribution of the presented paper is the application of the artificial recurrent neural network (ARNN) controller in order to improve the robustness and stability of the system, especially against the parameter change. In comparison with the conventional control, which is known by its sensitivity, the proposed ARNN-MPPT presents better performance under normal and abnormal conditions. The robustness and effectiveness of the proposed control has been validated through illustrative simulation results with different functional zones, and for fixed and variable wind speed

Keywords: Wind energy, Six-phase induction generator (6PH-IG) , ARNN controller, PI controller

ID: Ene-P-47

Faults Diagnosis of Power Converters In Solar Energy Systems

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Abstract: Power converters play a crucial role in solar energy systems by ensuring efficient energy conversion and distribution. However, faults in these converters can lead to reduced system performance, energy losses, and potential failures. Accordingly, this paper presents a reliable diagnostics approach that allows the detection and identification of multiple open-switches and open-phase faults in power converters used in solar systems. The proposed method provides normalized numerical signatures from the measured output currents without requiring either tuning effort or detection thresholds. The reliability and robustness of the proposed algorithm are proven through simulation tests.

Keywords: Power converters, Solar energy, Open-switches and open-phase

faults diagnosis.

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Model-Based Approaches for Fault Detection and Classification in PV Systems

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Abstract: Ensuring the reliability and efficiency of photovoltaic (PV) systems requires accurate fault detection and classification. This paper presents a model-based approach for diagnosing faults in PV systems, leveraging mathematical and physical models to identify deviations from normal operation. The proposed methodology enables precise fault detection and classification by comparing real-time system behavior with expected performance under varying environmental conditions. The approach effectively distinguishes between common PV faults, such as shading, line-to-line faults, and degradation, enhancing system reliability and performance. Simulation and experimental validation demonstrate the effectiveness of the proposed method, showcasing its potential for real-time monitoring and predictive maintenance.

Keywords: Photovoltaic (PV) Systems; Fault Detection; Fault Classification; Model-Based Diagnosis; PV System Monitoring; Anomaly Detection; Diagnostic Methods; Performance Analysis; Renewable Energy Reliability.

ID: Ene-P-49

Modeling and performance analysis of a vehicular PEMFC system

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Abstract: Vehicles powered by proton exchange membrane fuel cells (PEMFC) have received increasing attention due to their energy efficiency and low environmental impact. However, the auxiliary components of these systems consume a significant proportion of the primary energy produced. The present study focuses on the performance analysis of a 20 kW PEMFC system designed for automotive applications. The system comprises a PEMFC stack, heat exchangers, humidifiers, a water pump and compressors. It is important to mention that the waste heat generated by the PEMFC is recovered and used to preheat the reactants at the PEMFC inlet. A thermodynamic model and a simulation of the overall system are carried out to analyze the distribution of power consumption by the auxiliaries, as well as the net power. An exegetic analysis reveals that the PEMFC and the heat exchangers are the main sources of exergy losses. The system's optimum performance is achieved at an operating temperature of 348.15 K. In addition, a lower current density improves energy efficiency and reduces power losses, results in a slight reduction in net power.

Keywords: PEMFC, power, efficiency, exergy.

ID: Ene-P-50

Numerical Study of the Effect of Obstacle Design and Placement on the Thermal and Dynamic Efficiency of Mixing

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Abstract: This study aims to compare four designs of Y-shaped fluid mixing channels with two inlets and a single outlet, incorporating obstacles within the mixing channel to enhance mixing efficiency. The objective is to determine the most effective design for achieving optimal fluid mixing while minimizing pressure drop. The first design features rectangular obstacles placed perpendicularly to the channel walls, promoting turbulence. The second design is similar but with the obstacles oriented horizontally. In the third design, small spherical obstacles are uniformly distributed within the channel, while the fourth design strategically places four small obstacles at the fluid convergence point. A two-dimensional numerical simulation was conducted using ANSYS software to analyze fluid flow and heat transfer in these designs. The simulations were performed using the finite volume method, with the governing equations for mass, momentum, and energy solved under steady-state conditions. A range of Reynolds numbers (600–1500) was considered, with fluid temperatures at the first and second inlets set to 293 K and 350 K, respectively. The turbulence model and boundary conditions were appropriately defined to ensure accurate results. The designs were evaluated based on flow behavior, temperature distribution, pressure drop, and mixing efficiency. The results indicated that while the first design achieved effective fluid mixing, it exhibited a significant pressure drop of 2.98×10^2 Pa. Conversely, the fourth design, which utilizes small obstacles at the fluid convergence point, demonstrated high mixing efficiency within a compact mixing zone while maintaining a lower pressure drop of 1.42×10^2 Pa. Meanwhile, the second and third designs were less effective in promoting fluid mixing. The second design, with horizontally aligned obstacles, resulted in weak vortex formation, leading to poor mixing despite a lower pressure drop of 5.58×10^1 Pa. Similarly, the third design, which incorporated small spherical obstacles, exhibited insufficient turbulence for efficient mixing, with a pressure drop of 1.37×10^2 Pa. These findings suggest that strategically placing small obstacles at the fluid convergence point is a more effective approach for enhancing mixing performance while minimizing energy losses due to pressure drop.

Keywords: Numerical Simulation; Y-Shaped Channel; Fluid Mixing; Obstacles.

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Optimal Integration of WT-DG in a Distribution Network Using BA

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Abstract: In recent years, distributed generation units became attractive due to its technical, economic and environmental benefits. Installation of distributed generation (DG) based on renewable energy sources such as wind turbine (WT) could be an effective solution to the problem of shortage of the electric energy especially in populated areas. Insertion of WT-DG in non-suitable places can result in more energy losses and voltage instability which leads to higher operating cost. WT-DG should be placed optimally in the network to get maximum efficiency of the system. This paper presents a new method to solve the optimal sizing and placement of WT-DG with the aim of minimizing real power loss in a distribution system. Bat algorithm (BA) is used to find out the optimal size and to identify the WT-DG placement in a radial distribution system simultaneously. The method is implemented on IEEE 33-bus radial distribution system to demonstrate the performance and the effectiveness of the proposed method. The results obtained are discussed and analyzed where they proved the usefulness of the applied algorithm.

Keywords: Distributed generation; Radial distribution system; Bat algorithm

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Performance Analysis of Photovoltaic Modules under Variable Operating Conditions

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Abstract: This study investigates the impact of various operating conditions on the electrical performance and energy yield of two technically identical RAGGIE (RG-M165W) photovoltaic modules. The first module serves as a reference, while the second is the targeted module. Both modules were tested under identical climatic conditions in El-Oued, Algeria. The research examined the effects of a manually operated horizontal single-axis solar tracking system, variations in the tilt angle of the modules, and the cleanliness of the active module surface on energy productivity. The findings demonstrate a strong agreement between experimental and numerical results, identifying an optimal tilt angle of 33° for the El-Oued region, with deviations resulting in an efficiency loss of 19.31%. Manual solar tracking improved module efficiency by 1.63%, while dust accumulation of 14.5 g/m² reduced energy output by 34.68%. Economically, a photovoltaic system comprising 14 RAGGIE modules can supply a typical Algerian household with 136.6 MWh over 25 years, with a Levelized Cost of Energy (LCOE) of $0.037/kWh, achieving a CO_2 mitigation of 59.15 tons and a cost saving of $858. These results underscore the importance of optimizing module orientation, cleanliness, and tracking for maximizing photovoltaic performance in arid regions.

Keywords: Photovoltaic modules; Solar tracking; Dust deposition; Energy yield; Optimal tilt angle; Economic analysis

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Performance Enhancement of Vapor Compression Refrigeration Systems with Al_2O_3-Based Nanorefrigerant

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Abstract: This study examines the influence of incorporating Al_2O_3 nanoparticles on vapor compression refrigeration system performances, in which a comprehensive MATLAB-based numerical model linked to the REFPROP database has been developed to analyze the thermophysical and thermodynamic properties of nanorefrigerants. R1234yf refrigerant was examined under standard operating conditions at different nanoparticle mass fractions ranging between 0.1% and 0.5%. The obtained results showed that the incorporation of nanoparticles significantly affects the system's operation, where the coefficient of performance (COP) increased by up to 5.2% at the highest concentration of nanoparticle 0.5% compared to 0.1%. This outcome confirm the potential of employing nanorefrigerants instead of pure refrigerants in enhancing efficiency. Moreover, incorporating nanoparticles leads to a lower power consumption in the compressor and higher heat rejection in the condenser, while it did not show any positive effect on heat absorption at the level of the evaporator.

Keywords: Al_2O_3; nanorefrigerants; VCRS, R1234yf, thermophysical properties

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Performance Evaluation and Transient Behavior of Triple Concentric Tube Heat Exchangers

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Abstract: This research investigates how a Triple Concentric Tube Heat Exchanger (TCTHE) performs under different operating situations. The TCTHE is designed for increased thermal efficiency and compactness, with three concentric tubes for simultaneous heat transfer between three fluid streams. The system's thermal performance, pressure drop, and efficacy were assessed experimentally over various flow rates and intake temperatures. The findings show a considerable increase in heat transfer rate when Deionized Water (DIW) flow rates rise, reaching a maximum of 700 W at 35 L/h. The pressure drop, on the other hand, followed a linear pattern, increasing from 0.5 kPa at 10 L/h to 2.7 kPa at 35 L/h, indicating that hydraulic losses were tolerable. The system's effectiveness peaked at 0.82 for lower flow rates, demonstrating its potential for applications requiring lengthy fluid residence times. The system's efficiency was validated by energy balance calculations, which showed that experimental figures closely match theoretical expectations. The TCTHE performance was verified using dimensionless parameters such as the Nusselt number (Nu) and Reynolds number (Re), with differences less than 5% from theoretical models. These results show that the TCTHE is versatile enough for renewable energy systems, industrial cooling, and chemical processing, providing a high-performance option for energy-efficient heat exchange.

Keywords: Triple Concentric Tube Heat Exchanger (TCTHE); Heat Transfer Efficiency; Pressure Drop, Effectiveness-NTU Method; Thermal Performance;Renewable Energy Systems.

ID: Ene-P-55

Reliability of the measuring system of an LNG storage tank "WHESSOE 1146"

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Abstract: The WHESSOE 1146 metering system used in LNG storage tanks is the subject of reliability calculations for this study. This is a very important topic to consider because of the sensitivity of the systems and their vital role in maintaining the production and safety of industrial facilities. In addition to ensuring the safety of facilities, accurate LNG tank metering also helps to avoid leaks and promote the best possible storage management. Metering systems must be reliable to ensure measurement accuracy, reduce the likelihood of accidents, and increase operational efficiency. The mathematical models and analytical methods presented in this study evaluate the probability of system failure while considering several influencing factors, including maintenance procedures, equipment quality, and environmental conditions. This study is important because of its fundamental implications for the security of LNG storage facilities, which are essential to the country's energy supply. By increasing the accuracy and reliability of these systems, we not only improve the safety of workers and the community but also contribute to the stability of the country's energy and economy. The sector's ability to adhere to safety regulations and maintain business continuity is improved by reducing the risk of operational accidents. In addition, by reducing gas losses and extending equipment life, enhancing the reliability of the WHESSOE 1146 metering system in the Skikda LNG storage tank could lead to significant cost savings. Therefore, this study is essential to ensure the effectiveness and safety of LNG storage facilities

Keywords: Reliability, Maintainability, Availability, Liquefied Natural Gas (LNG).

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Study and Analysis of the Dynamic Performance of the Power Grid with Wind Energy Integration

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Abstract: This paper investigates the dynamic performance of the power grid with wind energy integration, emphasizing the role of Power System Stabilizers (PSS) in enhancing grid stability. A simplified test network combining synchronous generation and wind power is utilized to assess the impact of integrating wind energy via Doubly Fed Induction Generators (DFIG). Time-domain simulations and numerical analysis using MATLAB/SIMULINK demonstrate that incorporating PSS significantly improves the stability of the grid. The findings underline the critical importance of PSS in facilitating the seamless integration of renewable wind energy while ensuring overall system reliability and stability.

Keywords: Power Grid;Wind Energy Integration; Power System Stabilizers (PSS), Doubly Fed Induction Generators (DFIG);Renewable Energy;MATLAB/SIMULINK.

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The Effect of Electrode Surface Area on the Electrochemical Performance of Electrochemical Cells

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Abstract: This study investigates the influence of electrode surface area on the electrochemical performance of symmetrical electrochemical cells. Using La1-xSrxFe0.7Ni0.3O3 (LSFNx) as both cathode and anode materials, and La0.8Sr0.2Ga0.8Mg0.2O3 (LSGM) as the electrolyte, this study evaluates the polarization resistance (Rp) and area-specific resistance (ASR) at different temperatures. Results demonstrate that increased electrode surface area enhances cell performance, offering insights for optimizing solid oxide fuel cells (SOFCs).

Keywords: Electrode Surface Area ; Polarization Resistance (Rp); Area Specific Resistance (ASR) ;Solid Oxide Fuel Cells (SOFCs) ;Electrochemical Performance

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Thermal Effects on Pressure loss and Cuttings Transport Effeicienty of Non-Newtonien Drilling Fluids

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Abstract: in horizontal drilling, especially when the well depth reaches around 3500 to 4000 meters, the behavior of drilling fluids under extreme conditions becomes a real concern. During our work, we tried to understand how high temperatures and pressure influence pressure loss and the ability of the fluid to carry out cuttings from the well.

a numerical simulation method using CFD aproach using a non-Newtonian drilling fluid, following the Power Law model. The fluid was subjected to temperatures between 130°C and 145°C, which corresponds to typical values based on the geothermal gradient in deep wells, and pressures between 35 MPa and 45 MPa. These ranges were chosen to reflect real drilling conditions as closely as possible.

What we observed is that as temperature increased, the fluid's viscosity decreased. More specifically, the consistency index (K) dropped from 0.47 $Pa\cdot s^n$ to 0.30 $Pa\cdot s^n$, while the flow behavior index (n) increased from 0.44 to 0.60, meaning the fluid started behaving a bit more like a Newtonian fluid. This change directly affected the pressure losses — they dropped significantly, going from 185 Pa/m to about 120 Pa/m.

At the same time, the capacity of the fluid to transport cuttings improved. We noted an approximate 23% increase in cuttings transport efficiency, and the required velocity to ensure proper transport was reduced by about 11%. These findings were quite interesting, because although one might expect reduced viscosity to lower the transport performance, it turns out that under specific conditions, it actually helps the cleaning process in the annulus.

Overall, these results show how crucial it is to consider thermal and pressure effects when designing drilling fluid systems for horizontal wells. Optimizing these parameters could lead to safer, more efficient operations with lower energy consumption and better hole cleaning.

Keywords: Pressure loss;cuttings transport;temperature;drilling fluid

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Thermal Performance of a Nanofluid with Titanium Aluminum Carbide for Solar Collectors

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Abstract: This study evaluates the thermal performance of a nanofluid containing titanium aluminum carbide (Ti_3AlC_2) across temperatures ranging from 50 °C to 350 °C, simulating the operating conditions of a parabolic trough collector's heat transfer fluid. The thermophysical properties of Ti_3AlC_2 were integrated into a simulation program to assess key characteristics of the nanofluid, including thermal conductivity, heat transfer capacity, density, and dynamic viscosity. The results demonstrated a significant improvement in both heat transfer capacity and dynamic viscosity with the addition of varying volumetric fractions of the material. However, the relatively low thermal conductivity of pure Ti_3AlC_2 slightly reduced the overall thermal conductivity of the nanofluid. These findings suggest that while MAX phase materials can enhance the heat transfer capabilities of solar collector systems, optimizing the material composition is crucial to achieve a balance between thermal conductivity and viscosity for practical applications.

Keywords: MAX phase materials; Ti_3AlC_2 nanofluid; Solar collector; Heat transfer fluid; Thermal conductivity; Dynamic viscosity.

ID: Ene-P-60

Thermodynamic Analysis of Engine Performance Supplied by Alternative Fuels

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Abstract: In this study, the combustion performance of a cylindrical combustion chamber was analyzed using natural gas, biogas, and hydrogen as fuels. Energy consumption and sustainability efficiency were evaluated, along with a comparison of heat loss among the studied fuels. Furthermore, an exergy analysis was conducted to determine exergy destruction and efficiency. The effects of the air factor and the inlet air temperature to the combustion chamber on these parameters were also examined. The results showed that hydrogen exhibited the highest sustainability efficiency, while biogas demonstrated good combustion performance with relatively lower energy losses. Additionally, adjusting the air factor and inlet air temperature to the combustion chamber was found to enhance combustion efficiency and reduce energy losses.

Keywords: Energy analysis; Exergy analysis; Combustion efficiency; Alternative fuels; Biogas; Hydrogen.

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Thermodynamic performance comparison of single-pressure and dual-pressure evaporation organic Rankine cycles

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Abstract: In this work the dual pressure layout is compared against the single pressure one at subcritical conditions in the utilization of a hot heat source 120, 150 and 180 °C and considering a set of four pure organic fluids as working fluids. The results demonstrate that the evaporation temperature influenced the net power and thermal efficiency of the ORC system. When heat source temperature is 120°C, the best fluid is R245fa for both single and dual pressure configuration. The dual pressure configuration is advantageous because it leads to a 22.2% higher power output. At heat source temperature of 150°C the most performing fluid is R245fa, in this case net power output is 13,8% higher than that of the single pressure. At 180°C heat source inlet temperature, R245fa is the best performing fluid, R245fa produces 7,72% more net power output than in the single stage ORC. The single pressure ORC has higher thermal efficiency, giving around 28%, 16% and 10% more thermal efficiency for heat source temperature of 120°C, 150°C and 180°C respectively.

Keywords: Organic Rankine cycle; Dual pressure configuration; Waste heat recovery; Power output

ID: Ene-P-62

Trirutile-Structured $NiTa_2O_6$: A Promising Photocatalyst for Hydrogen Production Under Visible Light

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Abstract: Semiconductor materials play a crucial role in photocatalysis, particularly in hydrogen production, as they facilitate the conversion of solar energy into chemical energy via water splitting. Among them, trirutile-structured compounds have attracted interest due to their stability and suitable electronic properties for photocatalysis.

In this study, $NiTa_2O_6$ with a trirutile structure was successfully synthesized using the nitrate combustion method. The material was thoroughly characterized using various physicochemical and electrochemical techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), thermogravimetric analysis (TGA), (BET) surface area measurement, X-ray photoelectron spectroscopy (XPS), diffuse reflectance spectroscopy (DRS), and electrochemical analysis. These characterizations provided valuable insights into its structural, morphological, optical, and electronic properties.

$NiTa_2O_6$ was tested under visible light irradiation in a neutral medium using a hole scavenger, demonstrating positive results and promising activity for hydrogen photoproduction. These findings highlight the potential of $NiTa_2O_6$ as an efficient photocatalyst for sustainable hydrogen generation.

Keywords: Photocatalysis; $NiTa_2O_6$; Hydrogen production; Renewable energies

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Removal of Fluoride Contamination from Water Environment Using Eggshells Waste as an Affordable Alternative Adsorbent.

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Abstract: In southern Algeria, characterized by aridity and high temperatures, high fluoride ingestion, especially through drinking water containing more than 1.5 mg/L, poses a significant threat to humans. This study aimed to provide a low-cost alternative to sorbents used for fluoride absorption from water using eggshell waste (EW). After cleaning, eggshells were crushed and sorted into three particle sizes (0.2, 0.5, and 1 mm) and then dried at 105°C. XRD, FT-IR, pH, and IEP analyses were used to characterize the sorbents. Batch adsorption tests were performed to investigate the adsorption capacity of eggshell powder. Examples included particle size, preparation temperature, contact time, and sorbent dosage. Fluoride removal efficiency was evaluated using UV-Vis spectroscopy. Eggshell powder dried to 105°C with a particle size of 250 µm was found to be the most effective adsorbent, with a maximum fluoride removal efficiency of 55.3%, a maximum adsorption capacity of 0.062 mg/g, and a residual fluoride concentration of 1.07 mg/L in 160 minutes. Adsorption kinetics data on eggshells were effectively fitted to a pseudo-second-order model, yielding a satisfactory coefficient of determination (R2 = 0.994). A two-gram dose of the adsorbent and one hour of contact time were sufficient to reduce fluoride levels from 2 to 1.08 mg/L. Comparison of thermal decomposition data shows that the procedure is effective. It has been found that the best method for treating water in the Ouargla region, where the diet is rich in fluoride, is with eggshell waste. Another advantage is that this procedure is non-toxic and less expensive.

Keywords: Eggshell waste; Fluorosis; Water treatment; Adsorption; Green solution.

ID: Ene-P-64

Performance enhancement of small-scale horizontal axis wind turbine blade

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Abstract: A wind turbine is a device that extracts kinetic energy from the wind and converts it into mechanical energy. This extracted energy is influenced by the geometry of the rotor blades. Determining the aerodynamic optimum blade shape, is one of the main tasks of the wind turbine designer.

The goal of this work is to design and optimize the performance of a small Horizontal-Axis-Wind-Turbine to achieve the best power coefficient (CP) at a low wind speed (5-10 m/s). Different airfoils were used and compared to get the optimized configuration.

A parametric numerical study and Simulation was conducted, in order to determine the optimum distribution of chord length and twist angle along the length of the blade at given windspeed. The QBlade software based on the blade element momentum (BEM) theory was used. The numerical simulation is carried out by Ansys Fluent.

The results of the two approaches were compared for different tip speed ratio values and a good agreement between CFD and BEM results was found.

Keywords: small horizontal axis wind turbine, BEM, Qblade, CFD

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Thermal and Flow Behavior of a Hybrid Nanofluid (Al_2O_3+Cu–Water) in a Triangular Porous Cavity

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Abstract: This study aims to investigate the temperature and velocity distribution in a triangular cavity filled with a hybrid nanofluid (Al_2O_3+Cu–water) at a nanoparticle concentration of 0.01 and containing a porous medium with a porosity of 0.65. The analysis was performed for Rayleigh numbers (Ra) of 10^3, 10^4, and 10^5, and a Darcy number (Da) of 10^{-3}. The governing equations were solved using the finite volume method with appropriate boundary conditions, implemented in the commercial software ANSYS Fluent (version 17.1). The SIMPLE algorithm was used to compute the temperature field, while the QUICK scheme was applied to discretize the convective terms in the momentum and energy equations.

The results are presented as isotherm lines and velocity field contours for the different Rayleigh numbers. It was observed that, as Ra increased, flow recirculation within the cavity intensified, and the isotherms became more concentrated near the porous medium. Additionally, the porous medium's structure was found to slow down the flow, allowing more time for heat transfer. Higher temperatures were also noted in regions where the hybrid nanofluid was in close proximity to the porous domain.

Keywords: Hybrid nanofluid, Al_2O_3–Cu/water, Porous medium, Triangular cavity, Natural convection, Rayleigh number, Finite volume method

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Influence of Nanoparticle Concentration and Porosity on Heat Transfer in a Triangular Cavity with Hybrid Nanofluid

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Abstract: This numerical study investigates the effect of thermal properties of a hybrid nanofluid (Al_2O_3–Cu/H_2O) at various volume concentrations (ranging from 0.01 to 0.035) on heat transfer within a triangular cavity filled with a porous medium. The cavity is subjected to a constant heat source located at its base. The analysis is conducted for different Rayleigh (Ra) and Darcy (Da) numbers, both on the order of 10^{-3}.

The results show that increasing the nanoparticle concentration enhances the thermal conductivity of the fluid, thereby improving heat transfer. Moreover, higher Rayleigh numbers intensify natural convection, while reduced porosity (achieved through increased Darcy numbers) further enhances thermal performance.

Keywords: Hybrid nanofluid , Porous medium ,Numerical study ,Natural convection

ID: Ene-P-67

Implementation in Arduino of MPPT Using P&O, I_C and PSO algorithm for photovoltaic systems

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Abstract: To maximize the electricity output of a photovoltaic generator (PVG), maximum power point (MPPT) detection methods are most commonly used in photovoltaic systems. The principle of these techniques is to operate the PVG at maximum power (MPP), which depends on environmental factors, such as solar radiation and ambient temperature, and ensures optimal power transfer between the PVG and the load. In this article, we present the implementation of digital MPPT commands using the Arduino Mega type. The two proposed MPPT controls are based on the perturb and observe algorithm (P&O), InC, Fuzzy logic, PID based on PSO. The simulation results show that the Fuzzy logic controller provides good results and is the most efficient compared to the P&O, InC and PSO based PID algorithm. As the experimental results show, the P&O and InC algorithm give good results

Keywords: Photovoltaic (PV), artificial neural networks (ANN), MPP, Simulink, P&O, Maximum power point tracking,

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Microcontroller System for Enhancing the Performance of Solar dryer for Drying Food Products

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Abstract: The present experimental study, the thermal performance of a inverted solar dryer (ISD) with microcontroller system was investigated. ISD has been provided with solar tracking feature using a programmable logic control system. The ISD has been two-direction solar tracking feature with this system. The designed moving ISD was combined with a Glass Cover (GC) to compare the performance of the moving ISD without GC. In order to compare the drying time and efficiency of both systems, 20 carrot slices were dried simultaneously under climate conditions in El Oued city (Algerian Sahara). The results revealed that the thermal efficiency of the ISD incorporated with a GC was significantly improved by about 45% compared with the ISD without a GC. The highest thermal efficiency of 87.1% of the ISD equipped with a GC was achieved at the highest air flow rate of 0.01 kg/s. The drying rate of the carrot under ISD incorporated GC was considerably higher than that of either the ISD without GC or the ambient sun drying.

Keywords: Novel dryer; Glass Cover; Experimental; Dryer Efficiency; Sahara Climate.

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An Automatic Mechanical System for Accelerating Drying Process in Sahara regions of Algeria

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Abstract: This study was aimed to examine the effect of microcontroller system on the solar drying kinetics. A lab-scale PV-assisted solar drying system equipped with a sun tracking unit was designed and fabricated to study the drying behavior of tomato slices during the drying process. The samples were tested at different air velocities (0.5–2 m/s) and product thicknesses fixed (3mm) with and without application of sun tracking mechanism. The effect of sun tracking system on the drying behavior of tomato slices was evaluated by considering the drying time and activation energy. According to the results obtained, the sun tracking mechanism profoundly shortened the drying time of 41.6%. and the activation energy without any negative effect on the quality parameters of dried samples, i.e., color, rehydration ratio, and shrinkage. Overall, the sun tracking system could be a promising approach not only for accelerating solar drying process but also for propelling this drying technology one step further towards the industrial applications

Keywords: Microcontroller system; Experimental; Dryer Efficiency; Sahara Climate

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Adsorption of insctecide on activated carbon derived from carob pods

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Abstract: The study addresses a significant environmental issue regarding the removal of harmful agricultural chemicals from wastewater. Specifically, it investigates the potential of activated carbon produced from carob pods (CAC) as an effective adsorbent for removing

inscticede Abamectine from drainage water. The research highlights the importance of finding sustainable and cost-effective methods for treating agricultural runoff, which often contains toxic substances detrimental to ecosystems and human health. CAC was obtained using a saline solution (0.9 % NaCl). The CAC had a surface area of 441.15 m2/g and a

pore diameter of 1.18 nm. Adsorption equilibrium for each product was reached in 90 min. The results showed that the adsorption processes followed the pseudo-first-order model perfectly. Moreover, the adsorption of these products onto the CAC was affected by the initial pH of the drainage water. Furthermore, the adsorption isotherm data showed a closer fit to the Langmuir model, suggesting monolayer adsorption occurring on a uniform surface.

The maximum Langmuir adsorption capacities obtained were 10 mg/g . The thermodynamic parameters showed that adsorption was spontaneous, favorable and exothermic.

Considering its commendable adsorption capacity, the adsorbent formulated in this study

demonstrates promising potential for the treatment of phytosanitary products wastewater within practical

applications.

Keywords: Drainage water, Insecticide, Abamectine, Adsorption, Carob pods, Activated carbon

ID: Env-O-2

Etude de la dispersion du radon à l'intérieur une salle à l'aide de la modélisation CFD

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Abstract: Le radon a été désigné comme cancérigène par l'Organisation Mondiale de la Santé car son inhalation peut provoquer une exposition interne aux radiations chez l'homme et entraîner un cancer du poumon. En effet, le radon une fois inhalé, il continue sa décroissance radioactive à l'intérieur des poumons. Ses descendants solides irradient les cellules les plus sensibles des bronches. Le radon est susceptible de se diffuser en raison de ses caractéristiques de gaz inerte et des concentrations élevées de radon peuvent avoir des effets néfastes sur le corps humain.

Des études antérieures ont rapporté que les concentrations intérieures de radon sont liées aux paramètres météorologiques environnementaux et aux conditions de ventilation des bâtiments. Dans les espaces confinés, le taux de ventilation est un facteur essentiel pour la santé humaine, la qualité de l'air intérieur et l'efficacité énergétique, car le degré d'exposition peut être important, en particulier dans les bâtiments dotés de systèmes de ventilation médiocres où le gaz radon, plus lourd que l'air, peut facilement s'accumuler et atteindre des concentrations d'activité mortelles pour la santé humaine.

Du fait que c'est un outil multifonctionnel, la dynamique numérique des fluides (CFD) a pris une place de choix dans la simulation des problèmes de la qualité de l'air intérieur et la distribution des polluants tels que le radon. La présente étude prend en compte différentes conditions de température et des taux de ventilation et d'autres paramètres potentiellement importants pour déterminer leurs effets sur la distribution intérieure de la concentration de radon. L'estimation de la distribution du radon à l'intérieur de la salle typique à ventilation naturelle se fait dans deux scénarios: conditions de portes fermées et ouvertes. Par conséquent, la vitesse d'entrée a été calculée sur la base du taux de ventilation. Le flux de radon (taux d'exhalation) provenant des murs, du plafond et du sol d'une salle (terme source) et la géométrie de la salle sont des paramètres d'entrée clé pour les modèles de dispersion à utiliser pour prédire la concentration de radon à l'intérieur et finalement la dose au public.

Keywords: Météorologiques ; ventilation ; confinés ; exposition ; CFD ; polluants ; distribution

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Etude d'un procédé hybride adsorption/Photo Fenton Hétérogène via un matériau de type spinelle pour la dépollution des eaux colorées.

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Abstract: Cette étude porte sur la synthèse d'un catalyseur supporté l'oxyde de fer (Fe3O4) sur le charbon actif magnétique (Fe3O4/CAM) par des méthodes de chimie douce (Co-précipitation et imprégnation). La caractérisation de catalyseur a été effectuée par différentes technique a savoir: DRX, BET, MEB et EDX. La dégradation des colorants a été réalisé par un procédé hybride: Adsorption /Photo Fenton hétérogène.

L'étude d'équilibre d'adsorption de la Rhodamine B (RhB) a été réalisée dans les conditions optimales en mode batch. Cette étude révèle que le modèle de Langmuir décrit correctement les isothermes d'adsorption.

Une série d'expérience a été réalisées afin d'étudier l'influence la concentration de l'oxydant H2O2 sur l'activité catalytique pour la dégradation de colorant (RhB). Les résultats obtenus indiquent une bonne dégradation du polluant en présence de l'eau oxygénée avec une concentration optimale de 5mM, qui présente plus de 96%.

Keywords: Dépollution de l'eau, Colorants, Catalyseur supporté, Adsorption, Photo Fenton hétérogène.

ID: Env-O-4

Green Synthesis of Graphene Oxide Using Onion Peel and Orange Peel Extracts: Exploring Its Potential for Cationic Dye Degradation

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Abstract: Graphene has gained considerable attention due to its exceptional mechanical, electrical, thermal, and optical properties. This study focuses on the green synthesis of graphene oxide (GO) using onion peel and orange peel extracts as natural reducing agents. The extracts, derived from onion and orange peels, offer a cost-effective, renewable, and environmentally friendly alternative for GO synthesis. The green-synthesized GO was characterized using FTIR and XRD analyses, confirming the formation of nanosheets with an average width in the scale on nano. Furthermore, GO was evaluated as a nanoadsorbent for the removal of methylene blue (MB) dye crystal violet (CV), employing response surface methodology (RSM) for process optimization and AI tools. Adsorption studies demonstrated both MB and CV removal efficiency under optimal conditions. These findings highlight the potential of onion and orange peel-derived rGO as an efficient, green alternative for both environmental remediation and antimicrobial applications.

Keywords: Green synthesis, Graphene oxide, Onion peel and orange peel extracts, Adsorption

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La résilience des systèmes agricoles oasiens face aux défis du changement climatique : Cas pratique : Les Oasis de Kébili en Tunisie

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Abstract: Les systèmes agricoles oasiens, caractéristiques des zones arides et semi-arides, sont confrontés à des défis croissants en raison du changement climatique. Ces écosystèmes fragiles, qui dépendent d'une gestion précise des ressources en eau et en sol, voient leur résilience mise à l'épreuve par des conditions climatiques de plus en plus imprévisibles. Cette étude, menée dans les oasis tunisiennes essentiellement dans les oasis de Kébili, vise à évaluer la résilience des systèmes agricoles oasiens face aux changements climatiques. En se concentrant sur la culture du palmier-dattier, nous avons analysé les stratégies d'adaptation mises en œuvre par les agriculteurs, ainsi que les facteurs biophysiques et socio-économiques influençant leur résilience. Nos résultats soulignent l'importance de la diversification des revenus, de l'amélioration de l'efficacité de l'irrigation et du développement de variétés de palmiers-dattiers plus résistantes. Ainsi que de soutenir les initiatives de recherche-action et de renforcer la coopération entre les acteurs locaux et les institutions de recherche.

Keywords: Oasis, Ecosystème, stratégie, changement climatique, résilience, adaptation.

ID: Env-O-6

Monitoring the environmental quality of the marine environment along the algerian coast

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Abstract: The marine environment, a vast reservoir that serves as a habitat for a wide array of species of marine fauna and flora, provides humanity with a highly valuable source of nutrition through its various seafood products.In recent years, desalination plants have been installed in a number of countries (the case of our country) at an increasing rate to meet people's water needs, due to the depletion of water resources (low rainfall, reduction in underground resources, etc.).

The preservation of the marine environment and its resources is imperative, given the substantial pressures exerted by anthropogenic activities.The periodic evaluation of the health status of the marine environment is crucial for the identification of prevailing issues and the formulation of effective strategies to avert and mitigate future damage.In this context, a comprehensive environmental quality assessment is being conducted on Algerian coastal sites using bioindicators. Four metallic trace elements (copper, zinc, nickel and manganese) that are essential to the life of organisms have been selected for spatiotemporal environmental monitoring. The samples included mussel individuals from two size classes (small and medium-sized).

The analytical results demonstrate a highly significant variation in trace metal concentrations between the two size classes of mussels, with the highest levels recorded in the smallest individuals.

Keywords: Biomonitoring, trace element, mussel, concentration

ID: Env-O-7

Alkaline activation of a clay from the Tiaret region

application in the adsorption of a pharmaceutical pollutant

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Abstract: Using Illite-montmorillonite (IMN), a naturally occurring clay in the Naima-Tiaret-Algeria area, as a raw material, this effort intends to develop geopolymers (GPIMN). To do this, we will calcine the clay to 700 oC. and then activate it alkaline using high concentrations of NaOH and Na_2CO_3. The IMN and GPIMN clays were characterized using X-ray diffraction (XRD), infrared spectroscopy (IRTF), scanning electron microscopy (SEM), and X-ray fluorescence (XRF). The study looked at how the efficiency of the Ibuprofen (IBP) adsorption process was affected by the starting concentration and how long the adsorption process took. About forty minutes was found to be the duration of the adsorption process. The models that were used were the Elovich, pseudo-first-order, and pseudo-second-order versions. The most accurate model for the current application is the pseudo-second-order model, with an R^2 value better than 0.99. Thermodynamic study demonstrates that the adsorption is directly proportional to the starting concentration. Thermodynamic models using Langmuir, Freundlich, and D-R were used to determine the adsorption capacity of IBP with IMN-GPIMN. These simulations validated that the adsorption capacity of IMN-GPIMN was 48.54–66.66 mg/g. Given that it has a significant connection with the heterogeneous surface function (R^2 value more than 0.93), the Freundlich model is thought to be the most appropriate for use. Both the raw and blended versions of the local clay had a significant ability to adsorb ibuprofen, which was more than that shown in previous studies.

Keywords: adsorption; clays; isotherms ;kinetics; geopolymer ; pharmaceutical pollutant

ID: Env-O-8

Physicochemical Characterization of Industrial Effluent Discharges from Mining Operations: A Case Study of Boukhadra Mine

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Abstract: This study evaluates the physicochemical quality of industrial liquid effluent discharges from the Boukhadra mine (Algeria). Samples were collected from the washing water to identify the level of contamination of these liquid discharges and to measure the physicochemical parameters such as temperature(t), hydrogen potential (pH), electrical conductivity (EC), suspended solid (SS), chemical oxygen demand (COD), biological oxygen demand for five (05) days (BOD5), oils and greases (O&G), iron (Fe+2) and kjeldahl nitrogen (NTK). It was found that the concentration values of those effluents exceeded the maximum contamination limit specified by international standard industrial waste. A simple and reliable prediction model was developed to estimate the DBO5, based on SS , COD, and O&G, by using classical regression analysis, and Design of Experiments (DOE) methodology fitting. When comparing the analytical results, it was found that the quadratic model provided a better estimation, with a high correlation coefficient (R2) of 0.9976. The parameters determined in this study will enable engineers to quickly estimate the degree of wastewater contamination degrees and choose the adequate strategy for the treatment.

Keywords: Characterization; wastewaters; Design of experiments (DOE); environment; ANOVA

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ID: Env-O-9

Sustainable Water Management in Algeria: The Role of IWRM in Environmental Sustainability and Development

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Abstract: Algeria faces significant challenges in managing its water resources due to fluctuating availability and high demand. Therefore, the Algerian government has made efforts towards sustainable development, including adopting strategies for environmental conservation and economic diversification such as IWRM that align with the Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action). This work aims to address the critical issue of water scarcity in Algeria and the crucial role IWRM plays in addressing these challenges with an analysis of the current state of integrated water resource management (IWRM) in Algeria, highlighting both the challenges and the successes encountered. Furthermore, it will shed light on the specific environmental and developmental impacts of water scarcity, emphasising the need for sustainable solutions. Ultimately, this presentation aims to draw attention to the crucial role of IWRM in achieving environmental sustainability and supporting sustainable development in Algeria.

Keywords: Environmental Sustainability; Water Managment; Water Scarcity; Algeria

MATERIALS ENERGY ENVIRONMENT 3rd Conference

THE THIRD INTERNATIONAL CONFERENCE ON MATERIALS, ENERGY & ENVIRONMENT (MEE-2025)

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Using Agricultural Waste to Remove Heavy Metals from Wastewater

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Abstract: The rise in industrial activities has led to an increasing accumulation of waste, causing notable environmental challenges. Effective waste management is vital, emphasizing the conservation of resources and encouraging innovative reuse of waste materials. This study investigates the conversion of agricultural waste (Date Palm Waste, Cereal Straw, Olive Pomace and Leaves) as feedstock which primarily composed of cellulose polysaccharides, into effective carbon adsorbents for removing heavy metal contaminants from water. Through hydrothermal carbonization and KOH treatment, cellulose was transformed into activated carbon with a high specific surface area of 790 m^2/g and an abundance of surface oxygen groups of 6.12 mmol/g. This resulted in a higher interest in heavy metal ions, due to its capability to adsorb 20 mg/g. The results indicate that utilizing waste materials can promote eco-friendly industrial methods and demonstrate the efficient use of polysaccharide-based adsorbents for treating heavy metal-contaminated water, contributing to environmental sustainability.

Keywords: agricultural waste; cellulose; polysaccharide-based material; hydrothermal carbonization; heavy metal; pollution.

ID: Env-O-11

Assessment of surface water quality for drinking purposes in two dams in the semi-arid region of Northeast Algeria

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Abstract: The quality of surface waters from the Timgad and Yabous dams in the semi-arid region of northeastern Algeria was assessed using physicochemical data collected monthly from May 2023 to April 2024. These data were analyzed to determine the suitability of the water from the two dams for human consumption; this study used the Water Quality Index (WQI) and the Canadian Council of Ministers of the Environment Water Quality Index (CCME-WQI) were employed. The WQI results indicated that water from the Timgad dam was in the permissible class throughout the year (100%), while the Yabous dam consistently presented a good quality class with 100% of stations. However, the CCME-WQI classified the Timgad dam as a marginal water category (100%) of sites, and the Yabous dam as fair with a fair category with (100%) of year-round surveys.

The results obtained during this investigation revealed that these two environments require integrated and rational management of water resources, particularly for the Timgad Dam.

Keywords: WQI; CCME-WQI; Drinking; Hydrochemistry; Timgad Dam; Yabous Dam; semi-arid region; Algeria.

ID: Env-P-1

Radiation induced preparation of conducting polymers-loaded biocomposite hydrogels for photocatalytic applications

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Abstract: γ-radiolysis is an alternative eco-friendly technique which has been shown to allow polymerization of various kinds of conducting polymers, such as PEDOT polymers, in aqueous solution, in the absence of any toxic solvent or any additional oxidative compound [1, 2]. In the present work, we originally used this radiation-based methodology for the preparation of PEDOT polymers-loaded biocomposite hydrogels. First, a hydrogel was prepared by mixing sepiolite fibrous clay and alginate together with EDOT monomers. γ-radiolysis was then used to in situ polymerize EDOT into PEDOT polymers in order to obtain nontoxic conducting hydrogel biocomposite particles (AS5PD-γ) with improved physico-chemical properties. Chemical and morphological characterization of radiosynthesized biocomposites were evaluated by UV-Visible absorption spectrophotometry, FTIR spectroscopy and XRD analysis. The obtained results demonstrated the successful formation via γ-radiation of biocomposite particles loaded with conducting PEDOT polymers and the enhancement in the crystallinity of radiosynthesized materials when compared with chemically synthesized ones (AS5PD-χ). Besides, the photocatalytic activity of radiosynthesized biocomposites was evaluated in the context of degradation of Rhodamine B (RhB) as model pollutant in aqueous solution and then compared to the activity of chemically prepared materials. The results highlight the superior photocatalytic properties of radiosynthesized materials and demonstrate the relevance of radiation chemistry as cheap and safe alternative methodology for the preparation of alginate-based materials with enhanced properties.

Keywords: ɣ-radiolysis, photocatalysis, PEDOT, Raw Sepiolite, Alginate

ID: Env-P-2

Contribution à l'évaluation de la qualité des rejets des eaux usées de la zone industrielle de la wilaya de Ghardaïa.

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Abstract: La pollution des eaux souterraines au niveau de la région Sud de l'Algérie est directement liée aux activités humaines, les rejets non contrôlés des eaux usées domestiques, agricoles et industrielles en sont responsables. Il est à noter que les activités industrielles prennent de l'ampleur d'année en année et que les conséquences sur l'environnement peuvent atteindre des dimensions importantes. La plupart des entreprises industrielles utilisent l'eau pour divers services tels que le lavage, le refroidissement, le nettoyage, le traitement, etc... Après utilisation, la plus grande partie de cette eau usée est rejetée dans le milieu naturel sans traitement préalable, généralement chargée en matières polluantes, elle devient dès lors une source de pollution importante pour le milieu récepteur. C'est dans ce contexte que s'inscrit notre étude relative à l'évaluation de la qualité des effluents liquides de la zone industrielle de la wilaya de Ghardaïa. Les analyses des échantillons d'eau prélevés ont permis de caractériser l'état de la qualité du rejet à partir des indicateurs chimiques globaux de la pollution des eaux usées à savoir les MES, DBO5 et DCO. Ces deux derniers paramètres indiquent l'état de pollution organique et chimique de l'eau rejetée après usage : plus la demande est élevée, plus l'eau est polluée. Les analyses effectuées sur ces rejets montrent des teneurs élevées en DBO5 (40 à 4760 mg/l), en DCO (121 à 2300 mg/l) et en MES (29 à 2300 mg/l). De ce fait, le traitement préalable des effluents avant déversement dans le milieu naturel ou dans le réseau d'assainissement est impératif pour la préservation des écosystèmes et particulièrement les ressources hydriques comme le stipule la réglementation nationale.

Keywords: Effluents industriels liquides ; paramètres de rejets, normes de déversements.

ID: Env-P-3

Evaluation of Groundwater Quality and Hydrochemical Properties Using Water Quality Indices and Statistical Methods in the Wadi Righ Region, Algeria

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Abstract: This assessment research focuses on the hydrochemical characteristics and groundwater suitability in the Wadi Righ region, in southern Algeria. The statement of the problem revolves around determining water quality using various indices including Permeability Index (PI), Residual Sodium Carbonate (RSC), Water Quality Index (WQI), Sodium Percentage (Na%), Sodium Adsorption Ratio (SAR), Canadian Council of Ministers of the Environment's Water Quality Index (CCME WQI), Magnesium Hazard (MH), Irrigation Water Quality Index (IWQI), and Kelly Index (KR). Additionally, statistical methods were utilized to establish correlations between these indices and chemical elements. The working method involved investigating hydrochemical parameters in Wadi Righ's groundwater and analyzing 52 samples. The results indicate that water quality, as assessed by the water quality indices, was categorized as very poor and unsuitable overall, with lower quality observed particularly in the central and southern regions. However, groundwater demonstrated excellence and suitability for irrigation purposes. Qualitatively, the findings suggest that there are significant relationships among irrigation suitability indices, as indicated by Pearson correlation analysis. These relationships stem from shared inputs and hydrogeochemical characteristics of groundwater. This analysis reinforces the quantitative findings and provides insights into the underlying factors influencing groundwater quality and suitability for irrigation in the Wadi Righ region.

Keywords: Groundwater, Wadi Righ, Suitability, Water Quality Indices, Statistical Methods.

ID: Env-P-4

Monitoring and Optimization of Anaerobic Digestion at the Urban Wastewater Purification Plant : Case of Baraki plant in Algeria

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Abstract: This study investigated the anaerobic digestion process at the urban wastewater purification plant of Baraki, with a focus on various key parameters affecting digestion functioning, including temperature, pH, Total Ammoniacal Nitrogen (TAC), Acute Gamma Vermilion (AGV), Mixed Volatile Solids (MVS), and biogas production. The results show that the measured parameters are within the normative ranges for anaerobic digestion, indicating a well-functioning digestion process. Furthermore, the biogas composition was found to be optimal, with a high methane content (72%) and a moderate carbon dioxide content (27%). Additionally, the presence of trace amounts of hydrogen sulfide, oxygen, and ammonia was detected. These findings provide valuable insights for optimizing the anaerobic digestion process at the Baraki wastewater plant, ultimately contributing to the efficient treatment of urban wastewater and the production of renewable energy.

Keywords: Anaerobic digestion, Biogas production, Renewable energy, Wastewater treatment, Urban infrastructure.

ID: Env-P-5

Recent Advances in Methods for Synthesis of Carbon Nanotubes and their Emerging Applications

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Abstract: Carbon nanotubes (CNTs) are fascinating nanomaterials that have received great attention from the scientific community and have wide applications in industry and environment. CNTs come in two types, single-walled CNTs and multi-walled CNTs. Currently, CNTs are synthesized by several chemical and physical methods. This work focuses on the vital research and application for the synthesis of CNTs. The goal is to provide recent advances in the synthesis methods, their current applications, future applications, and the potential of using agricultural and industrial wastes for the synthesis of CNTs and nanomaterials.

Keywords: Carbon-nanotubes; nanomaterials; Waste-treatment; Environment-remediation; Green-synthesis

ID: Env-P-6

Treatment of Wastewater Contaminated with Fly Ash Loaded with Heavy Metals Using Iron Oxide Nanoparticles Synthesized from Fly Ash

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Abstract: In recent years, water pollution has become a major environmental issue that threatens our lives. Among the largest types of industrial pollutants is coal fly ash (CFA), which contains a variety of heavy metals that can reach water bodies through contact with surface water or rain. Due to heavy metal contamination, water becomes unsuitable for drinking. For this reason, iron oxide nanoparticles (IONps) could be a promising material for the remediation of toxic heavy metals. IONps recovered from wastewater, such as CFA, exhibit remarkable properties due to their low cost and recyclability. The synthesis of IONps involves three successive steps. The first step is the extraction of ferrous materials from CFA, followed by acidic treatment to obtain acidic leachate, and finally, the precipitation of iron oxides by an alkali. The size of the obtained particles ranges from 30–70 nm with a purity of about 90–93%, characterized by transmission electron microscopy (TEM) and electron diffraction spectroscopy (EDS). The synthesized IONps were applied to a 20% CFA aqueous solution, showing remarkable properties in heavy metal removal, especially lead (Pb) and chromium (Cr). The developed method aims to use a cost-effective and greener route for water heavy metal removal.

Keywords: Coal fly ash; cost-effective synthesis; iron oxide nanoparticles; heavy-metal removal; water remediation

ID: Env-P-7

Numerical study of the impact of different nanofluids on the cooling efficiency of high-voltage transformers

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Abstract: This study delves into the thermal and hydrodynamic characteristics of Barium Titanatenanofluids applied within the winding core of a transformer, enclosed within a sealed tank. Synthetic ester (SE), mineral oil (MO), and gas-liquid (GTL) are utilized as base fluids for the nanofluids. The investigation employs a mathematical framework for convective heat transfer in nanofluids to evaluate the impact of nanoparticle volume fraction distribution on the momentum, energy, and continuity equations, utilizing the Fluent program. The computational approach relies on the SIMPLER algorithm coupled with the finite volume technique. It is possible to optimise the parameters of the cooling system (such as the concentration of nanoparticles and the thermophysical properties of the liquids) to improve the cooling efficiency, which can be difficult to do experimentally. Numerical results illustrating heat transfer are depicted through streamlines and isotherm profiles, considering various base fluid compositions, Rayleigh numbers, and a nanoparticle volume fraction of 10%. Additionally, the study examines the influence of these parameters on local and average Nusselt numbers. The results showed that the local Nusselt number of $BaTiO_3$ nanofluids with MO or GTL as base fluids did not exceed 20 at maximum, observed at Rat = 106 and φ = 10%. However, when SE was used as the base fluid, the average Nusselt number reached 47 along the outer wall surface. Noteworthy findings confirm the enhanced properties of nanofluids dispersed in Synthetic Ester base fluid compared to those dispersed in mineral oil and gas-liquid. The novelty of this research lies in the use of advanced numerical simulations to assess the impact of nano-liquids on the cooling efficiency of high-voltage transformers, providing a detailed analysis of thermal and fluidic interactions that was previously difficult to achieve experimentally. The present research numerically investigates heat transfer via laminar permanent natural convection of nanofluids enclosed in a transformer (winding core) housed inside a closed tank with a discrete heating source. The purpose of this work is to estimate the influence of the basic fluid type and Rayleigh number upon heat exchange, as well as to present the most up-to-date literature on the numerous effects of using nanotechnology in ester, mineral oil, and gas-liquid based insulation liquids for electrical transformers.

Keywords: Heat transfer; Electrical transformers; Nanofluid properties; Enhanced cooling

ID: Env-P-8

Remediation of a soil polluted by petroleum hydrocarbons through biological treatment followed by advanced oxidation"

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Abstract: The main objective of this study is to assess the feasibility and impact of different combinations of Fenton-like advanced oxidation and biostimulation, using a molar ratio of H2O2/Fe/EDTA of 20/1/1 and a molar ratio of C/N/P of 100/10/1, for remediation in the case of soil contaminated with petroleum hydrocarbons at the microcosm scale, and subsequently at the semi-pilot scale under aerobic conditions. After testing the three combinations of Fenton-like advanced oxidation and biostimulation at the microcosm scale, it was observed that the first combination, which involved biostimulation followed by Fenton oxidation, proved to be the most effective. Consequently, it was decided to adopt this combination at a semi-pilot scale, where the removal rate of TPHs reached 92% after 6 weeks of treatment.

Keywords: Biostimulation; Fenton-like; Soil remediation; Hydrocarbons.

ID: Env-P-9

Assessment of salinity and hydrogeochemical processes of MPQ Teleghma groundwater : geochemical approach.

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Abstract:

The alarming growth of salinity in Mio-Plio-Quaternary MPQ Teleghma groundwater represents a real menace for the flora, and causes a serious problem to the irrigated soil. As a part of a study on this region, twenty samples were taken during the period of October 2015 around the territory. The present study is based on the physical and chemical analysis (Electric conductivity EC, pH, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, NO_3^{-} and Sr^{2+}). This study showed disquieting anomalies of electric conductivity that reached the value of 4376.14 µS.cm-1. Sr^{2+}/Ca^{2+} ratio and water type showed that the hydrogeochemistry of Teleghma groundwater is controlled by two hydrogeochemical processes : the dissolution of carbonate rocks of Neritic Constantine Nappe and the leaching of evaporitic formations processes , which proved that these anomalies of the MPQ groundwater's salinity of Mchira-Teleghma are mainly determined by the leaching of Triassic gypsum formations process.

Keywords: key-word1 Teleghma groundwater; key-word2 Salinity; key-word3 Hydrogeochemical processes; key-word4 Sr^{2+}/Ca^{2+} ratio; key-word5 Triassic gypsum.

ID: Env-P-10

"Impact of Different Diluents on the Structural Properties of Copper(II) Complexes in Extraction Using D2EHPA"

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Abstract: The extraction of copper(II) using di-2-ethylhexyl phosphoric acid (D2EHPA) was studied across various diluents to assess the influence of solvent properties on extraction efficiency. A range of polar and non-polar solvents, including chloroform, dichloromethane, carbon tetrachloride, cyclohexane, 1-octanol, and methyl isobutyl ketone (MIBK), were utilized to examine the behavior of the copper(II)-D2EHPA complex. The effects of solvent polarity, dipole moment, and interactions with the extractant were investigated through analysis of extraction constants and copper(II) distribution coefficients at varying pH levels. The results revealed that extraction efficiency was maximized in 1-octanol and cyclohexane, with polar solvents favoring a tetrahedral copper(II) complex, while non-polar solvents induced a square planar geometry. This study underscores the critical role of diluent characteristics in determining the coordination environment and extraction capacity of D2EHPA for copper(II), offering valuable insights for optimizing industrial extraction processes.

Keywords: liquid-liquid extraction, effect of solvent, copper(II),

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Contribution to the Valorization of a Desert Plant of Ramarame family and Study of Its Extracts' Properties

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Abstract:

The aim of this study is to evaluate the valorization of Cornulaca monacantha plant, a desert plant belonging to the Ramarame family, by extraction and estimation of biological activity, as it was harvested from Hamadin area - Al-Muqrin - Oued state in December 2023The aerial part was extracted with the following solvents: distilled water, ethanol, a mixture of distilled water and ethanol (70/30), and we also detected some secondary metabolic compounds (alkaloids, flavonoids, terpenes, saponins), and some secondary metabolites. Through the extraction process, we found that the aqueous extract had the highest yield of 16.76%, and the results of quantification of phenols showed the highest value of ETOH/H2O extract estimated at 142.889mg EAG/g, while the highest value of flavonoids was for the aqueous extract 55.733mg EQU/g, and we performed the DPPH and FRAP test to study the antioxidant activity and found that the aqueous extract had the best antioxidant activity in both methods. Finally, the antibacterial activity was studied, where four strains of bacteria were tested at different concentrations and the results showed that some of the studied extracts have antibacterial activity.

Keywords: Cornulaca monacantha plant, extraction, biological activity, flavonoids,

antioxidant, antibacterial.

ID: Env-P-12

Modeling Groundwater Salinity Using Supervised Machine Learning: A Case Study of the Gaza Coastal Aquifer (Palestine)

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Abstract: Seawater intrusion and anthropogenic contamination are major causes of groundwater salinization in coastal aquifers. This study assesses the ability of a supervised machine-learning algorithm, the Multilayer Perceptron Neural Network (MLP), to predict Total Dissolved Solids (TDS) concentration of Gaza Strip coastal aquifer in Palestine. We focused on a dataset of 2000 samples obtained from 150 wells was analysed, including various physico-chemical parameters. In the Gaza coastal aquifer, Total Dissolved Solids (TDS) concentrations ranged between 175 and 7,713 mg/L, indicating significant salinity variations. The Multilayer Perceptron Neural Network model provided excellent predictive performance with a correlation coefficient (R) of 0.96. These results emphasize the application of machine learning approaches for improving groundwater quality assessment, and offer a practical tool for sustainable coastal water resource management.

Keywords: Salinization; Machine Learning;Total Dissolved Solid; Gaza Coastal Aquifer.

ID: Env-P-13

Hydrogeochemical Characterization and Multivariate Statistical Analysis of the Continental Intercalary Aquifer in Oued Souf (Algerian Sahara)

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Abstract: The Continental Intercalary aquifer in the Oued Souf region of the Algerian Sahara, composed of Albian-age sandy and sandstone formations, has garnered increasing attention due to concerns over its water quality and the processes driving its mineralization. Recent assessments have aimed to elucidate these processes, shedding light on the aquifer's hydrogeochemical characteristics. This study explores the hydrogeochemical dynamics affecting water quality in the Continental Intercalary aquifer. Analysis of 20 water samples collected in 2021 revealed pH values ranging from 7.2 to 8.1, the findings indicate significant mineralization with high electrical conductivity measurements. The primary geochemical processes identified include the incongruent dissolution of evaporitic formations, resulting in the prevalence of sodium chloride and sodium sulfate facies. These findings enhance our understanding of the factors influencing water chemistry in this critical aquifer system.

Keywords: Continental Intercalary; Oued Souf; Hydrogeochemical; Evaporitic formations.

ID: Env-P-14

Optimization by experimental design for the turbidity of desalinated water by reverse osmosis from water treatment Station-el Hamma-Algiers

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Abstract: The increase in the need for good quality water remains a topical challenge, the desalination technique for the treatment of seawater has become among the common techniques given the lack of availability of fresh water. Among the desalination techniques, reverse osmosis, a technique for purifying water containing suspended matter (very fine particles suspended in water) by a filtering system that allows only the water molecules to pass. The approach adopted in this study is to carry out a quality control of the water resulting from the desalination, the objective is to verify that the water at the outlet of the reverse osmosis station presents a good quality by comparing the values resulting from physico-chemical and organoleptic analyzes in accordance with the standards of drinkability established by the regulations of the World Health Organization. In order to produce good quality water, the evaluation of the pre-filtered water in terms of turbidity is essential, the measurement of the latter has been mathematically modeled using the experimental designs.

Keywords: Desalination; turbidity; sea water,;reverse osmosis; experimental design.

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ID: Env-P-15

A Green Strategy for Fungal-Based Nanomaterials Biosynthesis: Characterization and Performance Evaluation in Water Treatment

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Abstract: The rising demand for sustainable and eco-friendly solutions in environmental remediation has heightened interest in nanomaterials' green synthesis methods. This study introduces an innovative method for the biosynthesis of nanomaterials via fungal sources, providing an eco-friendly alternative to traditional chemical and physical techniques. The fungal-mediated synthesis process was refined to yield nanomaterials with regulated size, shape, and improved stability. Extensive characterization methods, such as XRD and FTIR, were utilized to examine the produced nanomaterials' structural, morphological, and chemical attributes. Moreover, UV-visible spectroscopy evaluated their efficacy in water treatment applications by eliminating impurities like dyes. The findings exhibited significant removal efficiencies, validating the capability of these fungal-derived nanomaterials for sustainable water purification. This green synthesis approach minimizes the utilization of hazardous substances and fosters the creation of economical and environmentally sustainable solutions for ecological issues.

Keywords: Nanomaterials; Fungal sources; Green synthesis; Environmental remediation; Characterization

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Development and Optimization of ZnO/Activated Carbon Biocomposite Synthesized via Sol-Gel Process for Efficient Congo Red Adsorption

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Abstract: In this study, a novel ZnO/activated carbon biocomposite was synthesized via the sol-gel method and evaluated for its potential in removing Congo Red (CR) dye from wastewater. The biocomposite exhibited high adsorption efficiency, driven by the synergistic properties of ZnO and activated carbon. Fourier-transform infrared (FTIR) spectroscopy characterization demonstrated the successful incorporation of functional groups responsible for enhanced dye uptake. The optimization of adsorption parameters, including adsorbent dosage, solution pH, and contact time, was performed using Box-Behnken Design-Response Surface Methodology (BBD-RSM). The optimal conditions were determined, achieving maximum adsorption efficiency. Comprehensive studies of adsorption kinetics and isotherms revealed that the adsorption process followed pseudo-second-order kinetics and was best described by the Langmuir isotherm model, indicating monolayer adsorption. Thermodynamic analysis further confirmed the spontaneous and endothermic nature of the adsorption process. The point of zero charge (pHPZC) of the biocomposite was measured, providing insights into its surface charge behavior under varying pH conditions. These findings highlight the potential of the ZnO/activated carbon biocomposite as a cost-effective and sustainable material for water treatment applications.

Keywords: ZnO/activated carbon biocomposite; Congo Red; sol-gel; BBD-RSM optimization; adsorption.

ID: Env-P-17

Système solaire combiné de production d'eau potable avec récupération d'énergie intégrée utilisant la concentration thermique.

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Abstract: Face à la pénurie croissante d'eau potable, particulièrement dans les zones arides et semi-arides, ce projet propose une solution innovante et durable : un système solaire combiné de production d'eau potable avec récupération d'énergie intégrée. Ce système autonome vise à assurer un approvisionnement continu en eau potable, quelles que soient les conditions météorologiques. Il repose sur une combinaison ingénieuse de technologies:

1. Préchauffage optimisé : L'eau brute est préchauffée efficacement grâce à un concentrateur cylindro-parabolique, réduisant la consommation énergétique globale du système.

2. Distillation solaire à haut rendement : Un concentrateur solaire parabolique focalise les rayons du soleil sur un réservoir de distillation, utilisant un transporteur de chaleur pour optimisant le transfert de chaleur et la vaporisation de l'eau.

3. Condensation efficace : La vapeur d'eau est collectée et condensée par un tube de condensation sous forme de gouttelettes pour produire une eau distillée qui est à la fin reminéraliser et rendu potable.

4. Récupération d'énergie intégrée : La vapeur produite dans le réservoir d'évaporation (focalisation) actionne une turbine couplée à un générateur électrique. L'électricité générée alimente un système de chauffage intégré au réservoir d'évaporation, afin d'amélioré le rendement global du dispositif.

Ce système hybride offre de multiples avantages : Dessalement de l'eau de mer et déminéralisation des eaux souterraines saumâtres à faible coût, utilisation d'une source d'énergie propre et renouvelable (l'énergie solaire), autonomie énergétique grâce au système de chauffage intégré, adaptabilité à divers contextes (zones rurales isolées, régions arides, situations d'urgence, etc.), et potentiel de réduction significative des coûts de production d'eau potable. Ce projet représente une avancée significative vers un accès à l'eau potable plus fiable et durable, contribuant à améliorer les conditions de vie et à préserver les ressources en eau.

Keywords: Eau potable, distillation solaire, énergie solaire, concentration thermique, récupération d'énergie, autonomie, zones arides, déminéralisation, dessalement

ID: Env-P-18

Evaluation of chemically treated bark as a low-cost and environmentally friendly adsorbent for the removal of cationic red dyes

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Abstract: Water pollution is a major problem caused by various industrial and agricultural activities. All this wastewater can contribute to the destruction of flora and fauna, as well as polluting the aquifers from which humans draw part of their drinking water. That's why it's essential to treat and reuse wastewater. The aim of this work was to modify the bark of an invasive tree “Acacia saligna” with citric acid to improve the removal efficiency of a toxic dye “Basic Red 12” from an aqueous solution. Citric acid-modified Acacia saligna bark (ASB) was characterized by FTIR, ATG, pHzpc and SEM. Batch tests were carried out to verify the impact of several parameters on the adsorption performance of the toxic Basic Red 12. The pHzpc of ASB was 3. Kinetic data were best represented by the Pseudo-second-order model (R2=0.999). The maximum removal capacity predicted by the Langmuir model was 330 mg/g (R2=0.993). The thermodynamic study showed that the adsorption process was possible, spontaneous and endothermic depending on the values of enthalpy ΔH°, entropy ΔS° and free enthalpy ΔG°. As a result, the ASB bioadsorbent has proved very important for the decontamination of aqueous solutions containing toxic dye such as Basic Red 12.

Keywords: Bio-adsorption, Basic Red 12, Depollution, Kinetics, Isotherm

ID: Env-P-19

Impact of Adsorption on Biological Oxygen Demand and Deoxygenation Rate in Wastewater Treatment

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Abstract: The increasing production of wastewater is endangering the safety and cleanliness of water supplies, Adsorbents are commonly used in various industries to remove contaminants from wastewater. Key kinetic parameters for Biological Oxygen Demand (BOD) include the reaction rate constant, which indicates the rate of organic matter decomposition by aquatic aerobic microorganisms, and Ultimate BOD, the total oxygen consumed during the reaction. The objective of this study was to evaluate the impact of adsorption on enhancing the deoxygenation rate coefficient (k) and reducing ultimate Biological Oxygen Demand (BOD_u) in treated wastewater. Water samples were collected from the Kouinine (El-Oued) wastewater treatment plant following AFNOR NF EN 25667 (ISO 5667) standards using an ASP Station 2000 automatic sampler. Powdered activated carbon (Riedel-de Haën), with a particle size of 20 µm and a specific surface area of 658 m^2/g, was used as the adsorbent. The effect of agitation time was evaluated by varying contact times from 0 to 120 minutes. After adsorption, the samples were separated into solid and liquid components using vacuum filtration with a membrane pore size of 0.45 µm. BOD was tested for each filtered sample over a ten-day period. The constant rate (per day) and ultimate BOD (mg/L) were calculated using the Least Squares method. The results showed a significant increase in the BOD reaction rate constant (k) after adsorption, rising from 0.10 per day to 0.22–0.36 per day, indicating faster organic matter degradation. In contrast, the ultimate BOD decreased from 69.5 mg/L before adsorption to 28.83–40.56 mg/L after adsorption, demonstrating a substantial reduction in overall oxygen demand. The optimal contact time for adsorption was determined to be 30 minutes, beyond which no significant improvements were observed

Keywords: adsorption1; rate constant1; Ultimate BOD2; Least Square3; kinetic parameters

ID: Env-P-20

Increasing Solar Still Efficiency with Thermo-Electric Cooling: An Experimental Study

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Abstract: The process of distilling seawater typically involves using a thermal energy source derived from conventional fossil fuels, which releases greenhouse gases into the atmosphere. As a sustainable alternative, solar energy can be utilized at no cost. This study focuses on enhancing the productivity of solar stills by integrating a condensation chamber and employing the thermoelectric effect to cool the system, resulting in a more compact setup. Two solar stills were constructed: one conventional model used as a reference and the other incorporating a condensation chamber at the back. A cooling system, consisting of two Peltier modules and two fans, was installed to cool the chamber's back wall. Experimental tests conducted in Khemis Miliana, Algeria, from September to November, showed that the cooling system increased productivity by 74% compared to the uncooled system. Additionally, the novel technique increased productivity by 14% compared to a conventional solar still under the same conditions. The optimal operating time for the cooling system, influenced by solar radiation, was determined to be 3 minutes every 30 minutes. The daily output data from the modified solar still was employed to assess CO2 emissions, mitigation potential, and the carbon credits accrued over varying operational lifespans of the system, centered on energy-based assessments. Future opportunities for this work include integrating a flat plate collector and optimizing the cooling system's operating time in relation to solar radiation, potentially further enhancing efficiency and productivity.

Keywords: Solar energy; solar distillation; brackish water; separate condenser, basin solar still, Radiative cooling.

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Performance d'adsorption de méthyl orange à l'aide d'un matériau respectueux de l'environnement à base de Luffa Cylindrica.

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Abstract: La pollution est l'introduction d'une entité de type physique, chimique, biologique ou de radiation qui affecte le fonctionnement des écosystèmes ou de la biosphère. Elle entraîne des conséquences telles que le réchauffement climatique, l'apparition de maladies provoquant des décès prématurés, ainsi que la migration de certaines espèces, voire leur extinction. Devant cette situation catastrophique, l'être humain a repris conscience du danger qui le guette et qui menace son existence et, pour y remédier, a eu recours aux différents traitements chimiques, physiques et biologiques. Il y a plusieurs méthodes et procédés, à savoir les procédés d'oxydation classiques, les procédés d'oxydation avancée (POA), les procédés d'oxydation avancée électrochimique et les procédés d'oxydation avancée photochimique, des procédés physicochimiques tels que la coagulation-précipitation, les techniques membranaires, l'échange d'ions et l'adsorption. Mais durant les dernières décennies, beaucoup de recherches ont porté sur la technique de séparation par adsorption. Ce procédé a déjà montré son potentiel dans le traitement de polluants inorganiques (métaux lourds) et de substances organiques toxiques.

Ce travail porte sur l'étude de l'adsorption de méthyl orange des eaux à l'aide d'un biomatériau à base de plante locale (luffa cylindrica). L'étude a été menée à l'aide de différents essais. Les influences des paramètres suivants ont été étudiées pour optimiser l'adsorption : la masse d'adsorbant, la granulométrie, la température, le pH de la solution, la force ionique, la concentration et le temps de contact. Les résultats montrent que le système est exothermique et l'absorption a été effectuée avec succès, sans oublier que la matière première de notre adsorbant est moins chère par rapport aux autres adsorbants.

Keywords: Biomatériau; Polluant; Eau; Adsorption; Méthyl orange; Luffa Cylindrica.

ID: Env-P-22

STUDY OF THE PHYDISICOCHEMICAL PARAMETERS OF DRINKING WATER FROM SOME ADRAR REGIONS

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Abstract: Groundwater is threatened by various diffuse sources of pollution. In order to assess the quality of AlFaqara water intended for human consumption in the sub-Saharan desert, we carried out physico-chemical analyzes of water from four different regions (Adrar - Reggane - Fenughil - Zaouit Konta) to determine the quality of this water.

The results obtained show that the water quality in each of (Adrar - Fenoughil - Zaouiet Kounta) is acceptable, as it did not exceed local and national standards. Regarding the Reggane region, the quality of the water was polluted and unfit for consumption, and this is due to the quality of the soil which could have been affected by the French nuclear explosions and the bombs to which the region was exposed in the period (1960-1965).

Keywords: Underground waters; Physico-chemical analyses; Adrar region; Pollution.

ID: Env-P-23

Brackish water softening using Moringa Oleifera seeds: parametric study

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Abstract: In the recent years, the capacity of desalination plants has increased significantly and production costs per m3 have declined significantly. Demineralization of brackish water is a necessity for regions in a situation of pre-water stress.

This study focuses on the possibility of producing drinking water from brackish water taken from a region in northern Algeria by reducing the calcium and magnesium hardness of brackish water using a natural material, Moringa Oleifera Seeds (MOS) that were prepared from the seeds of Moringa Oleifera in their natural state and without any modification or chemical preparation, after washing them and drying in the open air for 5 days and shelling by hand. The operational parameters were optimized in terms of the effect of contact time, the bio-material mass, the pH and the initial calcium concentration. Characterization of MOS has been done by using FTIR and DRX technics.

Obtained results revealed that a retention of respectively 45.7 % of calcium and 17.42 % of magnesium in the brackish water can be efficiently obtained after 5 hours of contact time on 1g of MOS at room temperature in a discontinuous reactor. In the case of synthetic aqueous solution, equilibrium is reached during 2 hours at pH of 6 on 1 g of material. About 23.3% of calcium retention was obtained under these conditions at room temperature and 〖[Ca]〗_initial=600 mg.L^(-1). The pseudo-first order model describes well the calcium biosorption kinetics. Isotherms sorption of calcium are satisfactorily described by the Freundlich model which supposes a multilayer sorption on heterogeneous surfaces of MOS. The experiments carried out show that MOS materials can be envisaged for softening brackish water, especially in regions suffering from water shortages or those with groundwater and surface salt water tables such as the southern Algerian regions and the Sebkhas.

Keywords: brackish water, softening, Moringa Oleifera, biomaterial, sorption

ID: Env-P-24

Caractérisation statistique multivariée et hydrochimique des eaux de la nappe phréatique utilisées en irrigation dans la vallée d'Oued Souf (SE Algérien)

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Abstract: La vallée d'Oued souf a connu une intensification des activités agricoles au cours des dernières années, et les eaux souterraines sont largement exploitées pour l'irrigation. Une enquête a été menée où des échantillons d'eau sont prélevés selon le protocole standard dans 17 puits, et différents paramètres ont été analysés sur le plan physico-chimique, Les méthodes d'étude sont basées sur l'application de diagrammes (Piper, Riverside, Wilcox) et de Phreeqc (indice de saturation) et par le logiciel Diagramme et statistiques (analyse en composantes principales, ACP et analyse de classification hiérarchique, ACH) par le logiciel XLSTAT, La distribution spatiale des paramètres de qualité a été cartographiée en utilisant ArcGIS 10.1

Les résultats ont montré que le type d'eau est Na-Cl- et, Cl- avec des ordres d'abondance de Cl->SO42->HCO3- et Na2+ avec des ordres d'abondance de Na2+>Mg2+> Ca2+>K+ sont les anions et les cations dominants, respectivement. Les valeurs de l'indice de saturation (calculés par le programme PHREEQC) montre que presque tous les échantillons d'eau sont dominées par les faciès évaporitiques, ayant comme origines; la dissolution des évaporites (gypse et halite).L'Analyse en Composantes Principales ACP a confirmé cette parenté. D'après les diagrammes le diagramme de Wilcox et de Richards, les eaux d'irrigation, sont de qualité médiocre à mauvaise, généralement fortement minéralisées fait peser un risque de salinisation des sols et doivent être utilisées avec beaucoup de précautions dans l'irrigation.

Keywords: La nappe phréatique; Analyse en Composantes Principales (A.C.P); Hydrochimie; Salinité; Faciès chimique; d'Oued souf.

ID: Env-P-25

Preparation of Cellulose/ZnO nanoparticles (CNC/ZnO NPs) from peanut and pea shells and evaluation of their Antimicrobial activity.

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Abstract: This study aims to repurpose plant waste, specifically Peanut and pea shells, to synthesize cellulose/zinc oxide nanoparticles (CNC/ZnO NPs) using two environmentally friendly and low-cost techniques. Initially, cellulose nanocrystals (CNCs) were extracted from the cellulose-rich biomass of Peanut and pea shells through chemical treatments. Subsequently, a hybrid material of CNCs and ZnO NPs was fabricated using two techniques.

The fierst, involving the dissolution of cellulose (Cs) in a basic solution, and the second, utilizing Cs crystals directly. Various analysis techniques, including Fourier-Transform

Infrared spectroscopy (FT-IR), X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM), Energy Dispersive X-ray Spectroscopy (EDX), and Ultraviolet visible spectroscopy (UV–Vis), were employed to study the material's different properties. Furthermore, CNC/ZnO NPs were tested against human pathogenic bacteria and a fungus. Results indicated the crystalline nature of the CNC/ZnO NPs, with an average size varied between 19.64 and 27.31 nm, while the gap bands ranged between 3.27 and 3.66 v for the two methods used. Morphological analysis showed a notable contrast in ZnO nanoparticle distribution on CNC surfaces. In the first method, ZnO NPs formed a complete and evenly distributed coating, resulting in a smooth structure. Conversely, the second method led to ZnO NPs appearing as scattered dots on the CNCs, resulting in the lowest ZnO NP content.

The study demonstrated a significant increase in antimicrobial properties after coating Cs nanoparticles with ZnO NPs, with the hybrid material exhibiting higher antimicrobial activity than pure CNCs. These findings suggest the potential of CNC/ZnO NPs for antimicrobial pharmaceuticals and as a natural food preservative to control the growth of microorganisms.

Keywords: Peanut shells; Peas shells; Cellulose Nanocrystals; CNC/ZnO NPs; Antimicrobial activity.

ID: Env-P-26

AI-Driven Smart Irrigation System for Optimizing Water Use in Date Palm Plantations

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Abstract: Date palm cultivation is a vital economic activity in arid regions of Algeria, such as Biskra and Ouargla. However, water scarcity, soil degradation, and climate change pose significant challenges to the sustainability and productivity of this sector. Traditional irrigation methods are often inefficient, leading to water wastage and reduced crop yields. This paper proposes an AI-driven smart irrigation system that leverages Internet of Things (IoT) sensors and artificial intelligence (AI) to optimize water use in date palm plantations, ensuring sustainable agricultural practices and improved productivity. The system integrates IoT sensors to monitor key environmental and plant parameters, including soil moisture, weather conditions, plant health, and water quality. These sensors transmit real-time data to a cloud-based platform, where AI algorithms analyze the information to predict water requirements and optimize irrigation schedules. The system automatically adjusts water distribution, ensuring that each palm tree receives the precise amount of water needed for optimal growth. Farmers receive real-time alerts and recommendations via a mobile application, enabling them to manage irrigation remotely and make informed decisions. Key IoT sensors used in the system include soil moisture sensors, weather sensors, plant health sensors, and water quality sensors. These devices are interconnected via IoT networks, such as LoRaWAN or cellular networks, to ensure seamless data transmission. AI models, trained on historical and real-time data, provide predictive insights into water needs, detect early signs of plant stress, and identify areas requiring intervention. The AI-driven smart irrigation system offers numerous benefits, including a 30-50% reduction in water consumption, increased crop yields, and lower operational costs. By promoting efficient water use and reducing environmental impact, the system contributes to the sustainability of date palm farming in arid regions. Moreover, its scalability makes it accessible to both small-scale and large-scale farmers, ensuring widespread adoption and impact. In conclusion, the integration of AI and IoT technologies into date palm cultivation represents a transformative approach to addressing water scarcity and climate change in Algeria. By optimizing water use and enhancing agricultural efficiency, this innovative solution has the potential to revolutionize date palm farming, ensuring its sustainability and economic resilience. However, successful implementation requires collaboration among farmers, researchers, policymakers, and technology providers. With proper planning and support, the AI-driven smart irrigation system can pave the way for a prosperous future for Algeria's agricultural sector.

Keywords: Artificial Intelligence; IoT sensors; smart irrigation; date palm cultivation; arid regions; water optimization; sustainable agriculture; climate resilience.

ID: Env-P-27

Valorization of agricultural waste to produce Activated Carbon for the elimination of Zn (II) from aqueous solutions.

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Abstract: Abstract:

Industrial activities are very important sources of environmental pollution, containing many highly toxic heavy metal ions that are harmful to living organisms, including humans. The objective of this study is the removal of heavy metals from aqueous solutions, by adsorption on activated carbon, prepared from a natural Biomass waste (BMC), a prevalent environmental concern, was harnessed as the foundational material for biochar. The maximum adsorption efficiency of Zn^{2+} rapidly reached 88% after about 100 min of stirring times with an amount of 0.1 g adsorbent and an initial Zinc concentration of 120 mg L^{-1} at an optimum pH of around 6 and ambient temperature of 25°C. The activated carbon was characterized thoroughly using FTIR and DRX analyses.

Keywords: Agricultural waste; Activated Carbon; Zn^{2+}; DRX ; FTIR; Aqueous solutions.

ID: Env-P-28

Rétention De CO2 par des adsorbants à caractères basiques

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Abstract: Étude de la synthèse hydrothermale de matériaux mesoporeux purement siliciques MCM-48 et leurs modifications par incorporation de composés organiques qui sont susceptibles d'augmenter la capacité de rétention de CO2. Après caractérisation exhaustive des solides obtenus, ils seront testés dans la rétention de CO2.

la MCM-48 une silice mésoporeuse, qui possède un réseau tridimensionnel avec une surface spécifique et porosité élevées [1,8]. Les traitements post-synthèse de la MCM-48 par incorporation de dihexylamine (DHA), suivie de l'élimination de DHA et calcination, avec incorporation de polyol dendrimère, devraient produire des homologues de silice présentant des interactions avec CO2 dont la force est intermédiaire entre la forte basicité de la fraction organique incorporée et la faible acidité de la silice. La désorption thermique programmée de CO2 (TPD) et la calorimétrie à balayage différentiel (DSC) ont été utilisées dans cette recherche. La capacité de rétention du CO2 (CRC) et la force de rétention ont été corrélées avec la chaleur de désorption et discutées en termes de force et de l'interaction acide-base.

Keywords: Adsorbant , CO2 , TPD ,Désorption

ID: Env-P-29

Fonctionnalisations et Caractérisations Des Adsorbants

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Abstract: L'objectif de ce travail est d'étudier l'effet du chargement en dendrimères sur les propriétés physico-chimiques des adsorbants à base d'organo-montmorillonite en utilisant diverses techniques de caractérisation. Le caractère hydrophile des interactions dendrimère-argile.

Divers organo-montmorillonites ont été préparées par intercalation avec trois dendrimères de polyglycérol dérivés de soja (masse moléculaire de 500, 1100 et 1700). Les effets du contenu en dendrimères seront discutés en termes d'augmentation du caractère hydrophile, de la porosité et la surface. Le rôle des groupes OH greffés sur le fragment dendritique sera examiné en corrélation avec la quantité d'eau adsorbée et/ou du dioxyde de carbone.

Keywords: Adsorbant , Dendrimère-Argile , Corrélation H2O-CO2,

ID: Env-P-30

Using hybrid of low cost bioadsorbant to remove heavy metals from aqueous wastewater

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Abstract: This study's Goal was to synthesize and construct biomaterials of the cationic and anionic.Removal of effluents in aqueous media,particularly the adsorption technique,which appears to be well suited to remove polluants due to its shown efficacy as well as for financial reasons.using inexpensive adsorbent such agriculture and industrial wastes.

Keywords: Caractérisation,water treatment, Bio adsorbent, matériels,metal

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La Gestion des Déchets à Risques Infectieux en milieu Hospitaliers: Cas du CHU de Mostaganem

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Abstract: La ville de Mostaganem connait ces dernières années une croissance démographique rapide et ce, face à un développement des infrastructures industriels et médicales important, entrainant une augmentation de la production des différents types de déchets, qui menace directement la santé de la population ainsi que l'environnement.

Parmi ces déchets, on compte les déchets hospitaliers produit par les structures sanitaires (CHU, Cliniques, Secteurs de soins médicaux.) qui génèrent des déchets en forte croissance, surtout ceux à risque infectieux, déchets piquants coupants et tranchants, déchets anatomiques, déchets chimiques et toxiques, déchets radioactifs.

La gestion des déchets d'activités de soins présente un intérêt capital face à un enjeu économique et environnemental majeur, a cet effet, le respect des étapes suivantes est fondamentale : le tri, la collecte, le stockage, le transport et le traitement, ainsi que la formation du personnel.

L'objectif de cette étude est de comprendre comment le prétraitement par désinfection permet de réduire le volume des déchets et leurs risques infectieux et de proposer des solutions pour améliorer le processus de gestion des déchets hospitaliers.

Keywords: Déchets d'activités de soins (DAS)1, Déchets d'activités de soins à risques infectieux (DASRI)2, gestion des déchets3, élimination des déchets4, traitement des déchets5.

ID: Env-P-32

Radiological hazard and natural radioactivity levels in soil using gamma ray spectrometry

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Abstract: Natural radioactivity in soil is a key factor influencing enviromental safety and human health. Soil naturally contains radionuclides, which contribute to background radiation levels and can impact ecosystems over time. This study evaluates the activity concentrations of naturally occurring radionuclides in soil samples from the eastern region of Algeria using high-resolution gamma ray spectrometry with a high purity Germanium (HPGe) detector. To assess potential enviromental risks, the specific activities of 232Th, 40K and 226Ra were determined, radiological hazard indices, including the external (Hex) and internal (Hin) hazard indices were calculated, with values ranging from 0.10 to 0.18 for Hex and 0.14 to 0.24 for Hin. The results showed that these indices were within permissible limits. The Radium equivalent activity (Raeq) varied between 40.14 to 65.47 Bq/Kg , which is within the internationally accepted safety limits. The results confirm that the studied area meets international radiological safety standards and poses no risk to soil quality or ecological health.

Keywords: Gamma spectrometry; Soil samples; Activity concentrations; Internal and external hazard indices; Radium equivalent activity.

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Extraction, Characterization, and Antioxidant Evaluation of Essential Oils from Two Medicinal Plants: A Multi-Approach Study

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Abstract: This study focuses on the extraction and characterization of essential oils from two medicinal plants and their antioxidant potential. The oils were obtained through hydrodistillation and analyzed using gas chromatography-mass spectrometry (GC/MS) to determine their chemical constituents. Their antioxidant activity was assessed through in vivo and in vitro assays, evaluating their ability to neutralize free radicals and reduce oxidative stress. Additionally, an in-silico investigation, including molecular docking and molecular dynamics simulations, was conducted to explore their interactions with antioxidant-related enzymes. The findings provide valuable insights into the therapeutic potential of these essential oils in combating oxidative stress-related disorders.

Keywords: Essential oils; GC/MS analysis; Antioxidant activity; In silico approach; Oxidative stress

ID: Env-P-34

Elaboration and characterization of iron oxide nanoparticles by green chemistry: application to the adsorption of dyes

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Abstract: In this work, Artemisia herba-alba extract was used to prepare magnetic Fe_3O_4 iron oxide nanoparticles by green chemistry. Characterization by XRD, EDX and SEM techniques showed that these green-synthesized iron nanoparticles are crystalline and porous, of magnetite type, with sizes between 29 and 55 nm. The essential oil of Artemisia herba-alba was analyzed using FTIR and GC/MS techniques and showed the presence of the phenolic compounds required in the protocol used to prepare the nanoparticles. Application of magnetic iron oxide nanoparticles to the adsorption of dyes showed that the adsorption power of Fe_3O_4 nanoparticles due to their porosity visualized by SEM gives a better adsorption rate.

Keywords: nanoparticles; iron oxide; green chemistry; plant extracts; dyes

ID: Env-P-35

Synthèse d'un hydrotalcite et son application dans le traitement des eaux

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Abstract: L'industrialisation intensive qui a vu le jour au cours de ces dernières années a causé l'apparition dans l'environnement des polluants (pesticides, colorants, hydrocarbures, produits pharmaceutiques, …). Ces composés sont à l'origine de nombreuses perturbations de la faune aquatique et constituent un risque pour la santé humaine, qui peuvent entraîner une contamination chez les êtres vivants. Le défi majeur de l'industriel est de trouver une technique efficace et peu onéreuse pour réduire la pollution avant tout rejet dans l'environnement. En effet, l'adsorption est l'une des techniques les plus inefficaces face à la complexité des effluents. Dans ce contexte, l'utilisation des argiles anioniques qui sont nommées des hydroxydes doubles lamellaires (HDL) a été étudiée en raison de leur grande surface et de leur bonne capacité d'échange d'ions, ce qui fait de ces matériaux des adsorbants potentiels importants. Dans ce travail, nous avons opté pour l'étude de l'élimination du paracétamol en solution aqueuse par adsorption sur des hydroxydes double lamellaire de type Mg-Fe de rapport molaire R = 2. Le matériau Mg-Fe- HDL a été synthétisé par la méthode de co-précipitation, suivi par une caractérisation par différentes méthodes et techniques d'analyses. Les diffractogrammes des rayons X obtenus sont typiques des phases de type hydrotalcite. La spectroscopie infrarouge (IR-ATR) a montré que l'allure générale des spectres est similaire et caractéristique des phases de type hydrotalcite intercalées par des ions carbonates. L'étude d'adsorption du paracétamol a permis de montrer que l'adsorption dépend essentiellement de la masse d'adsorbant. La masse optimale est de 30 mg tandis que l'équilibre est atteint après un temps de contact de 150 min.

Keywords: layered double hydroxides; co-precipitation; adsorption; paracétamol

ID: Env-P-36

Plant ability to accumulate heavy metals as a solution to soil pollution

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Abstract: Heavy metals are among the most reactive and persistent pollutants in agricultural soils due to increasing human activities and poor management of biological resources. As a result, metal pollution has become a worrying environmental problem in our time. In view of this situation, phytoremediation is considered as an innovative, reliable and less costly biotechnology, which refers to the in situ use of plants to degrade, contain or render harmless contaminants in the environment. The aim of this study is to evaluate the phytoremediation capacity of Raphanus sativus L., a model plant for eco-toxicological studies, for use in soil remediation. For this purpose, radish was exposed to different concentrations of Pb (0, 500, 1000 and 2000 ppm), Cu (0, 400, 800 and 1000 ppm) and Zn (0, 200, 300 and 400 ppm). The determination of heavy metals in the different parts of the plant was carried out using an Atomic Absorption Spectrophotometer (AAS). The phytoremediation results show that radish massively accumulates Pb, Cu and Zn in the aerial and root parts, with the greatest accumulation in the root part in the order Zn<Cu<Pb. The translocation of Pb, Cu and Zn in radish is of the order Pb<Cu<Zn and increases with higher applied doses. The species Raphanus sativus seems to be promising for phytoremediation as it can be used to decontaminate soils polluted by heavy metals through phytostabilization, rhizodegradation and phytoextraction, In order to conserve biological resources and ensure agricultural sustainability.

Keywords: Metallophytes; Raphanus sativus; Soil depollution; Metallic pollution.

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Water desalination and intensification of organic dye removal using combined electrodialysis/electrocoagulation process

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Abstract: The simultaneous desalination of water and removal of organic pollution is considered the main challenge of the electrodialysis (ED) process because this leads to membranes fouling and thus hinders the treatment process. This work aims to combine electrodialysis and electrocoagulation (ED-EC) using an Aluminum anode, to intensify the organic pollutant (methyl orange, MO) removal and boost the desalination process. Combined ED-EC process is investigated for synergistic removal of MO dye and the intensification of salt ions (Na^+ and Cl^-) separation by ED. A comparison between single ED and combined ED-EC performances shows an excellent MO elimination and membrane anti-fouling activities which were obtained by this combination. The characterization of AMX membranes shows that the presence of MO in single ED without any additional treatment led to the strong fouling of the membrane, unlike in ED-EC process. Effect of some operating parameters including, current density applied in EC, initial concentration of MO as well as of NaCl and initial pH on the ED-EC were investigated. In addition, the sludge formed after ED-EC was characterized using SEM-EDS, XRD and FTIR techniques.

Keywords: Electrodialysis; Electrocoagulation; Aluminum anode; Water desalination; AMX membrane anti-fouling; Combined processes.

ID: Env-P-38

Recovery of plastic materials in the wastewater treatment process

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Abstract: This work is part of the recovery of plastic waste for the preservation of the environment. For this, we selected a plastic waste of the polystyrene type,based on our bibliographical research, it has been found that polystyrene material is generally considered to have little to no value or is undervalued in certain contexts.This material will be utilized in the treatment of water contaminated with toxic compounds, particularly textile dyes Basic Blue 41 (BB41). Before being used as an adsorbent, the polystyrene material experienced two treatment processes (cryogenic grinding and treatment with chemical acid). Afterward, the adsorbent underwent characterization techniques to gain a deeper understanding of its properties. Fourier Transform Infrared (FTIR) spectroscopy was utilized to analyze the functional groups present in the actived material. The adsorption experiments involved the manipulation of various physicochemical parameters, including pH solution, initial dye concentration, adsorbent mass, and medium temperature. Based on the experimental results, the adsorbent demonstrated a significant adsorption capacity of 1905.193 mg/g for BB41 dye. This indicates that the polystyrene waste has a high capability to remove and bind the BB41 dye from the solution.Furthermore, the application of various commonly used models confirmed that the Langmuir model provided a good description of the adsorption equilibrium for the BB41 dyes. This study further established that the thermodynamic studies of the experimental data exhibited positive values of the Gibbs free energy ($\Delta G°$), indicating the non-spontaneous under the given conditions and requires an input of energy.$\Delta H°$ indicate that the process adsorption of BB41 on the sulfonated polystyrene is endothermic.$\Delta S°$ negative the reaction of SPS is not thermodynamically favorable under given conditions.

Keywords: Polystyrene Waste, Removal dye, Adsorption, Thermodynamic Studies

ID: Env-P-39

Catalytic reduction of organic pollutants using AgNPs-doped Al-MCM-41

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Abstract:

This work focuses on the preparation of mesoporous silica Al-MCM-41 doped with silver nanoparticles (AgNPs). In order to study the catalytic behavior of this material in the reduction of organic pollutants in a simple and binary system, several Si/Al ratios were varied before AgNPs modification. The different materials were characterized by XRD, nitrogen adsorption at 77K, FTIR, SEM/EDS, TEM, XRF and XPS. The results showed that there is a direct relationship between the Si/Al ratio and the content of AgNPs loaded on the Al-MCM-41 surface. Thus, it was demonstrated that low Si/Al ratios (20 and 40) favor a better capture and stabilization of silver nanoparticles on the Al-MCM-41 surface. The ion exchange method, followed by chemical treatment using $NaBH_4$, allowed the formation of ultrafine and well-dispersed silver nanoparticles. The application of these materials in the reduction of organic pollutants showed good results in terms of pollutant conversion. It was thus shown that the catalyst with a Si/Al ratio = 40 gave the best results, due to the high content of AgNPs present on its surface. The reuse of this catalyst over five cycles showed better dye conversion without loss of performance.

Keywords: Al- MCM -41; mesopors materials: Pollutant reduction;Dye degradation;Catalysis

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Effet des vibrations sismiques sur les réponses dynamiques des bâtiments en portiques de faibles et moyennes hauteurs.

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Abstract: La stabilité aux vibrations sismiques est essentielle pour les bâtiments auto-stables en béton armé (RC), car elles sont exposées aux dommages causés par les séismes destructeurs. Dans ce contexte, cette étude compare les réponses de bâtiments de faible et moyenne hauteur soumis à différents spectres de réponse, notamment ceux d'El-Centro, de Kobé et de Boumerdès (station Dar El-Beida, Algérie), ainsi que le spectre réglementaire du code sismique algérien (RPA 99/ version 2003). Cette étude vise à analyser l'impact des spectres sismiques sur les efforts tranchants, les déplacements maximums et le rapport entre l'effort tranchant dynamique à la base et l'effort tranchant statique ainsi que les moments de renversement de trois structures de 1, 3 et 6 étages. Les résultats indiquent que le code sismique algérien RPA99/v 2003 nécessite des études complémentaires à base des séismes réels afin de couvrir les différentes périodes des structures.

Keywords: spectre de réponse; structure en béton armé; efforts tranchants; déplacements maximums; RPA99v2003.

ID: Env-P-41

Green Synthesis of 3,4-Dihydropyrimidin-2-(1H)-one via Biginelli Reaction Using LaNiMn and LaCuNiMnCatalysts

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Abstract:

The objective of this work is to synthesize 3,4-dihydropyrimidin-2-(1H)-one (DHPM) via the Biginelli reaction, using benzaldehyde, ethyl acetoacetate, and urea as reactants, in the presence of LaNiMn and LaCuNiMn catalysts prepared by the sol-gel method and calcined at 800°C. The structural and textural properties of the synthesized solids were investigated using X-ray diffraction (XRD), scanning electron microscopy (SEM), Nitrogen adsorption Brunauer-Emmett-Teller (BET).

The LaCuNiMn sample prepared exhibited the highest DHPM yield (75%), in free solvent with a reaction time of 3h.

Keywords: Heterogeneous catalysis; Biginelli reaction;Green chemistry; MnO2,

ID: Env-P-42

Impact des valeurs élevées du fluor dans les eaux souterraines sur la santé humaine, Cas du Sud Algérien

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Abstract: L'impact des valeurs élevées de fluor sur la santé humaine dans le Sud Algérien est un problème de santé publique important. Le fluor est un élément naturellement présent dans l'eau, mais à des concentrations élevées, il peut entraîner des effets néfastes sur la santé, comme la fluorose dentaire, la fluorose squelettique, des problèmes rénaux et des effets neurologiques. Dans ce travail on va présenter quelques points clés concernant cet impact dans le Sud Algérien.

Keywords: Fluor, Eaux souterraines, Fluorose, Sud Algerien, Défluoration.

ID: Env-P-43

Histoire des fluorures élevées dans les eaux souterraines du bassin oriental du Sahara septentrional

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Abstract: En Algérie ; les eaux souterraines du Sud Algérien sont caractérisées par des teneurs en

fluorures très élevées. Les sources en eau les plus importantes

sont constituées par la nappe phréatique, la nappe du complexe terminal (CT) et la nappe du continental terminal (CI). Les concentrations en fluor dépassent fréquemment les teneurs

recommandées par l'Organisation Mondiale de la Santé (OMS). La présente étude

tente de décrire l'histoire de l'existence et la provenance du fluor (F-) dans ces eaux souterraines.

Keywords: Eaux souterraines, Sud Algérien, Fluorures, CT, CI.

ID: Env-P-44

Traitement des eaux souterraines riches en fluorures par adsorption à l'aide d'un charbon modifié

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Abstract: Le traitement des eaux souterraines riches en fluorures est un enjeu important pour la santé publique, car une concentration excessive de fluorures dans l'eau potable peut entraîner des problèmes de santé tels que la fluorose dentaire ou squelettique. L'adsorption est l'une des méthodes couramment utilisées pour éliminer les fluorures de l'eau. Danc e travail une explication du processus et des matériaux utilisés pour l'adsorption des fluorures.

Keywords: Eaux souterraines, Fluorures, Adsorption, Charbon modifié.

ID: Env-P-45

Photocatalytic degradation of malachite green by (TiO2/2%Au) under solar irradiation

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Abstract: Environmental pollution is one of the major challenges facing humanity today. Dyes play a major role in this pollution, causing deterioration and threatening the life of flora and fauna. Heterogeneous photocatalysis is one of the effective solutions to this problem, using a photocatalyst, gold-supported TiO_2, which is the most widely used photocatalyst in recent times. The aim of this study was to degrade malachite green, a cationic dye widely used in the textile industry, by means of heterogeneous photocatalysis under solar irradiation, taking into account certain parameters such as the initial concentration of the pollutant, the mass of the catalyst, the stirring speed and the addition of H_2O_2. The results show that the best degradation (100% efficiency) is obtained at an ambient temperature of 25 C and an initial solution pH of 6.38 with a semiconductor mass equal to 0.15 g, a volume of H_2O_2 equal to 3 ml, an initial pollutant concentration equal to 20 ml/mol and a stirring speed of 300 rpm.

Keywords: Malachite green;Degradation; Heterogeneous photocatalysis;Semi-conductor.

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Valorization of Potato Peels as a Green Substrate for Sustainable Hyaluronic Acid Production

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Abstract: Potato peels, an agro-industrial byproduct, were utilized as a renewable and eco-friendly carbon source to develop an optimized culture medium for sustainable hyaluronic acid (HA) production under anaerobic conditions. Their rich composition provides an economical alternative to conventional carbon sources, promoting microbial growth while enhancing waste valorization and reducing environmental impact.

The optimization process involved fine-tuning nitrogen sources, essential vitamins, cofactors, and precursors to improve HA yield. Fermentations were conducted in Erlenmeyer flasks under strictly anaerobic conditions, with the medium pre-reduced using a nitrogen or carbon dioxide atmosphere, and cysteine HCl added to lower the redox potential. Anaerobic conditions were further maintained using gas-generating sachets and sealed incubation systems.

A sustainable bioprocess strategy was developed through an experimental industrial plan, evaluating key parameters such as salt tolerance, nutrient efficiency, and anaerobic stability. Optimization approaches included testing various culture conditions, implementing a fed-batch system to regulate nutrient supply, and monitoring HA production via viscosity changes and specific staining techniques. The optimized conditions led to a significant improvement in HA biosynthesis, demonstrating the potential of agro-industrial waste as a green material for biotechnological applications.

This study highlights the integration of circular economy principles into bioprocess engineering, offering an innovative approach to waste upcycling and sustainable bioproducts development.

Keywords: Waste valorization, Hyaluronic acid production, Anaerobic fermentation, Biotechnological applications, Sustainable bioprocess

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Modélisation SIG de la vulnérabilité des eaux souterraines par la méthode SI dans la plaine quaternaire d'El Mahmel (Nord-Est Algérie)

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Abstract: L'aquifère alluvial d'El Mahmel, localisé au sud-est de Khenchela et couvrant une superficie de 343,54 km², constitue une ressource hydrique stratégique pour l'irrigation agricole et l'approvisionnement en eau potable. Toutefois, son exploitation est soumise à des pressions anthropiques croissantes, notamment l'intensification des pratiques agricoles caractérisée par l'usage accru d'engrais chimiques, compromettant ainsi la qualité des eaux souterraines.

L'évaluation de la vulnérabilité intrinsèque de cet aquifère à la contamination par des polluants diffus a été réalisée en appliquant l'indice de susceptibilité (Susceptibility Index - SI). L'approche adoptée repose sur l'intégration des systèmes d'information géographique (SIG) comme outil d'acquisition, de gestion, d'analyse spatiale et de représentation cartographique des paramètres influençant la sensibilité du système aquifère.

Les résultats obtenus ont permis d'établir une cartographie détaillée de la vulnérabilité, révélant quatre classes de susceptibilité : très forte et forte, qui couvrent 55,20 % de la zone d'étude, modérée (25,08 %), et faible (18,70 %). Ces données constituent une base essentielle pour la mise en place de stratégies de gestion durable et de protection des ressources en eau face aux risques de pollution d'origine anthropique.

Keywords: Vulnérabilité; eaux souterraines; Agriculture; pollution; ElMahmel; Nord est Algérien.

ID: Env-P-49

Élaboration d'un charbon actif magnétique à base de tiges de pomme de terre pour l'adsorption du cuivre (II)

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Abstract:

L'industrialisation et l'urbanisation croissantes entraînent un rejet incontrôlé de métaux lourds dans les milieux naturels, causant une pollution environnementale majeure. Même à faible concentration, les métaux lourds représentent un danger significatif pour la santé humaine en raison de leur toxicité élevée. Cette étude a pour objectifs la synthèse d'un charbon actif à partir de tiges de pomme de terre et l'évaluation de son efficacité pour l'adsorption du cuivre (II), considéré comme l'un des métaux lourds les plus toxiques pour l'homme. Le charbon actif a été produit par pyrolyse, puis transformé en un matériau magnétique par co-précipitation d'oxydes de fer sous atmosphère inerte (N_2). Le matériau obtenu est un bio-composite adsorbant magnétique, présentant des propriétés intéressantes pour le traitement des eaux contaminées. Les résultats préliminaires ont montré une efficacité d'adsorption de 97,37 % pour l'élimination du cuivre (II). Ces performances confirment le potentiel de ce biocomposite pour des applications dans le traitement des eaux usées et dans divers processus industriels. Ainsi, la méthode d'adsorption proposée est simple, économique et prometteuse pour l'élimination des polluants inorganiques tels que le cuivre (II), offrant une solution durable face à la pollution par les métaux lourds.

Keywords: Adsorption, Biocomposite, Fe3O4, métaux lourds, cuivre, polluants inorganiques.

ID: Env-P-50

Synthesis, Characterization, and Multifunctional Applications of $Ca_5(PO_4)_3F@Ca_5P_8$ Nanocomposites from Phosphate Waste: Antioxidant Properties and Degradation of Evans Blue Dye

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Abstract: This study explores the synthesis and characterization of $Ca_5(PO_4)_3F@Ca_5P_8$ nanocomposites extracted from phosphate waste. These composite materials, formed from fluorapatite and an additional phosphate phase, exhibit interesting multifunctional properties, particularly in antioxidant activity and dye degradation.

Firstly, the nanocomposites are characterized using various analytical techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), and Fourier-transform infrared spectroscopy (FTIR) to determine their structure, composition, and morphology.

Additionally, these nanocomposites are tested for their effectiveness in degrading Evans Blue dye, a common marker in biological studies. The results show that these materials can catalyze the degradation of the dye, offering potential applications in water treatment or environmental pollution remediation.

Finally, the study proposes a sustainable approach by utilizing phosphate waste to create nanocomposites with versatile properties, useful both in health applications (through their antioxidant capabilities) and environmental applications (such as the degradation of pollutants like Evans Blue dye).

Keywords: key-Nanocomposites; key- Waste Phosphate; key-Antioxidant Activity

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ID: Env-P-51

Hydrochemical Assessment of Groundwater in Khenchela Province, Algeria: Implications for Environmental Sustainability

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Abstract: Groundwater is a crucial resource for biodiversity, agriculture, and human consumption, especially in semi-arid regions where surface water is scarce. In Khenchela Province, Algeria, increasing pressure from climate change and human activities is altering groundwater quality and availability, threatening ecosystems and sustainable development. This study investigates the hydrochemical characteristics of groundwater in the region to assess environmental impacts and inform sustainable water management strategies.

Ten groundwater samples were collected from various sources, including wells and springs, and analyzed for key physico-chemical parameters: temperature (T), pH, electrical conductivity (EC), total dissolved solids (TDS), and major ion concentrations (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, NO_3^{-}). The results indicate significant spatial and seasonal variability. Water temperatures range from 14°C to 24°C, influenced by climatic conditions and seasonal fluctuations. pH values (6.75 – 7.91) suggest a generally neutral to slightly alkaline nature, with higher alkalinity observed in areas affected by anthropogenic activities.

Salinity levels, assessed through EC (702 – 3360 µS/cm) and TDS (544 – 2579 mg/l), show a notable increase in the southern part of the province, attributed to enhanced evaporation and groundwater overextraction. High chloride concentrations (up to 245 mg/l) and sulfate levels (401 mg/l) pose risks to aquatic ecosystems and soil quality. Nitrate contamination (4 – 55 mg/l), primarily linked to agricultural runoff, raises concerns about drinking water safety and eutrophication in nearby water bodies.

The findings highlight the urgent need for sustainable groundwater management. Artificial recharge strategies, conservation of wetland areas, and stricter regulations on agricultural runoff are necessary to mitigate groundwater depletion and pollution. This study underscores the interconnection between climate change, water quality, and environmental resilience, providing critical insights for safeguarding groundwater resources and ensuring long-term sustainability in semi-arid regions.

Keywords: Groundwater quality; hydrochemical assessment; water pollution; climate change; environmental sustainability.

ID: Env-P-52

Environmental Applications of Zr:ZnO Films on Ceramic and Glass Substrates

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Abstract: Abstract

The environment demands advanced materials for sustainable solutions. This research evaluates zirconium-doped zinc oxide thin films deposited on ceramic and glass substrates, focusing on structural, optical, and photocatalytic properties. X-ray diffraction confirmed a polycrystalline wurtzite structure, with larger grain sizes on ceramic substrates (25–43 nm) compared to glass (19–32 nm). UV–visible analysis showed a band gap increase to 2.93 eV for ceramic substrates. Scanning electron microscopy highlighted rougher surfaces and larger grains on ceramic substrates.

Photocatalytic tests demonstrated that ceramic substrates with 5 wt% zirconium achieved 61.44% dye degradation under UV light, outperforming glass substrates and bare ceramic. Mechanistic studies indicated enhanced adsorption of hydroxyl ions and reduced recombination of charge carriers, leading to superior photocatalytic efficiency. These findings underline the potential of ceramic-based Zr-ZnO thin films for water purification applications.

Keywords: Thin films; Photocatalytic activity; Water purification; Different substrates

ID: Env-P-53

Amélioration de la qualité des eaux traitées des STEP N° 2 de la région d'Oued Souf (S.E Algérien) par l'utilisation du filtres remplis de sables des dunes et de graviers siliceux plantés de Phragmites australis.

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Abstract: Les eaux usées traitées par la station d'épuration n°2 de Hassani Abdekrim à Oued Souf, dans le sud-est algérien, ne sont pas conformes aux normes algériennes des eaux destinées pour l'irrigation des zones agricoles, ce qui pose le risque de contaminations des cultures. Donc nous avons souhaité étudier l'amélioration de la qualité des eaux usées traitées de cette station pour les réutiliser en toutes sécurités.

Ce travail vise à explorer expérimentalement les performances d'un système de filtres remplis de sable dunaire (DS), plantés de phragmites australis L'expérimentation a duré quatre (4) mois. Plusieurs paramètres physico-chimiques et organiques ont été suivis. Les résultats ont montré une bonne qualité de l'eau filtrée, reflétant la grande efficacité des filtres à flux vertical. La présence de plantes aquatiques (phragmite australis) améliore significativement l'élimination de l'azote et augmente la teneur en oxygène dissous en sortie.

Il a également été observé que les filtres plantés améliorent légèrement l'élimination de la DBO5, des MES et du PT pour les trois polluants. Le taux d'élimination moyen obtenu avec les filtres plantés était de 96,97 % pour la DBO5, 96,28 % pour les MES, 88 % pour le Ntot et 99 % pour le PT.

Keywords: Eaux usées, Filtres à sable, phradmites australis , Station d'épuration, Flux vertical, Zone aride

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Analyse de la dispersion atmosphérique des particules radioactives issues des essais nucléaires dans le Sahara algérien vers l'Europe à l'aide du modèle HYSPLIT

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Abstract: Le Sahara algérien a été le terrain d'essais nucléaires qui ont laissé des empreintes durables sur l'environnement, particulièrement en ce qui concerne la dispersion atmosphérique des particules radioactives. L'objectif de cette étude est d'analyser la trajectoire, la concentration et le dépôt des particules issues de ces essais à l'aide du modèle de dispersion atmosphérique HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory). À l'aide de données météorologiques et de simulations, nous avons évalué la fiabilité du modèle pour retracer la dispersion des particules vers l'Europe, en particulier la France et l'Espagne.

Les résultats montrent que les conditions météorologiques, en particulier les vents dominants, sont déterminantes pour le transport à longue distance de ces particules. Les simulations permettent de visualiser la trajectoire des masses d'air contaminées et d'estimer leur impact potentiel sur les zones géographiques habitées. L'analyse des cartes de concentration et de dépôt met en évidence les régions les plus exposées, soulignant l'importance d'un suivi rigoureux des retombées radioactives historiques et de leurs conséquences environnementales.

Ce travail contribue à la compréhension des mécanismes de dispersion des polluants atmosphériques et souligne la nécessité de renforcer les mesures de surveillance afin d'évaluer les risques sanitaires et environnementaux à long terme.

Keywords: Dispersion atmosphérique, HYSPLIT, radioactivité, Sahara, essais nucléaires.

ID: Env-P-55

Intelligence artificielle et internet des objets : outils pour une planification urbaine durable face aux défis climatiques et énergétiques

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Abstract: À une époque où les systèmes urbains subissent des pressions climatiques et énergétiques croissantes, l'intelligence artificielle (IA) et l'internet des objets (IoT) se positionnent comme des outils clés pour une planification urbaine durable et innovante (Agboola & Tunay, 2023). Selon les récentes projections, plus de 68 % de la population mondiale résidera en milieu urbain d'ici 2050 (UN, 2024), accentuant les besoins en stratégies d'adaptation aux stress environnementaux et en solutions pour une gestion économe des ressources énergétiques (UN, 2025).

Cette étude explore comment ces technologies numériques transforment la gestion des villes en intégrant des solutions basées sur les données pour anticiper les impacts climatiques, optimiser l'efficacité énergétique des infrastructures et préserver les écosystèmes urbains, le tout dans une perspective de durabilité environnementale. L'objectif est d'évaluer leurs contributions à une planification urbaine durable à travers une analyse de leurs applications émergentes.

Ainsi, l'IA, grâce aux avancées des réseaux neuronaux profonds et du traitement des données géospatiales, permet une modélisation prédictive à haute résolution des risques climatiques, comme la prévision des zones vulnérables aux vagues de chaleur ou aux submersions, tout en optimisant la consommation énergétique des bâtiments et des réseaux urbains. Parallèlement, l'IoT, via des réseaux de capteurs intelligents, surveille en temps réel les paramètres environnementaux et énergétiques, tels que l'humidité des sols, la qualité de l'air ou la demande électrique, facilitant ainsi une gestion proactive et durable des ressources. Des exemples concrets, comme l'optimisation des trames écologiques par l'IA ou le suivi des réseaux énergétiques intelligents via l'IoT, illustrent ces avancées.

Cette communication propose une réflexion sur leur potentiel comme levier d'une planification urbaine durable, tout en abordant les défis liés à la fiabilité des données et à leur intégration dans les cadres de gouvernance environnementale.

Keywords: Intelligence artificielle; Internet des objets; planification urbaine; durabilité; défis climatiques; efficacité énergétique.

ID: Env-P-56

Slope Stability Assessment of Landfills: Risks Evaluation Through Sensitivity Analysis

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Abstract: Slope stability assessment is a critical component of environmental geotechnics, particularly for landfill sites where geotechnical uncertainties and environmental risks intersect. The stability of landfill slopes is influenced by complex conditions which can compromise structural integrity and pose significant environmental hazards. This study employs sensitivity analysis to evaluate the impact of geotechnical parameters on the Factor of Safety (FoS) and overall slope performance. Through numerical modeling and analytical approaches, we examine how variations in soil and waste properties affect stability conditions. The results highlight the key factors governing landfill slope behavior and their implications for slope failure risk. The findings underscore the necessity of comprehensive site investigations, continuous monitoring, and risk mitigation strategies to enhance landfill design and ensure long-term slope stability.

Keywords: Mine waste management; Slope stability; Landfill stability; Environmental geotechnics; Factor of Safety; Sensitivity analysis.

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Maghnite as eco-catalysisst for a new method of synthesis of polyepichlorohydrin telechelic as polymer precursor for synthesis of hydrogel hydrosoluble for industrial application

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Abstract:

The polyether polyols were polymers widely used in industry among them the polyepichlorhydrine poly (ECH). The Cationic ring opening polymerization of epichlorohydrin offers the possibility to synthesize PECH telechelique.

Kubisa P. et al (1.2) have developed a new approach for preparation of polyethers which consists of oxide react in the presence of an alcohol such as ethylene glycol; this method allowed the synthesis polymers telechelic of epichlorhydrin whose average molar mass between 1000 and 2500.

Several catalysts (3) were used to prepare industrially PECH functional but the process is mainly based on sulfuric acid (H2SO4) and acid fluorosulfonique (HSO3F). These processes have disadvantages, acids are not recoverable their removal causes a real problem because of their toxicity and corrosiveness and their neutralization is extremely expensive. However, for possible industrial applications, it is even more interesting to synthesize this polymer under specific conditions to produce polymers free of all traces of toxins, such as traces of cationics initiators derive of metal.

For this purpose, we developed an alternative method for the synthesis of PECH telechélic. This method involves the application of Maghnite-H+, an eco-aluminosilicate catalyst (4), a new non toxic cationic initiator, used as catalyst for polymerization of a number of vinylic (5) and heterocyclic (6) monomers.

In the present work, we present a new method to design telechelic poly (epichlorohydrin) in one shot in the presence of acetic anhydride and catalyzed by Maghnite-H+. This catalyst can be easily separated, from the polymer product and regenerated by heating at a temperature above 100 °C. The reaction products were confirmed by various spectroscopic methods such as 1H and 13C NMR, IR.

Keywords: cationic polymerization, PECH, ECH, Maghnite-H+

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Analyse d’un système hybride solaire thermique et photovoltaïque pour la distillation d’eau

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Abstract: L'eau va devenir de plus en plus rare avec l'augmentation de la population. Les solutions traditionnelles ne répondent plus à nos besoins. De nombreux chercheurs ont travaillé et continuent à chercher des solutions adéquates pour l'approvisionnement en eau. L'implantation la plus favorable est la distillation et le dessalement de l'eau de mer. Ce travail présente une étude sur les paramètres physiques qui peuvent augmenter la productivité et l'efficacité du distillateur. Le distillateur hybride est équipé d'un générateur photovoltaïque connecté à un distillateur de serre. Les résultats de la simulation ont montré que la production du distillateur hybride atteint 100 l/m2, soit dix fois plus que celle produite par un distillateur passif. L'épaisseur du film d'eau et la résistance électrique ont permis d'améliorer considérablement la production et l'efficacité du distillateur. Pour une épaisseur de film d'eau m = 0,1 l/min, la production a augmenté jusqu'à 120 l/m2, et pour une résistance électrique r = 6 Ohm, la production a atteint 118 l/m2. Il est à noter que les températures de Tele et TW excèdent 100 °C sans diminuer à 18 heures, même en soirée, ce qui représente un avantage concurrentiel pour le distillateur hybride.

Keywords: Distillateur solaire hybride ; Conversion thermique électrique ; Cogénération d'énergie ; de Distillation photovoltaïque

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Assessment of Inherent Safety Mechanisms of the SPERT III-C Reactor under Reactivity Insertion Accident

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Abstract: The fundamental objective of nuclear reactor safety is to protect the public and the environment from the radioactive materials of the fission process. This goal is achieved by the design concept called defense-in-depth in which three barriers are placed between the radioactive products and the environment. These barriers levels are the fuel rods cladding, the reactor vessel and the containment reactor. Maintaining of the integrity of these barriers for both normal and abnormal operating conditions is the main task of the nuclear reactor safety engineering. The research reactor safety calculations entail usually the simulation of several selected accidents, such as RIA (Reactivity Insertion Accident), LOCA (Loss Of Coolant Accident), LOFA (Loss Of Flow Accident) and transient type as ATWS (Anticipated Transient Without Scram). the safety analysis of some transients without availability of protection systems (ATWS transients) is very interested, this could lead to revealed the contribution of some mechanisms of the inherent safety, such as Doppler effect, rod expansion, moderator expansion and voids and moderator temperature to ensure the reactor safety (self-limiting behavior). The aim of this work is to predict and analyze the behavior of the SPERT III-C-Core to various reactivity insertions (0.35 $, 0.77 $, 1.23 $, 1.25 $) when all safety systems are out of order, these conditions can lead to a rapid increase of reactor power, fuel, clad and coolant temperatures. The SPERT III-C-Core analysis is performed by the PARETANL/7.6, this code is used to simulate the coupled kinetics and thermal hydraulics of the SPERT III-C Core. The results show that all tests are considered as self-limiting or self-shutdown transients, these cases are well protected by the three mechanisms, the moderator expansion and voids, moderator temperature and rod expansion, the effect Doppler has no effect because the fuel elements are HEU type. The last test specified by 1.25 $ reactivity insertion is also a self-limiting transient, so the peak cladding temperature has reached the melting point (600.0 °C) in the hot channel. This reactivity value can be considered as the limit between the non-destructive and destructive tests, at this level, the SPERT III-C reactor should be operated with all safety systems and the inherent safety is not efficient. Finally, the comparison between calculated results and measured data shows good agreement, the maintaining of the integrity of the first barrier was ensured and no release of radioactive products to the environment has been observed.

Keywords: PARETANL; SPERT EXPERIMENTS; RIA; SPERT III-C CORE; ENVIRONMENT

ID: Env-P-60

CARACTÉRISATION HYDROCHIMIQUE DES EAUX SOUTERRAINES DE LA WILAYA EL OUED, POUR DÉVELOPPER DES STRATÉGIES DE GESTION

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Abstract: Le développement économique des régions sahariennes a accru les besoins en eau, détérioré la qualité des eaux souterraines, posant un risque pour la santé. Cette étude évalue la qualité des eaux souterraines de la Wilaya El Oued, en surveillant les paramètres physico-chimiques, l'hydrogéologie et les sources de contaminants. Il vise à développer des stratégies de gestion des ressources, contribuant au développement durable et à une bonne gestion des prélèvements d'eau. leur aptitude à la consommation et à l'irrigation.

Cette étude permettra d'élaborer des stratégies de gestion rationnelle de ces ressources et contribuera ainsi à l'instauration d'un développement durable dans la région

Keywords: caractérisation hydrochimique , hydrogéologie, gestion des ressources en eau, El oued.

ID: Env-P-61

Effet de la teneur du cation organique et du temps d'irradiation sur la structure de la montmorillonite modifiée sous irradiations micro-ondes

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Abstract: Les argiles présentent un intérêt croissant en raison de leurs applications qui ne cessent de se diversifier. Dans ce travail, nous nous sommes intéressés à la modification et à la caractérisation d'une organobentonite sous irradiations micro-ondes, ce type d'argile est très employé dans la réalisation d'une barrières pour les déchets industriels, ménagers (géo-membranes bentonitiques), radioactifs, et dans le traitement des eaux pour protéger l'environnement.

Dans cette étude, nous avons constaté que la possibilité d'intercaler la molécule organique le sel de bromure (DMIBr) » dans une bentonite a été réalisée, vu que les molécules de

de DMIBr sont polaires, elles accèdent facilement à l'espace interfollière de l'argile en formant ainsi des interactions physiques. L'effet de la teneur de la molécule organique (DMIBr) sur les propriétés absorbante de l'organomontmorillonite intercalée a été étudié. Nous avons modifié la smectite Mn-Ca de capacité d'échange cationique (CEC) de 1.23 mmol/g, par différentes proportions du sel de bromure précité sous irradiations micro-ondes. Nous avons également étudié l'effet du temps d'irradiation sous micro-ondes sur la structure de l'organomontmorillonite modifiée.

Les échantillons de l'organomontmorillonite obtenus ont été caractérisés par la diffraction des rayons X (DRX) et par la spectroscopie infrarouge à transformée de Fourier (IRTF). Les résultats de cette étude montrent qu'une quantité équivalente à 1 CEC du sel de bromure et un temps d'irradiation de 5 mn sont suffisants pour intercaler la molécule organique (DMIBr) dans l'espace interfollière de la montmorillonite.

Keywords: Les argiles intercalées; environnement ; capacité d'échange cationique CEC ; l'espace interfollière ; micro-ondes.

ID: Env-P-62

Efficient Lead Recovery from Car Batteries via Aluminium Foil Cementation: Optimization of Key Parameters and Application

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Abstract: This work focuses on the recovery of lead (Pb) from car batteries through cementation using aluminium foil, commonly used for food packaging. The study investigates the optimal conditions for this process, which include a temperature of 60°C, a pH of 2, and a stoichiometry where the amount of aluminium is twice that of the lead. Under these optimized conditions, the cementation process achieves a lead recovery yield of approximately 80%.

By adjusting these key parameters (temperature, pH, and stoichiometry) the process is optimized for maximum lead recovery. The temperature of 60°C accelerates the reaction, while a pH of 2 enhances the reactivity of the aluminium foil. Additionally, the stoichiometric ratio of aluminium to lead at 2:1 ensures an effective cementation process.

These findings demonstrate the potential for an environmentally friendly and efficient lead recovery method, contributing to the sustainable recycling of lead from spent car batteries. The optimized process can be applied on a larger scale and further refined for more efficient battery recycling operations.

Keywords: Lead recovery; Cementation; Battery recycling; Aluminum foil.

ID: Env-P-63

Elaboration de Matériaux adsorbants pour élimination d'un polluant organique pour protection de l'Environnement

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Abstract: L'industrie textile consomme de très grandes quantités d'eau. Celles-ci une fois rejetées provoquent des altérations du milieu aquatique à cause de leurs charges en colorants stables, très toxiques et faiblement biodégradables. L'objectif de cette étude est d'étudier le potentiel de valorisation des résidus naturels lignocellulosique communément trouvés en Algérie, à savoir « les noyaux de dattes » et son application dans l'élimination par adsorption de Méthyle violet contenu dans les eaux usées. Les étapes chronologiques d'obtention du charbon ont été : le nettoyage, le déshuilage, le séchage, le broyage et enfin un traitement thermique par carbonisation à 550°C et 750°. Une caractérisation des charbons obtenus par les méthodes analytiques de routine à savoir : Analyse élémentaire et la spectroscopie infra rouge (FTIR). Les essais d'adsorption en mode statique de Méthyle violet sur les charbons obtenus, ont donné une capacité maximale d'adsorption (à 25°C, concentration initiale en Méthyle violet : 25ppm et 60 minutes de temps de contact) de l'ordre de 4,65 mg/g et de 11,75 mg/g pour les charbons de ND550°C et de ND750°C. L'étude de l'influence du pH et de la température du milieu, a montré qu'à l'adsorption du Méthyle violet n'est pas grandement affectée par les changements de pH de 2 à 11 à la température ambiante 25°C et l'augmentation de la température défavorise l'adsorption et diminue la capacité d'adsorption. L'adsorption de Méthyle violet suit convenablement les modèles de Freundlich, la cinétique d'adsorption est de type pseudo-second ordre, l'étude thermodynamique nous a permis de constater que le processus d'adsorption est spontané, endothermique.

Keywords: noyaux de dattes; adsorption; méthyle violet ; cinétique d'adsorption ; thermodynamique

ID: Env-P-64

Encapsulating Origanum glandulosum essential Oil with Food-Grade Polymers for Active Packaging Applications

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Abstract: The growing demand for sustainable food packaging has prompted the creation of biodegradable films containing bioactive ingredients. Thyme essential oil (Origanum glandulosum) is well-known for its antibacterial and antioxidant characteristics, making it an ideal choice for active packaging. However, its high volatility and hydrophobicity prevent direct inclusion into polymeric films.

The goal of this study is to create and evaluate biodegradable polymeric coverings containing nano-encapsulated thyme oil utilizing the nanoprecipitation method. Food-grade polymers, including sodium alginate (2% w/v) and chitosan (0.5% w/v), were employed to improve the essential oil's stability, controlled release, and efficiency. The produced nanocapsules exhibited an average particle size of 120-180 nm, an encapsulation effectiveness of 85-92%, and a zeta potential ranging from -30 to -40 mV, indicating high stability.

Fourier Transform Infrared Spectroscopy (FTIR) was used to confirm encapsulation, Scanning Electron Microscopy (SEM) to examine morphology, and Dynamic Light Scattering (DLS) to measure particle size distribution. The films' antimicrobial activity was tested against Escherichia coli (E. coli) and Staphylococcus aureus (S. aureus) using an agar diffusion assay. Inhibition zones of 18.5 ± 1.2 mm (E. coli) and 22.3 ± 1.5 mm (S. aureus) were detected, indicating strong antibacterial efficacy.

Controlled release studies shown that 70% of the encapsulated oil was released over a 10-day period in simulated food storage circumstances. These findings show that nano-encapsulated thyme oil in biodegradable polymeric films could be a promising, environmentally friendly food packaging alternative that adheres to green chemistry and sustainable development concepts.

Keywords: Origanum glandulosum ; Nanoprecipitation ; Biodegradable polymers ; Active packaging ; Antimicrobial films

ID: Env-P-65

Etude comparative de la performance épuratoire de deux plantes macrophytes dans le traitement des eaux usées domestiques sous un climat aride (Sud-Est Algérien)

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Abstract: Le rejet des eaux usées brutes directement dans les exutoires naturels favorise l'apparition des maladies hydriques, des mauvaises odeurs ainsi que la dégradation de la qualité des eaux naturelles. Avant qu'elles ne soient rejetées dans le milieu naturel, elles doivent impérativement acheminées vers une station d'épuration où elles subissent plusieurs phases du traitement, et ceci afin de protéger l'environnement, la santé humaine ainsi que les ressources hydriques contre les différentes pollutions existantes dans ces eaux brutes. Les stations d'épuration classiques que l'on rencontre dans les villes demandent une grande technicité et une exploitation complexe et couteuse notamment en matière d'énergie électrique. De ce fait d'autres moyens plus simples et efficaces ont été mis en place pour l'épuration des eaux. Parmi eux un mode purement naturelle où les agents actifs dans le processus sont des Macrophytes (plantes supérieures). Dans ces procédés, l'intervention de l'homme est très limitée et l'installation n'est pas trop coûteuse.

Dans ce sens, notre objectif primordial est de comparer la performance épuratoire de deux plantes macrophytes (Acacia, Nerium Oleander) vis-à-vis certaines pollutions présentes dans les eaux usées brutes urbaines arrivant à la station d'épuration (STEP1) de la commune de Kouinine daira d'El-Oued. Nos expériences ont été menées pendant trois mois (février, mars et avril) avec des mesures prises au début de chaque mois pour l'eau non traitée et tous les dix jours pour l'eau traitée. L'ensemble des résultats que nous avons obtenu ont montré que l'ensemble des résultats que nous avons obtenu ont montré que les plantes sélectionnées sont capable à améliorer fortement la qualité des eaux usées testées. Les meilleurs résultats en matière d'efficacité d'élimination de DBO5, MES , Azote total sont obtenus par le filtre planté par Acacia comparativement au filtre planté par Nerium Oleander et au filtre non planté (témoin). Tandis que les pourcentages d'élimination du phosphore total sont les mêmes aussi bien en utilisant la plante Acacia que celle de Nerium Oleander (99.38%).

Keywords: Eaux usées, pollution, filtre planté, efficacité d'élimination, Acacia, Nerium Oleander

ID: Env-P-66

Improvement of the production of a hemispherical solar still through the addition of a heat storage system.

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Abstract:

In arid regions grappling with water scarcity, solar distillation stands out as a beacon of hope, meeting the rising demand for clean drinking water. This study investigates the integration of a hot water storage system, heated by a flat plate solar collector, into a hemispherical solar still configuration. Placing the storage tank beneath the hemispherical still's absorber not only boosts heat input but also efficiently stores excess daytime thermal energy for night time use. Conducted in Bouismail from December 2022 to October 2023, the study revealed compelling results: the modified hemispherical solar still outperformed its conventional counterpart, achieving production increases of 157% during winter and an impressive 207% during summer. Furthermore, the modified solar still demonstrated remarkable efficiency improvements, with rates of 20.14% and 68.66%, compared to the simple hemispherical solar still, which achieved 19.10% and 20.38% during winter and summer days, respectively.

Keywords: solar distillation; hemispherical solar still; energy storage ; flat plat solar collector.

ID: Env-P-67

Mitigating the Environmental Impact of Algerian Buildings through Insulation Thickness Optimization for Different Wall Configurations Using Life-Cycle Analysis

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Abstract: The building sector is highly energy intensive affecting the environment and contributing to global warming. This study highlights the importance of optimizing insulation strategies to enhance energy efficiency, reduce reliance on fossil fuels, and mitigate the environmental impact of residential energy consumption in Algeria. The optimization is carried out using a life-cycle cost analysis (LCCA). The goal of the optimization is to determine the insulation thickness that minimizes the total cost over the building's life span while achieving significant reductions in energy use and carbon emissions. To calculate the heating and cooling energy demand, the study employs the degree-day method for the selected cities. Natural gas, butane gas and electricity are considered, reflecting the country's current energy infrastructure, where fossil fuels remain the dominant sources of energy. The window to wall ratio (WWR) is introduced in the optimization procedure as a new parameter in order to provide a more accurate assessment of wall system performance. Expanded polystyrene is selected as the insulation material due to its affordability and widespread availability in the Algerian market, making it a viable solution for large-scale residential applications. As a result, for the heating season, the optimal insulation thickness varies between 2.9 cm and 11.6 cm according to the wall structure, the fuel source and the percentage of glazed area, which ranges from 0% to 10%. In the case of an annual assessment, the optimal thickness varies between 4.8 cm and 12.6 cm. At the optimal insulation thickness and considering heating and cooling demand, CO_2 emission reductions range from 53.80% to 81.7% for a 10% glazed area. The highest reduction in carbon dioxide emissions, reaching 88.7%, is achieved for walls without windows.

Keywords: Insulation thickness; Life cycle cost analysis; Window to wall ratio; Degree-days; Heating; Annual assessment.

ID: Env-P-68

modification de dolomite comme catalyseur efficace dans le procédé Fenton: Cinétique, thermodynamique et modélisation à l'aide d'un logiciel de modélisation.

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Abstract:

Dans ce travail, la dégradation de l'orange de méthyle a été étudiée en utilisant de la dolomite modifiée par le fer, préparée par simple imprégnation de fer suivie d'une calcination à 500 °C pendant 4 h. La dolomite naturelle avant et après la modification a été soumise à une analyse complète de ses propriétés chimiques et physiques. et après modification a fait l'objet d'une caractérisation caractérisation complète à l'aide de diverses techniques. LES ANALYSES XRD et FTIR ont confirmé la préservation de la structure et des groupes fonctionnels de la dolomite. de la structure de la dolomie et des groupes fonctionnels. La composition chimique obtenue par XRF et EDX a montré une insertion réussie du fer dans la structure de la dolomite. une insertion réussie du fer dans la structure de la dolomite avec une augmentation de 1,3 à 5,3 % en poids de ce métal. L'étude des paramètres de réaction a montré que que la performance de décoloration dépendait de manière significative de la température, du dosage du catalyseur, de la concentration en H2O2 et de la concentration initiale du colorant. En outre, la réaction cinétique a suivi le modèle du premier ordre avec des constantes de vitesse comprises entre 3,2-10-2 et 45-10-2 min-1. L'étude thermodynamique a révélé que la réaction était endothermique (ΔH°=65,48 kJ/mol) et accompagnée d'une diminution du désordre (ΔS°=-0,055 kJ/mol-K). La valeur de l'énergie d'activation (Ea=63.98 kJ/mol) a montré que le processus était contrôlé par une réaction de surface. processus était contrôlé par une réaction de surface. La modélisation à l'aide d'un plan composite central (CCD), avec 40 expériences réalisées pour compléter la matrice du plan expérimental, a permis d'établir la réaction optimale. Le plan expérimental a permis d'établir les conditions optimales de réaction à C 0=40 mg/L, 0,93 g/L de dosage de catalyseur et 7,26 mM de concentration de H2O2. Le catalyseur a conservé de hautes performances et une grande stabilité après six cycles successifs (90,23% d'efficacité de décoloration) avec une faible lixiviation du fer inférieure à 0,75 mg/L. L'effluent final L'effluent final a montré une faible écotoxicité avec une demande chimique en oxygène (DCO) inférieure à 8,23 mg O2/L.

Keywords: Dolomite; Iron impregnation; Methyl orange; Fenton process; DRX; FTIR

ID: Env-P-69

Photocatalyst of Ag/Ag2ONPs synthesized using Matricaria pubscens

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Abstract: In this work, we were synthesized nanoparticles using a green synthesis approach, aiming to develop an efficient and environmentally friendly photocatalyst activated under sunlight. By employing Matricaria pubscens as reducing and stabilizing agents, nanoparticles with desirable catalytic properties were prepared. These nanoparticles demonstrated excellent photocatalytic activity, efficiently degrading methylene blue (MB) dyes under sunlight exposure. The green synthesis method not only reduced the ecological impact but also enhanced the biocompatibility and sustainability of the process.

Keywords: green synthesis, Matricaria pubscens, nanoparticles, photocatalytic activity

ID: Env-P-70

Phytodesalination as a Sustainable Approach for Mitigating Soil Salinity: Efficiency, Challenges, and Future Prospects

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Abstract: Phytodesalination is a recent, green method that is being used to decrease soil salinity by employing salt-tolerant plants with the ability to absorb soluble salts from saline soils. In the globe, approximately 1 billion hectares of land are experiencing an excess of salinity that significantly reduces agricultural productivity by 20–50%. Its objective is the efficiency and feasibility of phytodesalination, in particular by plants such as Suaeda maritima, Atriplex halimus, and Salicornia europaea, with the ability to desalinate up to 10–20 tons of salt per hectare annually. Its field trials have demonstrated reductions of soil electrical conductivity (EC) by 30–50% over two or three cropping seasons, improving the agricultural potential of the soil. Phytodesalination equally contributes effectively towards carbon sequestration, biomass production, and ecosystem rehabilitation. Despite these benefits, the success of the method depends on the plant species used, prevailing climatic conditions, and soil characteristics. Further research directed towards improving species selection, planting densities, and management practices is thus necessary to unlock the full potential of phytodesalination as an effective solution to problems of soil salinity.

Keywords: Phytodesalination ;Soil salinity ;Salt-tolerant plants ; agriculture ;Saline soils ; Salicornia; Atriplex .

ID: Env-P-71

Removal of Trivalent Chromium (Cr III) from Tannery Wastewater Using a Cation Exchange Membrane: Optimization and Performance Evaluation

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Abstract: Chromium present in the environment can originate from natural sources, such as minerals like chromite, or from anthropogenic activities including metallurgy, leather tanning, dye production, and waste incineration. In particular, chromium salts used in the leather industry play a critical role, serving as effective stabilizing agents that preserve the material and enhance its properties for various applications.

However, the chrome tanning process using trivalent chromium (Cr III) presents a significant environmental issue. Approximately 50% of the chromium initially used is not fixed onto the hides, leading to substantial pollution. This study focuses on the separation of Cr (III) from wastewater generated by the tanning process at the OMEGA tannery in Batna. The primary objective is to evaluate the efficiency of a cation exchange membrane (CEM) as an adsorbent for the extraction of Cr (III).

Key operating parameters were optimized, including agitation speed (120 rpm), adsorbent dose (0.3 g/L), initial Cr (III) concentration (200 mg/L), and contact time, in order to determine the optimal conditions for Cr (III) adsorption onto the CEM.

Preliminary experimental results, obtained from both synthetic and real wastewater samples, are promising. They indicate that the CEM can be effectively used for Cr (III) ion removal, achieving elimination rates exceeding 85%.

Keywords: Chromium (III); Tannery wastewater; Cation exchange membrane; Adsorption; Environmental remediation; Wastewater treatment; Optimization

ID: Env-P-72

Study of heavy metal (Pb, Cr, Cd and Zn) speciation in the soil of the <<Ghedir Béni Hamza, el Kennar>> wetland in the wilaya of Jijel

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Abstract: Metallic trace elements (MTE) exhibit differents speciations in soils according to their origin. This has large consequences for their fate in the environment. It is thus necessary to determine this speciation in order to manage trace element behavior in soils. The speciation of trace metals (Pb, Cd, Zn, and Cr) in sediments of the wetland of "Ghedir beni Hamza in Jijel" was determined using sequential extraction associated with soil's physicochemical and mineralogical analysis. The sequential extractions were conducted using the four steps BCR protocol. The major part of trace metals (Pb, Cd and Zn) is related to the reducible fraction. The oxidizable fraction also manifested a significant percentage of these metals compared to the total content. The Cr is present in both residual and oxidizable fractions.

Keywords: soil physicochemical analysis. MTE total fraction. Sequential extraction, MTE speciation

ID: Env-P-73

synthesis of hydrogel polymer and spectroscopic study IR technic and study of the swelling rate weight in water

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Abstract: Polymer materials are currently essential in various industrial sectors (1) , ranging from small industries to high-tech industries. Gels are polymers with a three-dimensional network architecture. Moreover, hydrogels are exceptional materials because, (2)on the one hand, they are insoluble in water and, on the other hand, they are made of hydrophilic polymers that retain and release water and therefore, they are capable of swelling substantially in the presence of a large amount of water or aqueous solutions such as biological fluids.

Our work focuses on the synthesis and characterization of a hydrogel using environmentally friendly biocompatible reagents. The material is based on polyvinylpyrrolidone, which is a biodegradable and biocompatible polymer.

The synthesized hydrogel is being studied in wastewater treatment, (3) particularly for the removal of organic pollutants such as dyes and inorganic pollutants such as toxic metals, such as lead and cadmium. The swelling rate of the synthesized hydrogel in water was determined at various pH levels.

Keywords: polyvinylpyrrolidone, hydrogel, IR.

ID: Env-P-74

Traitement des eaux par l'utilisation des gousses de la plante Moringa oleifera

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Abstract:

La pollution des eaux par des matières organiques tels que les colorants, nécessite le recours à des procédés très performants. Parmi les solutions proposées, les techniques d'adsorption sur matériaux adsorbant moins couteux concrètement à partir de déchets végétaux

C'est dans ce contexte que s'inscrit ce travail, d'une part nous nous sommes intéressés plus en détails sur la valorisation des déchets végétaux des gousses de la plante Moringa oleifera de la région d'Adrar, d'autre part l'étude de leur pouvoir adsorbant.

L'objectif de ce travail est d'élaborer, de caractériser et d'évaluer les performances de biosorbant et charbon actif préparés à partir des gousses de la plante Moringa Oleiflera. La méthode d'élaboration de charbon actif étudiée est l'activation chimique par l'acide phosphorique suivi d'une carbonisation à 450°C. Les analyses de caractérisation faites sur les deux adsorbants ont montré qu'elles ont un faible taux de cendre (4,7% pour MOBr et 3,14% pour MOCA), un faible taux d'humidité (5,89% pour MOBr et 2,36% pour MOCA) et des taux d'indice d'iode acceptables (541,37 mg/g pour MOCA et 172,62 mg/g pour MOBr). Les performances des adsorbants synthétisés sont évaluées pour l'élimination de colorant (bleu de méthylène).

Dans ce travail, Nous avons constaté que les isothermes d'adsorption des systèmes adsorbant/adsorbât étudiés sont décrites de manière satisfaisante par le modèle mathématique de Langmuir où la capacité maximale d'adsorption du charbon actif est de 434.78 mg/g et celle de biosorbant est de 381.1 mg/g.

Les essais d'adsorption ont montré que l'équilibre s'établit au bout de (5 mn pour MOBr et 30 mn pour MOCA), L'ensemble des résultats obtenus montre que la cinétique d'adsorption du colorant sur les deux adsorbants est bien décrite par le modèle du second ordre. Le ph de la solution influé sur le rendement de décoloration. L'étude thermodynamique a révélé un processus spontané et favorable pour les deux adsorbant, exothermique pour MOBr et endothermique pour MOCA.

Keywords: Adsorption, biosorbant, charbon actif, gousses de Moringa Oleifera, colorant

ID: Env-P-75

Treatment of water by ion-exchange resins

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Abstract: The deposition of barium sulphate deposits is one of the most dangerous problems in the HMD field, due to their negative influence on production. To solve this problem A study has been carried out on the determination of the best water treatment technique between ion exchange resins, reverse osmosis, nanofiltration and distillation, in order to reduce th sulphate which generates the problem of deposits. The effectiveness of these methods was tested by Wave software, and the results obtained showed us the effectiveness of ion exchange resins (cation + anion) or the combination between Nanofiltration (NF) and ion exchange resins (cation + anion), considered as good techniques for the treatment of water, this was confirmed by removal of all salts therefore no possibility of $BaSO_4$ formation.

Keywords: deposition; sulphate; osmosis; Resins; Wave

ID: Env-P-76

USE OF FULLY ENVIRONMENTALLY FRIENDLY IN THE COMPOSITION OF CEMENTITIOUS MATERIALS

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Abstract: This study aims to exploit the sand from the desert dunes in the Oued Souf region (DS) and the debris from demolished concrete (RS) in order to optimise the formulation of a mortar based on dune sand. This mortar could then be used for paving, sports fields (stadiums with synthetic surfacing), etc.

In this study, 132 mortar specimens were made by mixing DS and RS in proportions ranging from 0% to 100%, in increments of 20% (MRS%, M80/20%, M60/40%, M40/60%, M20/80% and MDS%). These specimens were then subjected to physical-mechanical tests after being stored in water and in the open air.

The results showed that replacing 40% of the recycled sand with dune sand resulted in an increase in compressive strength of 5.69% and 3.80% compared with the MDS% and MRS% formulations, respectively. In addition, an improvement in flexural strength was estimated at 79.17% and 72% compared with these same formulations. Finally, physical performances, particularly in terms of density and ultrasound velocity, were also improved compared with the reference mortars (MDS% and MRS%).

Keywords: Mortar; Dune sand; Recycled sand; Physical-mechanical properties; Environmental waste.

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Fungal Endophytes and Green Nanotechnologies: Towards Bio-Based Materials for the Environment

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Abstract: Fungal endophytes, symbiotic microorganisms present in plant tissues, are attracting increasing interest in environmental biotechnology. Recent research has highlighted their potential in the synthesis of metallic nanoparticles and other biomaterials, paving the way for innovative applications in pollution control and environmental sustainability. This study highlights scientific advances related to the use of fungal endophytes in the development of sustainable nanomaterials. Several species, including Aspergillus niger, Penicillium chrysogenum, and Fusarium oxysporum, have demonstrated a remarkable ability to synthesize silver nanoparticles (AgNPs), gold nanoparticles (AuNPs), and zinc oxide nanoparticles (ZnO NPs). For example, Fusarium oxysporum can produce AgNPs with an average diameter of about 5 nm, showing strong antimicrobial activity against Escherichia coli, Pseudomonas aeruginosa, and Enterococcus faecalis. Additionally, studies have highlighted the use of these biosynthesized nanoparticles in bioremediation. Research has shown that ZnO NPs produced by Aspergillus terreus can reduce up to 85% of lead ions (Pb^{2+}) in contaminated water within just 48 hours of treatment. Furthermore, integrating nanomaterials derived from endophytes into biodegradable films enhances their mechanical and barrier properties, as demonstrated in research on eco-friendly food packaging. A review of scientific literature confirms that these microorganisms provide a promising alternative for the eco-friendly synthesis of nanoparticles, with various applications in pollution control, crop protection, and the development of bio-based and biodegradable materials. In the future, a better understanding of the molecular mechanisms involved in nanoparticle biosynthesis and the optimization of endophyte culture conditions could improve their efficiency and yield. These advancements could lead to broader industrial applications, promoting a sustainable and innovative approach to addressing current environmental challenges.

Keywords: Fungal endophytes, Nanoparticles, Environmental pollution control, Bioremediation, Bio-based materials.

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Traditional Medicinal Plants and Environmental Protection: Preserving Biodiversity Through Ancestral Knowledge.

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Abstract: Traditional knowledge related to the use of spontaneous medicinal plants represents an invaluable intangible heritage, orally transmitted from generation to generation. In the El Oued region, located in southeastern Algeria, these phytotherapeutic practices remain deeply rooted in local culture and serve as an essential resource for public health, particularly in rural areas where medical infrastructure is scarce. Through an in-depth ethnobotanical survey, supported by statistical analysis of reported uses, this study identified the most frequently used plant species, the parts of the plants employed, and the traditional methods of preparation. The findings reveal a strong predominance of spontaneous (wild) plants (70%), most commonly prepared as poultices, with leaves being the most frequently used part (32.57%). This empirical knowledge, shaped by observation and experience, demonstrates a remarkable adaptation to arid environmental conditions. Beyond their therapeutic potential, these plants represent a powerful tool for the preservation of local biodiversity and the sustainable valorization of natural resources. This research highlights the urgent need to document, protect, and integrate traditional knowledge into a comprehensive strategy for sustainable development, balancing human health with environmental conservation.

Keywords: Spontaneous medicinal plants, El Oued region, Traditional knowledge, Environmental conservation.

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Contribution to the Preparation of Activated Carbon from Some Agricultural Wastes with Mixed Surface Activity and Nanomaterials and Studying Their Impact on Removing Some Pollutants from Contaminated Aqueous Solutions

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Abstract: In this study, peanut shell-derived activated carbon, produced by orthophosphoric acid activation, was used as a material to adsorb methylene blue (MB). An optimization process was conducted to determine the optimal values for the adsorption parameters, including adsorbent dosage, temperature, pH, and contact duration. The outcomes of experiments were analyzed using four adsorption isotherms, while the pseudo-first and second-order models were deployed for assessing the kinetics. The adsorption of MB achieved equilibrium after 120 minutes, following the pseudo-second-order kinetic model. The Langmuir model accurately represented the adsorption process and achieved a maximum amount adsorbed of 219.7 mg/g at 25 °C. The thermodynamic variables ($\Delta H0$, $\Delta G0$, and $\Delta S0$) were calculated by investigating the impact of temperature, revealing that the adsorption was both exothermic and spontaneous. Carbon functionalization with Fe^{3+} or Ca^{2+} ions enhances the adsorption capacity and expedites the adsorption process, with equilibrium being achieved in 70 minutes and 50 minutes, respectively.

Keywords:

ID: Env-P-80

An Analytical Study of Pesticide Residue Levels in Selected Fresh Vegetables Locally Produced in the Southesatern Region of Algeria

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Abstract: Chemical pesticides, especially those used to control agricultural pests, are among the most prominent sources of chemical pollution in modern agricultural systems. Their overuse or improper handling leads to the accumulation of pesticide residues in agricultural products, posing a potential threat to food quality and human health, particularly for farmers and consumers. This is in addition to their negative impacts on the environment and biodiversity, including beneficial organisms.

In this context, studying pesticide residue levels in locally produced fresh vegetables is of paramount importance to assess their food safety and the extent to which agricultural practices comply with health and environmental standards. This study aimed to evaluate pesticide residues in two main types of greenhouse vegetables: tomatoes and zucchini. Imidacloprid and chlorpyrifos were chosen because they are among the most widely used pesticides in the study area. Analyses were conducted using chromatographic techniques, and the results revealed residues of both pesticides at concentrations exceeding the maximum internationally permitted limits, indicating a potential risk to human health and the environment. The results indicate that the concentrations observed in the studied samples exceeded the permissible values, as the concentration of imidacloprid in tomatoes reached 2.78 mg/kg and in zucchini 1.5 mg/kg As for chlorpyrifos, its concentration in tomatoes reached 1.88 mg/kg and in zucchini 0.87 mg/kg These values confirm the need to tighten control over the use of pesticides and adjust the doses and timing of spraying.

Keywords: chemical pesticides, environmental, pesticide residues, agricultural products.

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Chemically activated agricultural charcoal made from pits of three types of dates through three growth stages: to remove Dyes

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Abstract: High surface area microporous activated carbon has been prepared from Three types of date pits were collected at three growth stages of the Phoenix dactylifera.(Ghars vari ety)by chemical activation with ortho phosphoric acid as agent activation the process has been conducted at different impregnation (H_3PO_4 /precursor) rations 1/1, and carboniza tion temperatures 600 ◦C .the thermal decomposition of activated carbon was examined by thermo gravimetric analyser .micropore surface area, micropore volume, and pore size distribution of activated carbon were characterized by nitrogen adsorption isotherms. The scanning electronic morphology show that a porous structure formed during activation. the prepared activation carbon were characterized using ,PH zero point charge measurement

,boehm titration.

Keywords: activation carbon, date pits, chemical activation, adsorption.

ID: Env-P-82

Green Synthesis of Graphene Oxide Using Onion Peel and Orange Peel Extracts: Exploring Its Potential for Cationic Dye Degradation

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Abstract: Graphene has gained considerable attention due to its exceptional mechanical, electrical, thermal, and optical properties. This study focuses on the green synthesis of graphene oxide (GO) using onion peel and orange peel extracts as natural reducing agents. The extracts, derived from onion and orange peels, offer a cost-effective, renewable, and environmentally friendly alternative for GO synthesis. The green-synthesized GO was characterized using FTIR and XRD analyses, confirming the formation of nanosheets with an average width in the scale on nano. Furthermore, GO was evaluated as a nanoadsorbent for the removal of methylene blue (MB) dye crystal violet (CV), employing response surface methodology (RSM) for process optimization and AI tools. Adsorption studies demonstrated both MB and CV removal efficiency under optimal conditions. These findings highlight the potential of onion and orange peel-derived rGO as an efficient, green alternative for both environmental remediation and antimicrobial applications.

Keywords: Green synthesis, Graphene oxide, Onion peel and orange peel extracts, Adsorption

ID: Env-P-83

ANN-Based Optimization of Cationic Dye Biosorption Using Date Palm Residues

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Abstract: The rapid adoption of data-driven artificial intelligence (AI) tools has revolutionized the prediction of process performance, cost-effective monitoring, and control of waste treatment systems, particularly those focused on resource recovery. Against this backdrop, this study investigate the efficacy of date palm (Phoenix dactylifera) leaves as a sustainable adsorbent for the removal of Brilliant Cresyl Blue (BCB), a synthetic dye, from aqueous solutions. The research systematically evaluated the influence of three critical parameters—adsorbent mass, pH, and contact time—on BCB removal efficiency. To model and optimize the adsorption process, two advanced computational approaches were employed: the Box–Behnken design coupled with Response Surface Methodology (BBD-RSM) and an Artificial Neural Network (ANN).

Results demonstrated that the ANN model outperformed BBD-RSM in predictive accuracy, achieving a high correlation coefficient and effectively optimizing BCB removal under varying conditions. This superior performance underscores ANN's capability to handle nonlinear relationships within complex environmental systems.

These findings hold significant implications for sustainable wastewater management. The successful application of ANN-based modeling not only validates date palm leaves as a cost-effective and eco-friendly adsorbent but also establishes a robust framework for optimizing adsorption processes in industrial and environmental contexts. Furthermore, the integration of AI-driven tools like ANN offers a scalable pathway for advancing precision in pollution control and resource recovery strategies.

Keywords:

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Numerical simulation of the reduction in the salt content of water used to irrigate apple trees by fitting the pump with a new system

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Abstract : The aim of this study is to evaluate the potential of two plants to desalinate well water used to irrigate an apple orchard in order to reduce the percentage of wear and tear on irrigation pumps. Two halophytic plants, S. marina and halophyte 2, were tested for their ability to reduce water salinity in an apple orchard. Both plants were placed in jars containing salted water for 120h. At the start and end of the test (0h, 24h, 48h, 72h, 96h and 120h), physico-chemical parameters were measured (pH, electrical conductivity, carbonate and bicarbonate). According to the results obtained, the two plants were able to reduce the salinity of the water through their reducing effect on the levels of the water's physico-chemical parameters. Both plants reduced the pH value by 12%, although the S. marina plant showed a higher reducing effect than the second plant on EC, carbonate and bicarbonate). Both plants can be used to restore salinity-degraded soils and prevent cavitation of irrigation pumps caused by salt water.

Key words; water salinity, desalination, halophyte plants, cavitation, irrigation and pumps.

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ID: Env-P-85

In Vitro and In Vivo Antioxidant Effect of MnO NPs Against MTZ Liver Toxicity

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Abstract :

Background: Plant-based NP green synthesis is now regarded as a gold standard among these green biological techniques owing to its ease of use and the diversity of plants. However, (MnO NPs) have gained importance in the synthesis and manufacturing processes because of their lower toxicity.

Objective: The aim of this study was to evaluate the in vitro and in vivo antioxidant effect of MnO NPs against MTZ liver toxicity. Materials and Methods: In vitro anti-oxidant power was studied by DPPH free-radical scavenging activity and ferric reducing antioxidant power FRAP. In vivo antioxidant potential was studied by 18 healthy adult male Wistar rats that divided into 3 groups (n=6); the first group used as a control group, the second group exposed to low dose of MTZ in drinking water and the third group inoculated MnO NPs. Various oxidative stress markers (SOD, GPx, GSTs, CAT, GSH, and MDA) were estimated. Results: Concerning the results of in vitro, IC50 values in the DPPH and FRAP assays indicate that this plant has a high anti-oxidant activity. The results of in vivo show that MTZ caused an increase in the level of oxidative stress in the liver compared to the control, while MnO NPs provided an antioxidant effect against MTZ liver toxicity.

Conclusion: In conclusion, MnO NPs was able to induce highly effective anti-oxidant power which qualify to protect against oxidative stress induced by MTZ in liver.

Key words; MTZ; MnO NPs; Anti-oxidant power; Oxidative stress; Liver.

ID: Env-P-86

Nano-Niosomes Loaded with Sonchus maritimus Extract as Drug Delivery System Alleviate High-Fructose Diet-Induced Brain Metabolic and Histological Disorders in Rats: an Experimental Study

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Abstract :

In this study, we were evaluated the effect of Sonchus maritimus extract-loaded niosomes (SmEN) as a drug delivery system on metabolic disorder and oxidative stress in brain that induced by high fructose diet (HFD) in rats. 24 male rats were haphazardly divided into 4 groups (n=6); Control, HFD, HFD + SmE-N and HFD + metformin. Oxidative stress markers were assessed for all groups. The results showed that HFD induced significant change in behavior parameters, brain's protein and AChE levels. Furthermore, histopathological observation recorded a profound modification in brain tissues of HFD group. In contrast, the treatment by the SmE-N and metformin assured a partial amelioration in noticed biological parameters compared to HFD group. In conclusion, the use of Sonchus maritimus extract-loaded niosomes seems its powerful to treat complications of fructose-induced metabolic disorder through its neuroprotective abilities.

Key words: Sonchus maritimus, Niosomes, Oxidative stress, Brain, Rats.

ID: Env-P-87

Characterization and Cytotoxic Activity of Phragmites australis Rhizome-based Copper Nanoparticles.

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Abstract :

Background: The significance of nanomaterials in the field of biomedical application stems from their reduced dimensions and distinctive physicochemical characteristics, enabling precise drug release, targeted delivery of pharmaceuticals, and modulation of the immune response within living organisms.

Objective: Assessment of anti-cancer potential of Cu NPs synthesized using green method. Materials and methods: The green Cu NPs was synthesized using aqueous rhizome extract of Phragmites australis, and was characterized using different techniques including UV-Vis spectroscopy and TEM analysis. The anti-cancer potential was evaluated by the means of MTT assay against MCF-7 cell line.

Results: UV-Vis spectroscopy revealed a peak at 300 nm and TEM scan showed very fine nanoparticles with sizes between 5,49 nm and 19,75 nm. The cytotoxic effect of our green Cu NPS on MCF-7 cell line is dose-dependent. The IC50 level is found to be about 2,28µg/ml.

Conclusion: The green synthesis of Cu NPs, using Phragmites australis aqueous rhizomes extract, was successful. UV-Vis spectroscopy and TEM results revealed fine sized copper nanoparticles with a prominent anti-cancer power at very small doses.

Key words: Copper nanoparticles, P.australis, Anti-cancer potential.

ID: Mat-O-1

Preparation and validation of metallic electrodes used in electrolysis of water

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Abstract: The development of metallic catalysts used in water electrolysis is a very remarkable field in the last years, because of their importance in the production of hydrogen; which presents a widely used fuel; especially in energy and automobiles industries. The classical way recognized is its production of water electrolysis by the use of very noble metals namely: gold and platinum, which have the disadvantage of their very high cost. Therefore; the search for less expensive electrode materials is a very exploitable domain. Among these alternative materials, we find catalysts in cheaper noble metals, non-noble metals, metal alloys and alloys doped with other materials,…etc. The preparation method of these materials remains a great challenge because of the multitude of experimental parameters. In this work, we contributed by the preparation of some metallic catalysts by studying the effect of experimental parameters. We synthesized Mn-on-Fe, Mn-on-Cu, Mn/Ni-on-Ni, and Mn/Fe-on-steel electrodes by electrodeposition, considering the following parameters: pH, deposition potential, concentrations of products and improvement additives. We also prepared Cu/TiO2 and Ag/TiO2 electrodes by metallurgy and by surface heat treatment of C/TiO2, Cu/TiO2, and Ag/TiO2 electrode materials. We examined their H2 production efficiency by the NaCl solution (10%) electrolysis process; hence, they showed a difference of about 15 to 20 % in H2 production, compared with the base electrode materials of each tested material.

Keywords: Electrodeposition, Metallic catalysts, Water electrolysis, Carbone, TiO2.

ID: Mat-O-2

INFLUENCE DU VOLUME DE PÂTE SUR LA PERFORMANCE RHÉOLOGIQUE DU MORTIER DE BÉTON ÉQUIVALENT

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Abstract: Cette étude a pour objet d'étudier l'influence de la variation du volume de pâte sur la performance rhéologique du mortier de béton équivalent correspondant (MBE) à base de granulats naturels et recyclés. Cinq différents volumes de pâte ont été testés. L'approche entreprise est de faire augmenter le volume de pâte au dépend du volume des granulats. La performance rhéologique est approchée par des essais de caractérisation du MBE et en absence d'outils normalisés pour cet usage, des outils non conventionnels ont été préconisés et il s'agit du mini cône, la mini boite en L, le temps d'écoulement (T250), la mini boite LCPC et la résistance à la ségrégation au tamis 2 mm. Également. Il en ressort des résultats obtenus que l'augmentation du volume de pâte apporte Pour les mélanges MBE une supériorité est assuré par l'utilisation des sables naturels. Le sable recyclé utilisé dans le MBE est à forte absorption d'eau.

Keywords: Béton autoplaçant Mortier de béton équivalent, Granulats recyclés, Propriétés

ID: Mat-O-3

Shell material effect on X/CIGS core/shell nanowire solar cell: X=ZnS, ZnSe, and In2S3

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Abstract: This paper focuses on the study by simulation of the shell material effect on X/CIGS core/shell nanowire solar cell (NWSC) performances, with X=ZnS, ZnSe, and In_2S_3 in goal to find the best shell material. Our results have been shown that ZnSe/CIGS NWSC presents good performances with an efficiency and short circuit current of about 5.26 % and 13.98 mA/cm2, respectively. The temperature impact on the same structure was also investigated. It was shown that a temperature of 273 K gives an optimal efficiency of about 6.12 %. This reveals that the solar cell operates better at low temperature with the same solar spectrum AM1.5.

Keywords: Core/shell; Nanowire; efficiency; Solar cell

ID: Mat-O-4

Investegation on physical properties of new Silicon Telluride compounds

from First-Principles Calculations.

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Abstract: Silicon telluride (Si2Te3) is a new tow –dimentional 2D material recently synthetised. First principles calculation are used to predict structural properties of Si2Te3 at the trigonal structure. Elastic constants confirm the mechanic stability of silicon telluride. Various mechanical parameters, including (Young's E, bulk B, shear G, Pugh's) modulus, Poisson's ratio and anisotropy factors are also ditermined. Results of electronic Band structure show that the Si2Te3 is an semiconductor with bandgup equal to 1.52 eV. Furthermore, we determined frequencies of vibrational phonon using phonopy programs. Results show that all frequency are positive confirming stability of this material.

Keywords: Silicon telluride; 2D material; bandgap.

ID: Mat-O-5

Effect of cold rolling and preheat treatment of an AISI 316Ti austenitic stainless steel on its microstructure and mechanical properties

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Abstract: Abstract – The AISI 316Ti austenitic stainless steel has an adequate combination of mechanical resistance, formability and resistance to corrosion. It is commonly used for the production of construction parts and machines, especially in chemical, petrochemical and pharma¬ceutics industry, and also for the production of tanks for the transport of aggressive substances. In this paper the microstructural properties of the AISI 316Ti austeitic stainless steel in the rolled condition (20%, 37% and 88% cold work) and in the heat treated conditions were characterized by various techniques: optical microscopy, scanning electronic microscopy, X-Ray Diffraction analyzer (XRD). In order to characterize the mechanical properties of 316Ti, nanoindentation tests were conducted. The elastic module and hardness are two most important parameters used. Microstructural analysis showed that cold deformation causes significant microstructural modifications in the steel, mainly hardening. This modification increases the mechanical resistance of the materials appropriately with their foreseen application.

The formation and the amount of strain-induced martensite depends on the austenite stability. When the ratio of cold deformation is high, the martensite content will be higher. The preheat treatment leads to a significant decrease in martensite ratio.

Keywords: Keywords: Stainless steels; Mechanical properties; Heat treatment / Nanoindentation tests; Microstructure.

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Analyse du comportement en flexion des matériaux composites stratifiés soumis à des cycles de fatigue

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Abstract: L'objectif fixé au présent travail est l'étude du comportement mécanique en flexion 3 points de composites stratifiés croisés sollicités en fatigue. Une étude statique a été faite sur deux types de matériaux composites stratifiés afin de déterminer leurs caractéristiques mécaniques et d'évaluer l'influence de la vitesse d'essai et l'effet de la séquence d'empilement sur leur comportement mécanique. Différents modes d'endommagement entraînant la rupture de ces matériaux seront mis en évidence afin de déterminer leurs types.

Keywords: Flexion 3-points -- Composite --Stratifié -- Fatigue -- Endommagement.

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Influence of (Cu, Zr) in the mechanical, adhesion and tribological performance of TiAlN films for biomedical application

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Abstract: Recently, many research has shown that the addition of transition elements to the ternary TiAlN system improves its structure, mechanical and tribology properties. They are classified as refractory materials with very high melting temperatures. In this study, a comparison was made between the effect of adding Cu and Zr on the properties of TiAlN. The TiAlN, TiAlCuN and TiAlZrN films were deposited by RF magnetron sputtering. The structural, morphological and compositional analyses of the films were performed using SEM, EDS, nanoindentation and tribometer. A morphological change from dense to columnar films was observed with the addition of Cu and Zr. The mechanical property of the TiAlZrN film was higher than that of the TiAlZrN film. With the addition of Cr and Zr, the coating wear mechanism changes from adhesive wear for the TiAl(Cu, Zr)N with low COF to abrasive wear, and finally peeling at high applied load. Indeed, the preferred orientation could effectively adjust the microstructure and improve the mechanical and tribological properties of TiAlN coatings, thereby indicating its potential as an effective coating material for the protection steel in biomedical fields

Keywords: TiAlN, Structure, Hardness, scratch, antibacterial activity

ID: Mat-O-8

Advancements in Perovskite Materials: Structural Properties, Solar Cell Applications, and Future Prospects

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Abstract: Since their discovery, perovskites have continued to fascinate the scientific community due to their exceptional properties. Recently, the discovery of hybrid perovskite materials has revolutionized third-generation photovoltaic devices. Within half a decade, the efficiency of perovskite solar cells has increased to 22%. In this work, we introduce this class of materials by describing their symmetries and allotropes, the rules governing their structures, and their unique electronic properties, which make them highly promising for the solar cell industry. The preparation methods of perovskite films and the architecture of their solar cells will also be detailed. We conclude by discussing future prospects and challenges.

Keywords: Perovskites; Photovoltaic devices; Efficiency; Electronic properties.

ID: Mat-O-9

Porous material: ”characterisation and application as adsorbent”

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Abstract: Zeolites, a category of inorganic microporous crystalline materials, are extensively utilized in various applications such as catalysis, adsorption-separation, and ion exchange processes. Different hydrothermal synthesis conditions are established by methodically varying the synthesis parameters, specifically crystallization duration, heating temperature, and the quantities of reactants (SiO_2, Al_2O_3, K_2O, Na_2O and H_2O) to examine their impacts on the crystal growth of the zeolite. The results indicate that each parameter significantly influences the crystallization process, which in turn affects the overall outcome.

the first step is the synthesis of zeolites A and T characterized by extra-large pores and enhanced thermal stability[1], which are particularly beneficial for the adsorption of environmental pollutants.

At elevated temperatures, specifically around 75-100 °C, zeolites emerge as a predominant phase during the crystallization process. The synthesized products were analyzed using infrared spectroscopy (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). The XRD and FTIR results confirmed the successful formation of analcime zeolite and T, which exhibited well-defined crystal morphology. These products were subsequently employed to adsorb like the methylene blue from contaminated water and catalysis reaction.

Keywords: zeolite, caracterizations, application.

ID: Mat-O-10

Computational Study of $FASn_{(1-x)}Ge_{(x)}I_3$ Hybrid Perovskite as a High-Efficiency Wide Bandgap Absorber for Enhanced Dual-Junction Solar Cell Performance

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Abstract: This study examines the potential of the hybrid perovskite material FASn(1-x)Ge(x)I3 , where x denotes the variable germanium content, as a high-efficiency wide-bandgap absorber in tandem solar cell architectures. The investigation relies on numerical simulation to evaluate the photovoltaic performance of that single solar cell with a configuration of Au/Spiro-OMeTAD/FASn(1-x)Ge(x)I3 /TiO2 /FTO which will use in the top part of the dual-junction sructure, reliying on a model that considers the variation of physical parameters of the absorber material as a function of x, enabling systematic evaluation and optimization based on the absorber's composition.

Initially, optimization efforts focused on identifying the optimal germanium concentration and absorber thickness through contour plots of photovoltaic parameters and analyzing the variation of energy bandgap offsets around the perovskite material as functions of x. The results showed that a germanium concentration of x=0.55 and an absorber thickness of 2 µm provide the best balance between composition and thickness, yielding single-cell efficiencies exceeding 25%. This configuration demonstrated superior performance in terms of short-circuit current density, fill factor, and open-circuit voltage. Subsequently, the optimized structure was integrated into a two-terminal tandem dual-junction solar cell with the bottom subcell based on the narrow-bandgap perovskite material Cs2AuBiI6, which was studied previously. The findings indicated that efficiencies greater than 32% can be achieved for several combinations of absorber thicknesses, provided that current matching conditions are satisfied. The objective of this work is to develop high-efficiency tandem solar cells using perovskite materials.

Keywords: Perovskite; Solar Cell; Photovoltaics; simulation; Thin-film; Optimization

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Synthesis, characterization, and photocatalytic efficiency of Mg-doped ZnO nanoparticles for Basic Fuchsin dye degradation

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Abstract: This study synthesized Mg-doped ZnO nanoparticles using the co-precipitation method with doping concentrations ranging from 2% to 8%. The structural, morphological, and optical properties of the synthesized nanoparticles were systematically characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and UV-Visible spectroscopy. XRD analysis confirmed the successful incorporation of Mg2+ ions into the ZnO lattice, evidenced by lattice parameter shifts and a significant reduction in crystallite size from 30.91 nm (pure ZnO) to 18.10 nm (6% Mg doping). SEM images showed uniform morphology with reduced particle agglomeration at optimal doping levels, while FTIR analysis identified characteristic Zn-O and Mg-O bonding vibrations, confirming structural integrity. UV-Vis spectroscopy revealed strong absorbance in the UV region, with the band gap energy decreasing from 3.68 eV (pure ZnO) to 3.16 eV (6% Mg doping), indicating enhanced optical properties conducive to improved photocatalytic performance. The photocatalytic activity of Mg-doped ZnO nanoparticles was evaluated by degrading Basic Fuchsin (BF) dye under UV light irradiation. The Mg-doped ZnO nanoparticles exhibited significantly enhanced photocatalytic performance compared to undoped ZnO, achieving a maximum degradation efficiency of 99.38% at 6% Mg doping within 100 minutes. Optimal photocatalytic conditions were observed at pH 6, using 0.1 g of catalyst and an initial dye concentration of 10 ppm. These enhancements were attributed to improved electron-hole pair separation and increased generation of reactive oxygen species (ROS), facilitated by the strategic incorporation of Mg.

Keywords: Mg-doped ZnO nanoparticles; Characterization; Photocatalysis; Basic Fuchsin; Wastewater treatment.

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ID: Mat-O-12

Theoretical Insights into Magnetoelastic Interactions in Core-Shell Spin-Crossover Nanocomposites

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Abstract: Spin-crossover (SCO) materials have been extensively studied in various forms, including powders, single crystals, and nanoparticles, from both magnetic and structural perspectives. Recent advancements in chemistry have enabled the development of spin-crossover nanocomposites, which integrate two distinct SCO materials with different properties, such as transition temperatures and ligand fields. These hybrid systems exhibit complex transition behaviors, including two-step and even three-step spin transitions, as observed experimentally.

In this work, we present a theoretical investigation based on an elastic model of SCO nanocomposites, aiming to reproduce and interpret these experimentally observed multi-step transitions. Our results not only capture key experimental features but also provide deeper insights into the coupling between elastic and electronic structures within the nanocomposite. Furthermore, our approach highlights the influence of the lattice shape and the relative sizes of the two components, paving the way for the exploration of various nanocomposite configurations with tailored properties.

Keywords: Spin-crossover (SCO)1; Nanocomposites2; Magnetoelastic coupling3; Multi-step transition4; Theoretical modeling5; Elastic interactions6

ID: Mat-O-13

Inhibitory effect of a new Schiff base As an effective inhibitor for aluminum corrosion in 0.5 m H2SO4

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Abstract: This study explains the performance of organic inhibitors in preventing corrosion at the interface between aluminum and H2SO4 solution, as well as their adsorption behavior. A Schiff base is the organic inhibitor that is being used. Using electrochemical analysis, the corrosion behavior of this inhibitor is examined. The primary cathodic character of the inhibitor's mechanism of inhibiting aluminum corrosion is revealed by the results of the open circuit potential. Potentiodynamic polarization studies show an increase in inhibition efficiency starting at 95.86% at 40 ppm concentration. Measurements using scanning electron microscopy (SEM) demonstrate that the inhibitor protects the metal surface from acid attack. the structure of the inhibitor is confirmed by FTIR, UV and H-RMN spectroscopy.

Keywords: key-word1: characterisation, key-word2: Aluminum, key-word3: inhibition.

ID: Mat-O-14

Analytical function of electron range as function as energy (1-100keV) for low atomic number

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Abstract: The determination of the range of electrons and the backscattering in solid targets is an important parameter, and sometimes a central parameter for many applications such as radiation physics, nuclear physics, and electron microscopy, among others. In this work, we attempted to find an approximate expression for the changes in range as a function of energy in materials with low atomic numbers (Al, Si, Cr) using the Penelope Monte Carlo simulation code and also the same for the backscattering. From there, we derived the analytical function expressed the relationship between the electron range and incident electron energy, and an analytical function expressed the relationship between the backscattering and the incident electron energy (1-100KeV).

Keywords: 1electron range ; 2 Monte Carlo; 3Penelope; 4radiation ; 5charged particle

ID: Mat-O-15

Effect of Indium on physical and surface properties of SnO_2 thin films deposited by vacuum thermal evaporation

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Abstract: The main objective of this study is to deposit and characterize indium-doped tin oxide (SnO2) ultrathin films via vacuum thermal evaporation. Both undoped and indium-doped SnO2 ultrathin films were deposited onto ordinary glass and silicon substrates.

To prepare these films, a mixture of pure tin oxide powder (99.99%) and pure indium powder (99.99%) was used as the source material in varying mass proportions: 95:5, 90:10, and 85:15 by weight. After deposition, the films were undergone annealing at 500°C.

The properties of the films were analyzed using a range of characterization techniques, including X-ray diffraction to determine the crystal structure, UV-Vis spectroscopy to study transmittance and calculate the band gap, and the four-point probe technique to measure resistivity. Additionally, the contact angle between the films and a water droplet was measured to assess the films' surface behavior.

The X-ray diffraction patterns revealed that both undoped and In doped SnO2 films had a polycrystalline structure. Undoped films have a high transmittance greater than 80%, When 5 wt.% indium is incorporated to these layers, the transmittance increases even more and outrun 86%. Subsequently, it decreases and stabilizes around 80% as the doping level increases to 10 and 15 wt.% percent. The optical band gap shows a slight increase from 3.8 eV for undoped SnO2 to 3.81 eV for 5% In-doped SnO2. It then decreases to 3.78 eV when doped with 10 wt. % In, before rising again as the doping level increases to 15 wt. %. As the indium doping level increased, the resistivity of the films decreased. Furthermore, the deposited films exhibited hydrophilic behavior.

Keywords: SnO2-In, Vacuum thermal evaporation, XRD, UV-Vis, Hydrophobicity

ID: Mat-O-16

Investigation of the second harmonic generation in GaAs/AlxGa1-xAs elliptical quantum rings

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Abstract: In this work, we theoretically investigated the Second Harmonic Generation (SHG) of the GaAs/AlxGa1-xAs elliptical quantum ring (QR), taking into account the simultaneous effects of electromagnetic fields, temperature, pressure, QR morphology, hills and aluminum concentration. Therefore, we calculated the inter-band-transition energies and their attributed wave functions by solving the three-dimensional (3D) Schrödinger equation using the implicit Finite Difference Method (FDM) of second order.

The obtained results reveal that the combined effects mentioned above are crucial to controlling the nonlinear optical properties. It is found that the SHG is strongly influenced by the geometrical morphology such as the radii and hills coupled to the quantum ring system under investigation. Moreover, it is found that the SHG spectrum suffers a prominent stark- effect, and the resonant energies of the SHG shift to red or blue depending on the electric field intensity and orientation. Also, the second harmonic generation experiences a red or blue shift with increasing or decreasing the applied magnetic field intensity. As well, it is found that the SHG intensity increases (decreases) with increasing the temperature (pressure) resulting in blue or red shift achievement. Additionally, obtained results reveal that the SHG coefficient depends significantly on the Al concentration. Hence, our findings could be helpful as literature for researchers to control and adjust other nonlinear optical properties such as the linear, nonlinear and total absorption coefficients and the nonlinear optical rectification (NOR).

Keywords: Elliptical Quantum ring; morphology effects; Electromagnetic fields; Second harmonic generation; Pressure; Temperature.

ID: Mat-P-1

Advanced Manufacturing of Complex Shaped Composites

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Abstract: The manufacturing of composites with complex shapes presents a significant technological challenge, but it also offers an opportunity for advanced industries to produce parts that combine lightness, strength, and performance. The careful selection of materials and manufacturing methods, such as vacuum infusion, autoclave molding, and 3D printing, enables the fulfillment of modern application requirements while providing increased flexibility in the production of complex components. These advancements hold great potential in sectors where performance and innovation are key factors for success.

Keywords: Performance;Complex shapes;Composite materials;Advanced manufacturing

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Integration of geometric modeling and computer numerical control (CNC) for the production of a part

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Abstract: The design and production of mechanical parts, especially complex shapes, involve certain creativity and knowledge in design using computer design tools such as dedicated CAD/CAM software. The production involves machines with high performance in power and precision as well as high productivity such as numerically controlled machines. The design stage involves sketches in 2D and then in 3D by visualizing the final geometry having the dimensions of the definition drawing. The production using a CNC machine tool involves programming in selected code, choosing the tools and cutting parameters, and finally the production. Our work consists of producing a mechanical part with a different geometry using the SW tool in design, in G-code programming the Top-Solid tool and in production the Mitsubishi CNC M80 numerically controlled machine tool. Finally, the production was successful, the dimensions are in accordance with the definition drawing. The success of the production proves a mastery of the use of the machine's capabilities.

Keywords: Geometric modeling; Manufacturing Processes; CNC Machining; CNC

ID: Mat-P-3

Preparation and characterization of potato starch/bentonite organophylized by SDS

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Abstract: This study focuses on the development of nanocomposite films using potato starch via a casting technique. Glycerol was incorporated as a plasticizer, while Sodium Dodecyl Sulfate (SDS)-modified bentonite acted as reinforcement. Various analytical methods, including Fourier transform infrared (FTIR), X-ray diffraction (XRD), Thermogravimetric analysis (TGA), UV/vis spectroscopy, Electron microscopy (SEM), and Optical microscopy (MOP), were utilized to assess the material properties. Different concentrations of SDS, below, at, and above the critical micelle concentration (CMC), were investigated. The findings suggest that films containing higher SDS levels demonstrate enhancements in both physical and chemical characteristics.XRD assessments reveal that films with SDS concentrations surpassing the CMC level display homogeneity, indicating effective intercalation or exfoliation processes

This compatibility of the biofilm components is further evidenced through FTIR, SEM, and MOP. Moreover, the introduction of SDS significantly improves the film's biodegradability, as confirmed by thermogravimetric analysis.

Keywords: key-Biopolymer Starch; key-Bentonite; key-SDS Surfactant; key-Compatibility; key-biofilms

ID: Mat-P-4

Biosynthesis and characterization of copper oxide nanoparticles in an environmentally friendly manner

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Abstract: In modern materials science, research on nanoparticles (NPs) is one of the most attractive and active areas of research. Nanoparticles have wide-ranging applications due to their size, structure, and physical and chemical properties in industries and agriculture. Several methods have been reported for the synthesis of metallic nanoparticles, and plants seem to be the best option. Plant-produced nanoparticles are more stable, less toxic, and biocompatible (green synthesis). The properties of copper oxide nanoparticles (CuO) such as high-temperature semiconductivity, photovoltaic properties, and antimicrobial properties in general are said to be of novel use in nanotechnology. Based on the above, in this study, CuO nanoparticles were biosynthesized in a sustainable and environmentally friendly way called "green synthesis" by using the leaf extract of Psidium guajava. The success of its synthesis was confirmed using different characterization techniques, which are X-ray diffraction (XRD), Fourier transform infrared (FTIR) and ultraviolet-visible spectroscopy (UV-VIS). The results obtained proved the success of the green synthesis process and that the particles are nano-sized. These results open the way for many promising and useful applications of copper oxide nanoparticles.

Keywords: Green synthesis; Plant extracts; Copper Oxide nanoparticles

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ID: Mat-P-5

The effect of substrate temperature on the structural properties of CO3O4 thin films

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Abstract: This study aims to create cobalt oxide layers using the spray pyrolysis approach. During this process, a cobalt chloride ($COCl2.6H2O$) aqueous solution is sprayed onto preheated glass substrate at temperatures in the range of 250°C to 400°C. To evaluate and characterize the structural characteristics of the samples, several techniques were employed, including X-ray diffraction (XRD). Structural analysis of the X-ray diffraction displayed that Co_3O_4 developed in a controlled manner, forming a cubic structure. The films were found to grow preferentially along the (111) or (331) directions depending on the temperature of the substrate. Furthermore, (XRD) analysis clearly indicated that the average Co_3O_4 grain size increased with higher substrate temperatures.

Keywords: Co_3O_4 thin films. Spray-Pyrolysis. DRX

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ID: Mat-P-6

Novel Biocomposite Beads with Enhanced Thermal Stability and Delayed Biodegradability Properties

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Abstract: Nowadays growing attention is given to the development of novel interpenetrating polymer networks (IPN) from the hydrogel loaded with natural clay. In this work, we used the eco-friendly IPN strategy to develop novel hydrogel biocomposite beads, made of alginate. Hydrogel alginate double biocomposite network (DBN) beads were prepared at different sepiolite loads, via the diffusion of acrylamide monomer (AAM) inside alginate single biocomposite network (SBN) beads, followed by in situ free radical polymerization of AAM. The as-elaborated DBN beads were then characterized by ATR-FTIR, ATG and SEM characterization. FTIR results demonstrated that NaS and pAAM were successfully incorporated into alginate biocomposite beads, whilst ATG analysis revealed an enhancement in the thermal stability. Furthermore, SEM microscopy confirmed the porous spongy morphology of DBN beads. Additionally, delayed biodegradability properties were found improved.

Keywords: Biocomposite Polymers, Alginate Xerogel Beads, Sepiolite, Swellability, Biodegradability

ID: Mat-P-7

Analyse des caractéristiques opérationnelles de l'électrode en tungstène dans le processus de soudage TIG

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Abstract: Le soudage TIG, qui utilise une électrode en tungstène, est fondamental pour réaliser des assemblages métalliques de haute précision grâce à son arc électrique stable. Cependant, la gestion des contraintes thermiques et mécaniques sur l'électrode pose un défi majeur. Notre recherche se concentre sur l'analyse des paramètres opérationnels du soudage TIG et leur impact sur les performances de l'électrode. L'objectif est d'identifier des optimisations pour améliorer la résistance de l'électrode, garantissant des performances durables. Cette étude est essentielle pour rehausser la qualité et la longévité des soudures TIG, ce qui permettra des applications industrielles plus efficaces et rentables.

Keywords: Soudage TIG; electrode; cathode; tungstene pur; tungstene thorié

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ID: Mat-P-8

Effet combiné de la température et de l'humidité sur le comportement mécanique des composites hybrides verre-carbone/époxy

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Abstract: Cette étude examine l'influence conjointe de la température et de l'humidité sur le comportement mécanique des composites hybrides à matrice époxyde, renforcés par des fibres de verre et de carbone. L'analyse porte spécifiquement sur l'effet du nombre de plis et de la présence d'une entaille circulaire centrale sous différentes conditions hygrothermiques. Des essais expérimentaux ont été réalisés après un conditionnement rigoureux des échantillons dans des environnements contrôlés. Les résultats obtenus mettent en évidence les variations des propriétés mécaniques en fonction des paramètres étudiés et permettent d'identifier les mécanismes de dégradation induits par l'exposition prolongée aux sollicitations hygrothermiques. Ces travaux contribuent à une meilleure compréhension des interactions environnementales avec les structures composites hybrides et visent à optimiser leur conception pour des applications en conditions sévères.

Keywords: Composites hybrides; fibres de verre-carbone; résine époxy; température; humidité; comportement mécanique; entaille, durabilité.

ID: Mat-P-9

Structural and microstructural properties of NB0.98Ba0.02TZNZ ceramic prepared by molten salt method

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Abstract:

During these last twenty years, a very important research activity was dedicated to the study of lead-free piezoelectric ceramic compounds, which can replace PZT ceramics. The main objective of this work is based on the study of the doping effect of 2% of barium on structural and morphological properties of Na0.5Bi0.5[(Ti0.8Zr0.2)0.9(Nb2/3Zn1/3)0.1]O3 ceramic with a perovskite ABO3 structure . The samples chosen for this study were prepared by the molten salt method. Calcinated at 900°C and sintered at 1100°C. The characterization techniques that have been used for the structural and morphological study of our material are XRD and SEM. X-ray diffraction analysis showed that the composition crystallize in the perovskite phase and of tetragonal structure. the average grain size decreases with the addition of barium.

Keywords: Molten salt method; BNT; XRD.

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Preparation of New Biochar Based on Agricultural Waste and Its Application to the Elimination of Crystal Violet Dye from Water Media

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Abstract: In this work, the Washingtonia palm stems were used as a novel precursor to product biochar (BCW). The resulting BCW samples were characterized by N2 adsorption−desorption, scanning electron microscopy (SEM) and pH of zero-charge point (pHPZC). The results show a very large specific surface area and pore volume (SBET = 357 m2/g, V = 0.27 cm3/g). The SEM images show a more or less regular porous shape for BCW. The obtained values of pHPZC were 6 for BCW sample. The ionic strength from 0 to 1.0 M greatly affects the adsorption capacity of Crystal Violet (CV) on BCW. The adsorption process occurred quickly and the kinetic data were well described by the pseudo first order (PFO), pseudo second order (PSO), Elovich and Avrami models. The maximum adsorption capacity of CV on BCW calculated from the Langmuir model was 93 mg/g at 35°C. The values of the average free energy determined by the Dubinin–Radushkevich model are less than 8 kJ/mol, indicative of physisorption.

The thermodynamic study at different solution temperatures (15, 25, and 35°C) shows that the adsorption process occurred spontaneously ($\Delta G° < 0$) and was exothermic for BCW ($\Delta H° = –38.46$ kJ/mol).

Keywords: biochar, Washingtonia palm, Crystal Violet

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Preparation and characterization of nano zinc oxide

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Abstract: In this study, the green method was used to prepare zinc oxide with a nanostructure using pumpkin pulp juice and pumpkin peel extract as reducing and oxidizing agents, and zinc chloride as the salt.

Various techniques were employed to characterize the nanostructured zinc oxide particles, including UV-Vis, infrared, and X-ray diffraction. The UV-Vis spectrum showed a main absorption peak at a wavelength of 354 nanometers for zinc oxide prepared with pumpkin pulp juice, and at 354 nanometers for zinc oxide prepared with pumpkin peel. FTIR analysis revealed the presence of different energy bands in all prepared samples (C=C; C-C; O-H) with peaks at 422 cm-1, which corresponds to the stretching vibration mode of the prepared oxides. The manufactured oxides were highly crystalline, as confirmed by XRD. The average crystallite size was determined to be 20.05 nanometers for the nanostructured zinc oxide particles prepared using pumpkin pulp juice, while for those prepared using pumpkin peel, it was 16.42 nanometers for zinc oxide.

Keywords: nanoparticles; green synthesis; nanostructured zinc oxide particles; pumpkin pulp juice; pumpkin peel.

ID: Mat-P-12

Tuning of structure, surface morphology and optical properties of Ni doped ZnO thin films via spray-nebulizer technique

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Abstract: In this work, pure and nickel doped zinc oxide thin films with different mass ratios ranging from (0% -15%) were deposited on glass bases at 450 ° C for 10 minutes with spray nebulizer technique, in order to study the effect of doping levels on structural, morphological and optical properties. The results of Raman spectroscopy indicated the formation of zinc oxide ZnO nanoparticles with polycrystalline structure in the form of Hexagonal wurtzite. Scanning electron microscopy (SEM) images showed that all zinc oxide films become homogeneous, smooth, and clear surfaces. On the other hand, the optical transmittance results reveal that all the films had a high transparency in visible region exceeding 85%, while the energy band gap values were decreasing with increasing of nickel doping ratios. The values of refractive index and extinction coefficient showed a significant change according to nickel doping ratios.

Keywords: spray nebulizer technique, thin films, Raman spectroscopy

ID: Mat-P-13

An In Vitro Comparison of the Antibacterial Activity of CuO and ZnO Nanoparticles Synthesized by Green Method

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Abstract: Nanotechnology, an essential field of scientific research, has recently seen significant expansion in several fields. The biosynthesis of nanoparticles utilizing plants and microorganisms has attracted a lot of attention due to the growing need for environmental nanoparticle synthesis technologies. Because of the absence of pollution, green nanoparticle manufacturing is safe for both humans and the environment. In this study, we report the antibacterial activity of zinc oxide and copper oxide nanoparticles synthesized using an environmentally friendly, cost-effective, less complex, safe, and stable method by using Phoenix dactylifera L fruit extract as a reducing and stabilizing agent. X-ray diffraction, Fourier transform infrared spectroscopy, and scanning electron microscopy were some of the characterization techniques used to examine the crystalline structure and morphology of nanoparticles. Antibacterial activities of nanoparticles were tested against Gram-negative and Gram-positive bacteria using the agar well method.According to the study's findings, copper oxide nanoparticles exhibited superior antibacterial activity in contrast to zinc oxide nanoparticles, which exhibited none at all.

Keywords: CuO nanoparticles, ZnO nanoparticles, Phoenix dactylifera L, Antibacterial activity

ID: Mat-P-14

Efficiency enhancement chalcopyrite solar cell doped by Copper

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Abstract: Recent developments in the field of CIGSe and CTZSSe solar cells have led to improve the high efficiency. Where the CdS buffer layer is an increasingly important element in the InGaCuSe2-based solar cells, where the high efficiencies were reached 21.7% [1]. The n-CdS thin films is implemented in the solar cells as buffer layer because of theirs good properties such as chemical stability, high efficiency and easy to growth by many techniques such as RF-sputtering[2], chemical deposition [3] and others techniques [4, 5]. In contrary with their best characteristics, the Cd could be a contributing factor to environmental problem. This compound presents high toxicity in the environment where this element belongs to the toxic heavy metal. To have this high efficiency with conserving clean environment, it is so difficult. Which many researchers have tried to reduce this heavy toxic metal (Cadmium) from the environment.

Keywords: n-CdS:Cu/p-CuInGaSe2, Cadmium, environment, Electronic properties, Thermodynamic properties.

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New study of CuSe, GaSe and their ternary compound

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Abstract: This paper set out to determine whether the structural, electronic and magnetic properties of CuSe, GaSe and plus to these properties the thermodynamic properties were add advantage to clarify their chalcopyrite system. This study has been performed using the full-potential linear augmented plane wave (FP-LAPW) method. The generalized gradient approximation (PBE-GGA) was used for the exchange and correlation energy density functional. In particular, the lattice constant, bulk modulus and band gap energies of CuSe and GaSe compounds and their chalcopyrite system CuGaSe2 are calculated and discussed. We found, that the parent materials present a metallic behavior for GaSe in zinc blende phase and CuSe gives the Fermi level situated in valence band, so the half metallic behavior. But the chalcopyrite system offers a direct large band gap at (0.87 eV) with modified Becke Johnson Potential (mbj). The total magnetic moment was influenced by the local moment of Cu atom.

Keywords: CuGaSe2 chalcopyrite, Wien2K, MBJ, Structural properties, Electronic properties, Thermodynamic properties.

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Forecasting Second-Order Nonlinear Optical Properties of Nanomaterial Clusters

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Abstract: This study focuses on a series of atypical pentanuclear transition metal hydride clusters, systematically designed with electron-rich environments. The ground-state electronic structures, QTAIM analysis, electronic transitions, charge transfer characteristics (including charge distribution, interatomic distances, and dipole moments), hyper-Rayleigh scattering, and depolarization ratios (both static and dynamic) were comprehensively analyzed using DFT and TD-DFT methods. Quantum chemical calculations were conducted at the CAM-B3LYP/6-311++G(d,p)/sdd level, employing the sum-over-states (SOS) approach for evaluating nonlinear optical (NLO) properties in both static and dynamic regimes.

Our findings reveal that introducing the hydride group at the β-position significantly enhances the first hyperpolarizability compared to other substitution sites. Among the investigated clusters, cluster Cγ exhibits the highest first hyperpolarizability value, attributed to an efficient charge transfer from the ligand to the metal center, as indicated by an overlap strength index (Sr) approaching zero. This work provides novel insights into the NLO properties of atypical pentanuclear transition metal hydride clusters, highlighting for the first time the critical role of orbital overlap in modulating NLO responses.

Keywords: Nanomaterial; NLO, static; dynamic; HRS; DFT;TD-DFT; SOS.

ID: Mat-P-17

Thermodynamic and physical properties of Silicon- Terbium binary compounds: DFT study & reassessment phase diagram.

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Abstract: Si-Tb binary system have been thermodynamically assessed by means of the CALPHAD technique through Pandat software package based on the experiment information of phase equilibria and thermodynamic properties from the published literature data and calculated Vasp package.

The excess Gibbs energy functions of the solution phases including liquid, fcc_A4, W_A2, and Mg-A3 were formulated with Redlich-Kister polynomial functions. The intermetallic compounds Si2Tb, Si5Tb3, SiTb, Si4Tb3, Si3Tb5 were treated as stoichiometric phases. In this work we present first principles study of structural, elastic, mechanic and thermodynamic properties of all SiTb compounds. The computed structural features for the investigated compounds closely align with available experimental data.

A set of self-consistent thermodynamic parameters formulating the Gibbs energy of various phases in the Si–Tb binary system were then obtained. A much better agreement was achieved between the calculated results and the reported experimental data.

Keywords: Si-Tb phase diagram, thermodynamic properties, first principles.

ID: Mat-P-18

Evaluation of physical and structural properties of Ti-25Nb-25Zn alloy obtained by powder metallurgy for use as biomaterial

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Abstract: Titanium alloys, especially those containing only the β phase, have attracted increasing interest in both academia and industry for orthopedic applications, due to their mechanical properties comparable to those of human tissues. In this context, this study focuses on the nanostructured ternary alloy by analyzing the impact of the grinding time (2 h, 6 h and 18 h). For this, a titanium alloy with a nominal composition of Ti-25Nb-25Zr (by weight) was prepared by powder metallurgy from elemental powders, and the resulting compacts were sintered at a temperature of 1300 °C. The alloy characteristics, such as relative density, porosity and surface roughness, were evaluated using techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), surface profilometry and microdurometer. The results revealed that the crystallite size and average pore size decreased with increasing grinding time, reaching minimum values of 26 nm and 40 µm, respectively, after 18 h. Structural characterization showed an increase in the proportion of β-Ti phase as a function of grinding time, resulting in spherical morphology and texturing of the synthesized alloys. The structural evolutions and morphological changes of the ground alloys were closely related to their grinding times. Furthermore, the relative density, Young's modulus, and hardness increased due to the reduction in grain size with increasing grinding time.

Keywords: β phase; SEM; titanium; mechanical properties

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Multifaceted Properties of Double Perovskite Oxide Ba2CrTaO6 : DFT Perspective on the crystal, electronic and Magnetic Features

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Abstract: Double perovskite oxides have garnered significant attention in material science and spintronic applications due to their exceptional physical properties. In this study, the transition-metal double perovskite oxide Ba2CrTaO6 is investigated to explore the effect of the magnetic cation. The calculations are performed using the full potential linearized augmented plane wave (FP-LAPW) method within the framework of the generalized gradient approximation (GGA) and Hubbard correction (GGA+U).Under ambient conditions, our double perovskite adopts the hexagonal phase. The lattice parameters, bulk modulus, and the first derivative of the bulk modulus are determined. More importantly Ba2CrTaO6 shows a ferromagnetic insulator nature. It is deduced that the magnetic cation (Cr) significantly influences the magnetic moment and electronic conduction properties, in contrast to a non-magnetic Ta counterpart. These results suggest that Ba2CrTaO6 hold considerable potential for optoelectronic applications.

Keywords: DFT, Half-Metalicity, Magnetic properties, Spintronic, Double perovskite oxide

ID: Mat-P-20

Mechanical analysis performances of sand concrete modified with carbon nanotubes

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Abstract: This work involves studying the evolution of durability of sand concrete containing two mineral additives (crushed dune sand and carbon nanotubes (CNTs)) in four storage media (free surface, plastic film, tap water and groundwater). The potential negative effects of adding these alternative materials can be reduced by adding very small amounts of carbon nanotubes to the cement system. This study investigates the feasibility of using these alternative materials and carbon nanotubes (CNTs) in the production of lightweight concrete. The first step of our research was to characterize the ingredients used to produce sand concrete. Then, we studied the addition of 2% carbon nanotubes (CNTs) and dune sand powder from the Ouargla area (5%, 10%) as well as the combination of the two additions (2% CNT + 5% SDP; 2% CNT + 10% SDP). Flexural tensile and compressive strength tests were carried out after 7, 28, 90 and 120 days to be able to estimate and evaluate the durability.

The results obtained in this experimental study allow us to say that sand concrete with 5SDP 2 CNT or 10SDP 2 CNT has a stable compressive strength after 90 days in tap water and groundwater. These sand concretes show a positive improvement in strength at all times in the storage medium "plastic film".

Keywords: sand ; concrete ; mineral additions ; crushed dune sand ; carbon nanotubes(CNT); preservation media ; strength.

ID: Mat-P-21

ELECTROCHEMICAL PROPRIETIES OF TiO2 DEVLOPED BY DIFFERENT METHODS OF ELECTRODEPOSITION AND ITS EFFECT ON PHOTOELECTRODEGRADATION OF MO DYE

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Abstract: This work constitutes an humble contribution to the elaboration and characterization of the titanium dioxide (TiO2) films synthesized from TiCl3 precursor on semi-transparent plates of tin oxide doped by the Indium (ITO) glass substrates using two electrochemical techniques, namely direct electrodeposition (DE) and pulse electrodeposition (PE).The effect of the technique of electro deposition and also time-off (Toff) duration on the properties of TiO2 films and their photoelectrocatalytic activity were investigated.

The characterization of deposited layers of TiO2 was performed by electrochemical methods such as cyclic voltomperometry and electrochemical impedance spectroscopy . The electrical properties of thin films and TiO2 films were studied by photocurrent measurements at room temperature This study allows to determine the amount of electric current of TiO2.

The films of TiO2 deposited by the two methods result in difference and improvement in optical properties and photoelectrochemical responses.

The effect of the technique of electro-deposition and Toff duration on the properties of TiO2 films and their photoelectron-catalytic activity were investigated ON the degradation of methyl orange (MO).

Keywords: TiO2 ; Thin films ; Electrodeposition ; Photoelectrodegradation,MO

ID: Mat-P-22

Caracterization of biomass intended for bioenergy production: Arthrospira Platensis and Azolla Pinnta.

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Abstract: The increasing demand for renewable, sustainable and environmentally friendly energy sources has led to a direct confrontation to the production of bioenergy from microalgae and macroalgae. Therefore, this study focused on the characterization of the biomass of Spirulina Arthurspira platensis type M2 and Azolla pinnata grown in the Hassi Messaoud-Ouargla region under optimal conditions of temperature, humidity and pH. The growth of both algae species was monitored, the structural differences between these two algae species were determined and their oils were extracted using the Soxhlet method. The results obtained showed that good control of the growth conditions for both algae species and the adjustment of nutrients led to the production of good biomass containing a high percentage of lipids that can be used in energy production that aims to enhance sustainability, diversify energy supplies and reduce global warming.

Keywords: Renewable energy, Biomasse, Arthrospira platensis, Azolla pinnata, Bioenergy.

ID: Mat-P-23

XRD Analysis of the Effect of SMAW Welding Current on the Crystalline Structure of X60 Pipeline Steel

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Abstract: The effect of welding current intensity using the SMAW technique on X60 steel samples was investigated, analyzed, and compared. Welds were prepared using different current intensities, followed by XRD analysis to examine their crystalline structure. The analysis included measuring d-spacing, phase identification, full width at half maximum (FWHM), and crystallite size. A comparative study was conducted on the three different welds to evaluate their impact on the mechanical, corrosion, and metallurgical properties of X60 steel. The results emphasize the importance of controlling welding current intensity to achieve optimal crystalline properties in the welded metal.

Keywords: steel; XRD; SMAW; crystalline structure.

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Impact of Annealing Duration on the Sustainable Synthesis of Iron Oxide Nanoparticles and Their Structural and Optical Characteristics

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Abstract:

Iron oxide nanoparticles (NPs) were synthesized through a green synthesis method employing ethanolic extracts of Phoenix dactylifera L. leaves as a natural source of polyphenols and an aqueous solution of $FeCl_3$ as the precursor, with a 1:2 volume ratio. The precursor solution had a concentration of 0.04 M, and the synthesis process involved annealing the mixture at 500°C for 2 hour. Comprehensive characterization of the synthesized nanoparticles was performed using various analytical techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), ultraviolet-visible spectroscopy (UV-Vis), and Fourier-transform infrared spectroscopy (FTIR). XRD analysis identified magnetite and wüstite phases in the as-synthesized nanoparticles prior to annealing. Following the annealing process, three additional phases maghemite, hematite, and β-Fe_2O_3 were observed, indicating the transformation of the nanoparticle composition into a more complex mixture of iron oxides. SEM imaging confirmed that all samples consisted of spherical particles. UV-Vis spectroscopy demonstrated that the $FeCl_3$ concentration had a direct impact on the band gap of the nanoparticles, which ranged from 2.068to 2.718eV. FTIR analysis further verified the presence of abundant Fe-O bonds in all samples, confirming the successful synthesis of iron oxide nanoparticles.

Keywords: Iron oxide nanoparticles; Green synthesis; X-ray diffraction (XRD); scanning electron microscopy (SEM); ultraviolet-visible spectroscopy (UV-Vis); and Fourier-transform infrared spectroscopy (FTIR)

ID: Mat-P-26

Synthesis of F ; Cu and Al doped NiO monocrystalline thin films by spray deposition

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Abstract: The main objective of this work is to investigate based on fluorine and copper and aluminium doped NiO thin films by spray deposition technique. Nickel nitrate hexahydrate Ni(NO3)2.6H2O and ammonium fluoride (NHF4) with a ratio of F/Ni = 0.05 were used to prepare F doped NiO and Copper Acetate (〖Cu(CH_3.COO)〗_2) with a ratio of Cu/Ni = 0.03 were used to prepare Cu doped NiO- aluminium nitrate (Al (NO3)3) with a ratio of Al/Ni = 0.03 were used to prepare Al doped NiO. The structural, optical and electrical properties of thin films were investigated with NiO constant solution volume is equal to 10 ml using the spray technique. The prepared F ; Cu and Al doped NiO thin films have a monocrystalline nature with a cubic structure; the (111) diffraction peak is the preferred orientation; the maximum crystallite size is 15.49nm obtained for Al doped NiO thin films. The optical property appears that the all the prepared doped NiO thin films have a good transmittance reaching of about 80 % for F doped NiO thin films in the visible region. The F-doped NiO thin films deposited exhibit a minimum optical band gap energy of 3.51 eV and the highest Urbach energy value of 0.595 meV. The Cu doped NiO thin films prepared exhibits a minimum electrical resistivity of 442.7 Ω•cm.

Keywords: thin films -NiO thin films -spray deposition....

ID: Mat-P-27

Analysis of Enthalpy Distribution in the Cathode and its Interaction with the Arc during TIG Welding

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Abstract: The objective of this study is to analyze the enthalpy distribution in the cathode during the TIG welding process, taking into account the interaction with the electric arc. The central problem lies in understanding the thermal effects at the cathode, the distribution of thermal energy and its influence on arc stability and welding quality. The study seeks in particular to quantify the actual temperatures and thermal gradients on the surface of the cathode during welding. To do this, a numerical simulation was carried out using COMSOL Multiphysics software. The modeling integrated the phenomena of thermal conduction, gas ionization, and heat transfer between the cathode and the arc. The results obtained indicate that the maximum temperature of the cathode reaches approximately 1800 K, concentrated near the arc impact point. This high-temperature region is strongly influenced by the current intensity, which was simulated in the ranges of 120 A to 150 A. As the current intensity increases, the enthalpy distribution in the cathode becomes more localized, with temperature variations ranging from 1500 K to 1800 K on the cathode surface. This phenomenon generates significant thermal gradients that modify the arc dynamics and influence the quality of the material fusion. Variations in the arc geometry are also observed, affecting the shape of the weld pool and the penetration depth.

Keywords: Enthalpy distribution, cathode, TIG welding, electric arc, COMSOL simulation, cathode temperature, thermal gradients, thermal conduction, gas ionization, current intensity effects, welding quality.

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METHODS OF PROTECTING CONCRETE WORKS IN AGGRESSIVE AREAS

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Abstract: According to numerous experiments, several concrete structures have suffered pathologies of varying severity due to chemical aggressions, often resulting from high soil salinity. The Ouargla region is also known for its soil salinity and high sulfate content, as well as the existence of several sebkha zones. Concrete is a material characterized by its low resistance to chemical aggressiveness, which sometimes necessitates protecting the surface of the concrete element that will be in contact with the aggressive environment.

The present study focused on the impact of water aggressiveness on the degradation of concrete structures and aimed to estimate and evaluate the importance and effectiveness of various types of concrete protection in high-salinity environments. Thus, we studied the mechanical behavior of concrete specimens dosed at 350 kg/m³ with two different types of cement (CPJ and CRS) in two different curing environments (tap water—standard curing / sebkha water—aggressive curing) and with two types of protection: chemical protection with epoxy / traditional protection by Flintkote impregnation.

Keywords: Aggressivity, Concrete Deterioration, Preservation Media, Ouargla Area, Epoxy Coating

ID: Mat-P-29

Deformation effect on corrosion resistance of AISI 321 austenitic stainless steel

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Abstract: To evaluate compressive deformation effect on the AISI 321 austenitic stainless steel corrosion resistance, thick-walled cylindrical tubular specimens, intended for high-pressure and high-temperature equipment, were subjected to a series of upward cyclic compressive deformations. Electrochemical tests (potentiodynamic) were conducted at different sections along the compressed samples. The results revealed corrosion resistance disparities lengthways the samples. The observed discrepancies were attributed to the unequal quantities of the martensitic phase produced by deformation. In fact, AISI 321 steel is known for its high ability to undergo strain hardening. The non-uniform deformation produced along compressed specimen resulted in an irregular distribution of the induced martensite content. XRD analysis were performed on these sections and helped to confirm this thesis.

Keywords: AISI 321 stainless steel; compression; Deformation-induced martensite; corrosion resistance; XRD.

ID: Mat-P-30

Green synthesis of ZnO-NPs from Punica granatum L. aqueous extract; Characterization, and evaluation of their in vitro antioxidants and antibacterial properties.

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Abstract: Zinc oxide has attracted considerable interest in recent years due to its distinctive qualities and favourable characteristics. This paper centres on the production of ZnO-NPs by the use of Punica granatum L. peel extract and evaluates their possible biological effects. The synthesized nanoparticles undergo characterization using UV-vis spectroscopy, energy-dispersive X-ray spectroscopy (EDX), scanning electron microscopy (SEM), X-ray diffraction (XRD), and Fourier transform infrared (FT-IR) spectrophotometry. The antibacterial and antioxidant activities of the formed ZnO-NPs are also assessed. The formation and purity of the synthesized ZnO-NPs were validated by UV-vis, XRD, SEM, EDX, and FTIR techniques. In the UV-vis spectrum, we found a maximum absorption peak at 361 nm. The FTIR spectrum showed transmittance peaks at 415 cm1, which defined the Zn-O function. The crystallite size was measured to be 12.24 nm. SEM-EDX analysis of our sample revealed a granular form and major peaks for O, Zn, and C elements. The results of the antioxidant assays indicate that ZnO-PG nanoparticles possess significant antioxidant activities, as evidenced by IC50 values of 340.60 ± 1.94 ug/ml and 577.61 ± 3.82 ug/ml in the DPPH and FRAP tests, respectively. In addition, the ZnO-PG nanoparticles exhibited a total antioxidant capacity (TAC) of 20.88 ± 0.102 mgEq AA/g DE. ZnO-PG NPs demonstrate vigorous antibacterial activity against Bacillus subtilis and Staphylococcus aureus when used at a concentration of 5 mg/ml, resulting in inhibition zones measuring 15.26 mm and 15.03 mm, respectively. These findings have potential uses in the field of biomedicine, specifically in the advancement of antibacterial and antioxidant therapies. Additionally, they can be utilized to assess the efficacy of nano-directed drug delivery systems in living organisms.

Keywords: Punica granatum L.; Green synthesis; Zinc Oxide NPs; Antioxidant; Antibacterial.

ID: Mat-P-31

Contribution to the study of the structural, electronic and thermodynamic properties of RhBX3 antiperovskites (X= Al, Ge, In)

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Abstract: To study the structural, elastic, electronic and thermal properties of the antiperovskite RhBX3 (X= Al, Ge, In), we applied the pseudopotential linear plane wave (PW) method. We also used local density approximation (LDA) and generalized gradient approximation (GGA) for exchange and correlation potentials. The network equilibrium constants, compressibility module and its pressure derivative were calculated and compared to the available experimental and theoretical results. It was found that there is agreement between the structural properties of the cube and the experimental results. We also expected high convergence when calculating the elastic parameters, Young's modulus (E), Poisson's ratio (υ), and shear modulus (G). The band contribution for the different energy bands and the total and partial electronic density of states curves were also analyzed. We estimated sound speeds in the principal directions, and through the semi-harmonic Debye model, in which acoustic effects are taken into account, the effects of temperature and pressure on the lattice constant, heat capacity and Debye temperature were implemented.

Keywords: Intermetallic compounds, Ab initio calculations, Elastic properties.

ID: Mat-P-32

SYNTHESIS, STRUCTURAL CHARACTERIZATION, THERMAL ANALYSES AND ANTIBACTIRAIL AVTIVITY OF [Cu(C6H8N2O2S)2(NO3)2H2O] COMPLEX

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Abstract: Complexes containing copper (II) have attracted much attention owing to their superior biological and catalytic properties. In the last several years, the research in this field has been developing rapidly for coordination polymer. Sulfanilamide ligand represents an important class of medicinally active compounds which are successfully employed as antibacterial agents. Biological and pharmacological properties of sulfanilamide derivates are well known for many years. Morever, metal- sulfanilamide have attracted increasing attention owing to their antimicrobial activity.

As part of our ongoing studies on the synthesis, structures and biological activity of sulfanilamide complexes, we have synthesized and determined the crystal structure of the title compound. The crystal structure of [Cu(C6H8N2O2S)2(NO3)2H2O], were synthesized and characterized by spectrometric methods, thermal analysis and single crystal X-ray diffraction. In this crystalline material, the copper (II) ions are five coordination with a square pyramidal. In the crystal structure of complex, sulfanilamide is found to exhibit a monodentate behaviour coordinating through the amino nitrogen atom. Important interactions upon the molecular packing were also performed by the analysis of their Hirshfeld surfaces and compared to the 2D-fingerprint plots. Thermal stability of this crystalline material has been investigated by thermogravimetric and differential thermal analysis (TG– DTA) technique and DSC curves, which showed that complexe have high thermal stability and are stable up to 500°C.

The antimicrobial activity of synthetized metal complexes against various tested organisms such as Gram positive (Staphylococcus aureus) and Gram negative (Escherichia coli and Pseudomonas aeruginosa) in different concentration reveals variable responses depending on the strain and the concentration of the compounds tested.

Keywords: sulfanilamide; synthesis; X-ray diffraction; thermal analyses and antibacterial activity

ID: Mat-P-33

Effect of concentration and time of a new green protecting inhibitor of Lavande extract in 1M HCl solution in carbon steel.

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Abstract: Corrosion inhibitors are crucial for protecting metals and equipment. Consequently, researchers are increasingly focused on developing "green" corrosion inhibitors that are affordable, readily available, environmentally sound, ecologically acceptable, and renewable [1]. Traditional corrosion inhibitors used in the petroleum industry often present drawbacks due to their toxicity, carcinogenicity, high cost, and difficulty in decomposition [2].

This study investigates the effectiveness of lavender extract as a corrosion inhibitor for carbon steel in 1M HCl. We examined the corrosion inhibition performance of lavender extract on C45 carbon steel at 300 K using weight loss measurements, Scanning Electron Microscopy (SEM), and X-ray analysis. Our results demonstrate that the corrosion inhibition efficiency increases with increasing lavender extract concentration, reaching an impressive 95% at a concentration of 1.5 g/L. SEM analysis further confirmed the formation of a protective layer on the steel surface in the presence of the inhibitor.

Keywords: Carbon steel, hydrochloric acid, corrosion inhibition, Lavande, weight loss.

ID: Mat-P-34

Correlation Between Physico-Chemical Properties and Dielectric Behavior of Thermally Aged XLPE Polymer Insulation

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Abstract: This study aims to clarify the correlations between the physico-chemical properties and the variation of dielectric losses in Cross-Linked Polyethylene (XLPE) used as insulation in Medium Voltage cables subjected to thermal aging. The investigated cables were manufactured by ELSEWEDY CABLES and installed in Algeria, where they must withstand high temperatures exceeding 50°C in the southern regions. To achieve this, thermal aging tests were conducted on XLPE cable samples at 80, 100, and 140°C for a duration of 5000 hours. The chemical properties were analyzed using Fourier Transform Infrared Spectroscopy (FTIR). Additionally, the effects of aging on the crystallinity ratio, lamellar thickness, and melting peak temperature were evaluated through Differential Scanning Calorimetry (DSC). Frequency-domain dielectric spectroscopy was performed on aged XLPE cables to assess the evolution of dielectric losses. The results indicate that thermal oxidation is the primary aging mechanism, leading to morphological degradation and increased polarization and losses, particularly at low frequencies. Furthermore, color changes resulting from chain scission suggest an increase in interfacial areas between the insulating and semi-conductive layers, which may contribute to higher dielectric losses due to interfacial polarization.

Keywords: Cross-linked Polyethylene; thermal aging; dielectric losses;cristallinity.

ID: Mat-P-35

Investigation of the optical and dielectrical properties of Zn1-xFexO thin layers nanostucrure synthesized by SPM approach

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Abstract: This study involved the preparation of Zn1-xFexO (x= 0, 0.02) nano-crystal thin films utilising a straightforward spray pyrolysis method (SPM), with doping concentrations varied from 0 to 2 wt.% at a constant substrate temperature of 350 °C.The influence of Fe-doping concentration on the optical and dielectrical properties of ZnO thin films was examined and addressed. The optical properties revealed that the films with Fe-doping concentration (2 wt.%) showed high transmittance and wide band gap than the undoped ZnO samples. The estimated band gap showed a decreased from 3.27 eV to 3.09 eV as Fe doping concentration increses. The refractive index of the films exhibited a significant variation with increasing of doping. The interaction between free electrons and incident photons is indicated by the change in the real and imaginary parts of dielectric constants with photon energy.

Keywords: Thin films, Zinc oxide, spray pyrolysis; Optical properties, dielectrical properties

ID: Mat-P-36

Corrosion Resistance of Quenched and Tempered Chromoly Steel.

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Abstract: For decades, steel has been the most commonly used material for the manufacture of various metal parts, which must meet certain characteristics under different stresses. Among these steels, Chromoly steel which is widely used in mechanical manufacturing, it finds many applications as forgings for the aerospace, oil and gas, automotive, and defense industries. To improve the use properties of this steel such as corrosion resistance, heat treatments are considered in this study. Hence, the objective of this study is to investigated the effect of heat treatment by quenching followed by tempering at different temperatures on the corrosion resistance of chromoly steel in a 3.5 % NaCl chloride medium. The results revealed significant differences in corrosion behavior between the different samples, hence the untreated sample, has exhibits higher corrosion parameters than the heat-treated samples. However, the sample quenched and tempered at 600°C recorded the higher polarization resistance equal to 6.99.105Ω and the lower corrosion rate, and corrosion current density equal to 0.0004mm/year and 4.023.10-8A/cm2 respectively with a nobler corrosion potential (Ecorr) equal to -0.316V, showing an improved in corrosion characteristics. The EIS results for the same sample, show the highest charge-transfer resistance equal to 189 K Ω. The results obtained from EIS support the polarization results. The results provide valuable information on how the heat treatment cycle can be optimized to improve steel corrosion performance.

Keywords: Chromoly steel; Corrosion resistance; Heat treatments; Electrochemical property.

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Antibacterial and Antifungal activity Evaluation of Novel Substituted Imidazo-pyrimidine and Imidazo-purine derivatives

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Abstract: Imidazo-pyrimidines and imidazo-purines are a noteworthy class of N-heterocyclic compounds that have gained considerable attention due to their crucial biological properties The chemical structures of the newly synthesized compounds were confirmed by infrared spectroscopy (FT-IR), mass spectral analysis, proton (1H) and carbon (13C) nuclear magnetic resonance (NMR). The synthesized compounds were evaluated for their in vitro antimicrobial activity against representative strains of Gram-negative bacteria (Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853, Gram-positive bacteria (Staphylococcus aureus ATCC 25932), and Candida albicans ATCC 14053 fungus strain using well-diffusion method. Gentamicin and nystatin were used as a positive control for the antibacterial and antifungal assays, respectively.

Keywords: Imidazo-pyrimidines; imidazo-purines; Nitrogen heterocycles; antibacterial; antifungal activity.

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ID: Mat-P-38

Effect of concentration and time of a new green protecting inhibitor of Lavande extract in 1M HCl solution in carbon steel.

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Abstract: Corrosion inhibitors are crucial for protecting metals and equipment. Consequently, researchers are increasingly focused on developing "green" corrosion inhibitors that are affordable, readily available, environmentally sound, ecologically acceptable, and renewable [1]. Traditional corrosion inhibitors used in the petroleum industry often present drawbacks due to their toxicity, carcinogenicity, high cost, and difficulty in decomposition [2].

This study investigates the effectiveness of lavender extract as a corrosion inhibitor for carbon steel in 1M HCl. We examined the corrosion inhibition performance of lavender extract on C45 carbon steel at 300 K using weight loss measurements, Scanning Electron Microscopy (SEM), and X-ray analysis. Our results demonstrate that the corrosion inhibition efficiency increases with increasing lavender extract concentration, reaching an impressive 95% at a concentration of 1.5 g/L. SEM analysis further confirmed the formation of a protective layer on the steel surface in the presence of the inhibitor.

Keywords: Carbon steel, hydrochloric acid, corrosion inhibition, Lavande, weight loss.

ID: Mat-P-39

ETUDE CHIMIQUE DE L'EVOLUTION DES SAUMURES DU CHOTT MAROUANE DURANT L'EVAPORATION ISOTHERMIQUE

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Abstract: Several geochemical studies have been conducted on Chott Merouane because of its economic importance, its geographical location, its dry desert climate and its rocky composition.

Keywords: Evaporation, chott, brine, program, isothermal

ID: Mat-P-40

Fabrication and characterization of pure Cu4O3 thin films using cost-effective nebulizer spray pyrolysis (NSP) method

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Abstract: Herein, we report the fabrication and characterization of pure Cu4O3 thin films using cost-effective nebulizer spray pyrolysis (NSP) method deposited on glass slide substrate. The microstructural, and optical, properties of the prepared films are studied using X-ray diffraction and UV–visible spectroscopy. The X-Ray diffraction (XRD) patterns revealed that all synthesized thin layer exhibit polycrystalline nature with tetragonal structure for pure Cu4O3 film. However, the film revealed a domination of the Cu4O3 with (002) diffraction plane present the preferential orientation. The obtained results indicate that the crystallite size of the deposited films is 10.45 nm. From UV-vis analysis, it was found that the thin layers exhibit highly optical transmission, The Eg values of the prepared films is 3.18 eV. In addition, the optical parameters such as, the refractive index and extinction coefficient of all films were determined.

Keywords: Cu4O3, Thin films, nebulized spray pyrolysis (NSP), X-ray diffraction, Optical properties.

ID: Mat-P-41

Structural and optical Analysis of nickel oxide thin films : Effect of copper doping

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Abstract: In this research, the effect copper on the structural and optical properties of nickel oxide thin films was studied at different copper concentrations. Thin transparent films of nickel oxide (NiO) doped with copper (Cu) were deposited on glass substrates at a temperature of 400 °C using the spray pyrolysis technique. The structural study showed that all the prepared polycrystalline films had a cubic structure with a preferential orientation along (111). Copper was well integrated into the host lattice without changing the structure. The optical band gap ranges from 3.70 eV to 3.50 eV, and the Urbach energy, which ranges from 0.34 eV to 0.5 eV.

Keywords: Thin Films, Metal Oxides, NiO, Pyrolysis spray

ID: Mat-P-42

Synthesis and characterization of CuO@Fe2O3 nanocomposites and photocatalytic applications.

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Abstract: In the present study, we successfully synthesized stable CuO@Fe2O3 nanocomposites and biosynthesized them using a green method involving Portulaca oleracea leaf extract. The results indicated that the synthesized CuO@Fe2O3 NC had a monoclinic crystal structure. The lattice constants were found to be as follows ; a = b = 3.02278Å and c = 17.0936Å, which are in good agreement with JCPDS reference card No : [01-085-0605] and belong to the orthorhombic spacing group R-3m. While the average crystallite size value is D = 28.3 nm. SEM images reveal that CuO@Fe2O3 NC exhibits a variety of agglomerated or aggregated shapes, including spherical and rectangular structures.The peak observed at 598 cm-1 is likely attributed to Cu-O stretching, which corresponds to (B2u mode) and a few functional groups were detected from the infrared (IR) spectra. The optical energy bandgap of CuO@Fe2O3 NC recorded by diffuse absorption spectra was 1.29 eV, making it an efficient catalyst under visible light. The photocatalytic performance of CuO@Fe2O3 NC was evaluated by photodegradation of aqueous methylene blue solution (2.5×10-5 M) under sunlight. The highest photodegradation rate of CuO@Fe2O3 NC is 40.15% at 120 min.

Keywords: CuO@Fe2O3; nanocomposites; structure; monoclinic; orthorhombic; crystallite size; photodegradation.

ID: Mat-P-43

Extraction, Characterization, and Multi-Approach Evaluation of an Essential Oil for Anti-Alzheimer Activity: A Comparative Study with Silver Nanoparticles

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Abstract: This study focuses on the extraction and characterization of an essential oil from a medicinal plant, with a comprehensive evaluation of its potential anti-Alzheimer activity. The essential oil was analyzed using gas chromatography-mass spectrometry (GC/MS) to determine its chemical composition. Its biological activity was assessed through in vivo and in vitro experiments to evaluate its efficacy in neuroprotection. Furthermore, an in-silico approach, including molecular docking and molecular dynamics simulations, was employed to investigate its interaction with key enzymes implicated in Alzheimer's disease. Additionally, silver nanoparticles were synthesized using the same essential oil, and their physicochemical properties were analyzed. A comparative study between the essential oil and its silver nanoparticle formulation was conducted to assess their respective bioactivities. The findings provide valuable insights into the therapeutic potential of essential oils and their nanoformulations in neurodegenerative disease management.

Keywords: Essential oil, GC/MS analysis, Anti-Alzheimer activity, In silico evaluation, Silver nanoparticles

ID: Mat-P-44

High-Frequency Acoustic Characterization of Rigid Porous Media Using an Impedance Tube

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Abstract: This study presents an experimental methodology for characterizing the high-frequency acoustic properties of rigid porous media using an impedance tube. Based on the equivalent fluid model, derived from Biot's theory, our investigation explores wave propagation within porous structures, emphasizing the roles of effective density and dynamic compressibility of the saturating fluid. A key objective is to solve the inverse problem by optimizing the agreement between experimental and theoretical absorption coefficients in the high-frequency regime. This process enables the precise determination of three fundamental parameters: the high-frequency limit of tortuosity, as well as the viscous and thermal characteristic lengths. The study further provides a comparative analysis of experimentally measured and numerically simulated absorption coefficients, employing optimized parameters across four distinct polyurethane foam samples. The findings contribute to a deeper understanding of acoustic wave behavior in porous media and offer insights for material design in acoustical applications.

Keywords: High-frequency acoustics; Porous media; Impedance tube measurements; Inverse problem optimization; Wave propagation; Acoustic absorption.

ID: Mat-P-45

Effects of Fe, Cu, and Mn addition on microstructure and corrosion properties of biodegradable Zn-0.8Mg alloy

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Abstract: Biodegradable metals represent a new class of biocompatible materials; they have attracted considerable attention in recent years. Recently, zinc (Zn) alloy has been considered a promising biodegradable material due to its good biosafety and acceptable biocompatibility, and many zinc alloys have been optimized to improve implant biodegradability. In the present work, we investigated the influence of the incorporation of micro-alloying metals iron (Fe), copper (Cu), and manganese (Mn) on the microstructure, mechanical properties, and corrosion resistance of Zn-Mg alloys prepared by gravity casting under a protective atmosphere of argon (Ar). The morphological and structural characteristics of samples were analyzed using an optical microscope, scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS), and X-ray diffraction (XRD). In vitro immersion and corrosion tests were conducted in Hank's simulated body fluid at human body temperature (37°C). Results of microstructural observations indicated that the addition of the Mn element significantly refined α-Zn grains compared to Fe and Cu elements. The results of XRD analysis showed that the above alloys have phases of α-Zn, Mg_2Zn_{11}, and $FeZn_{13}$, $CuZn_5$, and $MnZn_{13}$ phases for Zn-0.8Mg-0.3Fe, Zn-0.8Mg-0.5Cu, and Zn-0.8Mg-0.3Mn alloys, respectively. The electrochemical results in SBF solution showed that Zn-Mg-Cu based alloys exhibit much lower corrosion rate Cr (0.07 mm/year) of corrosion in comparison to the other alloys.

Keywords: Zn based biodegradable alloys, Microstructure, Corrosion

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Green synthesis of nickel oxide and Ag nanoparticles using Pelargonium graveolens plant extract

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Abstract: An environmentally friendly, green approach for the synthesis of silver (Ag) and nickel (NiO) nanoparticles was developed using Pelargonium graveolens leaf extract. The XRD revealed the formation of pure cubic crystalline structures of AgNPs and NiONPs. Plant extract acts as both a reducing agent and a capping agent, providing a rapid and simple method for the synthesis of nickel oxide and silver. Results confirmed that this protocol as simple, rapid, one-step, eco-friendly, nontoxic and an alternative to conventional physical/chemical method. Just a few times is enough to convert ions into nanoparticles without the use of hazardous chemicals.

Keywords: Ag, NiO, Pelargonium graveolens, nanoparticles, coprecipitation, environmentally friendly green method

ID: Mat-P-47

Isomorphisme entre la modélisation de la transition de spin par le modèle électro-élastique et le modèle de type Ising, sur une chaine monoatomique à 1D, émergence d'une auto-organisation des états de spin.

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Abstract: Elastic modelling of spin-crossover has boomed remarkably these last years. Among these models, the electro-elastic model combining spin and lattice degrees of freedom showed good abilities of fair description of the thermodynamics of spin-crossover solids. In the present work, we explore a new treatement of this model based on a homogenous description of the lattice spacing with well separate relaxation timescales for the lattice and spin states degrres of freedom. This description is analogous to the Born-Oppenheimer approximation and allows analytic treatment of the elastic part of the model, thus simplifying considerably the model resolution. As a result, we have been able to demonstrate the equivalence between the genuine electro-elastic model and Ising-like Hamiltonian with competing long-range ferro-like and short-range (nearest neighbors nn and next-nearest neighbors nnn) antiferro-like interactions, whose relation-ship with the high-spin to low spin misfit elastic energy has been established. The Hamiltonien of this model have been solved numerically by the Monte Carlo technique involving the spin states. This model generates intrinsinc elastic frustration in the lattice, wich leads to a rich variety of gradual transition, made of one, two step behaviors, incomplete transitions, with antiferro-elastic self-organization of the spin states in the plateau regions.

Keywords: Spin crossover materials, 1D chain, Electro-elastic model, homogenous model, Monte Carlo technique.

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Kinetic Modeling of Ultrafast Boriding of AISI 1045 Steel and Phase Homogenization

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Abstract: In this work, the Dybkov model was applied to simulate the boronizing kinetics of AISI 1045 steel and the subsequent phase homogenization (PH) by considering two fitting parameters and boride incubation times to reproduce the experimental thicknesses of FeB and (FeB + Fe2B) layers.

The bilayer (FeB/Fe2B) was generated on AISI 1045 steel using the ultra fast boriding (UFB) process in the range of 1123 to 1223 K for 0.25–0.75 h. New expressions of analytical solutions of Dybkov model were then developed.

As a main result, the boron activa ion energies in FeB and Fe2B were determined as 145.27 and 133.13 kJ mol–1 for FeB and Fe2B layers, respectively. The relations describing the evolution of layers thicknesses during the phase homogenization (PH) were derived. They were used to estimate the holding time required for dissolving completely

the FeB layer.

Keywords: Fe borides; Boriding ; Dybkov model; Activation energy; Phase homogenization

ID: Mat-P-49

Nano-investigation of Multilayer Structures Based on Heusler Compounds

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Abstract: The Heusler alloys are renowned for their outstanding properties, including high Curie temperature (~985 K) and excellent lattice matching with substrates, making them ideal for spintronic applications [1]. In tunnel magnetoresistance devices, oxide barriers like MgO are a focal point for achieving higher magnetoresistance ratios and resistivity compared to giant magnetoresistance devices [2]. These properties make them particularly suitable for magnetic sensors and data storage. This study investigates the structural and chemical properties of Heusler/MgO/Heusler multilayer structures subjected to various annealing temperatures. The morphological and compositional changes at the Heusler/MgO interface are examined using 3D atom probe tomography (APT), with composition profiles analyzed through diffusion models [3]. Furthermore, transmission electron microscopy (TEM) is employed to investigate the interface morphology and atomic structure, providing complementary insights [4]. These results enhance our understanding of interface behavior in Heusler-based multilayer structures, critical for optimizing TMR device performance.

Keywords: Heusler, tunnel magnetoresistance, MgO, atom probe tomography, diffusion.

ID: Mat-P-50

Silver Nanofluids in Healthcare: Fabrication, Properties, and Therapeutic Uses

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Abstract: Silver nanofluids are colloidal suspensions of silver nanoparticles dispersed in a liquid medium. These nanofluids can be synthesized using various methods, including chemical reduction, physical techniques, and green synthesis. Green synthesis employs natural reducing agents from plant extracts or microorganisms, offering an environmentally friendly and sustainable approach to nanoparticle production. In this study, silver nanofluid was prepared using green chemistry principles. The synthesized nanofluid was characterized by advanced techniques, including Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Dynamic Light Scattering (DLS), and Ultraviolet-Visible Spectroscopy (UV-Vis). The characteristic optical properties observed via UV-Vis spectroscopy confirmed the successful formation of silver nanoparticles. Silver nanofluids demonstrate immense potential in medical applications due to their potent antimicrobial properties. They are particularly effective in wound care and infection prevention, as their ability to inhibit bacterial growth accelerates the healing process in clinical settings. Additionally, silver nanofluids enhance drug delivery systems by improving the solubility and bioavailability of poorly soluble drugs. This targeted delivery reduces systemic side effects and increases therapeutic efficacy. Furthermore, silver nanofluids are being explored for their role in cancer therapy through photothermal effects. When exposed to light, these nanofluids generate localized heating that selectively destroys cancer cells while sparing healthy tissue. In diagnostic imaging, silver nanofluids function as contrast agents, enhancing image quality and facilitating early disease detection through their superior optical properties. The versatility of silver nanofluids positions them as valuable assets in modern medicine, offering innovative solutions to various therapeutic and diagnostic challenges. Ongoing research into their synthesis, characterization, and functional properties will further elucidate their capabilities, optimize their applications, and contribute to significant advancements in healthcare technologies.

Keywords: Silver nanofluids, green synthesis, antimicrobial activity, drug delivery, photothermal therapy, diagnostic imaging.

ID: Mat-P-51

Study of the specific surface area of silicas by finite concentration gas chromatography

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Abstract: Pyrogenic silicas , produced by combustion of SiCl4 into a mixture hydrogene/air, are widely used as filler for polysiloxanes, but also as one of the main components of super-thermal insulating. However, the nanoscale of these silicas and surface chemistry (silanol groups) is also responsible for their ability to adsorb water vapour, which alters their insulation and reinforcement properties, especially when stored in uncontrolled conditions.

Initially the surface of pyrogenic silicas is partially hydroxylated, silanol groups, but presents also strained siloxane bridges, which can react with adsorbed water, leading to a change in their surface properties when exposed to the atmospheric moisture.

The evolution of the surface properties of these silica samples, aged during about 1000 h, was followed by inverse gas chromatography at finite concentration (CGI-FC) conditions.

The ageing process will take place at the border between hydrophobic and hydrophilic domains, the former containing the reactive hydrophobic species, siloxane bridges and the latter that permit the water adsorption on silanol functions.

Keywords: Pyrogenic silica; Ageing process; Gaz chromatography at finite concentration (CGI-FC)

ID: Mat-P-52

Propriétés Thermodynamiques du système de nano-alliage de surface ordonnée Au/Cu(111)

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Abstract: La thermodynamique des phonons de surfaces dans la structure de nano-alliage de surface Au/Cu (111) constitue l'objectif principal de notre travail. Celle-ci a été étudiée en déposant des atomes d'or sur la surface du cuivre orientée selon la direction (111), afin d'examiner l'influence des atomes adsorbés sur un substrat métallique sur ses propriétés thermodynamiques. Dans ce travail, nous analysons comment ces propriétés diffèrent de celles du volume et de la surface propre de Cu (111). Nous étudions également l'influence du nombre de coordination, des constantes de force et du rapport de masse sur ces propriétés.

Les propriétés thermodynamiques examinées incluent la chaleur spécifique, l'énergie interne, l'énergie libre et l'entropie. Ces grandeurs sont calculées numériquement en utilisant un formalisme basé principalement sur les fonctions de Green et la méthode de raccordement. Cette dernière permet de décrire le mouvement vibratoire des atomes d'un système semi-infini en le réduisant à un nombre fini d'équations. Nos résultats numériques sont obtenus grâce aux programmes que nous avons développés sous MATLAB.

Keywords: Nano-alliage de surfaces; Phonons de surface; propriétés thermodynamiques; énergie; entropie; chaleur spécifique.

ID: Mat-P-53

surfactant effect on the characteristics of pure zinc oxide films.

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Abstract: This study focuses on the impact of polyethylene glycol (PEG) on the physical and optical properties of ZnO thin films. The sol-gel process was chosen because it is simple, has good chemical uniformity, and produces a high purity product. The sol solution is prepared using zinc acetate, isopropanol, and ethanolamine. The samples are then annealed at 500°C to evaluate the phase composition of PEG-added ZnO thin films and pure ZnO films using X-ray diffraction (XRD) analysis. The structural surface is studied with scanning electron microscopy (SEM).UV-visible spectroscopy investigates the optical properties.

XRD analysis shows the presence of the hexagonal wurtzite phase for the pure ZnO thin film sample, while the PEG-added ZnO thin film displays a similar phase with additional microstructural changes. The SEM micrograph reveals that the film without PEG is porous, and the porosity increases with the addition of an appropriate amount of PEG.. The transmittance spectrum shows high transmittance in the visible region. The ZnO thin film with 0.6 g of PEG exhibits a transmittance of approximately 90%, which is higher than the transmittance of the film without PEG, recorded at about 80%.

Keywords: surfactant, PEG, ZNO, Sol Gel, Thin Films

ID: Mat-P-54

On the correlation between Dynamic Strain Aging and Plastic Instabilities in an Al-2.5% Mg Alloy

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Abstract: The Portevin-Le Chatelier (PLC) effect, which causes jerky flow, is studied in an Al-2.5% Mg alloy at room temperature under uniaxial tension. The results show that dynamic strain aging (DSA) becomes more significant as strain hardening progresses, leading to increasingly pronounced heterogeneous plastic flow. Localized plastic strain bands were identified through hardness measurements, which revealed higher values in the localized strain zones compared to the surrounding areas. These findings indicate that the overlapping of multiple bands leads to the superimposition of hardness zones, highlighting the correlation between strain localization and material hardening, as well as its link to plastic instabilities. A statistical analysis of stress drops reveals a power-law distribution at low strain levels and an asymmetrical Gaussian distribution at high strain levels. This transition reflects a decrease in the spatial correlation of plastic events, indicating shifts in the PLC dynamic regime as the strain level changes. These results are discussed in accordance with DSA mechanisms.

Keywords: Portevin-Le Chatelier effect, Strain localization, Mechanical behavior, Vickers hardness, Statistical analysis

ID: Mat-P-55

Reactivity of ZnO oxide catalyst in the production of 3,4-dihydropirimidinone via Biginelli reaction. Kinetic and modelling study

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Abstract: The objective of this work is focused on the kinetic study of the production of 3,4-dihydropyrimidinone molecule (DHPM) via Biginelli multicomponent reaction in the presence of ZnO oxide catalyst. The Biginelli studied reaction has been carried out using benzaldehyde, ethyl acetoacetate and urea as reagents in solvent free conditions by varying several reaction parameters such as catalyst and urea amounts, reaction time and temperature. The preliminary catalytic tests confirmed the in-situ thermal decomposition of urea to ammonia in the presence of water leading to the contribution of the formed ammonia in the parallel Hantzsch reaction and thus decreasing the DHPM production via Biginelli reaction. A negative effect of the catalyst mass increase on the DHPM yield has been noticed confirming the switching effect between Biginelli and Hantzsch reactions due to the contribution of catalyst in both reactions. The variation of the urea amount has no influence on the DHPM yield. The kinetic modelling performed at different reaction temperatures, with an order 1 toward benzaldehyde and ethyl acetoacetate for a reaction time of 2 h and with a catalyst mass of 10 mg by setting benzaldehyde and ethyl acetoacetate as limiting reactants leads to an activation energy of 59.9 kJ.mol-1 with a pre-exponential factor of 2.01 x 108 L.mol-1.min-1.g-1.

Keywords: ZnO oxide, Biginelli reaction, Kinetic modelling

ID: Mat-P-56

Computational analysis of the influence of process parameters on the flow field of a plasma jet

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Abstract: This research presents a numerical simulation of plasma thermal spraying with substrate interaction. In this work, a 2-D axisymmetric numerical simulation of plasma thermal spraying using the ANSYS-CFD code will be presented, taking into account the fluid interaction with the substrate during the process. Understanding the impact of the grid on simulation accuracy is crucial, as the independence of the grid from numerical results was studied through four grids to enhance the efficiency of plasma thermal spraying. Two turbulence models, k-w (SST-k-w) and k- ε (RNG-k-ε), were utilized. Argon gas was used at the nozzle outlet in the first stage of this work. A numerical study of plasma thermal spraying was conducted, and the experimental and numerical results were compared. It was found that the CFD simulation results agree well with the experimental results, and the calculations were performed according to computational fluid dynamics. To further this study, we will discuss the dynamic and thermal aspects of plasma spraying to optimize the process in the near future.

Keywords: plasma, thermal spray, RNG-k-ε, SST-k-w, argon, ANSYS-FLUENT CFD, 2-D axisymmetric

ID: Mat-P-57

Development of a Magnetic Carbon Nanotube-Based Nanocomposite with Goethite for Efficient Adsorption of Congo Red Dye from Aqueous Solutions

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Abstract:

Carbon nanotubes are nanomaterials that have seen significant development in recent years, characterized by their fibrous structure, large accessible external surface area, and well-developed mesopores. However, the prohibitively high cost of these materials remains a major obstacle to their application across various fields, particularly in water purification. On the other hand, the use of magnetic particle technology to engineer novel nanomaterials has garnered considerable attention in recent years.

In this context, the primary objective of this work is to prepare a novel material that combines the high adsorption capacities of carbon nanotubes with the magnetic properties of iron. Specifically, this involves developing a nanocomposite based on double-walled carbon nanotubes and iron oxyhydroxides, such as α-FeOOH. Subsequently, the study aims to demonstrate the efficacy of this nanocomposite in adsorption processes for the removal of Congo red dye from aqueous solutions under static batch conditions.

The nanomaterial (DWCNTs/α-FeOOH) was synthesized via precipitation. The synthesized adsorbent was characterized using Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), specific surface area analysis (BET), and zeta potential measurements.

The adsorption of methyl orange onto the nanomaterial was investigated by studying adsorption kinetics, pH effects, adsorbent mass, and initial dye concentration. The maximum adsorption capacity was found to be 17.5 $mg \cdot g^{-1}$ at pH 7 and an initial methyl orange concentration of 10 $mg \cdot L^{-1}$. The adsorption process was determined to follow second-order kinetics. Isotherm modeling revealed that the Langmuir model best described the adsorption process, with a high correlation coefficient ($R^2 = 0.97$).

Keywords: Carbon Nanotubes ; nanomaterial; Adsorption; Congo Red; α-FeOOH

ID: Mat-P-58

Synthesis of PPH/Ag nanocomposite hydrogel for antimicrobial application

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Abstract: In this work, a nanocomposite hydrogel (NCH) was synthesized by integrating silver nanoparticles (Ag NPs) into a potassium polyacrylate hydrogel (PPAH) matrix using a simple in-situ reduction approach. This process involved two key steps: (i) loading Ag^+ ions from silver nitrate ($AgNO_3$) solution into the hydrogel matrix at varying concentrations (2, 5, 10, and 16 mM) and (ii) reducing the embedded Ag^+ ions using sodium borohydride ($NaBH_4$) at different concentrations (4, 10, 20, and 32 mM) to form Ag NPs. The synthesized NCH was specifically designed for antimicrobial applications. Characterization techniques such as UV-Vis, FTIR, and XRD confirmed the successful formation of well-distributed silver nanoparticles within the hydrogel, with an average crystallite size of 31.83 nm. Antimicrobial testing against three bacterial strains—Pseudomonas aeruginosa ATCC 27853, Escherichia coli ATCC 25922, and Staphylococcus aureus ATCC 25923—demonstrated excellent antibacterial activity. Particularly, the PPAH/Ag NPs exhibited superior antimicrobial efficacy compared to conventional antibiotics such as Ofloxacin. This research demonstrates the promising potential of PPAH/Ag NCH as a highly effective and versatile antimicrobial agent, with implications for a wide range of applications in areas where controlling microbial growth is of utmost importance.

Keywords: Silver nanoparticles; Potassium polyacrylate hydrogel; Nanocomposite hydrogel; Antimicrobial.

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Synthesis, Characterization and in vitro Antioxidant Activity of Novel Thiadiazole Derivatives

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Abstract:

Thiadiazoles are important synthetic targets for both academic research and the pharmaceutical industry, owing to their presence in a wide range of natural products, synthetic materials, and bioactive compounds. In this study, we describe the synthesis of new thiadiazole derivatives through a multicomponent reaction involving hydrazine or phenylhydrazine, substituted aromatic aldehydes, and potassium thiocyanate (KSCN). The in vitro antioxidant activity of the synthesized compounds was assessed using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay and the total antioxidant capacity (TAC) method. The structures of the newly synthesized compounds were characterized using proton (1H) and carbon (13C) nuclear magnetic resonance (NMR) spectroscopy, Fourier Transform infrared (FT-IR) spectroscopy, mass spectrometry, and elemental analysis.

Keywords: Thiadiazole; Multicomponent reaction; antioxidant activity; Total Antioxidant Capacity (TAC).

ID: Mat-P-60

Biosynthesis and Photocatalytic Applications of Nanocomposites Using Plant Leaf Extract for Dye Degradation

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Abstract: This research explores the eco-friendly synthesis and practical applications of Hematite@Zinc Oxide Nanocomposites derived from plant leaf extracts, utilized as natural agents to promote sustainable material development for environmental cleanup. Structural analysis verified the successful formation of the nanocomposites, revealing a well-defined crystalline and porous morphology with evenly distributed particles. Spectroscopic techniques confirmed the presence of key chemical bonds, affirming the material's purity. Optical studies highlighted the nanocomposites' promising light-absorption properties, suitable for photocatalytic processes. The Hematite@Zinc Oxide Nanocomposite exhibited exceptional performance in degrading both anionic and cationic dyes under sunlight, including the degradation of Rose Bengal (RB) dye, demonstrating efficient photocatalytic activity. These findings emphasize the potential of green-synthesized Hematite@Zinc Oxide Nanocomposites as a versatile solution for treating dye-polluted wastewater, supporting advancements in sustainable environmental technologies.

Keywords: Hematite@Zinc Oxide Nanocomposite; Rose Bengal; Dye Degradation; Biosynthesis

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ID: Mat-P-61

Chemical synthesis of nanocomposites via in-situ polymerization of pyrrole using Activated carbon

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Abstract: The focus of this research is to synthesis nanocomposite by in situ chemical polymerization. The nanocomposite was prepared by adsorption of monomer into Activated carbon leads to significant improvements in its mechanical and thermal properties when compared to the virgin polymer. Due to their large surface area interacting with the polymer matrix, . The synthese was carried out using ammonium persulfate as oxidant . The resulting nanocomposite was investigated and confirmed by UV-visible, FTIR spectroscopy .The FTIR and UV-vis spectroscopic results also confirmed the presence of pyrrole in the nanocomposite.

Keywords: Nanocomposites, conducting polymers, pyrrole ,activated carbon

ID: Mat-P-62

Effect of porosity on bending of FG sandwich beams using HSDT theory

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Abstract: This work presents a simplified approach for analyzing the static bending of advanced composite beams, specifically functionally graded materials (FGMs) with various porosity distributions. The method is based on a higher-order shear deformation theory, which offers several advantages:Reduced complexity: Requires fewer unknowns and governing equations compared to conventional methods.Improved accuracy: Accounts for thickness stretching effects, leading to more precise results.The governing equations are derived using the virtual work principle, and analytical solutions for static bending are obtained via the Navier solution. The proposed method demonstrates strong agreement with existing literature on FGMs and other advanced composite beams. Finally, numerical results illustrate the influence of material distribution (including power-law FGMs), geometry, and porosity on beam deflections,and stresses.

Keywords: beams1, functionally graded materials2, porosity3, Navier solution4; virtual work5

ID: Mat-P-63

docking study to treat the Omicron variant of COVID-19 infection using biosynthesized nanocomposites.

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Abstract: The global health crisis brought about by the SARS-CoV-2-induced COVID-19 pandemic has underscored the need for immediate endeavors to identify effective treatments. Molecular docking has emerged as a valuable resource in the field of drug discovery, enabling the investigation of potential interactions between small molecules and target proteins.in this study, molecular docking studies were conducted to upgrade Fe3O4 nanoparticles to ZnO@Fe3O4 NC to enhance composite efficiency. Leveraging the FDA-approved use of Fe3O4 nanoparticles and their known antiviral activity, our docking experiment demonstrated promising results in the interaction between ZnO@Fe3O4 nanocomposite and the spike protein receptor-binding domain of SARS-CoV-2 S Omicron. These findings suggest that ZnO@Fe3O4 nanocomposite could potentially inhibit virus attachment to host cell receptors more stably, providing a promising avenue for further exploration in developing effective medications against SARS-CoV-2.

Keywords: SARS-CoV-2 S Omicron Spike; ZnO@Fe3O4 nanocomposite; Molecular docking.

ID: Mat-P-64

Analysis of mechanical properties at different rotation speeds and elongation of friction-welded steel

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Abstract:

Welding is one of the most common methods used to join materials of a similar or dissimilar nature. When welding, filler metal may or may not be used. In the case of friction welding, no filler metal is used. In this case, the material itself acts as the filler metal. Friction welding is used to join two parts, at least one of which is rotating, with this movement causing the temperature to rise until the two parts are joined. In this work, we study the evolution of the hardness and tensile strength of an A3 cylindrical specimen made of ordinary steel during friction welding at minimum and maximum rotation speeds, as well as their elongation as a function of the applied stresses. The consequences of this difference give an idea of the strength of these specimens, since any increase in material heat during rotation leads to an increase in hardness in the welded zone.

Keywords: Friction welding; rotational movement; hardness; tensile force; rotation speeds.

ID: Mat-P-65

EDTA and Ni-Anderson Polyoxometalate: A New Supramolecular Hybrid as an Effective Electrocatalyst for Alkaline Water Splitting.

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Abstract: Hydrogen production via water electrolysis requires efficient catalysts to overcome energy barriers in alkaline conditions. This study introduces a novel organic-inorganic supramolecular hybrid material, $\{[Na_6(CoEDTA)_2(H_2O)x]\bullet(NH_4)_3[NiMo_6O_{18}(OH)_6]\bullet xH_2O\}_n$ (Hybrid-1), synthesized from Co-EDTA and Ni-Anderson polyoxometalate (POM) under hydrothermal conditions. Advanced characterization techniques, including UV-Vis, FTIR, TGA, PXRD, BET, SEM, XPS, and EDX, validated its structure and composition. Hybrid-1 exhibited exceptional electrocatalytic performance, achieving low overpotentials of 80 mV (HER) and 111 mV (OER), with Tafel slopes of 45 mV dec^{-1} (HER) and 48.8 mV dec^{-1} (OER). Its high electrochemical surface area (ECSA), double-layer capacitance (Cdl), and 30-hour stability further enhanced its catalytic efficiency. The synergistic integration of Co-EDTA and Ni-Anderson POM endows Hybrid-1 with remarkable structural and electrocatalytic properties, positioning it as a promising catalyst for efficient water-splitting applications.

Keywords: Co-EDTA Supramolecules; HER & OER; Water Electrolysis; Anderson Polyoxometalate (POM); Organic-Inorganic Hybrid; Alkaline Environment.

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Investigation of surface roughness profile during grinding of composite materials

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Abstract: The grinding of composite materials involves refining the surface of a composite material to achieve precise geometry and tolerances. This step is often necessary after manufacturing or molding to ensure a high-quality finish, dimensional accuracy and optimum mechanical properties. During the process, we achieve a smooth, flat surface by carefully removing a light layer of material, followed by microscopic analysis of surface quality at each grinding stage and 3D roughness measurement. As with all composites, grinding heat can have an impact on the polymer matrix and plastic fibers.

Keywords: composite materials; grinding; roughness; matrix; fibers; grinding depth.

ID: Mat-P-68

Effect of Cd Doping on Structural, Optical and electrical Studies of Nano CuO Films Prepared by Sol–Gel spin coating Technique

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Abstract: Undoped and Cd-doped CuO thin films were prepared using sol gel spin coating technique over glass substrates with cadmium doping concentrations varied from 0 to 8 at.% in increments of 2 at.%. The effects of Cd doping on the structural, optical, and electrical properties of CuO thin films are reported. X-ray diffraction (XRD) spectra of pure and Cd-doped CuO films reveals a polycrystalline with a monoclinic structure and a slight shift in peak positions due to Cd incorporation. The AFM images showing a modification in grain size and decrease of surface roughness due to Cd doping. UV-Vis-NIR spectroscopy showed that CuO and Cd doped CuO thin films are highly transparent in the NIR region. Optical band gap of CuO thin films increased with increasing of the Cd concentration. Hall Effect measurements indicated that the films are n-type semiconductor. An improvement in the electrical conductivity of the films, suggesting enhanced carrier concentration due to Cd doping. The sol-gel spin-coated films are exceptionally well-suited for modern applications, including hydrogen production through water splitting, gas sensing, and various optoelectronic technologies.

Keywords: sol gel spin coating technique; thin films; Cadmium; Cupric oxide

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ID: Mat-P-69

Comprehensive approach to fracture mechanics applied to composite materials (Case of polymers)

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Abstract: In this paper, the high-density polyethylene (HDPE) is a polymer model of the family of semi-crystalline; it represents a real industrial interest since it is one of the most produced thermoplastic polymers in the world. The study of the deformation and damage behavior and breaking HDPE was proposed from experimental and numerical approaches. Two approaches to energy (J integral and EWF) of fracture mechanics were examined on two types of specimens (CT, DENT) under tension. We conclude that the EWF method for its simplicity is the most suitable parameter for characterizing the intrinsic break our material.

Keywords: High density polyethylene; Triaxiality; Fracture; J integral; EWF method; Damage models; Finite element computations.

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The Influence of Temperature on Cracked Plate in fretting fatigue

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Abstract: Contact plate/pad fretting fatigue is the focal point of aerospace structural component durability. This paper deals with temperature and its effects on crack growth through fretting in Aluminum 2024-T3 plates. Fretting behaviors with changes to the material, stress intensity factor, and growth of cracks across different temperatures were illustrated using Abaqus simulation. The study shows that with rising temperature, contact pressure reduces and the contact area expands. Moreover, the pattern of shear stress shows clear slip and stick zones, and temperature changes stress symmetry. The stress intensity factor (K1) reduces because of material softening and stress spreading, which slows down crack growth. These results show that heat plays an important role in fretting fatigue. They also continue to say that fatigue life prediction models should be able to simulate the material behavior at different temperatures.

Keywords: Fretting fatigue; temperature effects; numerical simulation; stress intensity factor.

ID: Mat-P-71

The Impact of Physical and Geometric Parameters on the photonic Band Gap PBG Width in Photonic Crystals PhC

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Abstract: The photonic band gap is a crucial property in photonic crystals PhC, influencing their ability to control the propagation of electromagnetic waves within specific frequency ranges. This gap arises due to the periodic structure of photonic crystals, which creates band gaps for photons similar to how semiconductors create electronic band gaps. The width of the optical band gap plays a significant role in determining the performance and applications of photonic crystals in devices such as waveguides, filters, and sensors. Various physical and geometric parameters, including the material properties, lattice structure, and dimensions of the crystal, can significantly impact the size and behavior of the optical band gap. Understanding these influences is essential for optimizing photonic crystals for specific applications in fields like telecommunications, imaging, and optical communications. This study explores the effect of these parameters on the width of the optical band gap, shedding light on the factors that govern the performance of photonic crystals in practical scenarios.

Keywords: photonic crystal (PhC);photonic band gap (BIP);refractive index (RI);form factor (FF)

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Étude numérique et évaluation des réactions sous contrainte mécanique d'une plaque percée d'une cavité centralisé

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Abstract: Une charge statique est définie comme une force appliquée progressivement à un composant mécanique et dont l'intensité et la direction ne varient pas dans le temps. Souvent, la présence de trous dans un corps le rend sujet à une concentration de contraintes, ce qui entraîne une augmentation des contraintes à proximité de ces concentrateurs de contraintes par rapport à la contrainte nominale. Cette contrainte peut être déterminée par des méthodes analytiques ou d'autres méthodes appropriées, telles que l'analyse par éléments finis (AEF). L'AEF divise (discrétise) la structure (autrement continue) en petites sous-structures élastiques finies et bien définies (éléments). Dans la présente étude, une plaque élastique continue de dimensions 400 mm x 100 mm x 10 mm, en acier, avec un trou elliptique central de grand axe de 10 mm, a été modélisée et discrétisée à l'aide d'un logiciel commercial d'éléments finis, ANSYS. Le petit axe a été déterminé pour chaque cas en fonction du rapport d'aspect correspondant. La plaque est discrétisée avec des éléments SOLID95, disponibles dans la bibliothèque d'éléments d'ANSYS. Le modèle est analysé pour différents rapports d'aspect (0,2, 0,4, 0,6, 0,8 et 1,0) du trou elliptique, en maintenant les dimensions de la plaque constantes. La valeur maximale de la contrainte équivalente de Von Mises et la déflexion de la plaque sous une pression constante sont déterminées à l'aide d'ANSYS. L'effet de la géométrie du trou sur la distribution des contraintes autour de celuici est étudié. Les résultats des différentes analyses sont présentés à l'aide de tableaux, de graphiques et de diagrammes nodaux fournis par ANSYS.

Keywords: Contraintes – Ansys – Déplacement – Analyse – MEF - Von-Mises

ID: Mat-P-73

Physico-mechanical properties and durability of mortars based on dune sand

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Abstract: The abundance of dune sand, particularly in the Sahara deserts that occupy a large part of the Algerian territory, the idea of promoting its valorization in the manufacture of concrete and mortars is of great economic importance. Dune Sand in concrete or mortar is a material composed of dune sand with different percentage, where sand dunes replaces alluvial sand. Although this material is promising, it has some drawbacks, such as a high content of fine grains, which increases the specific surface area and requires more cement. This can lead to excessive heat of hydration and reduced mechanical strength. Additionally, increased capillary absorption reduces impermeability and increases shrinkage. Research in Algeria aims to optimize this material, particularly in sand-rich regions like the south. The solutions explored include: Granular correction: Mixing coarse and fine sands to improve mechanical performance. Durability of dune sand concrete. The goal is to develop high-performance mortars suitable for hot and dry climates, characterizing their mechanical behavior and long-term resistance, especially against sulfate attacks.

Keywords: dune sand, Mortar, mechanical behavior, durability, sulfate.

ID: Mat-P-74

In vitro study of biosynthesized silver nanoparticles using Nigella sativa extract against SARS-CoV-2

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Abstract: Pathogens resistant to multiple drugs, commonly known as superbugs, pose a significant threat to human health. Consequently, the search for potent, safe, and viable antimicrobial alternatives is crucial. In this study, an eco-friendly and rapid method for synthesizing silver nanoparticles (AgNPs) using Nigella sativa seed extract was developed. Characterization techniques such as ultraviolet-visible (UV-Vis) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDX), and Zeta potential analysis confirmed the formation of AgNPs. SEM images revealed agglomerated spherical AgNPs with an average size of ~50 nm. The optical band gap energy was determined to be 2.43 eV (direct) and 1.87 eV (indirect). The antiviral activity of AgNPs was evaluated against the XBB.1.5 SARS-CoV-2 variant, revealing their ability to suppress viral replication. These findings suggest that AgNPs hold promise as therapeutic agents, particularly against multidrug-resistant viral strains. However, further research is necessary to elucidate their mechanism of action and assess their biosafety.

Keywords: Nigella sativa; Silver nanoparticle; Antiviral activity; Pathogens resistant

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Synthèse verte des nanoparticules de ZnO à l'aide d'un extrait de plante et caractérisation.

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Abstract:

La recherche en nanotechnologie connaît une croissance rapide de nos jours en raison des propriétés uniques des nanomatériaux, telles qu'une conductivité électrique et thermique élevées, une grande stabilité chimique, un pouvoir oxydant puissant, une activité photocatalytique élevée, une combinaison de dureté et de ductilité, ainsi qu'une résistance mécanique accrue et de bonnes propriétés optiques.Cette étude propose une méthode écologique et économique pour la synthèse de nanoparticules d'alumine (ZnO) en utilisant des extraits de feuilles de Calligonum comosum L. Les groupes fonctionnels impliqués dans cette synthèse verte ont été caractérisés à l'aide de spectres FT-IR, des motifs de diffraction des rayons X (XRD), et d'analyses UV-Vis des nanoparticules ZnO.

Par ailleurs, cette méthode met en avant l'importance de réduire l'utilisation de réactifs chimiques toxiques, favorisant ainsi des procédés respectueux de l'environnement. Les résultats obtenus montrent une bonne homogénéité et pureté des nanoparticules synthétisées, ce qui ouvre la voie à des applications potentielles dans divers domaines, tels que la catalyse, les matériaux composites, ou encore les dispositifs optoélectroniques.

Keywords: Synthèse verte; Nanoparticules; UV-Vis; FTIR; XRD.

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ID: Mat-P-76

Study of Structural Characteristics of Sand from the HASSANI Abedlkrim Sand - ElOued-Region

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Development of Renewable Energies in Arid Zones-ElOued

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Abstract: This paper aims to study the structural characteristics of HASSANI Abedkarim -Eloued- sand as a farming region. The chosen sample to X-ray diffraction (DRX) and Fourier transform infrared (FTIR) analyses. DRX shows that there are many phases, which are quartz, Calcite, Fe_2O_3, Al_2O_3, and KO_2. As well, the result appears that the predominant phases are Fe_2O_3 and Al_2O_3. Through FTIR spectrum, the bonds of $Si-O-Si$, $O-H$, and $(CO_3)^{-2}$ are the bonds existing in this sand

Keywords: sand, DRX, FTIR, phases, bonds.

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ID: Mat-P-77

Hydrothermal Synthesis of Nanostructured CdSe Semiconductor powder for photodetectors application

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Abstract: Nanostructured semiconductor samples of cadmium selenide (CdSe) powder were synthesized hydrothermally using various protocols. The obtained samples were then annealed at 200 °C for different durations (0, 4, 8, and 12 hours). To achieve well-crystallized powders with a stable phase structure, the structural, morphological, and optical properties of all hydrothermally synthesized samples were analyzed. The study focused on monitoring changes in these properties as a function of annealing time to optimize crystallization. Additionally, the elemental composition was examined to confirm the presence of Cd and Se, in the expected atomic ratios, ensuring the absence of impurities from elemental solutions. This characterization required the use of multiple analytical techniques. X-ray diffraction (XRD) analysis of the CdSe powders after specific annealing durations revealed the formation of a hexagonal wurtzite phase with nanocrystalline domains of approximately 13 nm. These findings were further corroborated by Environmental Scanning Electron Microscopy (ESEM), which showed a granular morphology. Energy Dispersive X-ray (EDX) spectroscopy confirmed the presence of CdSe as a stable phase, while Fourier Transform Infrared (FTIR) spectroscopy further validated these results.

Keywords: Hydrothermal,; Nanostructured,; Semiconductor; Photodetectors,; CdSe.

ID: Mat-P-78

Experimental investigation of the influence of silica and clay nanoparticles in chemical flooding to improve residual oil recovey

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Abstract: The study investigates the synergistic effects of silica nanoparticles, nanoclayand their combinations in nanoflooding to enhance oil recovery efficiency and mitigate asphaltene deposition. Two micromodel cases were studied: a cylindrical sand model and a cylindrical asphaltenic sand model. Various formulations including silica nanoparticles with different concentrations (0.01%, 0.05%, 0.1%, 0.5%), nanoclay concentrations (0.001%, 0.005%, 0.01%) to stabilize the nanomaterials and enhance the displacement efficiency we did add a biopolymer with the concentration of0.1/100ml, also we added a surfactant to the injected solution to keep the dispersion of nanomaterials and reduce the interfacial tension. Experimental setups simulated reservoir conditions, focusing on nanoparticle interactions with reservoir fluids and rock surfaces. Core flood experiments revealed that silica nanoparticles alone increased the recovery factor, with further enhancements observed at higher concentrations (0.1% optimal) and with the addition of biopolymer.

Keywords: Nanoflooding; silica nanoparticles; nanoclay, biopolymer; surfactant; interfacial tension.

ID: Mat-P-79

Comparative Analysis of Essential Oils from Two Medicinal Plants: Extraction, Characterization, and Antidiabetic Potential

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Abstract: The present study explores the extraction and bioactivity of essential oils derived from two medicinal plants with potential antidiabetic properties. The oils were extracted using hydrodistillation and analyzed through gas chromatography-mass spectrometry (GC/MS) to determine their chemical composition. Their antidiabetic activity was assessed through in vivo and in vitro experiments, evaluating their effects on key metabolic enzymes. Additionally, molecular docking and molecular dynamics simulations were performed to predict their interactions with targets involved in glucose regulation. This comparative analysis provides new insights into the pharmacological applications of essential oils in diabetes management.

Keywords: Essential oils, GC/MS profiling, Antidiabetic evaluation, Computational study, Metabolic enzymes.

ID: Mat-P-80

Intelligent Design and Optimization of Transdermal Patches for Enhanced Vitamin C Delivery: Innovations in Materials Science and Environmental Sustainability.

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Abstract: In this research, we leveraged the power of artificial intelligence to formulate transdermal patches containing vitamin C. The database originated from experimental findings centered around the phenomenon of vitamin C release within a phosphate-buffered saline solution. This collection of data underwent conversion into dimensionless values, encompassing various concentrations of chitosan (Chi) and sodium-alginate (Alg), as well as release time (t). In this study, a methodology was given to select the ANN model to predict the diffusion of vitamin C on the skin. The objective of this study was to select the best model. The methodology begins with extensive research to select a model with minimum complexity and optimal performance. The number of observed data used in ANN is 320, which are divided into three sections: the training set (256 data), the test set (32 data) and validation set (32 data). By exploring different ratios of chitosan (Chi) and sodium-alginate (Alg) biopolymers, and incorporating glycerol and Tween 80% as plasticizers and permeation enhancers, we aimed to optimize the delivery of vitamin C. Comprehensive evaluations were conducted on the physicochemical attributes of eleven patches (F1 to F11). These evaluations encompassed parameters such as thickness, which ranged from 0.12 mm for F9 to 0.44 mm for F2, as well as folding endurance and moisture content. Through advanced techniques such as Fourier-transform infrared (FTIR) analysis, we confirmed the interaction between Chi and Alg while ensuring no interaction with the drug (Vit C), indicating successful encapsulation of vitamin C in our formulations. By employing MATLAB, we constructed a robust architecture featuring three inputs in the input layer, a hidden layer comprising eight neurons, and an output representing the drug delivery percentage (DD%). The ANN model exhibited exceptional accuracy in predicting the release kinetics of vitamin C from each formulation, as demonstrated by the high R2 value of 0.99973. The model's performance was further validated with low root mean square error (MSE = 0.244036) and absolute relative error (ARE max = 2.441), resulting in an overall satisfactory root mean square error (RMSE = 0.4940). In order to control the drug delivery, and after conducting a sensitivity analysis, it found that all input variables have strong effect on the estimation of the drug delivery. This study showcases the successful integration of artificial intelligence techniques in the optimization of transdermal patches for vitamin C delivery. By leveraging the capabilities of ANN modeling, we have achieved precise control and prediction of drug release kinetics, opening new avenues for the development of intelligent and targeted transdermal drug delivery systems.

Keywords: ANN modeling; Biomaterials, Vitamin C; drug delivery; encapsulation; transdermal patches.

ID: Mat-P-81

Étude de la Photocatalyse de Fe_2O_3 pour la Dégradation du Bleu de Méthylène

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Abstract: L'oxyde de fer(III) (Fe_2O_3) est un matériau semi-conducteur aux propriétés photocatalytiques prometteuses, notamment dans le traitement des polluants organiques. Cette étude explore son efficacité dans la dégradation du bleu de méthylène (MB) sous irradiation LED et halogène, en fonction de la température de calcination (1000°C et 1100°C).

Les analyses XRD ont montré une cristallisation plus complète à 1100°C, tandis qu'à 1000°C, des phases secondaires persistent. L'analyse FTIR a révélé des bandes caractéristiques des liaisons Fe–O–Fe (~450-500 cm^{-1}) et O–Fe–O (~900 cm^{-1}). Les images SEM ont montré une croissance cristalline significative, avec des particules de 0,3 à 6 µm, tandis que l'analyse EDX a confirmé une augmentation de la teneur en fer (de 78,61% à 81,15%), indiquant une amélioration de la cristallinité.

L'évaluation photocatalytique a révélé que Fe_2O_3 présente une efficacité maximale de 73,86% sous LED en milieu basique, contre 30% sous halogène. En milieu acide, la dégradation est plus faible, montrant une forte dépendance au pH. De plus, à faibles concentrations (1-10 mg/L), l'efficacité dépasse 90%, mais diminue avec l'augmentation de la concentration en polluant.

Ces résultats démontrent que Fe_2O_3 est un bon photocatalyseur sous lumière LED en milieu basique, mais que son efficacité reste limitée par la recombinaison des paires électron-trou, nécessitant une optimisation pour des applications environnementales avancées.

Keywords: Fe_2O_3; Photocatalyse; Dégradation; Bleu de méthylène; LED; Halogène.

ID: Mat-P-82

Biosynthesis and characterization of novel nanocomposite ZnO/BaMg2 efficiency for high speed adsorption of AZO dye

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Abstract: In this study, a new ZnO/BaMg2 nanocomposite was synthesized, using the green synthesis method in which lemon peel extract was used as a reducing agent to form ZnO/BaMg2 nanocomposites. The synthesized nanoparticles were characterized by visible and ultraviolet light spectroscopy showing absorption peaks at around 277 nm. The chemical bond configurations of ZnO/BaMg2 were confirmed by Fourier Transform Infrared (FT-IR) spectroscopy analyses. The results of X-ray diffraction (XRD) analysis revealed the formation of a hexagonal crystal structure, and the particle SEM analyzes showed irregular shapes around 45 nm for the synthesized nanoparticles. The catalytic activity of synthesized ZnO/BaMg2 in the decomposition of Methyl Orange (MO) and Rose Bengal (RB) dyes was studied by visible and UV-vis spectroscopy . The decolorization ratios of both dyes for ZnO/BaMg2 composite were 90.2% . and 98.71% of , for RB and MO, respectively within 120 minutes.

Keywords: Biosynthesis · Nanocomposite · ZnO/BaMg2 · Characterizations · Dye degradation

ID: Mat-P-83

Tuning Optical and Electronic Properties of Nickel Thin Films with Aluminum Oxide

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Abstract: Nickel oxide (NiO) thin films are pivotal in optoelectronic devices due to their distinctive optical and electrical properties, yet optimizing these characteristics through doping remains crucial for enhancing device performance. This study explores the impact of aluminum (Al) doping on NiO thin films, synthesized via spray pyrolysis. Using nickel nitrate hexahydrate as a precursor, films were deposited on glass substrates at 450–500°C with Al concentrations ranging from 0% to 2%, followed by optical and electrical characterization. Optical analysis revealed that increasing Al doping reduces light transmission and narrows the optical bandgap from 3.71 eV to 3.46 eV, while the Urbach energy rises from 0.231 eV to 0.379 eV, signaling heightened structural disorder. Electrically, conductivity initially drops due to compensation of native defects by Al^{3+} ions, reaching a minimum at ~0.5% Al, then increases with higher doping, reflecting shifts in defect dynamics and band structure. These findings underscore Al doping's potential to fine-tune NiO properties, offering valuable insights for optimizing its application in hole transport layers for solar cells and transparent conductive oxides, thus advancing energy conversion and transparent electronics technologies.

Keywords: Nickel oxide;Thin films; Aluminum doping; Spray pyrolysis; Optoelectronics

ID: Mat-P-84

Stress Analysis of Ankle-Foot Orthosis under Applied Forces: A Finite Element Modeling Approach

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Abstract: This study utilizes finite element modeling to assess how varying applied forces impact the performance of the polymer ankle-foot orthosis (AFO) model produced using 3D printing technology, with the aim of improving their production. The study involves a numerical simulation that replicates real-life conditions to analyze stress distribution and predict the resistance of AFO under different loading scenarios. By incorporating the experimental mechanical properties of the polymer material in the AFO model, the critical regions and stress concentrations are predicted, leading to the determination of the evolution of forces up to the maximum tolerable value. The comparison of stiffness results highlights the optimization and prediction to manufacture a well-designed AFO model before the 3D printing

Keywords: Polymer ; 3D Printing ; Ankle-Foot Orthosis ; Force ; Finite Element Modelling

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Optimization and Characterization of Friction Stir Welding of 7075 T6 Aluminum Alloy

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Abstract: Friction stir welding (FSW) is emerging as a promising alternative to conventional welding processes for high-strength aluminum alloys. This study explores the optimization of process parameters for the joining of homogeneous sheets of 7075 T6 aluminum alloy, widely used in the aerospace and automotive industries due to its excellent strength-to-weight ratio.

Four welding trials were conducted, varying the tool's feed rate and rotation speed to analyze their impact on weld quality. The evaluation combined non-destructive testing through X-ray inspection and mechanical characterization via tensile and microhardness tests. Observations revealed improved homogeneity in the weld zone and a significant reduction in internal defects such as porosity and cracking, which are commonly encountered in MIG and TIG welding processes.

The results show that the tensile strength achieved in FSW exceeds 300 MPa, representing an improvement of 30 to 35% compared to MIG and TIG welding. This study confirms the superiority of FSW in terms of mechanical strength and weld quality, highlighting its potential for integration into demanding industrial applications.

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Keywords: Friction Stir Welding (FSW), 7075 T6 Aluminum Alloy, Welding Optimization, Mechanical Characterization, Tensile Strength.

ID: Mat-P-86

Investigation of structural, morphological, optical and electrical properties of doped and co-doped Co3O4thin films.

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Abstract: Spray pyrolysis successfully synthesizes doped and co-doped thin films using the formula $Cu_xBi_{0.04}Co_3O_4$($x = 0.0, 0.02, 0.04, 0.06, 0.08$, and 0.1). So, the prepared samples were examined for structural, surface morphology, and optical properties using X-ray diffraction (XRD), scanning electron microscope (SEM) analyses, and ultraviolet–visible spectrophotometer (UV–Vis). X-ray diffraction (XRD) analysis of all the samples verifies the presence of a single-phase spinel cubic structure, devoid of further heterogeneity or structural transition. The direct band gap Eg2 has decreased to 2.04 eV.

Keywords: Co doped, thin films, spray pyrolysis, Co_3O_4

ID: Mat-P-87

In vitro antibacterial and antifungal properties of fused pyrrolo[1,2-a]benzo[d]imidazole derivatives.

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Abstract: Here we describe pyrrolo[1,2-a]benzo[d]imidazole derivatives with antibacterial and antifungal activity. A novel series of pyrrolo[1,2-a]benzo[d]imidazole derivatives, labeled as compounds 1a-c, was synthesized using multicomponent reactions. All the compounds presented here were obtained with high yields and under easy experimental conditions. Synthesized compounds were characterized by IR, 1H NMR and 13C NMR. Synthesized compounds were screened against E.coli and S. aures for antibacterial activity, as well as against C. albicans for antifungal activity. We were able to obtain compounds with moderate to good results compared to the reference compounds (Gentamitcin and Nystatin).

Keywords: Pyrrole, imidazole, multicomponent reaction, antibacterial activity, antifungal activity.

ID: Mat-P-88

Synthèse et caractérisation d'un nano-composite hybride à base d'hydroxyapatite co-dopée en Zn/Mg et d'amidon

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Abstract: Ce travail porte essentiellement sur la synthèse d'un nouveau nano-composite hybride à base d'une hydroxyapatite co-dopée (en Zn/Mg) préparée préalablement par la méthode de précipitation et d'amidon. Ce composite est synthétisé suivant un protocole de lixiviation bien défini (50% HAp co-dopée et 50% d'amidon). L'identification de ce nouveau nano composite est réalisée par différentes techniques d'analyses :(MEB /EDX ; DRX ; IRTF). Les résultats de MEB ont montré que la morphologie de surface est agglomérée avec de petites particules sphériques de tailles nanométriques de l'ordre de 67 nm. Le diffractogramme EDX a permis d'identifier les différents principaux constituants du composite en proportions importantes. La technique par DRX a révélé la présence de deux phases : une apatitique majoritaire et une seconde minoritaire indésirable de type whitlockite, une taille de cristallites de l'ordre de 40 nm et un taux de cristallinité de 67%. Les résultats de l'analyse IRTF ont révélé la présence des groupements OH- et PO43-, ainsi la présence de groupements vibrationnels de la liaison C-H et les principales bandes caractéristiques des glucides. Le nano-composite a été testé in vitro contre cinq bactéries (Escherichia Coli ; Klebsiella Pneumoniae ; Pseudomonas aeruginosa ; Staphylococcus aureus et Bacillus subtilis) et deux souches fongiques (Candida albicans et Aspergillus niger). Des zones d'inhibitions allant de 9 à 17mm ont été constatées contre les bactéries á Gram (+) et de 9 à 11 mm contre les bactéries à Gram (-). Les souches fongiques elles même ont été qualifiées comme des souches extrêmement sensibles avec des zones d'inhibitions de 18,66 mm ± 1,55 contre A. niger, et de 12 mm± 1,00 contre candida. Les résultats obtenus ont donné naissance à un nouveau nano-composite prometteur pour de nombreuses applications orthopédiques et dentaires.

Keywords: Hydroxyapatite co-dopée; Nano-composite; Lixiviation, Activité antimicrobienne.

ID: Mat-P-89

Synthèse et Caractérisation de Zéolithe 4A à partir de produits

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Abstract: In this study, kaolin kt1 was used as a natural source for the production of zeolite after its conversion to meta-kaolin Mkt1. Zeolite is used as an adsorbent support for the removal of methylene blue, a model for cationic dyes.

The zeolite is synthesised by the microwave-assisted alkaline fusion method, and then characterised by various physico-chemical methods, namely: DRX, FTIR-ATR and SEM-EDX. The XRD analysis confirmed the appearance of a type 4A zeolitic phase with a density d= 1.7 g/cm3 and a degree of crystallinity of around 97%, FTIR-ATR analysis suggested the presence of functional groups characteristic of zeolite, in particular SiO_4 and AlO_4 groups, while SEM-EDX analysis showed cubic nanocrystals with a Si/Al ratio of 1.75, the zero charge point of the zeolitic material is 7.6.

The methylene blue adsorption test on the zeolite showed that the adsorption equilibrium was established after one hour, with an elimination rate of 97%. The study of the modelling of adsorption isotherms showed that the Langmuir model is the most suitable for the zeolite matrix.

Keywords: Zeolite; meta-kaolin; microwave; adsorption.

ID: Mat-P-90

Quantitative Analysis of Microstructure Influence on the Elastic Parameters of Hexagonal Metals.

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Abstract: Nowadays, despite the use of ceramics, polymers and composite materials in different applications, metals, as bulk materials and/or thin films, keep an important role not only in the development of new technologies but also in their large and potential applications in modern micro- and nano-technological applications. Metals are essential in various industries, especially in automotive technology, and industrial products. Their unique properties—such as strength, durability, conductivity, and resistance to corrosion—make them indispensable for manufacturing engines, structural components, and intricate electronic systems. Their elastic properties are usually determined by different destructive techniques but very rarely by non-destructive methods. The ultrasound efficiency in the field of non-destructive characterization of materials is widely proven. The propagation velocities of these surface acoustic waves, SAW, strongly depend on the structural parameters of the materials. In this context, we have studied the SAW propagation polycrystalline materials and more precisely in hexagonal structure metals, HC. This study aims to identify and analyze the relationships between the microstructural characteristics of the materials and those of the ultrasonic beam. To do so, we considered several metals with hexagonal structures: HC (Ru, Os, Re, Ti, Hf, Zr, Lu, Tm, Er, Ho, Dy, Tb and Gd). They are characterized by a wide range of densities (4500 kg/m3 < ρ < 22600 kg/m3) and a large spectrum of surface acoustic wave, SAW, velocities (2800 m/s < VL< 6800 m/s), as well as by an interatomic distance interval: (2.7 Å < a < 3.7 Å) and an energy of cohesion (2.4 eV < W < 8.5 eV). The procedure consists of quantitative investigation of microscopic physical parameters (interatomic distance, a, and cohesive energy, W) on certain elastic parameters, such as (the propagation speed of a surface acoustic wave, VR, and acoustic impedances, Z). It is found that the effect of interatomic distance on Rayleigh velocity is opposite to that of cohesive energy due to governing physical phenomena. The analysis of these effect was quantified to a universal formula of the form: VR = C1+ C2 exp(□P) with P = (a, W); where □□represents a characteristic constant. The observed behavior trend can be justified by the crystal structures of these metals. Furthermore, we have precisely quantified the influence of the interatomic distance on the different types of acoustic impedances: longitudinal, ZL, transverse, ZT, and that of the solid, Zsol. We were able to record a linear behavior described by: ρ/Zsol = A + Ba, where □ is the materials density and A and B, are characteristic constants. These results are of great importance in evaluating the structure-elastic parameter interdependence in nanomaterials and nanotechnologies.

Keywords: Hexagonal metals; interatomic distance; cohesive energy; Rayleigh velocity; SAW; acoustic impedance.

ID: Mat-P-91

Theoretical and Computational Insights into Quinoline-Based Molecules

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Abstract: This study focuses on the electrostatic potential (ESP) and its role in determining the structure-activity relationship (SAR) of quinoline-based molecules. By employing quantum chemical calculations, we aim to analyze the molecular electrostatic potential distribution and how it influences chemical reactivity and intermolecular interactions.

Additionally, the molecular orbital energies, including the highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO), will be investigated to understand the electronic properties and stability of quinoline derivatives. These parameters are crucial for predicting the reactivity, potential biological activity, and interaction mechanisms of these compounds.

By integrating density functional theory (DFT) and chemoinformatics approaches, this study provides a comprehensive theoretical framework to explore the electronic, structural, and reactivity properties of quinoline derivatives, contributing to the rational design of novel compounds with improved properties.

Keywords: DFT ; ESP ; quinoline-based ; LUMO; HOMO

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Synthèse des oxydes mixtes de type spinelle

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Abstract: Pour cette étude on a préparé un échantillon de l'oxyde de type spinelle $NiAl_2O_4$ par voie sol gel. Après calcination à la température 800 °C pendant 5heures.

Les caractérisations de ces poudres ont été effectuées par l'analyse DRX.

Les spectres DRX montrent La présence de la phase spinelle, de système cubique.

Keywords: Oxydes mixtes , Spinelles, Procédé sol gel , Caractérisation des oxydes.

ID: Mat-P-93

Evaluation the effect of the W/C ratio on the durability of mortar exposed to an aggressive environment.

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Abstract:

Mortar, a building material used to bond bricks, blocks, or stones and to fill the gaps between them. Generally, mortar is made in the form of a paste that hardens when dried and consists of various materials such as clay, clay, cement, or a mixture of these materials, with sand and water added. In this study, we use three types of mortar with three different ratios of W/C, respectively 0.55, 0.50, and 0.45, while maintaining the same workability for all mixes using a high-range water reducer at rates of 0.40% and 0.25% for W/C = 0.50 and W/C = 0.45 ratios, respectively. We also use sulfate-resistant cement (CRS) in the mix to prepare 216 samples, exposed to different environments such as open air, tap water, seawater, brackish water, and water containing an HCL acid solution at a concentration of 0.3%, as well as water containing a CH3COOH solution at a concentration of 3%. Seventy-two samples are exposed in each medium. The experiments include measuring the workability in the fresh state of the mortar, bending, compression, mass change for periods of 7, 14, 28, and 45 days, as well as measuring shrinkage for periods of 1, 2, 3, 4, 7, 14, and 28 days in the hardened state. Our study aims to investigate the effect of the W/C ratio on the physical and mechanical properties of mortar exposed to aggressive environments. Our results show that, for workability, the same level of workability is maintained using a high-range water reducer in mixes with W/C ratios of 0.50 and 0.45, ensuring ease of handling of the mortar during casting. Regarding bending and compression, the results show that the bending and compression strength of the mortar decreases with increasing W/C, with the high-range water reducer helping to maintain strength with lower water ratios. As for mass change, samples with W/C = 0.45 show less mass change, indicating better resistance to corrosion and deterioration. As for shrinkage, it decreases with decreasing W/C ratio, and the use of the high-range water reducer helps significantly reduce shrinkage in samples with lower water ratios, thus reducing the risk of cracking.

Keywords: workability, bending test, compression test, shrinkage test, durability

ID: Mat-P-94

Crystallization Study of $Co_{71}Fe_4Si_{10}B_{15}$ Amorphous Alloy Ribbons

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Abstract: Accurate measurements of electrical resistivity and absolute thermoelectric power (ATP) also referred to as absolute Seebeck coefficient (S) both as a function of temperature and time was used to study the thermal behavior and crystallization mechanism of amorphous Co71Fe4Si10B15 ribbons. Structural transformations as crystallization stages can be clearly observed at same temperature during heating through both electrical resistivity and ATP measurements, first crystallization occurs at 495°C, and the second at 542°C, these temperatures are strongly dependent on the heating rate. The elevated temperature reached during our measurements prompted the crystallization of the amorphous phase, as confirmed by X-ray diffraction (XRD) patterns and scanning electron microscopy (SEM) observations, and further supported by our electrical resistivity measurements during the first decrease and second increase in temperature

Keywords: Amorphous alloy; Electrical resistivity; Absolute Seebeck coefficient; Crystallization mechanism

ID: Mat-P-95

Development and Definition of Thin Zinc Oxide Films Made by Spray Pyrolysis Using Solar Energy

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Abstract: Zinc oxide (ZnO) has been deposited in the form of thin films on glass substrates using the pyrolytic spray technique, which relies on the decomposition of dihydrate zinc acetate in an ethanol solution at different concentrations. The ZnO films were applied at a temperature of 400 °C, with substrates heated using a solar oven. The glass substrate used was reference R217102, measuring 30 cm x 7.5 cm x 0.1 cm.

To analyze our film, we performed X-ray diffraction characterization on the thin zinc oxide layers deposited on the reference glass slides 217102. Additionally, optoelectrical characterizations were carried out using a UV-visible device and the four-point probe method.

We developed a new heating coupling system to replace the costly electrical method with a classical thin film deposition technique, specifically spray (CVD). This method uses solar radiation as a heat source. To our knowledge, this combined spray approach will be studied for the first time in the field of thin film deposition.

Keywords: Zinc oxide (ZnO); Thin films; Pyrolytic spray technique; Dihydrate zinc acetate; Ethanol solution

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Impact of the preparation method on the structural properties of the CaFeO2.5 compound

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Abstract: CaFeO 2.5 samples were synthesized by solid solution, mirror furnace and Sol-gel methods. The effect of the synthesis method on the behavior structure was investigated. Phase structures are comparatively characterized and studied by means of X-ray powder diffraction. Experimental results have revealed that the synthesis method has a strong influence on the structure of the studied compounds. All samples obtained by the three methods are crystallized in the Pnma orthorhombic system. We obtained the best results in the case of the Sol-gel technique. In the Sol-gel method, the lattice parameters obtained are a= 5.41631 Å, b= 14.73899 Å and c= 5.58790 Å. Also, the value of the average crystallite size D= 52.03 nm and the dislocation density δ= 3.69 x10 10/cm². Since the values of the lattice parameters in this method were the smallest of the three methods, which exhibiting a weak shrink of the volume compared to the solid solution and mirror furnace one. This shrinking is a natural result of the decrease in the value of the average crystallite size and the increase of dislocation density, with a reason for the inverse relationship between them. This allows us to conclude the importance of the Sol-gel method for obtaining CaFeO 2.5 nanoscale compound.

Keywords: Crystallite size; Dislocation density; Nanoparticle; Sol-gel; X-ray powder diffraction

ID: Mat-P-97

A proposed approach for separation between demagnetization and eccentricity faults in permanent magnet synchronous motor

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Abstract: This research provides a new approach for diagnosing and separating between the frequency signatures of eccentricity faults and demagnetization in a Permanent Magnet Synchronous Motor (PMSM). This method is based on using a very selective band-pass filter in the stator current. A careful determination of the filter's settings allows for the extraction of only the frequency signatures of the searched faults. The utilization of relevant information on the magnitude and phase angle of the signatures obtained through filtering allows us to distinguish between both of the analyzed faults. This distinction is made possible by simply monitoring the graphing in polar coordinates of the combined information (magnitude / phase angle) of the signatures of these two faults. Experimental results demonstrate the usefulness of the proposed approach in determining the reliability of demagnetization and eccentricity defects in a PMSM.

Keywords: Diagnostic; PMSM; Eccentricity faults; Demagnetization faults; Band-pass filters; Stator current

ID: Mat-P-98

Morphological analysis of high entropy alloy produced by ball milling

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Abstract: The FeCoNiTiNbIn high entropy alloy was prepared by high-energy ball milling, heat treated up to 800°C using a differential scanning calorimeter (DSC) and sintered at 550°C for 1 hour. X-ray diffraction was used to investigate the phase formation, and the morphology was examined using a scanning electron microscope (SEM). The milling process introduced severe plastic deformation, leading to the formation of disordered structures. The structure of the heat-treated powders consists of FeCo solid solution, Fe2Ti, and FeNb phases, whereas the sintered pellet contains FeCo, Fe2Nb, and FeNb phases. The distribution of constituent elements is homogeneous and well-balanced. A modification of the morphology is observed for the heat-treated powders.

Keywords: High entropy alloy ; Mechanical alloying ; X-ray diffraction ; Scanning electron microscope

ID: Mat-P-99

Formation and Properties of Nickel Silicides in the Ni/Mo/Ni/Si(100) Thin Film System

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Abstract: Silicides are crucial for reducing contact resistance in microelectronics, and controlling their formation and stability remains a key challenge for improving device performance. This study investigates the structural and electrical properties of nickel silicides in the Ni/Mo/Ni/Si thin film system, focusing on the role of a molybdenum (Mo) interlayer as a diffusion barrier. Samples were prepared via cathodic sputtering and characterized using X-ray diffraction, Raman spectroscopy, and four-point resistivity measurements. The results reveal that the Mo interlayer delays the formation of NiSi to 400°C and limits its agglomeration, ensuring phase stability up to 600°C. The complete transformation to $NiSi_2$ occurs only at 800°C, highlighting the interlayer's effectiveness in suppressing undesired phase transitions. Furthermore, the Mo interlayer reduces electrical resistivity by extending the stability of the low-resistivity NiSi phase. These findings offer valuable insights for optimizing silicide properties and thermal stability in microelectronic applications, paving the way for more efficient and reliable devices.

Keywords: NiSi thin films/ Diffusion barrier / Heat treatment / Resistivity / Raman spectroscopy / Cathodic sputtering

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ID: Mat-P-100

Theoretical Studies Of Complexes Containing Of Derived from Olefinic Phosphines

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Abstract: Molecular materials based on the assemblage of organometallic fragments and conjugated organic ligands are among the most studied compounds in coordination chemistry. This is due to their relatively good stability combined with their excited-state and redox properties which confer them interesting physical properties in several domains (magnetism, optics, electrochemistry…). In the field of complex transition alkynyl ligands, we are interested in a series of compounds containing or derived from olefinic phosphines. The work to be presented has focused on the study of a series of molecules with P(CH2)mCH=CH2 moieties synthesized in the laboratory of John A. Gladysz.[1-2]

TD-DFT calculations are shown to provide an excellent cost-effective computational approach for the treatment of the excited states of these complexes.

Keywords: TD-DFT; Absorption spectrum; Charge transfer; electronic excitations.

ID: Mat-P-101

Effet du remplacement du ciment blanc par de la poudre de déchets céramiques (CWP) sur les propriétés des mortiers à base de sable concassé.

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Abstract: L'énorme quantité de déchets céramiques générés mondialement suscite la demande de réutilisation à des fins environnementales et économiques dans le secteur de la construction. Cette étude examine le recyclage des poudres de déchets de céramique CWP pour la production de mortier durable. Cette étude a été menée en incorporant du CWP à des taux de 0 %, 5 %, 10 %, 15 % et 20 %. en remplacement partiel de mortier de ciment blanc à base de cinq formulations, à savoir sable concassé. Les dimensions de chaque prisme étaient de 4x4x16 cm 3.

Les propriétés évaluées comportent la masse volumique, la force de compression, et la vitesse des ondes ultrasonores canalisées UPV. Les résultats obtenus indiquent que l'augmentation de la part de CWP se traduit par une réduction de la masse volumique de résistance à la compression et de l'UPV. Des relations linéaires ont aussi été trouvées. Cette étude démontre les avantages de CWP dans la production de mortier et son utilisation en ciment blanc réduit, promouvant des méthodes de construction plus durables.

Keywords: ciment blanc; poudre de déchets céramiques; sable concassé; résistance à la compression; vitesse des ondes ultrasonores.

ID: Mat-P-102

Investigating The Chemicophysical Characteristics of Trivalent Metal-Doped Nickel Oxide Thin Films

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Abstract: The effect of Al doping on optical, structural and electrical properties of deposited $Ni_{1-x}Al_xO$ thin films on glass substrate by spray pyrolysis technique has been studied. The main objective of this research is to study the change of the physical and optical properties of $Ni_{1-x}Al_xO$ thin films that are fabricant to semiconductor with different doping levels x . These levels are 0 at.%, 1 at.%, 3 at.%, 5 at.% and 9 at.%. The transmission spectra show that the $Ni_{1-x}Al_xO$ thin films have a good optical transparency in the visible region from 73 to 88%. The optical gap energy of the $Ni_{1-x}Al_xO$ thin films varied between 3.91 and 4.02 eV. The urbach energy varied between 276 and 311 meV. However, the $Ni_{0.97}Al_{0.03}O$ thin films have many defects with maximum value of urbach energy. The $Ni_{0.97}Al_{0.03}O$ thin films have minimum value of optical gap energy. The $Ni_{0.97}Al_{0.03}O$ thin films have maximum value of the electrical conductivity which is 0.027 $(\Omega.cm)^{-1}$. The $Ni_{0.95}Al_{0.05}O$ thin films have maximum value of the transmission which is 88%. The average electrical conductivity of our films is about (0.0228 $(\Omega.cm)^{-1}$). XRD patterns of the $Ni_{1-x}Al_xO$ thin films indicate that films are polycrystalline with cubic structure.

Keywords: Nickel oxide, Thin films, Spray pyrolysis, Optical gap energy, Urbach energy, The electrical conductivity.

ID: Mat-P-105

Using enhanced silica nanoparticles as a low-cost adsorbent for the removal of methylene blue (MB) dye from aquatic environment.

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Abstract: Algerian Sahara encompasses unlimited reserves of sand dunes of high silica contents (SiO_2>80%) [1]. It can be used in many industrial felds, namely glass manufacture, cement, bricks, and water treatment packed beds [2–3].

Whereas, the challenge of the synthesis of silica nanoparticles are very expensive . This issue has led to the development of economical methods to prepare nano-silica materials from locally available, low-cost, and renewable materials.

This work aims to extract, silica nanoparticles from natural sand using the sol–gel method, a simple, economic, and environmentally friendly chemical process.

The asproduced silica was characterized by several analytical techniques. XRF, (SEM/EDX) , XRD , FTIR and (BET).

The applicability of the BBD-optimized silica as a low-cost adsorbent toward removing Methylene blue (MB) dye from the aqueous environment was investigated.

A maximum silica yield of 87.62% was achieved when the T = 495.3 °C, t = 2 h and SiO_2/ NaOH = 7.88. with a maximum adsorption capacity of 209.23 mg/g at 55 °C.

Keywords: Silica nanoparticles; Sand dune ;Cationic dye; Adsorption; Box–Behnken design.

ID: Mat-P-106

Effect of Cd Doping on Structural, and electrical Studies of Nano CuO Films Prepared by Sol–Gel spin coating Technique

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Abstract: Undoped and Cd-doped CuO thin films were prepared using sol gel spin coating technique over glass substrates with cadmium doping concentrations varied from 0 to 8 at.% in increments of 2 at.%. The effects of Cd doping on the structural, optical, and electrical properties of CuO thin films are reported. X-ray diffraction (XRD) spectra of pure and Cd-doped CuO films reveals a polycrystalline with a monoclinic structure and a slight shift in peak positions due to Cd incorporation. The AFM images showing a modification in grain size and decrease of surface roughness due to Cd doping. Hall Effect measurements indicated that the films are n-type semiconductor. An improvement in the electrical conductivity of the films, suggesting enhanced carrier concentration due to Cd doping. The sol-gel spin-coated films are exceptionally well-suited for modern applications, including hydrogen production through water splitting, gas sensing, and various optoelectronic technologies.

Keywords: sol gel spin coating technique; thin films; Cadmium; Cupric oxide

ID: Mat-P-107

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

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Abstract: Our study focuses on a biodegradable composite material based on polylactic acid (PLA) and common reed (CR) developed by hot pressing.

First, the raw materials were transformed into powder (for PLA) and into short fibers (the common reed). Then, PLA-20%CR (vol.%) blends were hot pressed at 180°C under 10 MPa during 5 minutes. 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 material has a relatively homogeneous microstructure, with a continuous interface between PLA (polylactic acid) and common reed fibers in several areas. In some regions, the interfaces appear to suffer from a lack of interfacial adhesion, while FTIR analyses seem to indicate fiber-matrix interaction through the formation of chemical bond groups.

Keywords: Biodegradable composite, common Reed, PLA, SEM, FTIR, DSC.

ID: Mat-P-108

Geotechnical and Environmental Evaluation of Iron Ore Tailings from Ouenza Mine as a Sustainable Backfill Material

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Abstract: The disposal of iron ore tailings (IOT) is a significant environmental challenge, particularly in mining regions such as Ouenza, Algeria. This study investigates the potential use of IOT from the Ouenza Iron Mine as a sustainable backfill material from geotechnical and environmental perspectives. Laboratory characterization indicates that the IOT exhibit sandy-like properties, with favorable particle size distribution, permeability, and compaction characteristics suitable for geotechnical applications. The results suggest that IOT can be utilized in various construction projects, including road subgrades, embankments, and mine reclamation, reducing the environmental footprint of tailings disposal. Furthermore, the environmental assessment highlights the potential for safe reuse, contributing to sustainable waste management in the mining sector. This study demonstrates that IOT can serve as an alternative backfill material, promoting circular economy principles in mining and construction industries.

Keywords: Iron ore tailings; Backfill material; Geotechnical properties; Environmental sustainability; Circular economy

ID: Mat-P-109

La caractérisation thermique d’un mortier à base d’éco-matériau local pour la rénovation thermique passive du patrimoine bâti

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Abstract: L'adaptation du patrimoine architectural aux normes contemporaines d'efficacité énergétique et de confort thermique constitue un défi majeur auquel sont confrontés les professionnels et les chercheurs du monde entier de nos jours. En effet, compte tenu des conditions climatiques actuelles, cette enquête est essentielle pour toute entreprise axée sur la préservation et la conservation du patrimoine bâti. En Algérie, l'abondance et la variabilité du patrimoine architectural, associées au contexte climatique, nécessitent un examen approfondi des mécanismes qui devraient être mis en œuvre pour faciliter une gestion efficace de l'aspect confort thermique dans la conservation des édifices historiques. En effet, la durabilité des structures patrimoniales est intrinsèquement liée à leur utilisation continue, qui dépend du maintien du confort thermique tout au long de l'année. Dans le cadre des recherches doctorales en cours, nous nous concentrons sur l'application d'éco-matériaux dans les processus de rénovation. Nous avons commencé cette enquête en partant de l'hypothèse que la sélection d'un matériau écologique, en particulier le composite de « grignons d'olive et d'argile », pourrait améliorer le confort thermique des bâtiments du patrimoine algérien, favorisant ainsi un équilibre entre authenticité et confort. Pour évaluer notre hypothèse, nous avons produit des échantillons de mortier composé de grignons d'olive plus l’argile. Pour chaque échantillon, nous avons effectué trois tests qui ont pris en compte les incertitudes de mesure, garantissant ainsi des résultats de caractérisation statistiquement valides. La moyenne arithmétique dérivée de ces trois tests est utilisée comme résultat de caractérisation définitif pour chaque échantillon. Afin de déterminer les valeurs du coefficient de conductivité thermique de nos échantillons, nous avons utilisé la méthode du fil chaud. L'appareil utilisé est le CT-mètre, développé par le CSTB (Centre scientifique et technique du bâtiment). Les résultats préliminaires indiquent que l'incorporation de grignons d'olive dans l'argile facilite la création d'un matériau composite qui offre une efficacité énergétique remarquable et une légèreté substantielle par rapport à l'argile brute, améliorant ainsi le confort intérieur des espaces et contribuant à l'amélioration globale de l'efficacité énergétique des structures traditionnelles.

Keywords: Patrimoine bâti ; rénovation ; confort thermique ; Éco-matériau ; Grignons d’olives ; argile.

ID: Mat-P-110

La contribution des matériaux géosynthétiques au développement des infrastructures – Une étude numérique d'un mur de soutènement

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Abstract: L'utilisation des matériaux géosynthétiques dans les projets d'infrastructure suscite un intérêt croissant en raison de leurs performances, de leur rentabilité et de leur durabilité par rapport aux matériaux traditionnels. Ils améliorent les ouvrages en terre, tels que les culées de ponts et les murs de soutènement, grâce à leurs fonctions de renforcement, de filtration, de séparation et d'étanchéité. Cependant, malgré leur adoption généralisée, leur comportement dans des structures complexes, telles que les murs en sol renforcé par géosynthétiques, nécessite des investigations supplémentaires.

Cette étude analyse la performance des murs en sol renforcé par géosynthétiques à l'aide d'une modélisation numérique par éléments finis avec le logiciel PLAXIS 2D. Les résultats mettent en évidence les avantages des murs en sol renforcé par géosynthétiques dans les applications d'infrastructure et fournissent des informations essentielles sur les facteurs influençant leur performance, contribuant ainsi au développement de solutions d'infrastructure plus résilientes et durables.

Keywords: Géosynthétiques ; sol renforcé ; mur de soutènement ; stabilité ; modélisation numérique

ID: Mat-P-111

Mapping the Potential of Algerian Natural Fibers for Polymer Composite Reinforcement: A Review.

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Abstract: Natural fibers are gaining attention as sustainable alternatives to synthetic reinforcements in polymer composites. However, Algerian plant fibers remain largely overlooked in the literature despite their abundance and potential applications. This review addresses this gap by analyzing research on Algerian plant fibers, including Alfa, Lygeum spartum, date palm, giant reed, and corn husk. It examines their properties, effects on thermoset and thermoplastic composites, fiber treatments, characterization methods, and processing techniques. The study also explores bio-nano-composites based on nano-cellulose extracted from these fibers.

Research on Algerian plant fibers has increased significantly in the last five years, with Alfa being the most studied mainly by Tunisian researchers, Other researched fibers include date palm, corn husk, wheat straw, giant reed, Opuntia, Lygeum spartum, and Diss, though many studies are conducted outside Algeria. Most studies focus on composite development, followed by fiber extraction and characterization, while numerical modeling remains limited. Given the natural variability of plant fibers, their properties depend on environmental and regional factors, highlighting the need for localized studies.

By shedding light on this underexplored field, this review identifies research gaps and encourages further investigation into the integration of Algerian plant fibers in sustainable biocomposites.

Keywords: Natural fibers; Plant fibers; Algerian plant fibers; Biocomposites; Polymer composites; Bio-nano-composites; Fiber extraction; Fiber treatments; Characterization methods; Mechanical properties; Water absorption; Composite processing; Sustainable materials

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Mise en œuvre de panneaux composites à base de feuillettes de palmier dattier et déchets de polystyrène expansé par le procédé de moulage par compression à chaud

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Abstract: Les propriétés des composites polymères renforcés par les fibres naturelles sont généralement gouvernés par le procédé de traitement des fibres et par le procédé de mise en œuvre des composites. À cet égard, dans une étude précédente effectuée par l'équipe, un procédé de moulage par compression à froid a été utilisé pour la fabrication des panneaux composites à base de déchets en feuillettes de palmier dattier et de déchets en polystyrène expanse (LPC). Les auteurs ont évalué différentes propriétés du LPC et ont conclu que le procédé à froid permettait d'obtenir un comportement mécanique acceptable avec un module de flexion de 2,8 MPa et une contrainte maximale de 7,8 MPa. Le matériau LPC est un matériau léger d'une densité de 542 à 824 kg/m3. L'objectif de la présente étude est d'évaluer le procédé de moulage par compression à chaud dans le but d'améliorer les propriétés du LPC obtenues précédemment par l'équipe avec le procédé de moulage par compression à froid. Les renfort lignocellulosiques choisies dans cette étude a été obtenues à partir d'une partie renouvelable dans le palmier dattier (feuillettes du palmier dattier Phoenix dactylifera) avec une taille granulométrique de renforcement de ($0,1<D\leq0,315$ mm). La matrice a été préparée par dissolution des déchets de polystyrène expansé dans l'essence pour obtenir une colle organique. Les méthodes de caractérisations utilisées dans le cadre de la présente étude sont des caractérisations physiques, mécaniques. Elles ont été effectuées principalement pour déterminer la densité apparente, le module de flexion, la contrainte maximale et le taux d'absorption d'eau du matériau composite. En comparaison avec le même composite fabriqué précédemment par l'équipe, une amélioration significative des propriétés physiques et mécaniques du matériau a été observé. Les résultats montrent que les panneaux composites ont une faible densité comprise entre 414 et 511 kg/m3 et une contrainte maximale et un module de flexion améliorés pouvant atteindre respectivement 6,18 MPa et 13,5 MPa. Ces valeurs sont comparables avec celle rapportée dans la littérature telles que les panneaux MDF (13,5-25 MPa) et les panneaux DPCC (0,8-22,4 MPa), (0,7-43 MPa). Cependant, le résultat d'absorption d'eau allant de 77 à 95 % montre que les panneaux composites étudiés sont sensibles à l'humidité et présentent un pourcentage d'absorption d'humidité élevé, limitant ainsi leur possibilité d'utilisation dans des conditions humides. Cet aspect doit être pris en considération lors de la production de composites qui seront utilisés dans des endroits exposés à l'humidité. En raison de leurs propriétés mécaniques compétitives, les panneaux composites développés pourraient être utilisés pour des applications structurelles.

Keywords: Feuillettes de palmier dattier; Polystyrène expansé; Panneaux composite; Moulage par compression à chaud; Mise en œuvre; Propriétés mécaniques

ID: Mat-P-113

Simulation of Fe2B layers' growth kinetics on AISI D2 Steel using the integral method

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Abstract: The aim of this work is to simulate the kinetics of boriding using the integral method with the pack method of AISI D2 steel. The activation energy of boron in the Fe_2B layer was calculated based on experimental data from the literature. This diffusion model was then experimentally validated using an additional boriding condition corresponding to a temperature of 1253 K for 5 h. The mass gain was also simulated for differen treatment temperatures.

Keywords: Boriding ; kinetics ; Activation Energy ; Diffusion; Integral method.

ID: Mat-P-114

Spectroscopic, thermal and elastic properties of Ho^3+ doped fluoro-phosphate glasses

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Abstract: Holmium doped new fluorophosphate glasses were prepared by melt-quenching technique. Stability criteria indicate that these glasses exhibit a good resistance against devitrification. Elastic properties were calculated from the measured densities and ultrasonic velocities. The measured absorption spectrum was analyzed by Judd–Ofelt theory in order to obtain the spectroscopic properties such as radiative transition probability, branching ratios, radiative life-time and stimulated emission cross sections. The results show that these glasses have elastic and spectroscopic properties comparable to those of the other glassy systems. On the base of these results, these glasses can be used in the optical active applications such as lasers and optical amplifier.

Keywords: Holmium, fluoro-phosphate glass, elastic properties, Judd-Ofelt theory, Laser.

ID: Mat-P-115

Structural Engineering of Hole Doped Lanthanum Manganites: Unveiling the Impact of Parameters on Magnetotransport Properties

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Abstract: Manganite perovskites have emerged as key materials in modern technology, finding widespread applications in magnetic sensors, data storage, fuel cells, gas sensors, memory devices, etc.. Their remarkable combination of electrical, magnetic, and magnetoresistive properties positions them at the forefront of advanced functional materials, driving innovations across various industries. Using a conventional solid state reaction technique, $La_{0.6-x}Ca_xSm_{0.1}Ba_{0.3}MnO_3$ perovskite manganites were prepared in this work with Ca concentrations of x = 0.0 and 0.1, and experimentally characterized. The Rietveld refinement of the XRD diffractograms was used to determine the dislocation density ϑ, the strain ε, the Jahn-Teller distortion (JT), the electron bandwidth (W), the structural orthorhombic distortion, the average size of the A-site, the mismatch σ^2, the Jahn-Teller distortion σ_{JT}, the Goldschmidt factor, and the crystallite size D_{WH}. The experimental magnetotransport results were discussed using these parameters. The metal-insulator transition temperature (T_{MI}) ranges between 178.2 K and 219 K for doped and undoped samples, and a slightly shift toward a lower temperature with applied magnetic field is noticed. Large magnetoresistance (MR) is obtained in the low temperature range. It reaches 24 % under one tesla. The temperature coefficient of resistance (TCR) reaches a maximum value around 125 K for both samples. Basing on the resistivity curves fitting results, a combination of the residual resistivity, weak localization, electron-electron, and electron phonon interactions was found to govern the electrical transport in the low-temperature region, while adiabatic small polaron hopping (ASPH) governs it in the high temperature region.

Keywords: Hole-doped perovskite manganites, Magnetoresistance (MR), Rietveld analysis, Resistivity, Temperature coefficient of resistance (TCR), and Adiabatic small polaron hopping.

ID: Mat-P-116

The effect of bath alloying elements on the properties of galvanized coatings

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Abstract: Hot-dip galvanizing is one of the most widely used and effective techniques for protecting ferrous metals, particularly steel, from corrosion. This coating, generally obtained in a bath of liquid zinc or alloys, has excellent chemical properties in an aggressive environment and provides long-lasting protection for the steel against atmospheric contamination.

During galvanizing, reactions occur at the interface between the galvanized steel and the molten zinc, forming a coating of intermetallic compounds considered as phases in the Fe-Zn binary system. The gamma, delta, zeta, and eta phases, obtained as sublayers, differ in composition and structure. The gamma phase occurs directly at the (coating/steel) interface, while the eta phase of pure zinc forms the outer surface of the coating.

In terms of thickness and properties, the intermetallic layers forming the galvanized coating are influenced by numerous technological parameters. These factors include the bath temperature, the immersion time, the surface condition of the steel, and the chemical composition of the steel and the galvanizing bath.

In this research, we selected a single parameter, the chemical composition of the galvanizing bath, and studied the effect of this parameter on the structural and mechanical properties of the intermetallic compounds constituting the overall coating layer. This study focuses on the production of galvanizing layers by varying the concentration of certain elements, particularly aluminum and lead, and on the characterization of the layers produced using various analytical and control methods.

Keywords: zinc; galvanizing coatings; alloying elements; steel

ID: Mat-P-117

Theoretical study on the sulfonamide series: Enhancement through two methods of molecular complexation.

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Abstract: In this study a series of sulfonamide were examined through complexation via host-guest and charge transfer complexations, the interactions between our molecules and cyclodextrin as well as donor molecules were analyzed using molecular modeling techniques, including PM3, PM6, ONIOM/2 methods, and NBO analysis. The most stable and favorable structures were identified, with the host-guest reaction in vacuum being exothermic and enthalpy driven process, while in water is endothermic and co-driven by both enthalpy and entropy. The results of the charge transfer complex obtained through molecular modeling were compared by experimental results.

Keywords: Sulfonamide; cyclodextrin; picric acid; modeling; host-guest; charge transfer

ID: Mat-P-118

A Comparative Study of Rectangular and Circular Microstrip Patch Antenna at 2.45 GHz

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Abstract: This paper presents a comparative analysis of rectangular and circular microstrip-fed patch antennas operating at 2.45 GHz. Both antenna designs were simulated using CST Microwave Studio, with identical patch areas of 933.7 mm² to ensure that any observed performance variations are solely attributable to differences in geometric configuration. The circular patch antenna achieved a return loss (S_{11}) of -10.25 dB and a gain of 2.12 dBi. In contrast, the rectangular patch antenna exhibited superior impedance matching, with a return loss of -29.64 dB, while maintaining a comparable gain of 2.11 dBi. These findings indicate that the rectangular geometry offers significantly improved impedance matching without compromising radiation efficiency. Both antenna designs demonstrate suitability for 2.45 GHz applications, including Wi-Fi, Bluetooth, and other wireless communication systems requiring reliable and efficient signal transmission.

Keywords: Microstrip patch antenna; CST microwave studio; wireless communications; radiation pattern.

ID: Mat-P-119

Ab-initio Study of New Perovskite AgRaBr3 for Photovoltaic Applications

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Abstract: Perovskites with a wide gap energy band are essential for today's electronic devices as well as for various applications of energy conversion. Recent research has shown great interest in halide Perovskites due to their excellent optoelectronic properties. In This current study, the structural, electronic, optical and thermoelectric properties of cubic perovskite AgRaBr3 compound are investigated by using the full potential linearized augmented plane wave (FP-LAPW) method based on density functional theory (DFT) associated with Boltzmann transport scheme, implemented in Wien2k code. The exchange and correlation potentials were treated by the generalized gradient approximation (GGA-PBE) in the process of energy optimization. Moreover, the modified Beck Johnson potential approach parameterized by Tran-Blaha (TB-mBJ) was used to calculate the electronic and optical properties. Subsequently, the results of lattice constant calculated close to theoretical and experimental findings available data. The electronic properties show a semiconducting behavior with a direct band gap along. Regarding the optical properties, our compounds exhibit good light absorption in the visible and ultraviolet range, making them potential candidates for photovoltaic cells and optoelectronic applications.

Keywords: Perovskite, Optoelectronic, Photovoltaic, DFT Method, Wien2k.

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Anacyclus pyrethrum root-based green synthesis of NiO nanoparticles: characterization and photocatalytic investigations

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Abstract: The aqueous extract of Anacyclus pyrethrum root was used as a reducing, capping, and stabilizing agent in the current study's green, sustainable, easy, and inexpensive technique of synthesizing NiO NPs. Energy-dispersive X-ray analysis (EDX), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), ultraviolet–visible spectroscopy (UV–VIS), and X-ray difraction (XRD) were used to characterize the produced NiO NPs. The crystallite size of NiO-NP has been estimated using the Scherrer relation and found to be approximately 45 nm. Since then, NiO-NPs have been employed as adsorbents to adsorb methyl orange (MO). At room temperature, the effectiveness of dye removal from polluted water was examined for a number of critical factors, including initial dye concentration (Co), pH, and contact time, adsorbent dosage, agitation speed, and t = 100 minutes (Co = 30 mg/L, pH = 3, agitation speed = 400 rpm, and adsorbent dosage = 5 g/L). It was discovered that 90% of the (MO) dye could be removed.

Keywords: Synthesis; adsorption; methyl orange; NiO nanoparticles

ID: Mat-P-121

Antioxidants Produced in Oued Souf Desert

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Abstract: Antioxidants Produced in the Oued Souf Desert

Antioxidants are substances that protect cells from damage caused by free radicals, reducing the risk of chronic diseases such as cancer and heart diseases. They also contribute to strengthening the immune system and slowing down the aging process. They are crucial for maintaining overall body health.

As part of our research for new sources of antioxidants, two plant species from the Oued Souf Desert region were utilized to study their antioxidant potential. Active compounds were extracted from both plants using cold maceration with different solvents. The total phenolic and flavonoid contents of the extracts were studied, and the antioxidant activity was assessed using DPPH and TAC assays. Additionally, the toxic effects on cells or living organisms were examined to ensure the safety of these materials for medical and industrial use.

The results indicate that the two plants are rich in phenolic compounds, with the total phenolic content (TPC) reaching 21.26 mg ext/gGA and 17.94. The IC50 inhibition values for the DPPH free radical were found to be 1.4 and 3.7 mg/ml.

Toxicity testing showed that the methanolic extract was safe for live cells at concentrations lower than 40 mg/ml.

Keywords: Antioxidants, phenolic, flavonoid, DPPH.

ID: Mat-P-122

Bearing capacity of centrally loaded strip foundations near the slope for different soils

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Abstract: This paper presents a numerical investigation into the behavior of centrally loaded strip footings adjacent to a slope with both granular and cohesive soil. The Plaxis 2D finite element program was used to evaluate the effects of load centralization on the bearing capacity, soil pressure distribution underneath the footing and the pattern of failure mechanism. The results were presented using bearing capacity diagrams and failure envelopes in vertical and moment loading plan. The obtained results are compared with those found in the literature. The effect of distance from the edge of the slope was taken into account.

Keywords: Bearing capacity; foundation; numerical analysis; finite element method; slope stability.

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Characterization of Zn-Fe nanomaterials. Application in green organic synthesis.

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Abstract: Zinc-Iron based systems are very interesting materials because of their optical, magnetic properties and diverse applications especially in the domains of catalysis, photocatalysis and medicine such as hyperthermia treatment and magnetic resonance imaging [1-3]. A large variety of preparation methods has been developed in literature to synthesize Zn-Fe nanomaterials like ceramic, co-precipitation, hydrothermal and sol-gel techniques [4]. It has been demonstrated that the characteristics of these materials strongly depend on the preparation method, the nature of precursors and the treatment conditions. In the present work, a series of Zn-Fe mixed oxide samples with Zn/Fe ratio of 0.5 was synthesized by the hydrothermal method using two different temperatures (150 and 180°C) and a synthesis time of 24h. The catalytic properties of the synthesized nanomaterials have been tested in green organic synthesis especially the multicomponent reaction of Biginelli for the production of 3,4-dihydropyrimidinone (DHPM) molecule. The Biginelli synthesis that consists of mixing benzaldehyde, ethylacetoacetate and urea as reactants has been conducted in a reflux system at 100°C for 2h in solvent free conditions using a catalyst mass of 20 mg. The obtained results revealed that the structural, textural and the catalytic properties in Biginelli synthesis are very sensitive to the preparation temperature of Zn-Fe mixed oxide. The highest DHPM yield has been obtained using Zn-Fe nanomaterial prepared at 180°C and 24h preparation conditions.

Keywords: Zinc, Iron, nanomaterials, hydrothermal, Biginelli, dihydropyrimidinone

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Comparative Study of Er^{3+}-Doped $GdAlO_3$ Perovskite and $(Gd,Lu)_3Al_5O_{12}$ Garnet: Structural, Vibrational, and Optical Investigations

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Abstract: Erbium-doped (Er^{3+}) $GdAlO_3$ perovskite and $(Gd,Lu)_3Al_5O_{12}$ cubic garnet phosphor materials are highly promising as host matrices due to their exceptional optical properties, efficient energy transfer, and chemical stability [1,2]. In this study, 1% Er^{3+}-doped $GdAlO_3$ and $(Gd, Lu)_3Al_5O_{12}$ were synthesized using the co-precipitation method with a reverse strike process, using NH_5CO_3 as a precipitant agent, followed by calcination at 1300°C. The structural evolution and phase formation of Er^{3+}-doped $GdAlO_3$ and $(Gd_{1-x}Lu_x)_3Al_5O_{12}$ were analyzed via X-ray diffraction (XRD). The perovskite phase crystallizes in an orthorhombic system with the Pnma space group and lattice parameters a = 5.4877 Å, b = 5.3489 Å, c = 6.9210 Å. In contrast, the garnet phase adopts a cubic structure with the Ia-3d space group and a lattice parameter of a = 12.058 Å. Raman spectroscopy confirmed the presence of active vibrational modes for both compounds. Photoluminescence excitation (PLE) spectra revealed efficient energy transfer from Gd^{3+} to Er^{3+} in the garnet material, as indicated by a strong band around 270 nm [3]. For the perovskite phase, PLE spectra were recorded between 250 and 550 nm, with an emission wavelength of 540 nm. The photoluminescence (PL) spectra, recorded at excitation wavelengths of 375 nm for perovskite and 270 nm for cubic garnet, exhibited a prominent band at 450 nm, responsible for blue emission in the garnet material. Meanwhile, the perovskite phase displayed emission bands at 521 nm and 546 nm, corresponding to the green region [4] of the synthesized phosphors.

Keywords: Perovskite, cubic garnet, co-precipitation, erbium, photoluminescence.

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Comparative Study of ZnO-30%Al_2O_3 and ZnO-30%In_2O_3 Nanocomposites: Temperature-Dependent Phase Evolution and Properties

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Abstract: This study investigates the structural and optical properties of sol-gel synthesized ZnO nanoparticles doped with 30 at% Al_2O_3 or In_2O_3, calcined at 450-1000°C for 2 hours. Energy-dispersive X-ray spectroscopy confirmed the high purity of all compositions. X-ray diffraction analysis revealed three distinct behaviors: pure ZnO maintained a wurtzite structure across all temperatures; ZnO-Al_2O_3 exhibited initial $ZnAl_2O_4$ spinel phase nucleation at 450°C with progressive development, evidenced by continuous crystallite size reduction from 39 nm (450°C) to 13 nm (1000°C); and ZnO-In_2O_3 retained the wurtzite structure without spinel formation even at 1000°C, demonstrating complete crystallization inhibition by In^{3+} ions. Optical characterization showed opposing bandgap effects: the Al_2O_3-induced spinel phase increased the bandgap from 3.08 eV to 3.17 eV, while In_2O_3 incorporation reduced it to 2.86 eV due to intermediate defect states. These results demonstrate that Al_2O_3 doping promotes low-temperature spinel formation with progressive crystallite refinement, whereas In_2O_3 doping effectively suppresses both crystallization and phase transformation, enabling distinct bandgap engineering pathways in ZnO-based nanocomposites.

Keywords: : ZnO nanocomposites; spinel phase; crystallization inhibition; bandgap; sol-gel synthesis

ID: Mat-P-126

Contribuion à l'études des caractéristiques de la zone de soudage aux pipeline

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Abstract: Le but de ce travail est l'étude de la propagation de fissure dans le joint soudé de l'acier API 5L X70 utilisé en pipelines pour le transport du pétrole et du gaz naturel. Cette étude inclue une caractérisation microstructurale et mécaniques de traction et de dureté.

Keywords: Prpagation de fissure;Joint soudé;ZAT

ID: Mat-P-127

Copper Oxide Nanoparticles: Sustainable Synthesis, Characterization, and Photocatalytic Efficiency

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Abstract: This study focuses on the sustainable synthesis of copper oxide nanoparticles (CuO NPs) using starch as an eco-friendly reducing and stabilizing agent, with an emphasis on their photocatalytic efficiency. XRD analysis confirmed their crystalline structure, while SEM revealed uniform cubic particles. UV-Vis spectroscopy indicated excellent optical properties, with a distinct absorption peak and suitable bandgap energy, ideal for light-driven processes. EDX analysis verified their purity, showing a composition rich in copper and oxygen. The CuO NPs demonstrated exceptional photocatalytic performance, effectively degrading Evans Blue dye and Atrazine pesticide under illumination. This highlights their potential as a powerful tool for environmental remediation, breaking down pollutants efficiently. The findings showcase the success of sustainable synthesis in producing CuO NPs with superior photocatalytic capabilities, offering a promising solution for addressing ecological challenges through green technology.

Keywords: Sustainable Synthesis; Photocatalytic Efficiency; Copper Oxide Nanoparticles; Environmental Remediation

ID: Mat-P-128

Design of charts for the preparation of an eco-mortar based on recycled rubber aggregates and dune sand by using the Taguchi method

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Abstract: The object of the work is to apply the experimental designs of the Taguchi method to find the design of charts for the preparation of an eco-mortar and to see the different relationships between the factors targeted by our research, namely, water/cement (W/C) ratio, rubber aggregates (RA) content, and dune sand (SD) content, with the levels of each factor in the mortar mixture. This experimental and numerical work is part of the application of statistics in the field of materials in civil engineering, where the design was designed using an L9(33) orthogonal array. The results obtained demonstrated the robustness of the charts designed to determine the optimal levels of factors that give the desired mechanical properties of the eco-mortar without the need for retesting, which reduces time and cost.

Keywords: Charts; Rubber aggregates; Dune sand; Eco-mortar; Mechanical properties; Taguchi method

ID: Mat-P-129

Eco-Friendly Fabrication of Zinc Oxide Nanoparticles (ZnO NPs) Using Plant Extracts for Sustainable Applications

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Abstract: This study explores the eco-friendly synthesis of zinc oxide nanoparticles (ZnO NPs) using a plant extract derived from date palm waste as a natural reducing and stabilizing agent. The nanoparticles were characterized using UV-Vis spectroscopy, XRD, SEM, and TEM, confirming their spherical morphology, high crystallinity, and nanoscale size. The synthesized ZnO NPs exhibited promising behavior, making them suitable for water treatment and environmental applications. This approach promotes green chemistry and sustainable nanotechnology as an alternative to conventional.

Keywords: Zinc oxide nanoparticles (ZnO NPs); green synthesis; plant extract; date palm waste; eco-friendly; water treatment.

ID: Mat-P-130

Effect of Al doping and TiO2 interlayer on physical properties of ZnO thin films

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Abstract: In this study, the effects of Aluminum doping and a titanium dioxide (TiO2) interlayer on the structural, morphological and optical properties of ZnO thin flms were investigated. Undoped (ZG) and Al-doped ZnO (AZG) films were fabricated on glass substrates, with and without an TiO2 interlayer, using spray pyrolysis technique. The samples underwent comprehensive characterization via XRD, MEB, and UV–Vis spectroscopy. XRD analysis confirmed successful Al incorporation and enhanced ZnO crystallinity, particularly in the presence of the TiO2 interlayer. MEB analysis revealed improved grain distribution and size due to the synergistic effects of Al doping and the TiO2 interlayer. UV–Vis results indicated signifcant impacts on transparency and the Urbach energy, with Al doping alone reducing the band gap. These findings suggest that Al-doped ZnO films with TiO2 interlayers could have many potential applications in optoelectronics.

Keywords: Spray pyrolysis ; Al doped ZnO films ; TiO2 interlayer; XRD ; MEB; Optical properties.

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Effect of Magnet Design on Regulating the Target Erosion Profile in Magnetron Sputtering

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Abstract: Anomalous erosion in the erosion zones of rectangular targets can lead to reduced material utilization. To investigate the root cause of this phenomenon, a series of simulations were conducted to map the magnetic field intensity across different target sections. The results revealed that the uneven distribution of the magnetic field on the target surface plays a key role in causing anomalous erosion. To address this, an improved magnet design was proposed to enhance erosion uniformity. A 3D simulation model was employed to evaluate the effectiveness of the redesigned magnet arrangement. The findings showed that by achieving a more uniform perpendicular magnetic field distribution — maintaining variations within 10% across erosion zones — the erosion profile became more consistent and controlled. The erosion profile predictions were derived from a non-self-consistent particle simulation, which traced the complex trajectories of magnetized electrons within the magnetic trap, as well as non-magnetized ions bombarding the target surface. The simulated outcomes aligned well with experimental data, accurately reflecting normal erosion patterns, magnetic field strength measurements on the target surface, and erosion depth observations.

Keywords: Magnetron sputtering ; Erosion ; Magnetic field ; Finite element method ; Monte Carlo simulation

ID: Mat-P-132

Elaboration of New Colorimetric Sensor based on Nano-materials for Medical Sensing Applications

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Abstract: Ascorbic acid, commonly known as vitamin C, is an essential nutrient that plays a crucial role in various biological functions within the human body. In this study, we developed a new sensor utilizing nanoparticles for ascorbic acid detection. Our objective was to characterize the chemical interaction mechanism between ascorbic acid and gold nanoparticles using UV-visible spectroscopy, with measurements in the wavelength range of 300 to 800 nm. After treating the samples for 5 minutes at room temperature, we observed a color change from colorless to yellow, accompanied by a strong absorption peak near 420 nm.

We found a significant correlation between the absorbance at 420 nm and the concentration of ascorbic acid, establishing a spectrophotometric method capable of sensing ascorbic acid concentrations ranging from 0 to 200 µM. These findings suggest that this nanosensor provides an effective solution for monitoring ascorbic acid in environmental and medical applications.

Keywords: ascorbic detection; nanosensor, sensitivity

ID: Mat-P-133

Enhanced Detection of Phosphate Using Colorimetric Sensors: The Role of pH and Gold Nanoparticles

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Abstract: This study investigates the detection of phosphate using optical sensors. Two primary experiments were conducted. In the first experiment, a solution of Molybdate and Brilliant Green was tested across various pH levels, yielding low sensitivity. The second experiment enhanced detection by incorporating gold nanoparticles into the same solution and evaluating it at pH levels of 3, 4, 5, and 6. The results indicated that pH 4 provided optimal sensitivity. Further real-world tests confirmed the accuracy and enhanced sensitivity of the optimized detection methods, demonstrating their superiority over the initial approaches.

Keywords: Phosphate detection; optical sensors; sensitivity

ID: Mat-P-134

Étude des propérités physiques et mécaniques de bétons de terre stabilisée renforcés de fibres de Diss

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Abstract: Le secteur de la construction est responsable d'une part importante des émissions de gaz à effet de serre et de la consommation de ressources naturelles. Face à ces enjeux, la recherche de matériaux de construction plus durables est devenue une priorité. Les matériaux à base de terre crue, tels que l'adobe, le BTS, offrent une alternative écologique intéressante grâce à leur faible empreinte carbone, leur contribution à la régulation thermique des bâtiments. L'objectif de cette étude est d'évaluer l'effet de l'ajout de fibres végétales (Diss) sur les propriétés mécaniques de bétons de terre, dans le but d'améliorer leur durabilité et d'élargir leurs domaines d'application. Pour ce faire des tiges de fibres de diss ont été incorporées dans la matrice de terre à des taux de 0%, 2%, 4% et 6%. Les essais physiques et mécaniques de compression et de flexion ont démontré que les bétons de terre renforcée par fibre de diss présentent une densité plus faible comparent au béton de terre classique et de résistance à la flexion et à la compression comparable, voire inférieure à celle du béton de terre seule. De plus, les fibres de diss ont pour effet d'améliore le comportement a la rupture.

Keywords: Fibres végétales, Composite, Adobe, Résistance,BTS

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Generation of a 2D model for random fiber distribution based on SEM images

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Abstract: This study presents a methodology for analyzing and simulating random fiber distribution in unidirectional composite materials using Scanning Electron Microscopy (SEM), extracting micro-scale data to enable macroscopic processing while introducing an algorithm that employs repulsion factors to generate random CFRP fiber distributions at various volume fractions (40-60%), creating 2D representations that open avenues for future research on electrical and mechanical properties of composite materials at the micro-scale.

Keywords: Carbon Fiber; Composites; Modeling

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Green synthesis of AgO/Ag2O nanoparticles using Portulaca Oleracea

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Abstract: This study included the eco-friendly synthesis of AgO/Ag2O nanoparticles with Purslane (Portulaca oleracea) leaf extract as the reducing and capping agent. The nanopowder was analysed using X-ray diffraction, scanning electron microscopy, Fourier transform infrared spectroscopy, and UV-visible spectrophotometry. XRD analyses demonstrate the monophasic characteristics of these extremely crystalline silver nanoparticles. SEM analyses the form and morphology of the synthesised AgO/Ag2O. The existence of magnesium and oxygen was also validated by the EDS profile. FTIR analysis revealed the existence of certain functional groups. UV-vis spectrophotometric analyses indicate an absorption band at 450 nm attributed to surface plasmon resonance. The findings have shown the superior efficacy of the environmentally synthesised AgO/Ag2O nanoparticles in the photocatalytic degradation of dye (methylene blue).

Keywords: Green synthesis; AgO/Ag2O nanoparticles; Nanotechnology

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Inhibition effect of sodium molybdate on the corrosion of stainless steel in nitric acid medium

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Abstract: In energy infrastructures, including nuclear power plants, seawater desalination plants, and oil refineries, corrosion and scale deposition pose significant operational risks. Corrosion processes can compromise the structural integrity of cooling systems, leading to catastrophic failures, while scale accumulation on the surface of heat exchangers reduces thermal efficiency and disrupts heat transfer mechanisms. Descaling of these facilities is carried out using strong acids combined with corrosion inhibitors.

This research investigates the electrochemical behavior of AISI 321 stainless steel in nitric acid media with the presence of an inorganic inhibitor (sodium molybdate) or an organic inhibitor consisting of aniline, urotropine, and thiocyanate. The study employs a combination of electrochemical techniques—including potentiodynamic polarization, electrochemical impedance spectroscopy (EIS), and OCP measurements—as well as physicochemical characterization via X-ray fluorescence (XRF) and X-ray diffraction (XRD) to evaluate material composition and microstructural changes.

Electrochemical results revealed the susceptibility of AISI 321 to intergranular corrosion within a nitric acid environment. Weight loss experiments quantified a decrease in corrosion rate upon the introduction of the evaluated inhibitors from 0.013 mm/y to 0.010 mm/y. Notably, electrochemical impedance spectroscopy and potentiodynamic polarization measurements indicated that a 4×10^{-2} M concentration of sodium molybdate, and the mixture of organic inhibitor, significantly suppressed the corrosion of AISI 321. Considering the established toxicity profile of the organic inhibitor, sodium molybdate is recommended as a preferable, environmentally conscious alternative for mitigating AISI 321 steel corrosion in nitric acid solutions.

Keywords: AISI 321; Potentiodynamic test; OCP; EIS; scale deposition; corrosion; corrosion inhibitors; X-ray diffraction; XRF

ID: Mat-P-138

Mechanical Alloying Synthesis and 800°C Sintering Consolidation of FeCrCoMnNi High-Entropy Alloy: A Study of Structure, magnetic and Mechanical Properties.

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Abstract: FeCoCrNiMn powders were mechanically alloyed for 48 hours in a high-energy planetary ball mill under an argon atmosphere, followed by heat treatment in a differential scanning calorimeter up to 900°C. The milled powders were then compacted and sintered in a tubular furnace at 800°C for one hour. The X-ray diffraction analysis revealed the presence of a nanocrystalline mixture consisting of face-centered cubic (FCC) and body-centered cubic (BCC) solid solutions, along with a small amount of the Mn-type cubic phase after 48h of milling. The average crystallite size was found to range between 6 and 45 nm. The heat-treated powder exhibits an FCC solid solution and an Mn-type cubic phase. In contrast, the sintered sample exhibited a combination of FCC and oxide phases with larger crystallite sizes. Milled powder exhibited a higher saturation magnetization and coercivity value than the heat-treated powder. The achieved micro hardness of the Sintered pellet was 464.41 HV.

Keywords: Mechanical alloying; High-entropy alloys; X-ray diffraction; Magnetic properties; Mechanical properties.

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Obtaining and characterizing steel parts assembled by electric welding: Comparative study of MIG and TIG processes

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Abstract: Welding is the technique of assembling more metal parts with or without bringing metal. The several welding processes have been regrouped in a group of fusion welding. This last is based on the principles of heat application to assemble the materials to be welded. Different welding processes are determined by the thermal energy source whether it results from electrical, chemical and mechanical energy, with a variety of different techniques available.

The objective of this work is a comparative study of steel parts joined using two types of electric arc welding (TIG and MIG) by varying certain technological parameters corresponding to the processes used. This study focuses on obtaining weld beads between steel parts and characterizing these joined parts using different analysis and control methods.

Keywords: Welding ; Steel ; MIG process ; TIG process

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photocatalytic activity of iron oxide nanoparticles synthesized by Helianthemum (L) Pers plant extract for the degradation of Methylene blue and congo red dyes

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Abstract: Hematite (α-Fe_2O_3) nanoparticles (NPs) was biosynthesized using by Helianthemum (L) Pers plant extract and $FeCl_3.7H_2O$ precursor and characterized using X-ray diffraction (XRD), Ultraviolet–visible (UV-Vis), Fourier transform infrared (FTIR), and scanning electron microscopy (SEM) techniques. Moreover, the photocatalytic activity of synthesized sample calcined at 500 °C for the degradation of Congo red (CR) and methylene blue (MB) dyes was studied and results indicated good catalytic activity towards MB at natural pH and efficient degradation for CR at alkaline pH under sunlight irradiation. The produced nanoparticles showed potential for application in water treatment technologies due to the synthetic technique relative ease and the possibility of a low-cost catalyst.

Keywords: Helianthemum (L) Pers , photocatalytic activity , methylene blue, Congo red

ID: Mat-P-141

Preparation of a plant activated carbon. Application in the adsorption of an anti-inflammatory molecule

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Abstract: The preparation of activated carbon from a powder of date cores with an average diameter equal to 183.57 µm is obtained by chemical activation with zinc chloride. The determined iodine index and zero charge point indicate that the surface of the powder grains reflects an acidic character.

The application of this bio product valued in the adsorption of a pharmaceutical molecule; flubifene ® 100 mg has approved its adsorption efficiency. Recorded results show a maximum adsorption capacity of 0.297 mg/g and verify the Langmuir model 1.

Keywords: flubifene ®100mg ; Activated carbon ; recovery ; Adsorption ; iodine index chemical ; Chemical activation

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Preparation of cellulose/magnesium oxide nanoparticles from Algerian desert plants and their effect on antibacterial and antifungal activities.

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Abstract: Desert plants are a source of renewable natural materials and well-adapted to desert environments, these plants provide a renewable and underutilized raw material cellulose.This research objective on extracting cellulose and the synthesis of cellulose/magnesium oxide nanoparticles. from certain wild plants in Oued Souf region of Algeria. We extracted cellulose fibers using alkaline treatment, followed by bleaching with sodium hypochlorite (NaClO), and then synthesized CNC/MgO nanoparticles from the extracted cellulose and magnesium oxide.

These CNC/MgO nanoparticles were characterized using FTIR, DRX, and UV-VIS techniques. These cellulose/MgO nanoparticles were then tested against human pathogenic bacteria (Escherichia coli, Klebsiella pneumonia , and Staphylococcus aureus) and fungi (Candida albicans).

The results showed that the cellulose extraction yield was 32%. These cellulose/magnesium oxide nanoparticles exhibited antibacterial activity against E. coli, but did not achieve any results against other bacteria. They also demonstrated excellent antifungal activity against Candida albicans.

They hold promise as potential therapeutic agents for combating various diseases caused by pathogenic microorganisms.

Keywords: Peanut shells • Cellulose nanocrystals • MgO • Characterized • Antibacterial activity • Antifungal activity .

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Structural Assessment and Material Behavior of a Drone Propeller at Different Rotational Speeds

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Abstract: This study presents a structural analysis of a drone propeller modeled as a cantilever beam subjected to centrifugal forces. The analysis investigates the displacement, strain, and von Mises stress distribution along the propeller blade for different materials and rotational speeds. Five materials are considered: Aluminum, Titanium alloy, Carbon/Epoxy, Glass/Epoxy, and Reinforced Nylon. The rotational speeds range from 1000 to 7000 RPM, covering typical drone operating conditions. A finite element approach is implemented in MATLAB to compute the structural response of the propeller. The methodology includes discretizing the propeller into 100 segments, applying centrifugal force distributions, and solving for bending moments, shear forces, and resulting deformations. The deflections and stresses are derived using beam bending theory, and von Mises stress is calculated to evaluate material performance. Results indicate that composite materials Carbon/Epoxy exhibit lower deformation and stress levels compared to metallic and polymeric materials, making them suitable for lightweight and high-performance drone applications. The von Mises stress distributions are analyzed to determine the critical rotational speed at which each material reaches its yield strength, providing insight into material selection for safe drone operation. Comparative plots illustrate the variations in maximum displacement, strain, and von Mises stress as a function of rotational speed. Additionally, an estimation of the critical rotational speed for each material is performed based on the yield stress threshold. The study highlights the importance of material selection in optimizing drone propeller performance, ensuring both structural integrity and efficiency. These findings contribute to the development of lightweight, high-strength drone propellers, optimizing material performance under dynamic loading conditions. Future work may include 3D finite element validation and aerodynamic coupling effects to refine the structural analysis further.

Keywords: Drone Propeller, Structural Analysis, Displacement, Material Performance, Rotational Speeds, Finite Element Method.

ID: Mat-P-144

Study of Copper Nanoparticles BioSynthesis, Characterization, and Morphological Analysis

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Abstract: This study aimed to synthesize and characterize copper nanoparticles (CuNPs) using a simple and effective biological reduction method. Copper sulfate pentahydrate served as the precursor, while starch was employed as a stabilizing agent. Ascorbic acid functioned as the reducing agent, and sodium hydroxide was used to accelerate the reduction reaction and regulate the pH of the solution. Characterization was performed using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and energy-dispersive X-ray analysis (EDX) to determine their particle size, composition, and morphology. The results revealed that the CuNPs exhibited diverse and asymmetrical morphologies with an average size of approximately 10 nm. From this we conclude that starch is a biological polymer that can work to convert copper salts into nano- forms with distinct properties that contribute to the biological effectiveness of these elements.

Keywords: Copper_anoparticle1; Biosynthesis2; Starch3; Characterization4 .

ID: Mat-P-145

Sustainable Removal of Antibiotics and Organic Dyes from Water and Antioxidant Enhancement Using Zinc Oxide Nanoparticles Synthesized from Pomegranate Peel

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Abstract: This study explores the green synthesis and characterization of zinc oxide nanoparticles (ZnO NPs) derived from pomegranate fruit peel, aiming to enhance their photocatalytic and antioxidant activities. The ZnO NPs were synthesized using an eco-friendly method and characterized through UV-Visible spectroscopy, FTIR, XRD, XRF, and Raman spectroscopy. Their photocatalytic efficiency was evaluated for the degradation of Brilliant Cresyl Blue (BCB), Rose Bengal (RB), Ciprofloxacin (CIP), and Cefalexin (CEF) under sunlight irradiation. The results demonstrated remarkable degradation efficiencies of 95.46% for BCB and 90.57% for RB within 120 minutes, while CIP and CEF achieved 94.76% and 91.37% degradation, respectively, in just 50 minutes. Additionally, the ZnO NPs exhibited significant antioxidant activity, reaching 68.76%. These findings highlight the potential of ZnO NPs synthesized from pomegranate peel as an efficient and sustainable solution for environmental remediation and biomedical applications.

Keywords: Zinc oxide nanoparticles, Pomegranate peel, Green synthesis, Photocatalysis, Antibiotic degradation, Organic dye removal, Antioxidant activity, Environmental remediation, Sunlight irradiation, Sustainable nanotechnology.

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Synthèse et étude structurale d’un matériau hybride à transfert de protons : « 2-Carboxyanilinium hypophosphite »

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Abstract: Ce travail s'inscrit dans le contexte de l'étude expérimentale par diffraction des RX de nouveaux matériaux hybrides d'une matrice organique et d'un anion minéral. L'objectif des recherches sur ces matériaux est de générer des propriétés et des fonctionnalités désirées, de mettre en lumière ou d'améliorer les attributs optiques [1], électrochimiques, magnétiques [2] ou électriques [3]. Les composés hybrides ont une place essentielle dans le métabolisme cellulaire, intervenant dans le transfert d'énergie grâce à leur capacité à engager de nombreuses interactions intermoléculaires via les liaisons HYDROGÈNE.

L'association de la matrice organique (acide anthranilique) et des ions minéraux nous a conduit à découvrir des structures uniques affichant des liaisons hydrogènes de différentes forces : fortes, moyennes et faibles. Plusieurs cristaux ont déjà été isolés dans ce système [4-5-6-7].

Le nouveau composé original à base de l’acide anthranilique et de l’anion minéral [8] a été synthétisé par protonation de l’acide anthranilique et de l'acide hypophosphoreux. La cohésion de la structure cristalline formée par l’anion $(H2PO2)^{-}$ et le cation $(C7H8NO2)^{+}$ a été assurée par des liaisons hydrogène de type N – H ··· O et O – H ··· O.

Keywords: Matériaux hybrides ; liaison hydrogène ; diffraction des rayons X.

ID: Mat-P-147

Synthesis and Characterization of Natural Porous Bioceramic Scaffolds Derived From Biowaste

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Abstract: The aim of this study is to synthesize natural hydroxyapatite nanoparticles derived from bovine bone waste. Furthermore, to create porous bioceramic scaffolds using a pore-forming agent. The physical and chemical characteristics of the bioceramic were determined using X-ray diffraction analysis (XRD), thermal analysis (TGA), Fourier transform infrared spectroscopy (FTIR), and measurement of density and porosity and the antimicrobial activity was studied using disc diffusion method. The XRD results revealed of powder consists of hexagonal structure hydroxyapatite and the secondary compound were detected resulting of hydroxyapatite decomposition. The presence of phosphate groups, carbonates groups and hydroxyl groups in the bioceramic was ascertained by the FT-IR analysis. The TGA analysis confirms the results previously obtained by FTIR and XRD. While antibacterial activity studies showed zones of inhibition from 05–10 mm against Staphylococcus aureus an echericha coli bacteria. Porous HA scaffold up to 60% porosity can be prepared using ammonium bicarbonate as a pore forming agent.

Keywords: natural hydroxyapatite; bovine bone; antibacterial activity; porosity; porous scaffolds; bioceramic.

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Synthesis by Organic Solar Cells SnO2 Thin Films for Gas Sensing

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Abstract: This study successfully fabricated SnO_2 thin films on glass substrates using a pneumatic spray deposition technique with 0.1 M tin chloride dihydrate precursor at 450°C for organic solar cell applications. The investigation focused on the influence of deposition rate variations (5, 10, and 15 ml) on the structural, optical, and electrical properties of the films. Characterization revealed that the deposited SnO_2 films exhibited a polycrystalline structure, with the maximum crystallite size (35.3 nm) achieved at the intermediate deposition rate of 10 ml. Optical analysis demonstrated variable transmittance behavior in the visible spectrum, averaging approximately 60%, while the optical bandgap energy showed a progressive increase from 3.2 eV (5 ml) to 3.6 eV (15 ml) with higher deposition rates. Electrical measurements indicated enhanced conductivity, rising from 0.01 $(\Omega \cdot cm)^{-1}$ at 5 ml to 0.06 $(\Omega \cdot cm)^{-1}$ at 15 ml. The combination of stable phase formation and improved electrical conductivity suggests these SnO_2 thin films possess promising characteristics for gas sensing applications.

Keywords: SnO2, Thin films, Spray pneumatic method, Organic solar cells, Electrical conductivity.

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SYNTHESIS, CHARACTERIZATION, ELECTROCHEMICAL BEHAVIOUR AND THE ANTIOXIDANT ACTIVITY OF NICKEL (II) COMPLEX DERIVED FROM FUROPYRAN-3,4-DIONE LIGAND

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Abstract: Metal complexes approve a major importance in experimental research areas due to their several uses in catalytic activities, environmental issues, redox investigation and biological properties. This is principally related to their suitable electronic properties involving the central metal. In this context, many works based on metal complexes derivatives show a remarkable catalytic behaviour of these compounds, useful in electrochemical processes and organic synthesis reactions. Moreover, cancer and degenerative diseases are widely discussed in medicinal literature. The main factors causing these diseases are namely free radicals. In this regard, and in order to eliminate free radicals and to protect the human body from some serious diseases for instance cancer and heart diseases, new antioxidant agents are used . Since then, the development of antioxidant therapy has become a key goal to prevent chronic and degenerative diseases. For these reasons, we were interested in the synthesis, the characterization, the electrochemical behaviour and the antioxidant activity of a new complex of nickel (II) with Furo[2,3-c]pyran-3,4-diones derivative ligand. This complex was characterized by elemental analysis, spectroscopy measurements, magnetic measurement, conductivity and thermal analysis. FTIR and 1HNMR spectroscopy has revealed the coordination mode of the complex. Furthermore, the UV-Visible spectroscopy and the magnetic measurement results approved a tetrahedral geometry for Ni (II) complex. The electrochemical behaviour of the ligand and its respective complex were determined by cyclic voltammetry, which reveal different redox processes. The antioxidant activity was carried out using the DPPH method test. A good correlation was observed for the redox potential and the antioxidant activity of synthesized complexes.

Keywords: Nickel (II), Electrochemistry, Antioxidant activity, Furopyran-3,4- dione.

ID: Mat-P-150

The effect of TiO_2 on the anticorrosion barrier of acid-doped conductive polymer epoxy films applied onto stainless steel.

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Abstract: The incorporation of titanium dioxide (TiO_2) into epoxy coatings based on conductive polymers is a promising approach to enhancing the corrosion resistance of stainless steel. By forming a denser and less permeable coating, TiO_2 limits electrolyte penetration and chloride ion diffusion through the porosity of carbon chains. It also interacts with conductive agents such as polyaniline (PANI), stabilizing electron distribution and reducing crevice corrosion.

However, electrochemical studies (OCP, LPR, Tafel, and EIS curves) show that TiO_2 improves polarization resistance (Rp), decreases corrosion current density (Icorr), and stabilizes corrosion potential (Ecorr), thereby reducing the corrosion rate. It also enhances long-term durability by limiting water absorption, trapping free radicals, and providing partial cathodic protection, extending the coating's performance beyond 250 days in a 3.5% NaCl solution.

Ultimately, the effectiveness of TiO_2 depends on its concentration, dispersion, and synergy with epoxies and additives. Optimizing these parameters would maximize its role as an advanced anti-corrosion additive, thereby improving the long-term protection of stainless steel in saline environments.

Keywords: TiO2 nanoparticules; Anticorrosion barrier; Epoxy; Corrosion; Polyaniline

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The positive effect of incorporating limestone sand on the microstructural performance of concrete against the aggressions of rising groundwater in El Oued.

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Abstract: Thermogravimetric analysis was used to study the effect of incorporating 50% crushed limestone sand on the degree of cement hydration and the microstructural stability of concrete exposed to three aggressive environments (A, B, and C). The test concrete samples (C1) and reference samples (C0) were subjected to a thermal cycle ranging from 30 to 600 °C at a heating rate of 10 °C/min under a nitrogen atmosphere.

The thermogravimetric curves reveal four main phases of mass loss. The first phase, occurring between 113 and 119 °C, is related to the dehydration of capillary water and ettringite (AFt). The second phase, between 144 and 150 °C, corresponds to the dehydration of gypsum into anhydrite ($CaSO_4$). The third phase, observed at 270 °C for C0A, is associated with the dehydroxylation of aluminum hydroxide. Finally, portlandite undergoes dehydration between 450 and 462 °C.

Environment A induces greater mass loss than environments B and C, indicating more severe degradation. The C1 sample exhibits better thermal stability than C0 due to its reduced porosity and limited leaching of cement hydrates. These results confirm the beneficial effect of crushed limestone sand on the durability of concrete exposed to aggressive conditions.

Keywords: concrete, crushed limestone sand, Microstructure, Thermogravimetric Analysis, aggressive environment, cement hydrates.

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Thermal Behavior of a Layer Containing an External Crack and Subjected to Prescribed Heat Fluxes

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Abstract: In this study, we deal with the thermal analysis of a layer medium containing an external circular crack and subjected to prescribed heat fluxes. The presence of the crack introduces a mixed boundary value problem, rigorously addressed through the formulation of dual integral equations derived using Hankel transform techniques. To solve these equations, some integral formulas and the Gegenbauer addition formula are applied, reducing the problem to an infinite system of simultaneous equations. This analytical framework enables explicit determination of the temperature and heat flux distributions in the cracked layer.

A significant strength of the proposed methodology lies in its capacity to capture the singular thermal behavior near the crack edges—a challenge often faced by purely numerical approaches. To validate the analytical model and assess its accuracy, finite element simulations are carried out using ANSYS. The comparison reveals excellent agreement, particularly in capturing localized thermal gradients, thus demonstrating the reliability of the analytical solution and its advantage in providing closed-form insights where numerical mesh refinement would be computationally demanding.

This work offers valuable contributions to engineering applications where thermal integrity is critical, such as in heat exchangers and structural components in aerospace, nuclear, and sustainable energy systems. The analytical results serve as a powerful tool for predicting the thermal response of defect-containing materials and for benchmarking numerical methods commonly used in design and optimization tasks. Furthermore, the derived solutions can be extended to evaluate thermal displacements and stresses in thermoelastic problems.

These efforts would enhance the model's applicability to real-world engineering materials and structures, contributing to improved reliability assessments and better material and structural design.

Keywords: Heat conduction; External crack; Mixed boundary value problem; Hankel transform technique; Dual integral equations, Thermal fields

ID: Mat-P-153

Thermal, Physical and Structural Properties of Calcium Fluoro-Oxy-germanotellurite Glass-ceramics

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Abstract: Our work has focused on the development of new ceramic glass materials, combining the clean properties of amorphous glass with those of crystals. In this sense, new rare earth-doped germano-tellurite glasses have been synthesized and their thermal properties have been studied. The optimization of the experimental conditions, temperature and heat treatment time, resulted in the possibility of formation of crystalline phases. Structural analysis by High-Resolution Transmission Electron Microscopy (METHR) and X-ray diffraction (XRD) showed the formation of CaF2 fluorine crystals with a size of about 5-12 nm. The spectroscopic and magnetic properties of the Yb 3+ ions dissolved in the glass and in the nanocrystals, were investigated by absorption and emission spectroscopies and magnetic susceptibility measurements.

Keywords: glass ceramic; germano-telluritte; rare Earth; magnetic susceptibility

ID: Mat-P-154

Effet du dopage Sm/Ag NPs sur le verre de phosphate

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Abstract : Les verres constituent une grande famille de matériaux optiques. Ils possèdent plusieurs avantages, tels que la transparence, la facilité de mise en forme, et la flexibilité de leur composition chimique.

De nombreux matériaux solides sont utilisés comme des hôtes pour les lasers et les amplificateurs optiques. Parmi ces matériaux, les verres contenant des ions de terres rares se sont révélés similaires à bonnes matrices hôtes. Cependant, depuis plusieurs années, il y a eu un intérêt augmenté dans la caractérisation de nouveaux verres avec différentes compositions, et également sur les propriétés spectroscopiques des ions de terres rares dans les verres.

Nous avons étudié l'influence du dopage Sm^{3+} /Ag NPs sur les propriétés optiques des verres de phosphates.

Keywords : Ions de terres rares; Nanoparticules d’argent; Propriétés optiques ; Samarium; Spectres d'absorption; Verres de phosphate.

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Study of cracked FGMs subjected to velocity dynamic load by XFEM

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Abstract: Dynamic stress intensity factor (DSIF) is calculated to analyze the cracked structures made up of functionally graded materials (FGM) under velocity dynamic load. Keeping Poisson's ratio (υ) constant, the material constants like mass density (ρ) and Young's modulus (E) change exponentially and continuously along a given direction. The effect of d FGM grading direction on DSIF is investigated here. A computer program based on the Level-Set method (LSM) and the extended finite element method (XFEM) was created in an effort to accomplish this. The satisfactory agreement of the results and the previous research verifies the efficiency the robustness of the created program

Keywords: FGM ; DSIF ; XFEM

ID: Mat-P-156

Impact of chlorine doping on the density of localized states in amorphous selenium

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Abstract: The investigation of the density distribution of localized states in pure amorphous selenium (a-Se) and arsenic-doped selenium (a-Se: As), utilizing transient photoconductivity measurements, revealed a non-monotonic distribution on the valence band side. The research was facilitated by the simulation of transient photocurrents generated by a Laplace inverse program. The currents modeled with an exponential distribution combined with a Gaussian correspond to the observed currents [1]. The introduction of this model led Koughia's group to reassess their distribution, observing that the observed peaks in our study result from the diffusion phenomena recognized in transient photoconductivity studies [2]. The defensive reaction of the non-monotonic model pertained to the simulation of hole lifetime. The obtained values validate the concordance between our computations and the experimental data [3-4]. A comprehensive investigation is essential to address these difficulties. A method has been established to characterize the distribution of electronic states next to the valence band in chlorine-doped selenium.

Keywords: Density of localized states; Amorphous Selenium; Transient photoconductivity; Laplace transform.inverse Laplace

ID: Mat-P-157

Investigation of Density of States in Amorphous Semiconductors via Time-of-Flight (TOF) Photocurrent Analysis

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Abstract: We discuss the electronic transport properties of amorphous semiconductors, namely the structural model of amorphous selenium (a-Se), which was examined using Time-of-Flight (TOF) measurements in conjunction with numerical computations. This study has concentrated on the density of states (DOS) in amorphous selenium (a-Se) and the hole mobility in a-Se. We conduct a comprehensive investigation of the localized states within the mobility gap utilizing the Laplace transform approach[1-2] . This method effectively extracts the energy distribution of localized states that govern electronic transport processes. The TOF measurements[3] permit an examination of the time-dependent dynamics of charge carriers and a comprehensive evaluation of transport parameters, such as the drift mobility of holes. These numerical computations, employing various models of localized states, assist in elucidating how these states govern charge transport, particularly in disordered and amorphous materials. The long-range percolation model and its associated density of states will act as the foundation, with the study's objective being to elucidate the fundamental characteristics of these device materials via the scattering mechanics of charge carriers, thereby informing the design and enhancement of various electronic materials and devices, including thin-film transistors, electronic memory, and solar cells. The study examines the impact of temperature and material processing parameters on charge carrier mobility. The findings elucidate the influence of electronic states within the mobility gap on transport properties and provide valuable avenues for improving the performance of devices utilizing amorphous selenium in various applications. Our findings underscore the significance of localized states in the overall transport characteristics of disordered semiconductors and provide directives for improved material design in the future.

Keywords: Mobility band gap; Amorphous selenium (a-Se); Time of flight (TOF) photoconductivity; Laplace transform.

ID: Mat-P-158

Thermal conductivity of AlN thin films deposited by DC magnetron sputtering on different substrates for thermal management applications

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Abstract: In this work, we report the thermal conductivity measurements of Aluminum nitride (AlN) thin films deposited on different substrates by reactive magnetron sputtering at room temperature. The thermal conductivity values were obtained using the transient hot strip technique (THS) with integrated micro-sensors bridges designed for detecting transient temperature responses in the time window [100 ns – 10 µs] subsequent to an electrical pulse. A thermal transient model was developed in order to estimate the thermal properties by fitting the temperature signals and the numerical signals model. Examples of the architecture of the micro-sensors and numerical results on aluminum nitride will be presented to highlight their sensitivity. As well as, a strong relationship between thermal conductivity and the microstructure of AlN films is obtained.

Keywords: AlN, thermal conductivity, transient hot strip technique, thin films, magnetron sputtering, micro-sensors, microstructure, interfaces, thermal management

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Analysis of the distribution of localized states in Amorphous arsenic triselenide (a-As2Se3)

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Abstract: The extraction of the density of localized states within the bandgap of amorphous semiconductors from transient photocurrents has been a significant research focus for some time [1-2]. The continuous distribution of localized states arises from the simultaneous interaction of free carriers with various localized states, which involves the complex dynamics of trapping and recombination. To study these dynamics, several methods can be employed, including time-of-flight (TOF) and standard Transient Photoconductivity (TPC) [3]. The multiple trapping model effectively explains much of the experimental data, establishing a connection between the measurements and trapping dynamics. According to this model, information about the density of states is encoded in the transient photocurrent associated with free or localized carriers [4]. This work aims to critically analyze the ability to extract the density of states distribution from numerical simulations of standard transient photoconductivity. The technique derived from the multiple trapping model involves initially calculating the density of states function by solving the continuity equation via the Laplace transform of the I(t) data. The developed simulation model was validated using experimental TPC data from amorphous arsenic triselenide (a-As2Se3).

Keywords: Density of localized states; Amorphous arsenic; Triselenide (a-As2Se3); Transient photoconductivity; Laplace transform.

ID: Mat-P-160

QSPR Applications on Heat of formation of Monocarboxylic Acids using the quantum molecular descriptors

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Abstract: Quantum chemical descriptors of 19 monocarboxylic acids (C_2–C_{20}) were calculated using the DFT-B3LYP method with the 6-31G(d,p) basis set. These descriptors, along with the enthalpies of formation (ΔH°f liquid), were employed in quantitative structure–property relationship (QSPR) modeling using multiple linear regression (MLR). The resulting three-descriptor model demonstrated strong predictive performance, with a multiple correlation coefficient of R^2 = 0.997597, leave-one-out cross-validation R^2LOO = 0.996138, and a root-mean-square deviation of 7.74737. External validation confirmed the model's robustness, yielding a correlation coefficient of Q^2ext = 0.998652. These results indicate that the QSPR model possesses both high estimation stability and excellent predictive power. Overall, the findings reveal strong correlations between the molecular structure of monocarboxylic acids and their enthalpies of formation (ΔH°f liquid), total energy, dipole moment, and electrophilic character.

Keywords: Molecular descriptors, Multiple linear regression , Monocarboxylic acids, QSPR, DFT

ID: Mat-P-161

Green Synthesis of CaO NPs from Thermal Decomposition of Chicken Eggshells: Antifungal, Antibacterial, and Heavy Metal (Pb^{2+}, and Hg^{2+}) Adsorption Properties

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Abstract: Chicken eggshells, an abundant waste byproduct of the poultry industry, are rich in calcium and serve as ideal precursors for synthesizing calcium oxide nanoparticles (CaO NPs). This study aims to develop an eco-friendly synthesis method for CaO NPs using chicken eggshells. Additionally, the study evaluates the antibacterial and antifungal efficacy of CaO NPs and their ability to remove heavy metal ions ($Pb^{2+}$and Hg^{2+}) from aqueous solutions. The synthesis produced spherical single-crystal CaO NPs with a crystalline dimension of approximately 20 nm and a diameter ranging from 5 to 30 nm. NPs exhibited significant antibacterial activity against Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae, with inhibition zones increasing with concentration. They also effectively inhibited Candida albicans. Optimal heavy metal removal (90-95%) was achieved at pH 7, 25°C, with 30 minutes of stirring and 30 mg of adsorbent.

Keywords: Chicken Eggshells, Calcium Oxide Nanoparticles, Antibacterial Activity, Anticandidal Activity, Heavy Metal Removal, Adsorption, Waste Vaporization.

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Photocatalysis of biomass-derived MgO NPs

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Abstract: Biodegradability, antibacterial activity, biocompatibility, lack of toxicity, wound healing speed, and immune system activation are among the exceptional qualities of chitosan, one of the most prevalent biopolymers in nature. In this search, chitosan was extracted from Pimelia payraudi Latreille beetle and used to produce highly purified MgO NPs through a more straightforward and environmentally favourable procedure. The chitosan that was extracted exhibited exceptional physicochemical properties, such as a extraction yield (39%), and a degree of deacetylation (90%). The MgO NPs exhibited a spherical shape, with crystallite diameters of 17 nm, and particle sizes ranging from 20 to 70 nm. At a contact time of 60 minutes, a modest initial methylene blue concentration of $6 \times 10{-}5$ M, and a pH of 7, the removal of methylene blue dye from MgO NPs reached 60%.

Keywords: Chitosan; MgO NPs; Nanotechnology, photocatalytic activity, AZO dye.

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Spectral conversion for solar energy: Tm^{3+}-activated fluoride glasses enabling visible-to-NIR Down-Shifting

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Abstract: Rare-earth (RE) ions incorporated into various host matrices have garnered increasing attention due to their promising applications in solid-state lasers [1], planar waveguides [2] and as up- or down-conversion materials for photovoltaic devices [3]. The conversion efficiency of conventional silicon (Si) solar cells is fundamentally limited to approximately 30%, as only photons with energies close to the semiconductor bandgap (wavelengths below 1100 nm) can be effectively absorbed [4]. In this context, down-Shifting (DS) processes offer an innovative strategy by converting one high-energy visible photon into one lower-energy near-infrared (NIR) photon, which match the optimal absorption range of Si solar cells. In this work, Tm^{3+}-doped and Tm^{3+}/Yb^{3+} co-doped fluoride glasses based on the ZLAG system were successfully synthesized using the conventional melt-quenching method. Several characterization techniques were employed: absorption spectra were recorded using a Perkin Elmer Lambda 1050 spectrophotometer, while photoluminescence (PL) spectra and decay time measurements were conducted in the visible and NIR regions using a spectrofluorometer with a xenon lamp as the excitation source. All measurements were performed at room temperature. This is attributed to a cooperative energy transfer mechanism from Tm^{3+} to Yb^{3+}, as confirmed by photoluminescence analyses. These results highlight the potential of these materials as efficient down-shifting encapsulants for enhancing the performance of Si-based solar cells.

Keywords:

ID: Mat-P-164

Calcination Temperature-Dependent Structural, Morphological, and Optical Characteristics of M-Fe_2O_4 Spinel Ferrites

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Abstract: In this study, the impact of calcination temperature on the structural, morphological, and optical properties of M-Fe2O4 (M= Cd0.6Mg0.2Cu0.2) spinel ferrites was thoroughly investigated. Samples, designated as S950 and S1050, were synthesized using the sol-gel method and subjected to calcination at 950 °C and 1050 °C, respectively. The cation distribution within the samples was analyzed via X-ray photoelectron spectroscopy (XPS) and X-ray diffraction (XRD), with Rietveld refinement applied to determine atomic occupancy values. The structural properties were further examined using XRD and Fourier transform infrared spectroscopy (FTIR). Results indicated an increase in crystallite size with higher calcination temperatures. FTIR spectra confirmed the formation of metal-oxygen bonds at both octahedral and tetrahedral sites. Additionally, a blue shift in UV-visible absorption spectra was observed with increasing calcination temperature. This comprehensive analysis underscores the significant influence of calcination temperature on the various properties of M-Fe2O4 spinel ferrites.

Keywords: Nano ferrite; structural properties; optical; FTIR

ID: Mat-P-165

Design and numerical investigation of a broadband metamaterial absorber and thermal emitter based on manganese microstructures for thermophotovoltaic applications

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Abstract:

We propose a novel metamaterial-based broadband solar absorber and thermal emitter for thermophotovoltaic (TPV) applications. The designed structure consists of two concentric cylinders placed atop a dielectric spacer, with a manganese (Mn) layer as the bottom reflector. The absorber leverages the synergistic effects of plasmonic and photonic resonances to achieve high absorption across a broad spectrum, maximizing solar energy harvesting. The manganese backing enhances absorption efficiency while ensuring high thermal stability and selective thermal emission in the infrared range, which is crucial for efficient TPV conversion. Finite-difference time-domain (FDTD) simulations confirm that the proposed structure exhibits near-unity absorption over a wide spectral range, making it a promising candidate for next-generation solar energy and thermophotovoltaic systems.

Keywords: thermophotovoltaic systems, metamaterial absorber, solar energy harvesting, FDTD.

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Amélioration des propriétés mécaniques de lœss

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Abstract:

Le lœss est pr´esent sur toute la surface du globe, notamment aux ´ Etats-Unis, en Chine et en Europe occidentale. Sur le vieux continent, il se rencontre surtout au nord de l'Afrique, en Tunisie et dans le sud de l'Alg´ erie (Gharda¨ ıa). Il constitue un danger `a cause de sa capacit´ e `a se liqu´ efier en pr´esence d'eau. Ce travail s'int´ eresse `a l'am´ elioration du lœss de deux communes (Diai Bendahoua et Metlili) de Gharda¨ ıa avec l'ajout de bentonite, agrile Jaune et agrile bleu `a diff´ erentes concentrations. Afin de trouver des solutions aux probl` emes de liqu´ efaction du lœss en Alg´erie en valorisant les ressources naturelles alg´ eriennes dans un contexte de protection de l'environnement. Des essais de compression ont ´ et´ e r´ ealis´ es pour sept sp´ecimens `a diff´erents rapports argile (bentonite, argile Jaune agrile bleu)/lœss (0/100, 5/95, 10/95, 15/85, 20/80, 25/75 et 30/70) `a 28 jours de la date de la confection des ´eprouvettes, et ce dans le but de poursuivre l'´ evolution de la r´ esistance `a la compression des sp´ ecimens en fonction du rapport argile/lœss (0/100, 5/95, 10/95, 15/85, 20/80, 25/75 et 30/70) . Les r´esultats obtenus ont montr´ e qu'un rapport 20 bentonite/ 80 lœss, 20 argile Jaune/ 80 lœss et 20 argile Bleu/ 80 lœss am´ eliore r´ esistance `a la compression de lœss par 16.7% , 4.9% , 12.1% , 12.2%, 4.8% et 24.7% du lœss Metlili et Da¨ ıa Bendahoua respectivement.

Keywords: lœss, propri´et´es m´ecaniques, Am´ elioration, Bentonite, Agrile Jaune, Agrile bleu.

ID: MPh-O-1

Bound State of a Non-Relativistic Oscillator in Deformed Quantum Mechanics

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Abstract: To study the behavior of the majority elements brines and precipitation of salts from a primary mother solution at the laboratory. Add a crystallizer contains 3.5 liters of brine inside electric thermostat and constant the temperature to 35 ° C in each day the density, the pH, the temperature and conductivity are recorded, with filtration the solution after in fact the chemical analyzes to determine the concentration according to the isothermal state.

Keywords: Schrödinger oscillator, non-commutative space, Anti-de Sitter space, thermodynamic properties.

ID: MPh-O-2

A new generalization of normal operators

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Abstract: In this work, we define and study a new class of bounded linear operators which is a generalization of the class of normal operators. We study the product and the sum of such a class, also we give some spectral properties of this class of operators. Finally, we show further results concerning this class of operators on a finite dimensional Hilbert space.

Keywords: Selfadjoint operators; Normal operators; Unitary operators.

ID: MPh-O-3

Finite element analysis of critical whirling speed of drill string

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Abstract: This study presents a comprehensive analysis to investigate the critical whirling speed of drill strings, a crucial factor influencing drilling efficiency and safety. The finite element method is used to model the dynamic behavior of the drill string under different operational conditions. The Euler Bernoulli beam theory was used for the finite element modeling of the shaft. The effect of rotational inertia and gyroscopic effect are taken into account. The Campbell diagram, mode shapes and orbit plots are used to analyze the dynamic behavior of the rotating system. The study also explores the impact of drill stem wall thickness, demonstrating that thicker walls enhance the structural integrity and stability of the drill string, thereby increasing the critical whirling speed. Furthermore, the incorporation of stabilizers is shown to mitigate whirling effects by providing additional support and reducing lateral movement. Overall, the findings contribute valuable insights into the design and operational strategies for drill strings, aiming to optimize performance while minimizing the risk of failure during drilling operations.

Keywords: Finite element method; rotordynamics; drill strings; critical whirling speed.

ID: MPh-O-4

Electrical conductivity of weakly correlated plasma media

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Abstract: Transport coefficients are among the most important physical properties of plasma, as they can be expressed using correlation functions, and are calculated using several methods (numerical methods, analytical theories). The electrical conductivity, which is one of the main transport coefficients in the weakly coupled parameter limit, is calculated using both the electric field autocorrelation function and the velocity autocorrelation function. Their results are compared and the best method is determined.

Keywords: transport coefficients; plasma; correlation functions; electrical conductivity.

ID: MPh-O-5

Simulation Numerique de la Lubrication Hybride en utilisant des Fluides non Newtoniens

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Abstract: Les effets des fluides non newtoniens dans les problèmes de lubrification sont de plus en plus étudiés. Dans la littérature, très peu d'études ont été consacrées aux paliers hybrides lubrifiés avec ce type de fluide. Le présent travail est une contribution à l'étude de l'effet des fluides non newtoniens sur les performances de la lubrification des paliers hybrides (combinaison entre les effets hydrodynamiques et hydrostatiques). L'ajout de nanoparticules aux fluides lubrifiants peut améliorer sa viscosité et par conséquent modifier les performances du palier. Le comportement rhéologique devient non linéaire et il est donc nécessaire de prédire les performances à l'aide d'un modèle non newtonien. La théorie des fluides à micro-continuum des contraintes de couple a été utilisée pour développer le modèle mathématique. Les paliers hybrides de longueurs finies utilisés dans ce travail sont composé de six et douze cellules identiques régulièrement réparties sur la périphérie du palier. Les équations régissant les équations ont été résolues numériquement par différence finie. Les principaux paramètres de contrôle qui régissent les équations utilisées sont la pression d'entrée (d'alimentation) et le paramètre de couple de contrainte sur la pression générée dans le palier. Les résultats obtenus montrent une nette amélioration de la pression du film de fluide fonctionnant avec des fluides non newtoniens par rapport aux cas des fluides newtoniens. L'étude paramétrique a montré également que la présence d'additifs dans le lubrifiant peut modifier le régime de lubrification, notamment dans le cas de paliers fortement chargés tournant à grande vitesse. Dans le cas des paliers hydrostatiques, l'effet du fluide non newtonien (fluide à couple de contrainte) est négligeable.

Keywords: Lubrification Hybride, Fluide non Newtonien, Fluide à Couple de Contrainte.

ID: MPh-P-1

Thermodynamics and Black Hole Entropy in Noncommutative Spacetime

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Abstract: The results is a solid phase, including salts of sodium chloride and potassium chloride, as well as sodium sulfate and potassium sulfate and magnesium chloride hydrate between 1.20 g / L to 1.32g / L

Keywords: Black holes; Noncommutative geometry; Thermodynamics; Event horizon; Entropy; Hawking radiation

ID: MPh-P-2

The Effect of Optofluid on The zero Dispersion Wavelength in PCFs

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Abstract: Modeled these results of a hydro-chemical program to calculate the thermodynamic quantities of brines

Keywords: Optofluid; zero dispersion wavelength; soliton; supercomtinum generation

ID: MPh-P-3

Dispersion Relation in Laser-Induced Plasmas: A Theoretical Approach

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Abstract: The interaction of an intense laser beam with a solid target leads to the creation of hot plasmas that are moderately relativistic in temperature. In this context, the study of transport, absorption mechanisms, and instabilities triggered between the laser beam and these plasmas must be revisited and addressed within the framework of relativistic kinetic theory.A key aspect of this analysis is the determination of the dispersion relation for electromagnetic (EM) waves of different polarizations, derived from a kinetic treatment based on the relativistic Vlasov equation. The objective of our work is to study the mode couplings of the laser wave with electron plasma waves and ion acoustic waves, in order to better understand the complex dynamics present in these systems.

Keywords: relativistic plasma; parametric instability; filamentation; relativistic kinetic theory; fluid theory.

ID: MPh-P-5

Stator current spectrum analysis applied on static eccentricity fault diagnosis of SRM

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Abstract: Thanks to power electronics innovation, switched reluctance machine (SRM) are taking place on industrial applications. In this paper we present the static eccentricity fault diagnosis of the switched reluctance machine by the use of stator current spectral analysis. To do this, we modeled our switched reluctance machine by the finite elements (FE) method intended for the diagnosis. The simulation results show the interest and efficiency of the proposed model as well as the stator current spectral analysis technique for the static eccentricity fault diagnosis of the switched reluctance machine.

Keywords: Switched reluctance machine (SRM), finite elements (FE) method, static eccentricity fault, Stator current, Spectral analysis.

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Two dimensional optical simulation of amorphous silicon thin film solar cells using the finite-difference time-domain method

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Abstract: This work presents a two-dimensional simulation of solar cells using the Finite Difference Time-Domain (FDTD) method implemented in MATLAB. The simulation aims to model and analyze the behavior of solar cell structures under various operating conditions. By applying the FDTD method, we solved Poisson's equation for electric potential, and two continuity equations of semiconductors in the time domain, the work investigates the optical and electrical performance of solar cells, providing insights into the impact of material properties, geometrical configurations, and external factors on efficiency. The MATLAB implementation allows for rapid prototyping and parameter optimization, enabling a better understanding of light absorption, carrier dynamics, and energy conversion mechanisms in solar cell devices. The results of the simulation are expected to contribute to the design and improvement of next-generation photovoltaic technologies.

Keywords: FDTD, Solar cell, Numerical method

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Mathematical Modeling and Optimization of a Chemical Semi-Batch Reactor

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Abstract: The design and optimization of chemical reactors are essential in engineering, particularly for industrial applications . As the central unit of a chemical plant, the reactor directly influences overall costs and profitability. Therefore, optimizing its design and operation is critical for maximizing performance and economic viability. Given the diverse range of reactors used in industry, their complex nature necessitates the development of mathematical models to precisely describe their behavior. Such models must account for the intricate interactions between physical processes including heat and mass transfer, as well as fluid dynamics and the underlying chemical reaction mechanisms.

This study explores the mathematical modeling, analysis, and optimization of a semi-batch reactor, with a focus on developing a robust methodological framework. Key aspects of reactor modeling include material and energy balances, which are essential for understanding and predicting system behavior. By integrating chemical kinetics and transport phenomena, a comprehensive model is established to accurately simulate reactor dynamics. Specifically, the study examines a semi-closed pilot reactor where two reactions occur, emphasizing thermal stability analysis and the evolution of reactant and product concentrations over time. This approach lays the groundwork for a more advanced model that incorporates control and regulation mechanisms alongside fundamental balance equations. The findings provide valuable insights into reactor operation, enabling performance optimization, improving efficiency, ensuring product quality, and mitigating the risk of thermal runaway.

Keywords: Numerical Methods; Reactor; Optimization; Mathematical Modeling; Engineering

ID: MPh-P-8

Analysis of a thermo-viscoelastic contact problem with friction, wear and damage

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Abstract: In this work, we study a mathematical model that describes the frictional contact between a viscoelastic body and a foundation. The contact is modeled with a normal compliance law associated with a version of Coulomb's law on dry friction. We start by presenting a physics description of the problem under consideration, then we state the classical formulation of the problem, list the assumptions on the data and derive a variational formulation of the model. It is presented in the form of a differential variational inequality in which the unknowns are the displacement field and the surface state variable. Then, we prove the unique weak solution of the problem. The proof is based on arguments from history-dependent variational inequalities and variational equations.

Keywords: Viscoelastic material; frictional contact; normal compliance, variational inequality,weak solution.

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Condensed Matter in Intense Laser Fields : Application to Polyacetylene

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Abstract: In this work, we investigate high-harmonic generation (HHG) spectra in polyacetylene with two relevant bands by numerically solving the time-dependent Schrodinger equation. Using the Su-Schrieffer-Heeger (SSH) model, the problem reduces to a 2 x 2 tight-binding Bloch Hamiltonian. Additionally, coupling to the laser field requires solving the time-dependent Schrodinger equation numerically in reciprocal space. The HHG spectra are obtained by performing a Fourier transform in two consecutive steps: first on the lattice momentum and then on time. The k-integration of velocity is carried out to ensure the coherent addition of the momentum contributions of all electrons within the Brillouin zone. The time integration of the acceleration yields the HHG spectra. Our findings reveal the well-known signatures of high harmonics from solids.

Keywords: Condensed Matter; Polyacetylene; Attosecond physics; High harmonic generation.

ID: MPh-P-10

Existence of positive weak solutions for Kirchhoff parabolic systems

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Abstract: In this paper, we study of a sublinear Kirchhoff parabolic systems in bounded domains viasub-super solutions method combined with comparison principle،The study mentions the physical context, particularly in relation to elastic models under non-linear vibrations.It provides a mathematical foundation while indicating practical applications in various fields.

Keywords: Kirchhoff parabolic systems; existence; positive solutions; sub-supersolution;

multiple parameters.

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Exploring Quantum Mechanics with Fractional Caputo-Fabrizio Derivatives: Step Potential Analysis

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Abstract: This study investigates the fractional Schrödinger equation for a quantum particle under a step potential using the non-singular Caputo-Fabrizio derivative. By solving the fractional differential equation, we derive wave functions and compute reflection and transmission coefficients. Results show that fractional order β\betaβ alters quantum behavior, converging to standard outcomes as β→2\beta \to 2β→2. This approach highlights the versatility of fractional calculus in quantum mechanics, with implications for condensed matter and fractal media theories

Keywords: fractional Schrödinger equation; Caputo-Fabrizio derivative; reflection; transmission

ID: MPh-P-12

Nonlinear Impairments in High-Power Fiber-Optic Links for Energy-Aware Communication Systems

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Abstract: In response to the increasing demand for communication systems that are both high-capacity and energy-efficient, high-power optical-fiber links have been widely adopted. However, nonlinear optical impairments pose significant challenges to their performance. This study provides a detailed numerical analysis of various nonlinear effects, such as self-phase modulation (SPM), cross-phase modulation (XPM), and four-wave mixing (FWM), in high-power silica-based optical fibers. We employ the split-step Fourier method (SSFM) to solve the generalized nonlinear Schrödinger equation (GNLSE), simulating signal propagation under varying input power levels, modulation formats, and dispersion regimes. Stochastic models for amplified spontaneous emission (ASE) noise and thermal effects are incorporated to evaluate their interaction with nonlinearities in energy-aware system designs.

Our findings quantify the degradation in signal-to-noise ratio (SNR) and bit error rate (BER) as a function of launched optical power, identifying critical thresholds where nonlinear distortions dominate. We demonstrate that optimised power allocation and dispersion management can mitigate these effects while maintaining energy efficiency. Additionally, the study analyzes the trade-offs between power amplification, spectral efficiency, and transmission distance, providing guidelines for balancing performance and energy consumption in next-generation fiber networks.

This work highlights the importance of integrating nonlinear compensation techniques—such as digital backpropagation and adaptive modulation—into energy-aware system architectures. The results offer actionable insights for designing cost-effective, high-performance optical communication systems that comply with sustainable energy practices.

Keywords: Nonlinear Impairments; Optical Fiber Links; Generalized Nonlinear Schrödinger Equation; Numerical Analysis; Power Optimization

ID: MPh-P-13

Numerical Analysis of Effective Potential and Transport Properties in Plasmas

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Abstract: This work focuses on calculating transport coefficients for weakly coupled plasmas, starting with the Debye potential to describe electron-ion interactions. The effective potential energy (EPE) is then extracted and used to compute the velocity autocorrelation function (VACF). Finally, the electrical conductivity is determined and compared with Spitzer conductivity, providing insights into transport properties in weakly coupled plasmas.

Keywords: effective potential; velocity autocorrelation function; electrical conductivity; weakly coupled plasma.

ID: MPh-P-14

Empirical calculation of Ll, $L\alpha$, $L\beta$, and $L\gamma$ XRF cross-sections for Lead by photon effect at different excitation energies

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Abstract: X-ray fluorescence is a fundamental physical phenomenon with a wide range of applications in several fields, including atomic and molecular physics, radiation physics (transport in matter), dosimetry and medical research (such as cancer therapy). In this study, we investigate empirical method for determining the X-ray fluorescence cross-sections of Ll, Lα, Lβ and Lγ lines in lead (82Pb) when exposed to photons at different excitation energies. The analysis is based on the excitation of the element's of inner-shell electrons (K, L, M), leading to electronic transitions that produce characteristic radiation. These cross-sections provide valuable insights into atomic transitions and radiative processes. This work aims collect and organize experimental values of Ll, Lα, Lβ and Lγ for lead, as reported by other authors. Furthermore, we plotted the experimental values as a function of photon energy E for lead and fitted the data points using second-order polynomial regression for interpolation. These data were then used to calculate the empirical X-ray fluorescence cross-sections (XRFCs). To illustrate the deviations in our empirical results, a comparison was made with the expermental data from other work. Finally, our analysis revealed a good agreement between our values and the experimental values reported by other authors.

Keywords: X-ray fluorescence cross sections (XRFCs); Fitting; empirical cross sections

ID: MPh-P-15

Super-soliton dust-ion-acoustic waves in three-component dusty plasma using cairns-Tsallis electrons distributions

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Abstract: The nonlinear dynamics of a three-component dusty plasma, incorporating Cairns-distributed non-extensive electrons, are investigated using the Sagdeev pseudo-potential method and phase-portrait analysis. The study identifies three distinct electrostatic nonlinear wave structures: solitons, double layers, and super-solitons. The characteristics of these waves are highly sensitive to key plasma parameters, including the Mach number, the non-extensive parameter and the fraction of nonthermal electrons. A critical result is that super-solitons emerge exclusively in plasmas with more than two components, exhibiting a unique amplitude structure and distinct propagation properties that differentiate them from conventional solitons. A comprehensive parametric analysis delineates the existence domains of all nonlinear wave structures, revealing that each mode is constrained to specific plasma conditions. The results are in strong agreement with observations of electrostatic wave phenomena in the Earth's magnetosheath, highlighting the role of super-solitary structures in space plasmas.

Keywords: ion-dusty plasma, super solitary waves, Cairns-distributed non-extensive electrons.

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First principle study of Structural, electronic and optical properties of halide double Perovskite Rb2YCu(Br,I)6 for solar cells applications

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Abstract: Perovskite materials have gained significant attention as promising candidates for next-generation photovoltaic applications. This study provides an in-depth analysis of the structural, electronic, and optical properties of the halide double perovskite Rb2YCu(Br,I)$_6$. The investigation was conducted using the full-potential linearized augmented plane wave (FP-LAPW) method within the framework of density functional theory (DFT). The WIEN2K code was employed, incorporating the modified Becke-Johnson (mBJ) approximation for enhanced accuracy. Structural parameters were precisely determined through optimization and analytical techniques. Regarding electronic properties, the findings indicate that Rb2YCu(Br,I)$_6$ is an indirect band gap semiconductor with an energy gap of 1.50 eV, making it a strong candidate for various optoelectronic and transport applications. Additionally, optical absorption analysis demonstrated that Rb2YCu(Br,I)6exhibits a broad absorption range extending from the visible to ultraviolet spectrum, reinforcing its potential for solar cell technology.

Keywords: Rb2YCu(Br,I)$_6$, solar cells, WIEN2K, absorption coefficient, electronic properties.

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Concrete cracking due to multidirectional movements on gravity dams

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Abstract: The dynamic analysis and seismic safety assessment of concrete gravity dams are inherently complex. This study presents the results of a nonlinear seismic analysis of these dams. Two dams of different heights will be considered using the Westergaard added mass concept, with the foundation assumed to be rigid. Using ADINA software, a simulation of the dynamic behavior of a concrete gravity dam under various seismic conditions was performed. Cracks generated in the concrete dam body are considered one of the main types of damage to these dams during large earthquakes. Cracking in the concrete dam body can be considered as one of the main types of concrete gravity dam damage patterns during strong earthquakes. The smeared cracking approach is used to model crack initiation and propagation through the dams. The dam response is characterized by evaluating displacements, modal characteristics, and crack patterns. The results obtained provide valuable information on the expected behavior of concrete gravity dams during future seismic events and highlight the importance of considering both the dynamic characteristics of the dam and the frequency content of ground motions which are among the key parameters to consider when assessing the seismic safety of concrete gravity dams.

Keywords: Gravity dams, concrete, nonlinear analysis, smeared cracking approach, multidirectional movements.

ID: MPh-P-18

Deactivation of E.coli bacteria using an atmospheric cold plasma jet

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Abstract: Atmospheric Cold Plasma (ACP) has been extensively studied and applied in several fields and industries, among them the biomedical field, where ACP can be used for decontamination, wound healing, cancer treatment, and even dentistry [1][2]. In this work, a homemade and cost-effective plasma jet reactor was used to deactivate Escherichia Coli (E.coli) bacteria. This reactor is equipped with two coplanar electrodes, and the plasma jet is ignited using Argon gas that flows through a quartz tube. The effects of exposure time to the plasma jet and the distance between the plasma jet nozzle and the sample surface on the variation in the spread of surviving E.coli bacteria in Petri dishes of 55 mm in internal diameter each, were studied. These two plasma jet parameters have a significant influence on the effectiveness of bacterial sterilization, demonstrating the crucial role of the reactive species created by the argon plasma jet, such as ROS (reactive oxygen species) and RNS (reactive nitrogen species), in the process of deactivating E.coli bacteria. The longer the treatment with the plasma jet directed towards the center of the bacterial culture spread out on the Petri dish, the greater the surface area of the inactivated bacterial culture and the greater the reduction in bacterial density. Similar behavior of the affected surface area and the reduction of the bacterial density is observed when the distance between the plasma jet nozzle and the bacteria culture is decreased. Increasing the distance between the plasma jet nozzle and the surface of the bacteria culture beyond the length of the plasma jet, while keeping the treatment time fixed, significantly reduced the area of effect, while moving it closer beyond the length of the plasma jet had little effect on the variation in the surface area of the deactivated bacterial culture. On the other hand, treating the surface of the bacterial cultures for 2 minutes with a plasma jet in direct contact with the surface of the culture created a sterilized zone of about 22 mm in diameter, while extending the treatment to 10 minutes considerably enlarged the affected zone, reaching a diameter of 51 mm and inactivating almost all the E.coli bacteria initially present in the dish, therefore showing the efficiency of plasma jets in the biomedical field.

Keywords: Atmospheric Plasma Jet, Argon Flow, E.coli Deactivation, Surface Sterilization.

ID: MPh-P-19

Empirical and Semi-empirical Calculation of the Jump Factor JL3 for Selected Elements with Atomic Numbers 71 to 77.

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Abstract: This study introduces a comprehensive analytical framework, integrating empirical and semi-empirical models, to calculate the L_3-subshell jump factor (JL_3) for elements with atomic numbers Z = 71 to 77. The methodology employs advanced interpolation techniques, leveraging a widely accepted analytical function parameterized by coefficients (a_i) derived from atomic number dependencies. These coefficients enable the generation of precise JL_3 values across the specified atomic range.

The accuracy of the proposed framework was rigorously validated through systematic comparisons with both theoretical predictions and experimental datasets. Results demonstrate strong concordance with experimental findings, with deviations confined to a narrow range of 0%–3%. This close alignment underscores the model's robustness and reliability.

By establishing a refined analytical approach, this work provides critical insights into the dynamic behavior of jump factors in atomic systems. The study further highlights the pivotal role of JL_3 in elucidating atomic-scale phenomena, particularly in X-ray absorption spectroscopy and electronic structure analysis. Notably, the high correlation between the model's outputs and prior experimental results validates its utility for applications in atomic physics, materials science, and synchrotron research.

This research advances the field by offering a versatile tool for predicting jump factors, with potential extensions to broader elemental ranges and complex systems. The framework's precision and adaptability position it as a valuable resource for both theoretical investigations and experimental design

Keywords: jump factor JL3 ; analytical function; semi-empirical calculation ; empirical calculation.

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Etude d'un problème de contact avec frottement et usure pour de matériau électro-viscoélastique à mémoire longue.

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Abstract: L'objectif de ce travail est l'étude d'un problème de mécanique de contact entre

un corps déformable et une fondation isolatrice. Sous l'hypothèse des petites transformations, nous analysons un processus quasi-statique du phénomène pour de matériau électro-viscoélastique à mémoire longue. Les conditions aux limites sont de compliance normale et de frottement avec usure. Les conditions électriques sont introduites dans le cas où la fondation est isolatrice. Notre étude de phénomène de contact comprend les étapes suivantes : la modélisation mathématique, l'analyse variationnelle incluant de résultat obtenus concernent l'existence et l'unicité d'une solution faible pour le problème étudié, en utilisant les techniques du point fixe de Banach, des théorèmes de monotonie et du lemme de Gronwall.

Keywords: Problème quasi-statique, compliance normale, frottement, usure, solution

faible, point fixe.

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Laser-Plasma Interaction: Exploring Energy Absorption Dynamics and Applications in Inertial Confinement Fusion

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Abstract: Inertial Confinement Fusion (ICF) stands as one of the most advanced and promising pathways toward clean and sustainable energy. This approach utilizes high-intensity laser pulses to compress and heat plasma fuel to extreme temperatures and densities, triggering energy-releasing fusion reactions. However, the efficiency of energy transfer from the laser to the plasma is governed by intricate physical factors, including plasma density, laser intensity, wavelength, and absorption mechanisms.

In this study, we present an advanced analytical and numerical investigation of laser-plasma interactions, employing high-fidelity dynamic simulations in MATLAB to explore the influence of key parameters on thermal absorption efficiency and energy distribution within the plasma. Our findings reveal that increasing laser intensity significantly enhances heating efficiency, while higher plasma densities lead to increased energy reflection and reduced absorption. Moreover, optimal wavelength selection can improve laser penetration depth and the stability of the heating process.

This research contributes to the optimization of laser-based fusion systems, paving the way for novel strategies to maximize energy transfer efficiency and minimize losses, ultimately advancing the realization of practical and sustainable nuclear fusion energy.

Keywords: Laser-plasma interaction; Inertial Confinement Fusion (ICF); Energy absorption; Plasma heating; Laser intensity; Numerical simulation.

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Optimisation de la Fabrication des Bolus en Radiothérapie par Impression 3D : Comparaison entre le PLA et le TPU

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Abstract: L'utilisation des bolus en radiothérapie externe permet d'optimiser la distribution de la dose de rayonnement, notamment pour les zones anatomiques complexes. Cependant, les bolus conventionnels présentent des limites en termes de précision et de confort. Cette étude vise à évaluer l'efficacité des bolus fabriqués par impression 3D et à comparer les performances du polylactide (PLA) et du polyuréthane thermoplastique (TPU) en termes de flexibilité, de distribution de dose et d'adhérence à la peau du patient. Les résultats montrent que le TPU est plus adapté grâce à sa flexibilité et sa meilleure capacité d'adaptation aux surfaces anatomiques irrégulières. Les bolus imprimés en 3D offrent une meilleure précision dosimétrique, réduisant ainsi les variations de dose et améliorant la qualité du traitement. De plus, ils présentent une adhérence et un confort supérieurs aux bolus traditionnels, garantissant une meilleure reproductibilité et une adaptation personnalisée à chaque patient. L'analyse des unités Hounsfield (HU) et les tests dosimétriques ont confirmé leur compatibilité avec les exigences cliniques en radiothérapie. Ainsi, l'impression 3D représente une avancée significative en améliorant la précision, le confort et l'efficacité du traitement. Le TPU se distingue comme le matériau le plus performant, offrant une adaptation optimale aux besoins cliniques et ouvrant des perspectives prometteuses pour l'optimisation des traitements en radiothérapie et la personnalisation des soins oncologiques.

Keywords: Radiothérapie, Bolus dosimétrique, Impression 3D, TPU, PLA, Distribution de dose, Adhérence, Précision dosimétrique, Hounsfield Unit (HU), Personnalisation des traitements.

ID: MPh-P-23

The convergence of the finite element approximation of a thermo-elasto-viscoplastic contact problem with adhesion

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Abstract: We are interested in the numerical analysis of a contact problem, for a thermo-elasto viscoplastic materials. Under various conditions of contact with adhesion. We introduce a numerical approximation of a contact problem using a discretized scheme. For this scheme, we obtain an error estimation result.

Keywords: Dynamic Process; Thermo-Elasto-Viscoplastic Materials; Adhesion; Differential Contact Condition; Fully Discrete Scheme; Error Estimate.

ID: MPh-P-24

Mathematical Modeling and Predictive Control of Open-end winding Induction Motor drive: A Finite Set Approach.

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Abstract: This paper presents a mathematical approach to controlling an Open-End Winding Induction Motor (OEWIM) using Finite Set Model Predictive Control (FS-MPC). The study focuses on the mathematical modeling of the motor's behavior in a discrete-time framework, applying optimization techniques to improve torque and flux control. By using space vector modulation (SVM), the control method efficiently selects the best switching states to reduce torque ripple and enhance motor performance. The paper also explores stability analysis and error prediction to ensure reliable operation. Simulation results confirm that the proposed approach improves motor efficiency and optimizes control performance. This research highlights the role of mathematical modeling in solving practical control problems in systems.

Keywords: Mathematical Modeling, Discrete-Time Modeling, Predictive Control Algorithm, Finite Set Predictive Control, Open-End Winding Induction Motor.

ID: MPh-P-25

Analytical Approach to the Quantum Behavior of a Particle in a One-Dimensional Potential Box

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Abstract: This study explores the quantum behavior of a particle confined within a one-dimensional potential box through an analytical approach. The mathematical model derives energy eigenvalues, sinusoidal wavefunctions, and probability density distributions, highlighting the quantized nature of energy states. MATLAB-based analytical simulations validate the theoretical framework, ensuring proper wavefunction normalization and accurate physical interpretations. The results demonstrate the relationships between quantum numbers, energy, momentum, and wavelength, emphasizing essential concepts such as particle localization and the correspondence principle. By combining mathematical rigor with computational techniques, this research offers a comprehensive understanding of quantum mechanics in confined systems. The developed framework not only enhances insight into fundamental quantum phenomena but also provides a foundation for extending analyses to more complex scenarios, such as multi-dimensional quantum boxes and varying potential profiles. These findings emphasize the significant interplay between theoretical and computational approaches in understanding the discrete nature of quantum systems.

Keywords: Quantum confinement; Energy quantization; Wavefunction normalization; MATLAB simulations; Particle localization; Quantum mechanics.

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Effect of Enhanced Isolator Damping on the Seismic Response of an Irregular Base-Isolated Steel Structure

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Abstract: This study examines the impact of enhanced Lead Rubber Bearing (LRB) damping on the seismic response of an irregular, base-isolated steel building. Nonlinear time history analyses of a five-story model, subjected to three earthquake records and considering LRB damping ratios from 10% to 30%, reveal that increased damping effectively mitigates torsional response, as measured by top-story and base displacements, and relative rotation about the vertical axis.

Keywords: Base-isolation; Seismic-response; Irregular-structures; Lead Rubber Bearings (LRBs); Damping; Torsional-response

ID: MPh-P-27

Effects of Non-Commutative Differential Geometry on Top Quark Rapidity in Pair Production at LHC Collisions

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Abstract: We present a phenomenological study of the effects of non-commutative differential geometry (NCDG) on the rapidity distribution of top quark pair production at the Large Hadron Collider (LHC) within the framework of the non-commutative standard model (NCSM). Employing leading-order calculations that incorporate the NCDG parameter Θ and the strong coupling constant αS , we observe that the rapidity distribution generally retains the shape predicted by the Standard Model (SM), with significant deviationsemerging in the mid-rapidity region ($|y| \approx 0$) due to NCDG effects. At larger rapidities, the NCDG predictions gradually converge with those of the SM. Furthermore, a comparison with the next-to-leading-order (NLO) SM distribution highlights that deviations induced by NCDG effects become apparent beyond a specific lower bound of the NCDG parameter.

Keywords: top quark; non-commutative Differential geometry; QCD.

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One dimensional Feshbach-Villard oscillator for Spin 1/2 particles

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Abstract: In this work, we investigate the one dimensional Feshbach-Villard oscillator for Spin 1/2 particles. By formulating the Hamiltonian representation of the Dirac equation and utilizing the FV transformation, we evaluate the wave function components and the corresponding energy, both in absence and presence of external interaction.

Keywords: Dirac, oscillator, Feshbach-Villard, FVO

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The two dimensional Kemmer Oscillator: Application of the Second Quantization Formalism in Commutative and Noncommutative Space

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Abstract: In this work, we treated relativistic spin-1 particles using the Kemmer equation, which allowed us to solve the case of the two-dimensional Dirac oscillator in the presence of an external magnetic field. We introduced the complex formalism of second quantization in both commutative and non-commutative spaces.

Keywords: Kemmer, oscillator, Second quantization, Commutative, non-commutative