Table of contents

Nonisothermal melt crystallization kinetics of gamma irradiated Makrofol VLG 7-1 polycarbonate

Kaoutar Benthami [1], Omaima Alhaddad [2], Maha Tommalieh [3], Samir Nouh * [4]

[1] Physics Department, Faculte des Sciences, Universite Moulay Ismail, B.P. 11201, Morocco – Morocco
[2] Department of Chemistry, College of Science, Taibah University, 30002 Al-Munawarah, Saudi Arabia. – Saudi Arabia
[3] Department of Physics, College of Science, Taibah University, 30002 Al-Munawarah, Saudi Arabia – Saudi Arabia
[4] Department of Physics, College of Science, Taibah University, 30002 Al-Munawarah, Saudi Arabia. Physics Department, Faculty of Science, Ain Shams University, Cairo 11865, Egypt – Saudi Arabia

One of the most essential properties of polymers is the crystallization behaviour during the cooling process. This is due to the massive effect of crystallization on their mechanical and thermal properties. Makrofol VLG 7-1 is a sort of Makrofol (bisphenol-A polycarbonate) nuclear track detector. We believe that the current study is the first one that deals with the effect of gamma ray irradiation on the non isothermal kinetics of Makrofol VLG 7-1. Samples of Makrofol films were irradiated with different gamma doses (20–140 kGy). The resultant outcome of the gamma ray irradiation on the thermal properties of the Makrofol samples was explored applying differential scanning calorimetry (DSC). Nonisothermal crystallization kinetics of the Makrofol was investigated applying DSC with different cooling rates. The Jeziorny and Mo approaches were applied to describe the nonisothermal analysis. Several nonisothermal kinetic parameters, such as the crystallization peak temperature (Tc), the enthalpy of crystallization (ΔHc), the degree of crystallinity Xc, the crystallization halftime (t1/2), the Avrami exponent (n) and the activation of crystallization were evaluated and interpreted as a function of gamma dose.

Keywords: Polymers. Gamma irradiation, Crystallization, DSC

*Speaker

Simulation Par Geant4 de la Thérapie par Capture neutronique du Bore (La BNCT)

Khadija Charef * [1], Driss Benchekroun† [1], Youssef Khoulaqi‡ [1]

[1] université hassan ii – Morocco

Le cancer est une cause majeure de décès dans le monde à l'origine de près de 10 millions de décès en 2022, soit presque un décès sur six. Les cancers les plus courants sont le cancer du sein, le cancer du poumon, le cancer colorectal et le cancer de la prostate. Alors le traitement du cancer est devenu un défi des pays développés pendant les dernières décennies. Comme il existe des différents traitements conventionnels utilisés seuls ou associés entre eux : chirurgie, radiothérapie, hormonothérapie, immunothérapie, Chimiothérapie et nouveaux traitements cible. Pour adopter la BNCT comme une thérapie nécessaire contre le cancer, il faut s'assurer de quelques critères comme : la concentration du bore et les réactions induites qui n'auront pas lieu uniquement entre le Bore et les neutrons thermiques.

Ainsi, dans ce travail, nous proposons une étude basée sur un modèle à une cellule ou plusieurs cellules. Chaque cellule sera modélisée par un ensemble de quatre compartiments : noyau, cytoplasme A, cytoplasme B et membrane cellulaire. Ce modèle a été utilisé pour simplifier le calcul du comportement des particules.

Dans chacune des différentes régions cellulaires nous distribuons uniformément des particules alpha dont l'énergie est égale à celle produite par BNCT, c'est-à-dire 1,47 MeV. De même, nous distribuons des particules de lithium-7 avec des énergies de 0,84 MeV.
Le but de ces études, c'était d'évaluer les dépôts d'énergie reçue par les cellules tumorales et les tissus sains au cours d'un traitement des cancers sensibles par la BNCT.

Keywords: BNCT, Geant4, Simulation, Particules alpha, Lithium.

*Speaker
†Corresponding author: driss.benchekroun@cern.ch
‡Corresponding author: youssef.khoulaki@cern.ch

Radiation protection proprieties study of a new mixtures based on concrete by using experimental results and Monte Carlo Simulations MCNP

Brahim El Azzaoui *† [1], Mohamed Youssef Messous [2], El Mahjoub Chakir , El Mehdi Al Ibrahmi

[1] 1Materials Physics and Subatomics laboratory, Physics Department, University Ibn Tofail, Kenitra, Morocco 2National Center for Nuclear Energy, Sciences and Technology (CNESTEN), Rabat, Morocco – Morocco
[2] chercheur – Morocco

Radioactive sources are widely used in many fields such as agriculture, industry, research, medical, sciences, and nuclear power plants. To ensure radiation protection of workers, environment and public against ionizing radiations, researchers are continually seeking to enhance and develop new materials with high proprieties in term of efficiency of radiation protection point of view and also to respond to socioeconomic, physical and mechanical factors.
In this study we simulate some mixture materials by Monte Carlo Transport Particle (MCNP), then we irradiate the elaborated samples with radioactive sources such as Co-60 and Cs-137 in order to validate our theoretical calculation.

This new development of concrete mixture will be used as radiation shielding on activities involving radioactive isotopes of gamma and X ray like as Prompt Gamma Activation Analyses PGAA, radiation sources manipulation for experiment calibration or in the laboratory's walls. It can be used also at the immobilization and containment of radioactive waste.
In this study, we compared the characteristics of photon attenuation by Barite extracted from five Moroccan ore sites such as Zagora, Agdz. Tijjekht, Ras Kammouna, Tinejdad at Drâa-Tafilalet.

Keywords: Radiation Protection, Concrete, Baryte, ore, MCNP

*Speaker
†Corresponding author: brahim.elazzaoui1@uit.ac.ma

Electronegative plasma sheath properties in the presence of super-extensive electrons

Mohamed El Bojaddaini * [1], Hassan Chatei

[1] LMASI, Electromagnetism, Physics of Plasmas and Applications, Polydisciplinary Faculty of Nador, Mohammed First University – Morocco

Electronegative plasmas have recently attracted considerable interest due to their expanding applications in various fields like microelectronic industries, plasma-based surface treatment and fusion research. The negative ions play a crucial role in these applications and improve the performance of plasma processing of materials. In addition, the presence of negative ions in the plasmas can significantly influence the plasma sheath properties. In this study, taking into account the ion source term, the behavior of electronegative plasma sheath structure in the presence of super-extensively distributed electrons according to the q-statistics of Tsallis has been numerically investigated. The positive ions are described with the fluid approach, while the negative ions are assumed to obey the Boltzmann distribution. Considering the Sagdeev potential method, a modified Bohm sheath criterion is determined. The sheath characteristics have been studied for different values of electronegativity, ionization frequency and non-extensivity parameter. An important effect of the presence of negative ions in the plasma on the sheath structure is observed. It is also found that the q-non-extensivity parameter affects significantly the quantities characterizing the sheath.

Keywords: plasma sheath, negative ions, non, extensive statistics, fluid model, source term.

*Speaker

Dust particle behaviour under ion temperature effect in collisional RF plasma sheath

Morad El Kaouini *† [1], Hassan Chatei‡ [2]

[1] LMASI, Electromagnetism, Physics of Plasma and applications, Department of Physics, Polydisciplinary Faculty of Nador, Mohammed First University – Morocco
[2] LPMR, Department of Physics, Faculty of Science, Mohammed First University, Oujda – Morocco

In this work, the behaviour of an isolated micron-size dust particle in collisional plasma sheath of a radio-frequency (RF) capacitive discharge is investigated. The electrons are assumed to follow the Boltzmann distribution function and the positive argon ions are described by using a one – dimensional time – averaged fluid model. The charge of the dust particle in the plasma sheath is calculated using the orbital- motion- limited (OML) theory.
The numerical results show that the dynamic of the dust particle in the sheath depends on resultant force acting on the dust. For the case of the sheath with cold ions, the dust particle can levitate from the electrode without initial velocity and escapes the sheath to enter in the plasma region. However, in the case of thermals ions, the dust particle is suspended in the sheath and makes damped oscillations around its balancing position. The results also show that the ion temperature influences considerably the dust particle charging process. In fact, with increasing the ion temperature, the dust particle charge decreases near the polarized wall and increases near the sheath edge.

Keywords: RF Plasma Sheath, Dust Particles, Time, averaged Fluid Model, OML approach.

*Speaker
†Corresponding author: md.elkaouini@ump.ac.ma
‡Corresponding author: chateikariat@yahoo.fr

Radon measurement in various brands of Moroccan tobacco

Meryam El Moutmir *† [1], Meryame Jebbade , Fatima Ezzahra Elmoutmir , Abdellatif Nachab

[1] Meryam EL MOUTMIR – Morocco

The radioactive gas radon is a decay product of uranium normally found in rock and soils. It is the most important natural source of human exposure to ionizing radiation. The short-lived daughters of radon release ionizing radiation during radioactive decay and alpha particles emitted are capable of damaging DNA and increasing the risk of cancer. Studies of underground miners occupationally exposed to radon have demonstrated an increased risk of lung cancer among both smokers and nonsmokers, and the risk of exposure of miners has been found to be consistent with the risk of indoor exposure (1). The subject of the potential lung cancer, tobacco and radon concentration is present in the scientific literature for years. To check weather this correlation is real or if it is just an assumption, the radon concentration was measured in eight different brands of tobacco cigarettes found in the Moroccan market. Radon activity was measured using "sealed can technique" using LR-115 type nuclear track detectors. The results showed that radon concentrations in cigarette tobacco samples ranged from 159 Bq/m3 to 329 Bq/m3 with an average 210 Bq/m3. We note that the average value of two brands is identical which may mean that they are used the same source of tobacco.

Keywords: Radon, tobacco, lung cancer, health

*Speaker

†Corresponding author: meryam.elmoutmir@gmail.com

Measurement of Radon exhalation rate in soil samples from the province of Safi, Morocco

Fatima Ezzahra Elmoutmir *† [1], Meryame Jebbadeb , Meryam El Moutmir , Abdellatif Nachab

[1] Fatima ezzahra ELMOUTMIR – Morocco

Radioactivity is widespread in environment due to primordial radionuclides in surrounding and has adverse effects on human health. One of the main concerns for the environmental radioactivity is radon (222Rn), which is the decay product of radium present in earth crust in varying amounts. This variation depends mainly on geological and geographical conditions and appears at different levels in soils from different geological regions. Inhalation of radon and its daughters can cause a significant health hazard when they are present in high levels in enclosed spaces such as dwellings if they are poorly ventilated. In 2009, the world health organization considered exposure to radon and its progeny as the second cause of lung cancer, after tobacco (1). The soil or the bedrock is found to give the highest concentrations of radon gas in the indoor air. This poses the problem of quantifying the radon potential of any given soil which needs knowledge of radon generation and transport within soil matrix. In this context, we conducted a study aimed to study the natural radioactivity in the soils of the province of Safi. Radon activity and radon surface exhalation rates was measured using "sealed can technique" using LR-115 type nuclear track detectors. Radon activities varied from below the limit detection to 1096.18 ± 62.85 Bq/m3 with a mean value of 349,29 ± 36,85 (Bq/m3) Surface exhalation rates in these samples are found to vary 1.74 ± 0.55 to 33.14 ± 1.90 mBq/h.kg .We note that all the measured values of radon exhalation rates are under the limits reported worldwide.

Keywords: Natural radioactivity, Radon, Exhalation, soil, Environment

*Speaker

†Corresponding author: fatimaezzahra.elmoutmir@gmail.com

Design and Construction of a High Voltage Resonant Half-Bridge Flyback Converter

Achraf Hani * [1], Alyen Abahazem , Lahoussine Elmahni

[1] Laboratory of Materials and Renewable Energies , Department of Physics, Faculty of Science, University Ibn Zohr, Agadir – Morocco

High voltage power supplies are required in many applications as biomedical equipment, plasma generation, ozone production, and any other field are in high demand. This study aims to simulate and construct a high-voltage DC power supply able to produce voltages up to 10kV. The power supply design is based on a half-bridge flyback converter that operates in resonant mode. The output voltage of the realized converter is adjusted by changing the input voltage from 0 to 30V. The power supply consists of a two complementary pulse width modulation (PWM) generator with frequency and dead time control, a MOSFET driver and a high voltage flyback transformer. The operating principle of the proposed converter is discussed, and a prototype is built from the theoretical and simulation analysis. The power supply can generate DC voltages up to 10kV. The proposed mode of operation allows zero-voltage switching (ZVS) to reduce switching losses significantly and the leakage elements of the transformer are used to achieve resonance. Simulation and experimental results are presented in this work. The designed power supply is compact and has the advantage of low cost. It presents satisfactory performances and can be used in high DC voltage applications.

Keywords: High voltage, Half, Bridge, flyback transformer, DC, DC Converter.

*Speaker

Degradation of pharmaceutical pollutants in water using Pulsed-Corona Discharge

Djakaou Iya-Sou * [1]

[1] 1Laboratoire Plasma et Conversion d'Energie (LAPLACE), Université Toulouse III Paul Sabatier, UMR CNRS 5213, 31062 Toulouse, France – LAboratoire PLasma et Conversion d'Energie – France

The research in the efficiency of water treatment processes has always been a permanent challenge for
research groups. Among the classic POA used, there is classical Ozonation which is a selective process
that is limited to some molecules, adsorption processes and plasma processes. Plasma processes have the advantage of producing varied and highly reactive species depending on the carrier gas used.
Atmospheric pressure cold plasma is considered to have broad application prospects in different fields,
such as plasma agriculture, food preservation, material preparation, plasma medicine, and hazardous
pollutants (1-3). Regarding depollution, pharmaceutical wastewater is increasingly polluted by emerging
and recalcitrant molecules whose degradation can result from a high concentration of reactive oxidizing
species.
At the Plasma and Energy Conversion Laboratory (Reactive and Hors Equilibrium Plasma team), we
have set up a reactive Corona Discharge patterns. The process operates in ambient air at atmospheric
pressure, making it possible to generate high concentrations of reactive species (RNS and ROS). In
this study, measurement of the long-lived species (Nitrates, Nitrites and H2O2) in solution (deionized
water) subjected to the corona discharge and the degradation of Paracetamol were investigated. The
results showed After only 30 min with Corona treatment, 60% removal efficiency was achieved at initial
Paracetamol concentration of 500mg/L according to HPLC samples analysis, Fig 1. Furthermore,
possible pathways of Paracetamol degradation in solution are proposed.

Keywords: Plasma, Corona, pollutants, Paracetamol, water

*Speaker

Emergent organic pollutants removal mechanism using water falling film dielectric barrier discharge

Djakaou Iya-Sou * [1]

[1] 1Laboratoire Plasma et Conversion d'Energie (LAPLACE), Université Toulouse III Paul Sabatier, UMR CNRS 5213, 31062 Toulouse, France – LAboratoire PLasma et Conversion d'Energie – France

Non thermal plasma are increasingly used for degradation of organic pollutants in water (1,2), but the mechanisms and the role of the different oxidative active species remain controversial (3). In this study, the role of long and short-lived species created by the water falling film DBD reactor for the degradation of model pollutants. For this, two different treatment modes are used: (i) the Direct Discharge (DD) mode and (ii) spatial Post Discharge mode (PD). Three different model pollutants were treated in both types of reactors. The pollutants were chosen so that they differ according to their chemical structure, their air/water partitioning coefficient (Henry's constant kH), and their reactivity with ozone (3). The pollutants are 1-heptanol (kH = 1220, low reactivity with ozone), phenol (kH = 70 000, high reactivity with ozone), and para-chlorobenzoic acid, (kH ≈ 200 000, low reactivity with ozone). In each case the pollutants were classified according to their ease of removal, from easier to more difficult to remove, and they are as follows: 1-heptanol > phenol > PCBA. The removal mechanisms also differ depending on the characteristics of the pollutant.

Keywords: Plasma, DBD, pollutants, mechanisms, water

*Speaker

Ionization of the metastable atomic hydrogen H(2S) by electron impact

Mohamed Jakha * [1], Said Mouslih , Souad Taj , Bouzid Manuat

[1] Polydisciplinary Faculty - Sultan Moulay Slimane University - Maroc – Morocco

In recent years, much attention has been paid to the experimental and theoretical aspects of collision processes involving metastable atoms. This is principally due to the fact that atoms in metastable states own some properties such as long lifetimes, ability to transmit large amounts of energy, low excitation and ionization potentials, resulting in very large cross-sections. From the collision point of view, the ionization of metastable atoms is very important to understand the mechanisms that occur in astrophysical and fusion plasmas and in partially ionized systems; it also plays a major role in the gas discharge phenomenon. Apart from all of these, metastable states of atoms are nowadays gaining increasing importance in many areas of research, for example, cold atomic physics, in particular Bose- Einstein condensation, nanolithography and also famously in laser physics. In this contribution, we present a detailed analytical computation of the triple differential cross sections, in the first Born approximation, for the relativistic electron-impact ionization of hydrogen atom in the metastable 2S-state in the symmetric and asymmetric coplanar geometries. The process is investigated by using the relativistic Dirac-formalism where the effects of spin and relativity are taken into account. We also talk about some expected applications in the field of materials and renewable energies.

Keywords: Relativistic ionisation, Triple differential cross section, Dirac Volkov function, Exacte wave function of atomic hydrogen, Analytic calculations

*Speaker

Machine learning methods for predicting discharge current and discharge mode classification of Dielectric Barrier Discharge

Abdelhamid Laiadi *† [1], Abdellah Chentouf [1]

[1] Faculty of science and technology of Tangier – Morocco

Random forest (Machine Learning algorithm) is used for predicting the waveform of discharge current using multi-output regression, the training data has been collected from cold Plasma Gas discharge experiments. The multi-output regression is used for predicting the current discharge waveform for the homogeneous and filamentary modes of the discharge. The results of the prediction model are in correlation with the training data. In the second part, the random forest method is used also for the classification of discharge mode. We use the confusion matrix as a metric for the validation of our classification model. The features of the machine learning model for multi-output regression and classification are the experimental conditions of the experiments such as the pressure, the voltage, and the gap distance...etc. The results of this model are used for the completion of the electrical model.

Keywords: DBD discharge, Random forest, Machine Learning for plasma modelling, Filamentary discharge, Homogeneous discharge.

*Speaker
†Corresponding author: hamidlaiadi@gmail.com

On criticality of some classes of Ads black holes

Karima Masmar *† [1]

[1] University Hassan II - Casablanca – Morocco

A black hole is a region of spacetime where gravity is so strong that nothing no particles or radiation can escape from it. Thermodynamic behaviors of black holes have received particular interest through recent important works. Interpreting the cosmological constant as a thermodynamic pressure and its conjugate quantity as a thermodynamic volume, we investigate the critical behaviors of some black holes in lower and higher dimensions. Concretely, we give a nice interplay between the behaviors of the AdS black hole and the ordinary systems. In other words, the equation of states shares similarities with Van der Waals P-V systems. Such behavior opens new windows to our understanding of such objects which have an important role in modern physics and are laboratories for testing fundamental theories that explain how the Universe works on the largest and the smallest scales (General Relativity and Quantum Physics).

Keywords: Black holes, phases transitions, cosmological constant

*Speaker

†Corresponding author: karima.masmar@gmail.com

Influence of the low-frequency source on the plasma characteristics in a dual frequency capacitively coupled plasma including metastable atoms

Abdelhak Missaoui * [1], Morad El Kaouini [2], Hassan Chatei [3]

[1] LPMR – Morocco
[2] LMASI, Electromagnetism, Physics of Plasmas and Applications – Morocco
[3] LPMR – Morocco

In a dual-frequency capacitive argon discharge, the effect of the low-frequency source on the plasma characteristics is studied by a fluid approach including metastable atoms. The fluid model developed, consists of electrons, ions and metastable argon atoms continuity equations, momentum transport equations for charged and metastable particles reduced to the drift diffusion form, the energy balance equation of electrons and Poisson's equation. the system of equations is solved numerically by a finite difference method until the steady state is achieved. The simulation is performed for different low-frequencies 1, 2 and 6 MHz for a fixed high-frequency of 60 MHz and for different low-frequency voltage amplitudes 60, 90 and 120 V by keeping the high voltage amplitude at 100 V. The simulation results show that the argon metastable atoms cannot be ignored in the model since these particles have a significant effect on the electron density. Furthermore, as the voltage amplitude of the low-frequency source increases, the electron density decreases in the bulk plasma region, while the electric field and the electron temperature increase in the grounded sheath region. The results also show that for a fixed high-frequency (60 MHz), the low-frequency has a significant effect on the electron heating compared to the low-frequency voltage amplitude.

Keywords: Fluid model, CCP discharges, Dual, frequency excitation, Metastable atoms, Electron heating.

*Speaker

Finite Element Analysis to Simulate the Effect of Substrate Properties on a Ceramic Splat Formation in Plasma Spraying Conditions

Soufiane Oukach * [1], Hassan Hamdi [1], Mustapha Boumhaout [1], Mohamed El Hattab [2], Mohammed Elganaoui [3]

[1] Energies and Sustainable Development (E2D) research team, Higher School of Technology – Guelmim (ESTG), Ibn Zohr University, Guelmim, Maroc – Morocco
[2] Mechanics, Process of Energy and Environment Laboratory, ENSA, Ibn Zohr University, Agadir, Morocco – Morocco
[3] Laboratoire d'Etude et de Recherche sur le Matériau bois, Lermab – Iut de Longwy, université de Lorraine – 186 Rue de Lorraine, 54400 Cosnes-et-Romain, Longwy, France

The plasma spraying process is a high temperature technique used in several industrial applications (aerospace, nuclear, automotive, etc) to produce high quality sprayed coatings of ceramics, metals and alloys on structural target materials. These coatings are used to provide protection against high temperatures, corrosion, erosion and wear, to improve the efficiency and to enhance the performance of material. Coating is generated by injecting a precursor powder of the coating material into electrically generated plasma; the particles are heated and propelled with a high velocity toward the target. They arrive at the substrate to be covered in a molten or semi molten state, they flatten, cool rapidly and solidify. Coating is formed when millions of particles are cumulatively deposited on top of each other, layer by layer producing a characteristic lamellar structure. During the sprayed coating formation, stresses of thermal and mechanical origin, arise and develop under certain plasma-spray conditions. They have a significant effect on the functionality and the coating lifetime and influence strongly their quality and their performance (pores and micro and macro cracks). To understand how these stresses arise and predict their distributions in multi-layered coatings, a better understanding of the construction of the sprayed coating is required. Many studies have shown that the quality of the sprayed coating, their microstructure and physical properties are strongly related to the interaction between droplets and substrate or deposited droplets. So the impact of an individual droplet on a substrate is a crucial key in formulating a comprehensive understanding of the coatings structure. The aim of the present work is to simulate the spreading and solidification of a ceramic molten particle impacting onto a rigid substrate under plasma spraying conditions. This simulation is governed by the resolution of the Navier-Stokes and the energy equations. The interface between droplet and the surrounding air of the deforming droplet was defined using the "level set method". The Naviers-Stokes and the energy conservation equations coupled with the Level Set equation are solved using the software Comsol Multiphysics based on Finite Element Method. Thermal contact resistance, viscous dissipation, wettability and surface tension forces effects are taken into account. The effect of some substrate properties on the splat formation is analyzed.

*Speaker

Keywords: Droplet Impact, Level Set, Multiphase Flow, Thermal Contact Resistance, Wettability.

Surface modification of Agave Americana fibers by cold plasma surface treatment

Hassani Oudrhiri *† [1]

[1] 1Laboratory of Materials, Process, Environment and Quality, Cadi Ayyad University, Safi, Morocco – Morocco

Natural fiber-reinforced polymer composites are considered as a green substitute for conventional fibers (glass, carbon) and increasingly getting used in several sectors like automobile, aerospace, and building construction. The main advantages of these natural fibers are low density, biodegrability, low cost and availability. However, natural fibers have some poorer qualities, restricting their application in composites. They show some variability of properties and hydrophilic nature which leads to incompatibility with hydrophobic polymer matrix, and then can be limit their use in some applications. In order to modify and improve the surface properties of natural fibers, physical and chemical treatments are often used. In this work, a low-pressure plasma is used to study the influence of this treatment on surface and mechanical properties of Agave Americana fibers (AAFs). The fibers were treated by nitrogen plasma with incident power of 100 W and in two different exposure times 5 and 15 minutes. The nitrogen was introduced with a flow rate of 0,5 sccm (standard cubic cm per minute) and a pressure of 8 Torr. The influence of the plasma treatment applied on the (AAFs) fibers was performed considering the mechanical properties, and surface morphology. These properties were evaluated by tensile tests, Fourier transform infrared spectroscopy, X-ray diffractometry, and scanning electron microscopy images. The results of this study showed considerable modifications in Americana Agave fibers when these are submitted to plasma treatment. Ultimately, the use of cold plasma could be a practical method for enhancing fiber-matrix adhesion in the fabrication of biodegradable polymer composites.

Keywords: Plasma, natural fibers, composites, surface

*Speaker

†Corresponding author: f.oudrhirihassani@uca.ma

Simulation and measurements of ozone production in a multi pins to plane corona discharge reactor

Jean-Philippe Sarrette * [1], Valentin Ferrer [2], Gaëtan Wattieaux [3], Olivier Ducasse [4], Olivier Eichwald [4]

[1] Laboratoire Plasma et Conversion d'Energie (LAPLACE) – CNRS : UMR5213 – 118 Route de Narbonne 31062 TOULOUSE CEDEX 9, France
[2] LAboratoire PLasma et Conversion dÉnergie (LAPLACE) – Université Toulouse III - Paul Sabatier, Université Fédérale Toulouse Midi-Pyrénées, Centre National de la Recherche Scientifique : UMR5213, Institut National Polytechnique (Toulouse) – 118 Route de Narbonne 31062 TOULOUSE CEDEX 9ENSEEIHT, 2 rue Camichel, 31071 Toulouse Cedex 7, France
[3] LAPLACE-CNRS University of Toulouse (LAPLACE-CNRS Toulouse) – CNRS : UMR5213, Université Paul Sabatier - Toulouse III – 118 Route de Narbonne 31062 TOULOUSE CEDEX 9, France
[4] Laboratoire Plasma et Conversion d'Energie (LAPLACE) – Université Paul Sabatier [UPS] - Toulouse III, Université Paul Sabatier (UPS) - Toulouse III – 118 Route de Narbonne 31062 TOULOUSE CEDEX 9, France

This work presents a simulation of ozone production in a multi pins to plane atmospheric pressure corona reactor. When a positive DC voltage is applied to the pins, mono-filamentary discharges are generated between each pin and the common grounded plane electrode, with a mean natural repetition frequency of 10 kHz in ambient air.
The simulation of this reactor is particularly tricky, due to large differences:

- in the temporal scales, as each discharge phase lasts typically 150 ns and is followed by a long post discharge phase of about 0.1 ms during which convection and diffusion processes begin to operate, coupled with chemistry;

- in the spatial scales, the discharge diameter being typically of 50 μm while the reactor length is 8 cm.

A 2D model taking into account the spatio-temporal generation of primary radicals (N and O atoms) and the heat deposition in each discharge channel is presented and the behavior of the whole reactor described. In previous publications (1-2), the results corresponding to the first 0.1 s of simulation were presented. Parallelization of the code allowed us to here extend the simulation up to 30 s of activation of the pins, corresponding to 3 105 discharge / post discharge successive cycles. Calculated ozone densities are also compared with measured concentrations obtained by UV-C absorption, showing only a qualitative agreement.

Keywords: corona discharges, ozone, electro, hydrodynamics, atmospheric, pressure plasma, absorption measurements

*Speaker

Formation of molecular ions in rare-gas plasmas: a preliminary study

Fresnelle Tenanguena Nongni * [1]

[1] LAboratoire PLasma et Conversion dÉnergie (LAPLACE) – Université Toulouse III - Paul Sabatier, Université Fédérale Toulouse Midi-Pyrénées, Centre National de la Recherche Scientifique : UMR5213, Institut National Polytechnique (Toulouse) – 118 Route de Narbonne 31062 TOULOUSE CEDEX 9ENSEEIHT, 2 rue Camichel, 31071 Toulouse Cedex 7, France

Molecular ions, in particular, dimeric rare-gas ions have a very important influence on the behavior of rare-gas plasmas used in multiple fields. Therefore, the analysis and understanding of their formation are of great importance for the macroscopic modeling of these plasmas. The main objective of this work is to perform calculations of the rate constants of dimer ions formation in cold plasmas using rare gases as carriers over a wide range of reduced electric fields.

Keywords: Molecular ions, rate constants, cold plasma

*Speaker

Electric field determination in pulsed corona discharge in humid air at atmospheric pressure by finite element method

Hasna Guedah * [1]

[1] Laboratoire Matériaux et Energies Renouvelables (LMER) – Université Ibn Zohr, Cité Dakhla BP 8106, Agadir, Morocco

Electric field distribution is critically important for characterizing of a positive corona discharge. In this paper, we used a numerical technique based on finite element methods to determine the distribution of electric field in the case of pulsed corona discharge in humid air at atmospheric pressure. We analyzed the effect of operating parameters of corona discharge like the applied voltage, the gap distance, the hygrometry rate, and the frequency on the electric field distribution.

Keywords: Electric field, corona discharge, finite element methods.

*Speaker

Modeling hydrogen arcs in an Electric Arc Furnaces

Abdellah Kharicha * [1]

[1] Christian Doppler Laboratory for Metallurgical Applications of Magnetohydrodynamics, Montanuniversität Leoben – Austria

Electric Arc furnace (EAF) surpassed twenty-five percent of overall steel production and it is still in rapid growth every year. EAF is one of the most promising techniques for steel production in the foreseeable future. By using hydrogen, EAF enables to lower the carbon emissions for metal production by the utilization of green energy sources. The operation of the metal production hinges on transforming electrical energy to heat and melt down scrap metal using electric arc. Extreme conditions inside the furnace and around the arc imposes large difficulties on measuring thermophysical properties inside the furnace. Numerical modelling provides a helpful tool to study the behavior of the arc during the process. This paper presents a numerical model which is being in continuous advancement and can simulate several important phenomena inside the EAF for both scientific and industrial enhancement. We present a model that achieves to simulate the complex interactions of a 5 to 40 kA hydrogen electric arc (Figure 1). The model couples the high Magnetohydrodynamic speed flow of the arc with the melted pool under. Moreover, the study accounts for plasma compressibility and succeeds to capture realistic voltage fluctuation due to arc aerodynamic motion and instabilities. We will also present simulations of the arc impingement effect on slag and liquid metals in a full scale EAF and show the complexity of flows**.** This model aims to improve the understanding of EAF operation and predict and prevent failures that could occur during operation.

Keywords: electric arc, high amperage, metallurgy, green energy, magnetohydrodynamics

*Speaker

Effect of macroscopic parameters on electric barrier discharge actuators

Moustapha Ouali *† [1,2], Najlae Seddaoui , Youssef Lagmich

[1] Laboratory of sciences and advanced technologies, Physics Department, University of Abdelmalek Essaadi – Morocco
[2] Université Abdelmalek Essaâdi – Morocco

DBD actuators are certainly the most cited in the literature. Compared to DC actuators, their main advantage comes from their higher macroscopic stability. The plasma actuator to be modeled consists of an exposed electrode, a covered electrode and a dielectric layer separating the electrodes as shown in figure 1. In this work, our ambition is to perform a parametric study of the influence of macroscopic quantities (pressure, applied voltage, temperature, initial electron density and relative dielectric permittivity) on the momentum transfer between charged particles, which acquire kinetic energy under the effect of Coulomb forces, and neutral particles of the helium gas.

Keywords: Atmospheric pressure, ionic flow, plasma actuator, dielectric barrier discharge, surface discharge.

*Speaker
†Corresponding author: moustaphaouaali@gmail.com

Cold plasma micro-jet at atmospheric pressure and ambient temperature

Moustapha Ouali *† [1], Najlae Seddaoui , Youssef Lagmich

[1] Université Abdelmalek Essaâdi – Morocco

Plasma jets are becoming increasingly popular for their potential applications in a variety of fields, due to their low temperature and relative ease of implementation, as they do not require the use of vacuum pumps. Atmospheric pressure and room temperature plasma sources offer suitable solutions. However, the complexity of plasma modeling-which incorporates concepts from electromagnetism, reaction engineering, statistical physics, fluid mechanics, physical kinetics, and a variety of other fields-is at the root of this difficulty. In this work, our ambition is to build, using COMSOL software, a 2d axisymmetric simulation (Figure 1) able to follow the complete development of the discharge, from its creation between the electrodes in pure helium, to its propagation outside the device, and to better understand the influence of the experimental conditions and the geometry of the DBD on the properties of the helium plasma jets, and the variation of these properties when the jet collides with the gaseous helium at the outlet of the injector.

Keywords: Atmospheric pressure, microdischarge, plasma jet, Dielectric barrier discharge, cold plasma.

*Speaker

†Corresponding author: moustaphaouaali@gmail.com

Effect of humidity on the positive corona discharge in the tip-plane reactor

Karim Saber * [1], Guedah Hasna , Alyen Abahazem† , Nofel Merbahi , Mohammed Yousfi

[1] Université IBN ZOHR [Agadir] (fsa) – Morocco

This work is devoted to the study the humidity rate effect in the case of the positive corona discharge based on the reactor of the point-plan configuration, under a pulsed supply, in dry air and humid air at atmospheric pressure. We have determined the average discharge power and the average power delivered to the reactor, as well as the average energy efficiency based on the proposed electrical model (equivalent to the corona discharge) in our previous work, for different humidity levels (0%, 65%, 70%, 80%, 90% and 100%). then we have studied the evolution of these results obtained for different humidity levels. We found that the addition of 65% of water vapor to dry air, reduces the energy efficiency to a low value. Moreover, we found that the energy efficiency increases slightly from 65% to 70%, then decreases above this last value. Finally, we investigated the evolution of the ozone density for different humidity levels.

Keywords: Corona discharge, Average power delivered, Average energy efficiency, Average Discharge power, Ozone density.

*Speaker

†Corresponding author: alyenaba@yahoo.fr

Equivalent electrical circuit of the plasma jet reactor

Karim Saber * [1], Guedah Hasna , Alyen Abahazem† , Nofel Merbahi , Mohammed Yousfi

[1] Université IBN ZOHR [Agadir] (fsa) – Morocco

This paper is devoted to the determination and improvement of the plasma jet energy efficiency. For this purpose we have realized an electrical model equivalent to the discharge reactor. The latter contains variable electrical parameters. Their evolution has been determined by a mathematical identification method, based on the recursive least squares algorithm (RLSA). The good agreement between the measured current and the one calculated using the electrical circuit, as well as the significant shapes of the estimated parameters, validate the choice of the proposed model. This allowed us to use the estimated parameters to determine the energy delivered to the reactor and the one used during the discharge. This makes our reactor controllable at the energy level. thus, the ratio between the last two energies allows us to calculate the plasma jet energy efficiency at each discharge instant. we also studied the effect of the applied voltage on the efficiency. We found that the efficiency increases from 75 % to 90 % by increasing the voltage from 6 kV to 8 kV. All the results found in this work have been interpreted and compared with the discharge behavior. This proposed model will help us to choose the right operating conditions to reach the maximum efficiency.

Keywords: Corona discharge, electrical model, discharge power, delivered power, Plasma energy efficiency.

*Speaker

†Corresponding author: alyenaba@yahoo.fr

Physical and electrical simulations of dielectric barrier discharge

Najlae Seddaoui *† [1], Moustapha Ouali [1], Youssef Lagmich [1]

[1] Laboratory of sciences and advanced technologies, Physics Department, University of Abdelmalek Essaadi – Morocco

To more adequately describe the physical properties of dielectric barrier discharge, a DBD device based on the discharge between two electrodes, a powered anode and a grounded cathode, is simulated on Comsol-Multiphysics. In order to prevent the concentration of charges and the formation of an arc between the electrodes, this simulation is based on a 2D model at low pressure with one dielectric located close to the cathode. For the formation of homogenous discharges, the anode is powered by a sinusoidal voltage at a frequency of 50 Hz.
Second, an equivalent electrical model was simulated on Matlab/Simulink to better understand the electrical properties of DBD. In this case, the DBD is substituted by a capacity that is connected to a resistance and current generator.
In this work, the physical and electrical characteristics of dielectric barrier discharge were researched using physical and electrical model simulation, separately, and a comparison between them was investigated. We have even compared the simulation results produced in both studies with experimental investigations published by other researchers.

Keywords: DBD, electrical characteristics, physical charqacteristics, simulation model.

*Speaker
†Corresponding author: najlaeseddaoui@gmail.com

Thermodynamic re-assessment of the Ga – Tb system supported by ab-initio calculations

Mustapha Ait Boukideur *† [1], Ahmed Azzouz-Rached [2], Najim Selhaoui [1], Fatimazahra Chrifi-Alaoui [1], Kamal Mahdouk [1], Mohamed Idbenali [1], Hamza Bouchta [1], Khadija Achgar [1], Fatimaezzahra Kerboubi [1], Meriam Boulgana [1]

[1] Université IBN ZOHR [Agadir] – Morocco
[2] Université Djilali Liabès [Sidi-Bel-Abbès] – Algeria

Ab-initio calculations within DFT (density functional theory) (1) were employed to calculate the enthalpies of formation of the metal compounds in the Ga–Tb system. The phase diagram and thermodynamic data of this system were critically re-optimized using the Calphad method (2) and Thermo-Calc software (3). The Ga–Tb phase diagram contains six intermetallic compounds: Ga6Tb, Ga3Tb_BT, Ga3Tb_HT, Ga2Tb, GaTb and Ga3Tb5 (Fig.1). The Ga–Tb system was re-evaluated using the substitutional solution model to the description of the liquid phase, in which the excess Gibbs energy (G) was formulated with Redlich–Kister polynomial (4). The values of the enthalpies of formation that we obtained using this models are in good agreement with those calculated in this work using the WIEN2K (5) code and with data from the literature. The optimization procedure allows us to optimize all invariant equilibria, thermodynamic properties of the liquid phase and intermetallic compounds of the Ga–Tb system.

Keywords: Ab, initio calculations, Ga, Tb system, Calphad approach, WIEN2K code, Thermodynamic re, assessment.

*Speaker
†Corresponding author: mustapha.ait.boukideur@gmail.com

Kinetic study of the ageing and overageing of alloy Pb0,058%Ca0,12%Sr1,09%Sn

Youssef Ait Yassine *† [1]

[1] 1Higher School of Technology, Ibn Zohr University, Laâyoune, Morocco 2Laboratory of Thermodynamics and Energy, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco – Morocco

In this paper, we have described a systematic hardening mechanism of PbCaSrSn alloy. The evolution of structure hardening of this alloy to equilibrium occurs in two steps: a discontinuous transformation hardening and continuous precipitation characterize the first one. While a lamellar discontinuous precipitation that occurs after aging (over-aging) characterizes the second step.
In order to improve the mechanical and electrochemical properties of Pb, in previous works, the influence of minor additions of Sn, Sr and Ca has been studied. However, to the best of our knowledge, there are no theoretical and experimental studies carried out previously on the kinetics of aging and over-aging of this alloy. So, the objective of our work is the kinetic study of aging/over-aging by two methods which are Johnson and Mehl and Burke's methods, whose objective is the calculation of the apparent activation energies associated with the various transformations characterizing the hardening (aging and overaging) of the Pb0,058%Ca0,12%Sr1,09%Sn alloy at 20 and 80∘C. The obtained results show that activation energies of strengthening (ageing) and weakening (overageing) of Pb0,058%Ca0,12%Sr1,09%Sn alloy are 25 and 28 kJ/mole, respectively.
The results show that the influence of minor addition of Ca, Sr and Sn leads to an amplification of the maximum hardness from 5HV to 21HV and an acceleration of the transformation hardening process responsible for aging.

Keywords: Ageing, overageing transformation, hardening, apparent activation energies, PbCaSrSn alloy, Johnson and Mehl and Burke's methods.

*Speaker
†Corresponding author: y.aityassine@uiz.ac.ma

Modelling and Analysis of the Energy Performance of a Building Constructed with Earth Bricks

Abdelmounaim Alioui * [1,2]

[1] 1Polydisciplinary Faculty - Sultan Moulay Slimane University, Beni Mellal, Morocco – Morocco
[2] 2Industrial Engineering and Surface Engineering Laboratory, FST, University Sultan Moulay Slimane, Beni Mellal, Morocco – Morocco

Nowadays, decarbonization of buildings has become one of the most critical and immediate issues in the construction industry. As a result, environmental sustainability is considered a priority issue for humanity. In this context the use of raw earth as a building material is among the solutions to ensure energy efficiency in buildings, hence this material is used worldwide as a construction material since ancient times due to its well-known environmental properties of recyclability and low inherent energy through its production process. The main objective of this work is to analyze the energy performance of earth bricks by running a dynamic thermal simulation of an envelope constructed with this eco-friendly material and subsequently estimate the annual heating and cooling demands, which are then compared to those of an envelope with concrete bricks. The results of this study show that the earthen building offers a better energy performance than the concrete one, which can effectively reduce the heating and cooling energy needs in severe climates.

Keywords: energy efficiency, earth bricks, building material, eco, friendly, thermal simulation

*Speaker

Effect of Greenhouse Design Parameters on the Cooling Requirement of Greenhouses in Chtouka Ait Baha Climatic Conditions

Fatima Ezzahra Allali * [1], Hassan Demrati [1], Ahmed Aharoune [1], Lahoucine Gourdo [1], Younes Errami [1], Lahcen Bouirden [1], Ahmed Wifaya [2]

[1] Thermodynamic and Energetic Laboratory, Physics Department, University of Ibn Zohr, Agadir, Morocco – Morocco
[2] National Institute of Agronomic Research INRA Agadir, Morocco. – Morocco

Semi-arid regions are frequently subject to major temperatures, especially during the summer period, which may drastically affect greenhouse indoor climates. To improve the energy management of these buildings, you should study the effect of the greenhouse design as well as the cover material and structure on the greenhouse energy.
In this research paper, in the first part, we have studied a comparative study of the energy behavior of two structures of agricultural greenhouses (Canarian and Mono-span), under the same climatic conditions, to contribute to the choice of the type of the most energy-efficient greenhouse for the greenhouse growers in the semi-arid region during the summer period. This is a simple approach that we have used that can contribute to the development of sheltered crops in our country, as the choice of the type and geometry of the most energy-efficient greenhouse for farmers in arid and semi-arid climate regions. Our work focuses on the interaction of different phenomena that exist inside the greenhouse in the absence of plant cover during two periods: diurnal and nocturnal. We concluded that the Mono-span greenhouse is better in terms of microclimate during the summer period than the Canarian greenhouse based on the results of our experiments. It decreased the air temperature of the greenhouse during the daytime period by about 4○C compared to the Canarian greenhouse.
In the second part, we presented, via CFD simulation, a comparative study of the energy behavior of the different types of agricultural greenhouse structures, under the same conditions. Precisely we studied the difference between the two types of greenhouses; the results of simulations are identical to those of the experiment, which means that the Mono-span greenhouse is better in terms of energy efficiency than the Canarian greenhouse. We have also studied via CFD simulation the effect of roof height in the Canarian greenhouse, the most used greenhouse in Morocco, and we have concluded that in summer, the higher the roof, the more favorable the climate is in terms of temperature.

Keywords: semiarid, CFD simulation, High temperature, Greenhouse

*Speaker

Design of an electric floor heating system using solar photovoltaic energy for wet areas

Yassine Anigrou *† [1], Mohamed El Khlifi [1], Mohammed Zouini *

[2]

[1] Hassan II University of Casablanca, Faculty of Sciences and Techniques of Mohammedia, Morocco – Morocco
[2] Sidi Mohamed Ben Abdellah University ENS, Fez, Morocco – Morocco

In this study, we try to evaluate the economic and energetic potential of photovoltaic panels for the electric power supply of the electric underfloor heating intended to heat the showers and the heated rooms in the traditional hammams. Electric underfloor heating has been chosen as a renovation solution that has never been used in hammams for these reasons and in accordance with the context of the ecological hammam. In addition, the electrical energy consumed by this type of floor will be rewarded by the photovoltaic installation connected to the electrical grid. This heating system uses photovoltaic solar energy as a source of energy in the climatic conditions of Marrakech, Morocco, which presents a suitable solution for heating wet areas such as public baths. In addition, this paper presents a photovoltaic panel installation designed to cover part of the heating needs of wet areas with a total coverage rate between 65% and 75% per year on average. Therefore, the objective of this work is to determine the thermal, economic, and environmental performance of the solar photovoltaic heating system. In general, it can be said that this photovoltaic solar panel system represents an effective and excellent option, both environmentally and economically, for low-temperature space heating in Morocco. Therefore, the integration of such a renewable system will result in substantial energy and financial savings, as well as a reduction in CO2 emissions.

Keywords: Underfloor heating, Electric heating film, Photovoltaic solar energy, Economic study, Environmental study

*Speaker
†Corresponding author: yassine.anigrou-etu@etu.univh2c.ma

Optical and electrical Characterization of dust accumulated on PV panels in Agadir-Morocco

Abdellah Asbayou * [1], Ismail Isknan , Ahmed Soussi , Abdeslam El Fanaoui , Ahmed Ihlal , Lahoussine Bouhouch

[1] 1Laboratory of Materials and Renewable Energies, University Ibn Zohr, 80000 Agadir, Morocco – Morocco

The efficiency of photovoltaic solar panels is influenced by several factors including optical losses, such as transmission, absorption, reflectivity of solar radiation by encapsulation materials, and dust effect. These are the most important factors who can reduce the efficiency of photovoltaic solar panels. In this paper, Experiments of soiling effects on the performances of a PV panel have been performed using dust collected from two sites in the region of Agadir, Morocco. The nature of dust was studied by means of scanning electron microscopy and energy dispersive x ray spectroscopy. It was found that the granulometry of dust particles depends on the study area. The diversity of the behavior of soiled panel was explained in terms of the size of the particles collected from each area. The transmission of light across the front glass of the PV panel is more affected when the size of particles are small.

Keywords: dust, Characterization, Agadir, Morocco soiling, PV panels

*Speaker

Development of new high voltage fluorophosphates-based cathode materials for Li-ion batteries.

Ismail Assengar *† [1], Ismael Saadoune [1,2], Hasna Aziam [3]

[1] Innovative Materials, Energy and Development Laboratory (IMED-Lab), chemistry department, Cadi Ayyad University, Marrakech, Morocco – Morocco
[2] Applied Chemistry and Engineering Research Centre of Excellence (ACER CoE), Mohammed VI Polytechnic University, Ben Guerir, Morocco – Morocco
[3] High Throughput Multidisciplinary Research (HTMR), Mohammed VI Polytechnic University, Ben Guerir, Morocco – Morocco

Since the first commercialization of Lithium-ion batteries (LIBs) by Sony in 1991, extensive studies have been conducted by the researchers worldwide to develop new electrode materials and to satisfy the ever-increasing need for batteries with both high energy and power densities. As this technology continues to evolve, the development of new electrodes with low cost, high safety, high energy density, and long cycle life have emerged as prime concerns. For this matter, fluorophosphates-based materials are considered as promising electrode materials due to the covalent character of phosphate group which promotes them to be safe, and the high electronegativity of fluorine atom resulting in the enhancement of the metal redox potential.
Thus far, the reported synthesis method of this type of materials are generally a two-step solid state reaction or sol-gel method. However, the synthesis of pure fluorophosphate phase is a challenging task, as it decomposes to the LISICON-phase or suppressed by the formation of the OLIVINE-phase if the experimental conditions are not thoroughly controlled.

In this work, a novel fluorophosphate materials LiVxMyPO4F (M = Mn & Fe) were synthesized via one step water-based sol-gel method with optimized conditions. The XRD pattern of these materials matches well the standard reference (JCPDScard 42-1412), indicating the formation of high purity product. The fluorophosphate cathode materials were tested in Lithium-ion batteries, LiVxMnyPO4F——Li Charge-discharge cycling in the voltage window between 3.0V and 4.6V at 0.2C rate showed a discharge capacity of 82 mAhg-1 after 100 cycles.
Currently, in order to achieve high discharge capacity, the electrical conductivity of the studied cathodes materials is under improvement through various approaches.

Keywords: Li, ion batteries, Fluorophosphates, High voltage cathodes, sol, gel.

*Speaker
†Corresponding author: ismailassengar@gmail.com

Glass formation and evolution of local atomic structure of glassy Iron in relationship with pressure

Soufiane Assouli *† [1]

[1] Energy Engineering and Materials Laboratory, Faculty of Sciences and Technologies – Morocco

The aim object of this work is to study the local atomic structure and the effect of pressure on that structure of Iron monatomic metallic glass using Molecular Dynamic simulation under Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) under pressures between 0 and 30 Giga Pascal (GPa). The atomic interactions of this metal are presented by optimized Embedded Atom Method (EAM) potential. In order to achieve our goals, we shed light on the Pair Distribution Function (PDF), Voronoi Tessellation Analysis (VTA), coordination number (CN), glass transition temperature (Tg), relaxation and pressure dependence. During the quenching different values of cooling rates was tried: $\alpha = 1012$ K/s, $\beta = 5.1012$ K/s, $\gamma = 1013$ K/s, $\delta = 5.1013$ K/s and $\epsilon = 1014$ K/s. The γ was chosen as a better cooling rate in our case and the pressure effect was combined with it. β was very sensitive to the application of pressure. Beyond γ, metallic glass is always possible and the results obtained for this latest value can be generalized for higher cooling rate. A splitting in the second peak of the PDF is shown, proving the formation of amorphous phase. A tendency to crystallization was observed for relaxation of 300 ps. The $< 0,1,10,2>$ and $< 0,2,8,4>$ Voronoi polyhedron have been depicted as the most dominant clusters in the formed Fe monatomic Metallic Glass (MGs) for some favourable values of pressure. Namely, under 20 GPa. For higher values of pressure the $< 0,6,0,8>$ and $< 0,4,4,6>$ Voronoi polyhedrons took place.

Keywords: LAMMPS, Molecular Dynamic simulation, Embedded Atom Method Potential, Iron monatomic metallic glass, Pair Distribution Function.

*Speaker

†Corresponding author: soufiane.assouli-etu@etu.univh2c.ma

The expanding world of perovskite solar cells: Recent Advancements and Challenges

Lahoucine Atourki *† [1]

[1] 1MANAPSE Lab, Faculty of Science – Mohammed V University in Rabat, Morocco. 2LMER, Faculty of science – Ibn Zohr University, Agadir, Morocco – Morocco

The emergence of perovskite photovoltaic technology is revolutionizing the solar energy sector. In just over a decade, the power conversion efficiency of metal-halide perovskite solar cells has increased from 3.9% to 26.7%, suggesting this technology might be ready for large-scale exploitation in industrial applications. The key issue at this stage of development is how to improve both efficiency and long-term stability. We will present an overview of current research and our perspective regarding the use of PSC technology for large-scale manufacturing in the future. We will provide an overview of the strategies used to solve perovskite stability issues under environmental conditions. The environmental aspects and lead toxicity are also discussed among the challenges for the commercialization of PSCs. The view on the research opportunities offered by halide perovskites will be reflected.

Keywords: Materials, Solar energy, Low dimensional materials, Perovskite

*Speaker
†Corresponding author: l.atourki@um5r.ac.ma

Applied potential effect on one-step electrodeposition of CuSbSe2 thin films

Khadija Abouabassi * [1]

[1] Laboratory of materials and renewable energy (LMER), Physics Department, University of Ibn Zohr , 80000 Agadir, Morocco – Morocco

Thin films of copper antimony diselenide (CASe) were prepared in aqueous bath by low-cost potentiostatic electrodeposition technique onto Fluorine doped tin oxide (FTO) substrates. Cyclic voltammetry (CV) tests were firstly used to investigate the electrodeposition mechanism of unitary, binary and ternary systems. Then the effects of deposition potential toward the properties of the thin films were investigated from Cu-Sb-Se one step electrodeposition during 30 min. The Cu-Sb-Se deposit was annealed at 350 ∘C under N2/Se atmosphere for 20 min for its conversion into CuSbSe2 phase and to enhance the crystallinity. By combining CV, composition, morphology, and structure analysis, the most suitable deposition potential for the preparation of the films was determined at about -0.40 V vs. SCE. A Cu-poor, Sb-rich CuSbSe2 thin films having an optical band gap value of about 0.97 eV are produced.

Keywords: copper antimony selenide thin films, electrodeposition, applied potential, annealing, Characterization.

*Speaker

Peak power prediction of photovoltaic panels operating under real conditions using new analytical models

Fatima Ezzahra Ait Salah *† [1], Noureddine Maouhoub [2], Kawtar Tifidat [2]

[1] Laboratory of Materials, Signals, Systems and Physical Modeling, Department of Physics, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco – Morocco
[2] Laboratory of Materials, Signals, Systems and Physical Modeling, Department of Physics, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco – Morocco

A new method, based on an explicit model with three parameters: Isc short current, Voc open circuit voltage and S shape parameter, has been proposed to predict peak power from sunrise to sunset under real changing conditions of solar irradiation and module temperature. In this work, we suggested new models of Voc and maximum power point (Imp, Vmp), then, we adapted two steps; the first is to extract parameters by optimizing their suggested expressions and measured data over a reference day, and the second is to predict them at different times. This method is applied to three different technologies of photovoltaic modules: mono-crystalline silicon, multi-crystalline silicon and amorphous silicon. The optimized values of the characteristics of current voltage and peak power under reference conditions as well as the predicted maximum output values under arbitrary conditions are compared to the measured values for three modules tested outside Cocoa Florida, in the NREL laboratory. The normalized error indicator for three solar panels was found to be within 3%.

Keywords: Explicit model, Photovoltaic panels, Peak power, Normalized error.

*Speaker
†Corresponding author: aitsalahfatimaezzahra365@gmail.com

Synthesis of nanostructured transparent conductive oxide using a sweep voltammetry technique

Abderrahim Ait Hssi * [1], Ahmed Soussi , Abderrahman Nidlhadj , Mohamed Taoufiq , Abdeslam Elfanaoui , Ahmed Ihlal , Khalid Bouabid

[1] Materials and Renewable Energy Laboratory – Ibn Zohr University.BP8106, Agadir, Morocco

Pure n-ZnO nanorods and p-Cu2O films were prepared via an electrochemical technique under a variable applied potential. ZnO nanorods were elaborated using a two-step electrodeposition procedure, while Cu2O films grown via cyclic voltammetry technique. The properties of ZnO NRs and Cu2O films deposited according to both methods were studied and compared of oxides usually deposited under a fixed potential. The deposited ZnO NRs show a perfect crystalline hexagonal zincite structure with a preferred alignment along the (002) axis, these nanorods display a smaller diameter, high density, and transmittance of _˜70 -80% in the visible band. The Cu2O film exhibits a crystalline cubic structure of pure Cu2O phase, characterized by the preferential orientation along (111) plane, and a compact and uniform morphology composed of three-sided pyramid-shaped. This work sheds light on the great effect of the nucleation and the crystal growth modulation onto the physical properties of deposited oxides. It is also expected to enable the optimization of solar cell devices based on Cu2Onanomaterials in a subsequent step.

Keywords: Electrodeposition, Cu2O thin film, ZnO nanorods, cyclic voltammetry.

*Speaker

Effect of active solar heating system on microclimate, development, yield and fruit quality in greenhouse tomato production

Abderrahim Bazgaou * [1,2], Nabil Aqil [1,2], Aziz Benahmed [2], Bouchra Belhorma [2], Bouchaib Hartiti [3], Hicham Labrim [4], Hamid Marah [5]

[1] Institute for Research in Solar Energy and New Energies IRESEN, Rabat, Morocco – Morocco
[2] National Center for Energy, Sciences and Nuclear Techniques CNESTEN, Rabat, Morocco – Morocco
[3] Faculty of Science and Technology of Mohammedia, Hassan II University, Mohammedia, Morocco – Morocco
[4] National School of Applied Sciences of Kenitra, Ibn Tofail University, Kenitra, Morocco – Morocco
[5] National Center for Energy, Sciences and Nuclear Techniques CNESTEN, Rabat, Morocco – Morocco

Heating greenhouses is essential to provide favorable climatic conditions for growing plants under cold
periods. In this work, we have studied the performance of an Active Solar Heating System (ASHS) consisting of
two solar water heaters equipped with flat solar collectors, two storage tanks and exchanger pipes. During the
day, the water is heated in the thermosyphon solar collectors and stored in tanks before being placed into
circulation in the exchanger pipes to distribute the heat to the aerial and root zones of plants.
To assess the performance of the Active Solar Heating System, climatic and agronomic parameters were
monitored in two identical canarian greenhouses, one equipped with ASHS heater and the second without.
Experimental results show that the ASHS system improve the nocturnal climatic conditions under greenhouse.
The thermal comfort created by the ASHS system in root zone, increases the absorption of nutrients, which
improve the external quality (color, size, weight and firmness) and the internal quality (sugar content, acidity and
taste) of tomato fruits. This improvement is also reflected by increasing total tomato yield by 55% in winter
period. The results of economic analysis indicate that the ASHS system is a cost effective in terms of investment
and energy saving.

Keywords: Solar energy, Greenhouse heating, Tomato production, Tomato quality, Energy saving

*Speaker

Energy performance of building with composite based on mortar and date palm fibers in Atlantic climate of Morocco

Mhaijiba Belhous *† [1], Soufiane Oukach [1], Mustapha Boumhaout [1], Hassan Hamdi [1]

[1] Energies and Sustainable Development (E2D) research team, Higher School of Technology – Guelmim (ESTG), Ibn Zohr University, Guelmim, Maroc – Morocco

This work aims to study the effect of thermal insulation with date palm fiber materials on the thermal performance of a building in an Atlantic climate. The impact of this passive technique on cooling/heating loads and indoor comfort are analyzed by means of a numerical simulation created under the TRNSYS software. This technique is evaluated against a hypothetical reference case of the house without thermal insulation, built with conventional building materials. The results show that the insulation with palm fiber materials has a remarkable effect on the indoor air temperature and cooling/heating loads of the house. When thermal insulation is integrated in the studied house, better comfort conditions are obtained compared to the reference case, since the minimum indoor air temperature is raised up to 3 ∘C in winter, while the maximum indoor air temperature is reduced up to 7 ∘C in summer. In addition, the house reduces the annual cooling and heating load by up to 21% compared to the baseline scenario. On the other hand, it allows a financial saving and a reduction in the CO2 emission.

Keywords: Date palm fiber insulation, Modeling Cooling load, Heating load, Thermal comfort

*Speaker

†Corresponding author: blhoussemhijiba@gmail.com

Experimental Measurement and Modeling of the I-V characteristics based on evolutionary algorithm of the Photovoltaic modules

Dris Benhmamou * [1], Mustapha Elyaqouti [2], Brahim Ydir [2], Elhanafi Arjdal [2], Driss Saadaoui [2], Souad Lidaighbi [2], Imade Choulli [2], Abdelfattah Elhammoudy [2], Daoudi El Fatmi [2], Rabya Aqel [2]

[1] Laboratory of Materials, signals, systems and physical modeling, Faculty of Science, Ibn Zohr University, Aga-dir-Morocoo. – Morocco
[2] Laboratory of Materials, signals, systems and physical modeling, Faculty of Science, Ibn Zohr University, Aga-dir-Morocoo. – Morocco

As a result of the pollution of fossil fuels and its rising prices, deterioration of the environmental quality and air pollution with the greenhouse gases such as CO2 and CH4, some activities are raised worldwide in terms of technology to access clean and renewable energy sources (1).Thanks to Renewable energies benefits from the dynamic of the Kyoto Protocol, which favors this solution in the fight against greenhouse gases (2), the Photovoltaic power market has grown rapidly in the last decade, and the share of renewable energies in the world's electricity mix had an exponential growth over the last years (3).The performance assessment of operating photovoltaic modules under real conditions is a necessity. Engineers usually use commercial I-V curve tracers available in the market. Nevertheless, most of them are expensive and limited in the input voltage. The aims of this study in the first step is a conception of an electric equipment for tracing current-voltage characteristics of photovoltaic modules and cell by using a relay to connect the operating module under dynamic environment conditions test to the varying load, which is a capacitor. Also, in the last step we load to modelling the obtained experimental Current–Voltage characteristics. The single diode model (SDM) is adopted, in this step all parameter of our model are estimated based on evolutionary algorithm. The validity and accuracy of the model are fully verified with experimental data of three common types of silicon photovoltaic modules such as the Polycrystalline and Mono-crystalline silicon modules and thin film CIS, and for more accurate performance evaluation we are introducing as a criteria the root mean square Error (RMSE). The obtained results under real environment conditions show a strong agreement between the proposed model and the experimental characteristics.

Keywords: Characteristics Current, Voltage, photovoltaic modules, evolutionary algorithm, single diode model

*Speaker

Electrochemical, structural and morphological behavior of iron oxide Fe2O3 synthesis by spray pyrolysis: effect of voltammetry conditions and influence of calcium doping

Fatima-Zohra Bouamrane *† [1], Khadija Bahedi [1], Khalid Bouabid [1], M Addou [2], S Bayoud [2], H Cherrad [2], M Mrigel [2], Mariam Moustaine [1]

[1] Laboratory of Materials and Renewable Energies. Ibn Zohr University, Faculty of Sciences Agadir – Morocco

[2] Laboratory of Optoelectronics and Physical Chemistry of Materials. Ibn Tofail University, BP 133 Kenitra – Morocco

Undoped and Ca-doped thin films of iron oxide Fe2O3 were prepared using 0.05 M aqueous solution of iron chloride (FeCl3) precursor by well-known spray pyrolysis (SP) technique on the glass substrate at 500∘C. The doping concentrations are 2, 5 and 10 at. %. The samples were characterized by The X-ray diffraction (XRD), and the Scanning Electron Microscopy (SEM) in order to visualize their phases and their surfaces morphology. Structural properties showed that samples crystalize in rhombohedral structure with hexagonal setting in the space group (R-3c) with a preferential orientation along the (1 0 4) direction. From the SEM observations, it was seen that pure and Ca-doped iron oxide thin films had a good uniformity and adherence on glass substrates with a spherical particles. The electrochemical behavior of undoped and Ca-doped iron oxide films was evaluated using cyclic voltammetry in an aqueous electrolyte of LiClO4. The results shows that 5 at. % Ca-doped iron oxide films had the highest electrochemical performances in 0.5M of lithium perchlorate LiClO4 at scan rate 50mV/s with higher specific storage capacity. The influence of scan rate, potential window and lithium ions concentration on the interfacial capacitance of Fe2O3 samples shown on CV curves, were also discussed in order to find the optimum parameters who generate the greatest performances of iron oxide thin films. The finding demonstrate that the as-prepared Ca-doped Fe2O3 film could be good candidate electrode for supercapacitor devices.

Keywords: iron oxide, SPRAY, electrochemical properties, calcium, supercapacitor.

*Speaker

†Corresponding author: fatima.zohra.ee1998@gmail.com

Atténuation large bande dans un métamatériau de type fluide-fluide.

Ramdan Braik * [1]

[1] ENSA – Morocco

Les métamatériaux sont une nouvelle classe de matériaux capable d'exhiber des phénomènes exotiques. Ceci est dû à l'insertion d'éléments dits à résonances locales. Ces dernières se couplent aux continuums pour changer drastiquement le comportement de la matière vis-à-vis une onde. Dans notre étude nous considérons les ondes acoustiques. La structure utilisée consiste en des cylindres d'air dont le diamètre est sublongueur d'onde insérés dans une matrice d'eau. A travers des simulations numérique nous prouvons que cette structure peut révéler une atténuation d'onde allant jusqu'à 31 dB sur une bande de largeur relative arrivant à 190%.

Keywords: milieux complexes, les métamatériaux acoustiques, cristaux phononiques

*Speaker

Sizing PV-Hybrid Systems with Hydrogen Storage for Electrification un-der Semi-Arid Climate

Mohamed-Amine Babay *† [1]

[1] 1Industrial engineering laboratory, Faculty of Science and Technologies, Sultan Moulay Slimane University, Beni Mellal, Morocco. 2Green Tech Institute (GTI), Mohammed VI Polytechnic University, Benguerir, Morocco. – Morocco

Solar energy may be used to produce hydrogen in a variety of ways. The most extensively utilized solar hydrogen generation technique at the moment is to obtain hydrogen by electrolyzing water at low temperatures. According to the findings of this study, combining hydrogen and solar technologies is an interesting option for satisfying energy demand in distant locations that are not linked to the power grid. The fundamental advantage of a hybrid PV-Hydrogen system is that an electrolyzer, which converts the power into hydrogen, may store the energy.
When calculating energy bills and evaluating the system in terms of load requirements, and stored energy levels, the study described here attempts to provide a technique for the design of PV-Hydrogen hybrid systems that takes meteorological data and component electrical factors into account.
The entire design of the PEM electrolyzer green hydrogen production chain model is the focus of this research. After that, the model is utilized to conduct a techno-economic analysis of residential energy usage. We will look at using the thermal energy produced by the system's chemical reaction to show that the PEM fuel cell outperforms electrolysis. Direct-coupled systems operate at the intersection points of the PV output and electrolyzer input curves for varied degrees of solar irradiation, whereas battery-assisted systems reduce the size of the electrolyzer at the price of greater energy loss. The electrolyzer may be run at a low load at night, and the intensity of daytime operations could be varied to reach zero cumulative energy each season. These devices create hydrogen that is self-sustaining and long lasting.

Keywords: Renewable Hydrogen production, PV energy, Hydrogen, Electrolysis, Hybrid power systems. Fuel cells

*Speaker
†Corresponding author: mdamine.babay@gmail.com

Characterization of Copper doped SnO2 microtubes and their application to gaz sensor

Saaida Baoubih * , Abdeslam Elfanaoui [1], Radouane Leghrib [2], Ahmed Soussi [1], Mohamed Taoufiq [1]

[1] laboratory of materials and renewable energies LMER, Faculty of Science-University Ibn Zohr- Agadir – Morocco

[2] Laboratory of electronics, Signal processing and Physical Modeling LETSMP, Faculty of Science-University Ibn Zohr- Agadir – Morocco

Benzene is among the carcinogenic vapors found as air contaminant in indoor and outdoor air, especially in petrochemical factories and refineries. Recognizing such contaminant at traces in complex real environment, needs the use of gas sensors with high selectivity. More particularly, chemoresistive gas sensors based on metal oxide materials, are recognized as excellent candidates for the detection of various types of gases and vapors, owing totheir low cost, miniaturized size and their interesting physic-chemical properties. Commercially developed gas sensors based on metal oxide semiconductor were developed by Seiyama & Taguchi since the 60sand are still present in the gas sensor market . In the present work, a new fabrication technique is used to produce one dimensional microtubes of bare and copper doped SnO2 semiconductor . The prepared materials undergo different structural and compositional characterizations such as: SEM, XRD analysis. Furthermore, their sensing properties are also studied by exposing the developed sensors based on the above prepared materials towards towards benzene at low ppl level, and evaluating the cross sensitivity towards this vapor in presence of other organic interfering vapors with similar structure. Opposite figures gave an example of a SEM image and XRD spectra, illustrating the formation of Cu doped SnO2 micro-tubes. The relationship between the dopant concentration and the structural and morphological properties of as-prepared materials, and the obtained sensing properties of the final developed sensors, will be presented and discussed.

Keywords: microtubes, gaz sensor, metal oxide materials, SEM, XRD analysis.

*Speaker

Design and Simulation of a Maximum Power Tracking for Wind Power Generation System

Driss Belkhiri * [1], Benachir Boukhris [2], Mohamed Ajaamoum [1], My Rachid Elmoutawakil Alaoui [1]

[1] Laboratory, Engineering Sciences and Energy Management – University of Ibn Zohr, Agadir, Morocco
[2] Laboratory, Materials, Electrical Systems, Energy and Environment, University of Ibn Zohr, Agadir, Morocco – Morocco

The advancement of wind energy has undergone a huge global transformation. According to nonlinear and complex of wind systems within the standard parameters, the yield mostly relies on the operational condition. In most circumstances, it is challenging to attain the ideal yield. In this study, we present a robust guaranteed performance controllers for wind energy conversion system (WECS) geared with doubly-fed induction generator (DFIG). The suggested controllers based on a flexible scheme of an extended type-2 fuzzy logic controller (T2FLC) and the traditional type-1 fuzzy logic controller (T1FLC). In fact, type-2 can handle higher levels of uncertainty. Particularly, we introduce an inaccuracy in the value of total inertia J and electrical parameters (inductances, resistances) of the model which are known with only 30% and 20%. The quality of the proposed scheme is verified by the numerical simulation of a 1.5-MW wind-driven DFIG under the same conditions. The simulation results show that type-2 can track accurately the optimal operation point over their type-1 counterparts, under uncertainties generating from changing various systems parameters and fast-varying wind speed.

Keywords: Control and Optimization, Inteligent control, Maximum Energy, Fuzzy logic controllers, Interval type, 2 fuzzy logic system

*Speaker

Numerical analysis of copper alloy subjected to compression under dynamic loading

A Bendarma *† [1]

[1] 1Laboratoire d'Innovation Durable et de Recherche Appliquée (L.I.D.R.A), Universiapolis, Bab Al Madina, Qr Tilila, Agadir, Morocco 2Institute of Structural Analysis, Poznan University of Technology, Piotrowo 5, 60-965 Poznan, Poland – Morocco

In this work, numerical results of a copper alloy's mechanical behavior are presented. Over a wide range of strain rates (10–4 s–1 $\leq \epsilon \leq$ 103 s–1) the influence of the loading impact, velocity and temperature on the dynamic response of the studied material was discussed. The interface friction effect on the material's dynamic response is analyzed using a split Hopkinson pressure bar (SHPB) in a high temperature using finite element analysis (FEA). The effect of different friction conditions between the specimen and the transmitted/incident bars in the SHPB system was inspected using cylinder bulk specimens. The results of these numerical simulations allow a better understanding the mechanical behavior during compression tests at high and low strain rates with temperatures ranging from 21 to 200 ∘C.

Keywords: split Hopkinson pressure bar, cooper alloy, dynamic friction, specimen configuration, numerical simulation

*Speaker

†Corresponding author: b.amine@e-polytechnique.ma

Modeling and simulation of a photovoltaic generator

Meriem Boudouane *† [1]

[1] Materials and Renewable Energy Laboratory, Physics Department, University of Ibn Zohr, Agadir, Morocco – Morocco

The conception of an electrical model of a photovoltaic generator is based on the characteristic current-voltage of the solar panel. Many electrical models have been proposed in the literature to simulate PV cells operating under various conditions, for example single diode, dual diode and Bishop models.

The complexity of the models depends on the number of parameters to be identified (series resistance RS, parallel resistance RSh, diode current, photocurrent...). Each model is essentially an approximation of the ideal model which contains a current source representing the incident sun power and a diode representing the PN junction.

The single diode model is the most used model. This model is applied to PV cells and and PV modules for its simplicity and good precision in the power generation quadrant of energy production.

This work consists in the electrical characterization of a photovoltaic generator based on the single diode model using MATLAB Simulink. An analysis of the current delivered by the generator and the electrical power provided by this generator as a function of the output voltage was realized in this work.

The variation of serial and parallel resistors of the model adopted has an influence on the electrical parameters of the generator.
The results of this work confirm the validity of the numerical model of photovoltaic conversion using Matlab. This allows the photovoltaic generators to be operated in the optimal conditions in obtaining a better exploitation of the solar energy.

Keywords: modeling, Matlab simulink, photovoltaic generator

*Speaker
†Corresponding author: meriemprof@gmail.com

Le développement d'une application conçue pour la conception, Etude de faisabilité et analyse des données financières d'un système photovoltaïque/hydrogène

B Boukhris * [1]

[1] (LMS3E), FSAA, Ibn Zohr university, Agadir, Morocco – Morocco

Le recours aux énergies renouvelables n'est plus un choix ou une alternative, mais une nécessité absolue. Pour le Maroc, le choix des sources d'énergie renouvelable est tout indiqué : c'est le solaire en premier lieu. Notre travail vise, dans cette perspective, à donner une légitimité scientifique au choix et au développement des énergies renouvelables. Notre travail consiste ainsi à l'implantation d'un projet en énergie renouvelable, prenant en considération, dès la phase de dimensionnement, la variété des équipements solaires (panneaux, onduleurs, batteries ...) d'une part et les conditions météorologiques des sites d'installations (rayonnement et température) d'autre part. Il se focalisera aussi sur des alternatives du stockage des énergies renouvelables, notamment le stockage par l'hydrogène qui s'avère une solution innovante, durable et non polluante pour la production de l'électricité. Dans ce contexte, nous procédons à une optimisation passant par des simulations de fonctionnement du micro-réseau, suivies de l'implantation réelle sur des sites. Nous présentons une méthodologie d'optimisation de dimensionnement sur deux modèles : le modèle technique qui est développé selon le concept de la probabilité de perte d'alimentation de la charge et le modèle économique développé en utilisant le concept du coût de cycle de vie Enfin, nous proposons une étude de la préfaisabilité d'un système hybride PV à hydrogène destiné La contribution principale de nos travaux se concentre sur la modélisation du système PV /H2 et sa simulation sous Simulinken utilisant des données climatiques réelles et un profil de charge universel adaptés à notre région. Les résultats obtenus montrent que notre dimensionnement satisfait bien au besoin du cahier de charge.

Keywords: Site isolé, micro, réseau, optimisation, pompage PV, Matlab /Simulink, hydrogène, énergie renouvelable.

*Speaker

Numerical simulation of a new CuInS2 structure solar cells using SCAPS-1D software

Lahcen Boulkaddat *† [1]

[1] Department of Physics, Faculty of science, Ibn Zohr University 1Materials and renewable energies laboratory (LMER) Agadir, Morocco – Morocco

The chalcopyrite CuInS2 and its constitutes Ga and/or Se (Cu(InGa)S2 or Cu (InGa)(S,Se)2), have been leading thin films for incorporation in high-efficiency photovoltaics. In conventional ZnO-Al/ CdS/CIS solar cells, the inconvenience of using CIS films is the high cost of indium constituent. In order to overcome this shortcoming, an alternative structure of CIS thin film solar cells is suggested. The one-dimensional SCAPS-1D simulator is used to analyze numerically the performances of the newly proposed ZnO-Al/CdS/CIS/Si thin film solar cells. We show how the device performance is affected by adding the layer of Si. The carrier concentration as well as the thickness of the CIS absorber layer were shown to affect the cell's performance. We also examine the effect of operating temperature, resistors *Rs* and *Rsh* on both conventional and new ultra-thin CIS structures solar cells. The present results showed that the new ultra-thin CIS solar cells structure has performance parameters that are comparable to those of the conventional ones with reduced cost.

Keywords: Field empty!

*Speaker
†Corresponding author: lahcen58@gmail.com

Étude expérimentale de l'amélioration de l'efficacité électrique d'un panneau photovoltaïque à l'aide d'un matériau à changement de phase

Mohamed Bouzelmad * [1]

[1] 1 Laboratory of Physics, Energy and Information Processing (Lab.PETI), Polydiciplinary Faculty of Ouarzazate, University Ibn Zohr, Agadir-Morocco. – Morocco

Cette étude examine l'utilisation d'un matériau à changement de phase (PCM) pour améliorer la production d'énergie électrique et l'efficacité d'un panneau photovoltaïque (PV). L'objectif de ce travail est d'examiner, à l'aide d'une approche expérimentale, l'amélioration de l'extraction de chaleur par le module PV incluant le PCM. Le PCM a été placé sur un arrière du collecteur et les enregistrements de la température réelle des cellules des modules PV avec et sans PCM ont été fournis et évalués par comparaison. Selon les résultats expérimentaux, tout au long de la journée, la température d'un module PV/PCM est inférieure de 9,5 ∘C à celle d'un module PV standard (voir figure 1). Le 23 octobre 2022, le PV/PCM a généré une production d'énergie maximale de 47 W, tandis que le PV traditionnel a généré une production d'énergie minimale de 37 W (voir figure 2). Les résultats ont également montré que le meilleur rendement de l'énergie électrique atteint est de 9.3 % pour les panneaux PV/PCM, et de 7.4 % pour le PV traditionnel.

Keywords: Hybrid photovoltaic thermal, Photovoltaic panel, PV/PCM, Transient conditions, Phase change material (PCM)

*Speaker

EFFECTNIVESS OF SILICON NITRIDE DIELECTRIC FILMS PASSIVATING PROPERITES DEPOSITED ON SILICON SURFACES

Hicham Charifi *† [1]

[1] 1 Laboratory of Materials and Renewables Energies LMER , University Ibn Zohr, Agadir, Morocco – Morocco

Surface and bulk passivation of rich-defected crystalline silicon c-Si are of great importance towards low cost and high efficiency of solar cells. Reducing the Si absorber thickness requires an excellent surface passivation, bulk passivation as well as an efficient light trapping. The silicon nitride-based dielectrics deposited at relatively low temperature (< 400 ∘C) is one of the best alternatives to the high cost, high temperature silicon oxide thermally grown SiO2 for lowering the recombination rate.
In this work, we have analysed the surface passivation efficiency of a low resistivity bare p-type silicon and phosphorus-diffused emitters n+p with different surface concentrations and sheet resistances. The passivating properties of the silicon nitride films are investigated in terms of contactless injection dependent minority carrier lifetime (MCL) measurments for bare surface and in term of emitter saturation current for diffused surface by means of flash lamp photo-conductivity decay system. The emitters are formed from a solid source (spin-on doped oxide). The diffusion conditions (temperature, time) and dopants concentration in the source allow to obtain a large range of emitter sheet resistance ranging from 20 W/ to 450 W/.(1)

Keywords: Field empty!

*Speaker
†Corresponding author: hichamcharifi@gmail.com

Caractérisation d'un module photovoltaïque cylindrique

Khalid Cherifi * [1]

[1] Laboratory of engineering sciences and energy management, University Ibn Zohr, 80000 Agadir, Morocco – Morocco

For decades, scientists around the world have been working to analyze and improve all aspects of photovoltaic cell and planar module technology. Thus, techniques and models to study planar modules are already available and well known.

Recently, cylindrical shaped photovoltaic modules have been invented as one of the solutions to reduce the maintenance required in desert or high snowfall areas. The objective of this work is to characterize a cylindrical photovoltaic module to compare it to conventional modules present on the market.

The studied module is composed of monocrystalline back-contact cell characterized by the I-V curve shown in fig1. The shape of this module gives it the possibility to receive solar energy from any direction, whether direct, indirect or reflected by any surface surrounding it fig2.

In a first step, we will focus on the use of a model to simulate the module and to predict the energy production of the complete module. In a second step, we will use an experimental setup to validate the results of the simulation and theoretical work.

Keywords: Field empty!

*Speaker

Comparative study of six methods for estimating the parameters of photovoltaic devices

Imade Choulli * [1]

[1] Laboratory of electronics, Signal Processing and Physical Modeling – Morocco

To evaluate the energy efficiency of a photovoltaic device, it is necessary to extract the electrical parameters of its equivalent circuit in order to describe the curve representing its current-voltage characteristic.
This work presents a comparative study between six methods used in the literature for the electrical identification of the single exponential of a R.C.T France solar Cell obtained in (1) at irradiance G=1000 W/m2 and at temperature T=33∘C.

Three of these six methods are analytical (2-4), using simplifications and approximations to make the mathematical solution simple and easy. Another linear method based on curve fitting by a numerical calculation(5). The last two fall into the category of iterative numerical approaches that require powerful numerical computing devices (6,7).
The ability of each method was evaluated by comparing its results with the experimental data. Criteria such as mean square error and absolute error are also introduced to assert the advantage of the method proposed by Sera et al.

Keywords: photovoltaic, Analytical method, Iterative numerical method.

*Speaker

Real-time hardware-in-the-loop wind turbine emulator

Kaoutar Dahmane *† [1], El Mahfoud Boulaoutaq [1], Brahim Bouachrine [1], Belkasem Imodane [1], Mohamed Ajaamoum [1]

[1] Engineering Science Energy Management Laboratory (LASIME), ESTA, IBN ZOHR University, Agadir, Morocco. – Morocco

The wind turbine Emulator is used to test in the laboratory the associated power electronics and control, due to the fact that wind energy systems are highly-priced to build and the wind turbine may not always be available. This paper investigates real-time hardware-in-the-loop (HIL) implementation of a wind turbine emulator system. In order to make the permanent magnet synchronous motor shaft simulate the turbine of a wind turbine, we use the Texas Instruments F28069M launch board to adjust the voltage of the motor based on wind data. The digital simulations are carried out with the Altair Embed software to control the motor in an open loop. The simulation and experimental results are compared in order to verify the wind turbine emulator. Digital simulations and hardware results are in good accordance, confirming and validating the wind turbine emulator.

Keywords: Wind Turbine Emulator, Hardware, In, the, Loop (HIL), Permanent Magnet Synchronous Motor (PMSM), Voltage Control, Real, Time Implementation .

*Speaker

†Corresponding author: kaoutar.dahmane@edu.uiz.ac.ma

Computational study of the elastic and mechanical properties of the ZnAs compound under high pressure

Zakariae Darhi *† [1], Larbi Elfarh , Siham Malki , Ibtissam Guesmi , Allal Challioui

[1] Laboratory of Theoretical Physics, Particles, Modeling and Energies, Physics Department, University of Mohamed first, Oujda, Morocco – Morocco

The elastic properties of the orthorhombic compound ZnAs were studied up to 20 GPa, using first-principles calculation, in order to reach a proper understanding of their behavior at high pressure. From the nine calculated elastic constants , we predicted the pressure dependence of the bulk modulus, shear modulus, Young's modulus, the Poisson ratio, and the universal index of anisotropy. Moreover, we visualize the elastic anisotropy of ZnAs by illustrating the 3D projections for shear modulus, Young's modulus, and Poisson ratio. The elastic constants show that ZnAs is mechanically stable in the pressure range (0; 20 GPa). The results obtained from the ZnAs compound show that Young's modulus (E) and the Vicker hardness coefficient (HV) increase as a function of the pressure, which indicates respectively that the material becomes stiffer and harder. Similarly, the results of the Cauchy pressures and the Pugh ratio (P) increase as the pressure rises, which means that the material becomes easier to break.

Keywords: Elastic properties, Pressure, IRELAST

*Speaker

†Corresponding author: zakariae.darhi@ump.ac.ma

Performance of a Multifunctional Fluorinated Phosphite Electrolyte for High Voltage LiNi0.8Mn0.1Co0.1O2 Cathode Materials

Soukaina Darmal *† [1], Hasna Aziam [2], Hicham Benyoucef [2], Ismael Saadoune [1,3]

[1] Innovative Materials, Energy and Development Laboratory (IMED-Lab), chemistry department, Cadi Ayyad University, Marrakech, – Morocco
[2] High Throughput Multidisciplinary Research Laboratory (HTMR), Mohammed VI Polytechnic University, Ben Guerir, – Morocco
[3] Applied Chemistry and Engineering Research Centre of Excellence (ACER CoE), Mohammed VI Polytechnic University, Ben Guerir – Morocco

As one of the most advanced energy storage technologies, lithium-ion batteries (LIBs) have received extensive attention in the past few decades. Their high energy density and long life-span made them the main mobile power sources for portable devices, power tools, and electric vehicles. The rapid evolution of the technology in this field requires a sustainable development of next generation LIBs exhibiting not only high power, capacity and charging rate, but also presenting significantly improved safety performance and low cost. However, with the further improvement of energy density, the urgent need to beat safety problems becomes even more vital (1).

Among the LIBs' components, the electrolyte plays the leading role in the safety challenge. In fact, LiPF6 salt contained in conventional liquid electrolytes, is very unstable in contact with water and can degrade into highly corrosive and dangerous compounds (2). Furthermore, the flammable organic solvents are the main reason causing critical damages resulting in combustion or/and explosions. Moreover, the limitations of liquid electrolytes are, not only related to their flammability, but also to electrochemical degradations that occur with the prolonged use of the battery, causing dreadful irreversible capacity fade. Within this framework, the electrolyte issues required new approaches to assure the stability and reliability of LIBs (2).

For this purpose, we report the tris hexafluoro-propyl phosphite (TFP) as a flame-retardant phosphine additive. The use of TFP in optimal concentration in the baseline electrolyte (1 M LiPF6 in EC: DMC: DEC 1:1:1, by volume) with the well-known film-forming additive, lithium difluoro(oxalate) borate (LiDFOB) significantly optimizes the electrochemical performance of Ni-rich LiNi0.8Mn0.1Co0.1O2——Li cell (3). Compared with the commercial electrolyte, the prepared electrolyte possesses reduced flammability resulting in a higher safety level. The enhanced cycling performance is attributed to the formation of a robust Solid Electrolyte Interface SEI layer that minimized the continuous decomposition of solvents and LiPF6 salt. These results demonstrate the validity of the synergistic multifunctional additives approach in establishing the balance between electrochemical performance and flame-retardant efficiency.

*Speaker
†Corresponding author: darmal.soukaina@gmail.com

Keywords: Hexafluoropropyl phosphite, flame retardant, Ni rich LiNi0.8Mn0.1Co0.1O2, Solid Electrolyte Interface.

Numerical simulation and parametric analysis of a rock bed thermal energy storage system

Aicha Eddemani * [1]

[1] Thermodynamics and Energetics Laboratory, Faculty of Science, Ibn Zohr University, BP8106, 80006 Agadir – Morocco

Packed bed of rocks represents the most suitable thermal energy storage system for solar concentrators that use air as heat transfer fluid. In order to characterize and evaluate the behavior and the performance of air/rock bed thermal energy storage system, a two-phase transient numerical model has been developed and validated by experimental data. A good agreement is obtained between the numerical and experimental results. A parametric study was carried out to investigate the effect of different parameters: thermal capacity, thermal conductivity and diameter of the storage material, mass flow rate and number of successive thermal cycles charge/discharge. The results obtained show that these parameters strongly influence on the thermocline zone formed within the tank, the energy stored during the charging, the energy recovered during the discharge and thus on the efficiency of the system.

Keywords: solar energy, thermal energy storage, thermal cycles, stored energy, recovered energy.

*Speaker

ANN-PI based MPPT applied to PV pumping system using BLDC motor

Yassine El Aidi Idrissi * [1], Khalid Assalaou [1], Lahoussine Elmahni [2], Elmostafa Aitiaz [2]

[1] Materials, Signals, Systems and Physical Modeling Laboratory, Department of Physics, Faculty of Sciences-Agadir – Morocco
[2] Laboratory of Materials and Renewable Energy, Department of Physics, Faculty of Sciences-Agadir (FSA), – Morocco

In this paper, an artificial neural network and proportional integral controller-based maximum power point tracking algorithm are designed for brushless DC (BLDC) motors for photovoltaic water pumping systems. This controller is rapid and accurate to follow the maximum power point (MPP) during changes in solar irradiation. A PV pumping structure including the ANN-PI controller is studied, designed, and simulated in this work. The aim of this paper is to design a robust controller for PV applications based on ANN-PI controller and electronic commutation of voltage source inverter (VSI). ANN-PI controller adjusts the duty cycle of the DC-DC converter to extract the maximum power from PV array. Furthermore, a PWM signal control the voltage source inverter (VSI) to control the speed of BLDC motor. The performance of the ANN-PI controller is compared with the conventional perturb and observe technique. Simulation results reveal that the ANN-PI controller quickly tracks maximum power from the PV array under different irradiance. The simulation studies are carried out in MATLAB-SIMULINK software.

Keywords: PV sytems, boost converter, MPPT, ANN, VSI

*Speaker

ANN-PI based MPPT applied to PV systems

Yassine El Aidi Idrissi * [1], Khalid Assalaou [1], Lahoussine Elmahni [2]

[1] Materials, Signals, Systems and Physical Modeling Laboratory, Department of Physics, Faculty of Sciences-Agadir – Morocco
[2] Laboratory of Materials and Renewable Energy, Department of Physics, Faculty of Sciences-Agadir (FSA), – Morocco

This paper presents an intelligent approach for tracking the maximum power point (MPP) for photovoltaic (PV) applications. This approach is rapid and accurate for finding and tracking the maximum power in photovoltaic (PV) applications under variations of weather conditions such as solar irradiation and temperature. A PV application structure including a PV generator, a power converter and a maximum power point tracking (MPPT) controller is studied and designed in this chapter. The aim of this chapter is to develop a Maximum Power Point Tracking (MPPT) controller for solar PV system by using the artificial neural network (ANN) technique. An Integral Proportional derivative (PID) controller is also included to improve the performance of the ANN controller. In addition, the performance of the ANN based MPPT controller is compared with the conventional perturbation and observation (P&O) method. Simulations are performed using MATLAB/SIMULINK software.

Keywords: PV sytems, boost converter, MPPT, ANN.

*Speaker

Effect of the coating and cobalt content on the electrochemical performance of Ni-rich NMC electrode materials for Lithium-ion Batteries

Abir El Aouam *† [1], Noha Sabi [2], Hasna Aziam [3], Ouardia Touag [4], Hicham Benyoucef [3], Sonia Dsoke [2], Mickaël Dollé [4], Ismael Saadoune [1,5]

[1] Innovative Materials, Energy and Development Laboratory (IMED-Lab), chemistry department, Cadi Ayyad University, Marrakech, – Morocco
[2] Institute for Applied Materials (IAM), Karlsruhe Institute of Technology, Karlsruhe – Germany
[3] High Throughput Multidisciplinary Research (HTMR), Mohammed VI Polytechnic University, Ben Guerir – Morocco
[4] Laboratoire de chimie et d'électrochimie du solide (LCES) , Science Complex, University of Montreal, Montreal, Quebec – Canada
[5] Applied Chemistry and Engineering Research Centre of Excellence (ACER CoE), Mohammed VI Polytechnic University, Ben Guerir – Morocco

In the current and future challenges of integrating renewable energy and electric mobility in the modern society, lithium-ion batteries (LIBs) are seen as an effective storage system. Nevertheless, safety, cost, high electrochemical performance, and fast recharging remain the main challenges facing battery scientists.
In order to circumvent the safety problems and improve the electrochemical performances, which intimately depend on composition and synthesis method of the electrode material. In this work, we present the results of the synthesis of Nickel-rich Li(NixMnyCo1-x-y)O2 (NMC, where x $\geq$ 0.5) compounds by co-precipitation via a reactor (CSTR - Continuous Stirred Tank Reactor). These materials are considered as the most promising cathode materials for high energy LIBs. Hence, LiNi0.8Mn0.1Co0.1O2 (NMC811) particles, having the same size and morphology, were synthesized. Furthermore, as cobalt is a critical toxic and expensive chemical element, other Li(Ni0.8Mn0.1+xCo0.1-x)O2 compositions with a lower cobalt content than NMC811 were prepared under the same conditions and tested in Li-half cells.
On the other hand, Nickel rich NMC materials encounter some limitations resulting from their structural degradation and interfacial instability (1). Coating remains a good strategy to overcome these problems (2). Indeed, the development of a coating process for the synthesized cathodes is carried out in the present study, for development of better performing nickel-rich NMC cathode materials and thus contributing to advance the future development of the next generation long-life and low-cost batteries.
The synthesis, material characterization, and electrochemical performance of different prepared samples will be presented in this conference.

Keywords: lithium ion batteries, Ni rich NMC cathodes, cobalt content, coating.

*Speaker
†Corresponding author: elaouamabir@gmail.com

Blood flow containing nanoparticles through stenosis artery in the presence of magnetic field: A numerical study

Issa El Glili *† [1], Mohamed Driouich [1]

[1] Laboratory of Research in Physics and Engineering Sciences, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal – Morocco

In this numerical study, a mathematical model is designed to study the hemodynamics across an artery with stenosis in the presence of magnetic field and thermal radiation. Nanoparticles of Ag and Au are being used with blood as base fluid. The main reason for the adoption of gold and silver nanoparticles as nonmaterial's for drug delivery is due to their inert nature, stability, high disparity, non-cytotoxicity, and biocompatibility. A method of suitable similarity transformations has been utilized to convert the partial differential equations (PDEs) into dimensionless ordinary differential equations (ODEs), and then solved to get the numerical solutions. The effects of different emerging flow parameters are discussed through graphs and tables for different values of interest. Furthermore, a comparison has been made between Silver nanoparticle and Gold nanoparticle. The effects are noticeable and show that this model could be helpful in some biomedical application.

Keywords: Blood flow, thermal radiation, nanofluid, magnetic field, stenosed artery

*Speaker

†Corresponding author: elglili.issa@gmail.com

Pressure effect on the microstructural properties of amorphous monatomic Silver during quenching process

Tarik El Hafi *† [1], Soufiane Assouli [1], Omar Bajjou [2], Jihad Louafi [3], M. M'hammed Mazroui [4], Youssef Lachtioui‡ [1]

[1] Energy and Materials Engineering Laboratory, Sultan Moulay Slimane University, Faculty of Sciences and Technologies, BP. 523, 23000 Beni Mellal – Morocco
[2] Engineering in Chemistry and Physics of Matter Laboratory, Sultan Moulay Slimane University, Faculty of Sciences and Technologies, BP. 523, 23000 Beni Mellal – Morocco
[3] LPMAT, Faculty of Sciences Ain Chock, Hassan II University, B.P 5366 Maârif, Casablanca – Morocco
[4] Condensed Matter Physics Laboratory, Faculty of Sciences Ben M'Sik, University Hassan II of Casablanca, B.P. 7955, Casablanca – Morocco

Using molecular dynamics (MDs) simulations, we examine the influence of pressure on the change from amorphous to crystalline structure during the quenching process of a silver (Ag) model system. The structural development and phase transformation are analysed based on the variations of the pair distribution function (1,2). In particular, in order to distinguish the local structures and number of clusters in the system, the local structure of the system has been analysed from the bond angle distribution (3), the Voronoi tessellation analysis (4), and the coordination number (5). The crystal nucleation in the amorphous phase, the growth of the crystal nucleus, and the formation of a stable crystal phase during the crystallisation process are also investigated for the model system. The simulation results showed that the applied pressure on the system caused further transformation from an amorphous state to a stable crystal phase during the crystallisation process and also transformations from HCP/DHCP-like to FCC-like local structures.

Keywords: Silver monatomic metallic glass, pressure, Voronoi tessellation analysis, Bond angle distribution, Five, fold symmetry

*Speaker
†Corresponding author: tarik.elhafi@gmail.com
‡Corresponding author: y.lachtioui@gmail.com

Effects of cooling rate on the glass formation process and the microstructural evolution of Silver mono-component metallic glass

Tarik El Hafi *† [1], Soufiane Assouli [1], Omar Bajjou [2], Jihad Louafi [3], M. M'hammed Mazroui [4], Youssef Lachtioui‡ [1]

[1] Energy and Materials Engineering Laboratory, Sultan Moulay Slimane University, Faculty of Sciences and Technologies, BP. 523, 23000 Beni Mellal – Morocco
[2] Engineering in Chemistry and Physics of Matter Laboratory, Sultan Moulay Slimane University, Faculty of Sciences and Technologies, BP. 523, 23000 Beni Mellal – Morocco
[3] LPMAT, Faculty of Sciences Ain Chock, Hassan II University, B.P 5366 Maârif, Casablanca – Morocco
[4] Condensed Matter Physics Laboratory, Faculty of Sciences Ben M'Sik, University Hassan II of Casablanca, B.P. 7955, Casablanca – Morocco

In this work, we have studied the local atomic structure as well as the effect of cooling rate on the microstructure of Silver monatomic metallic glass using molecular dynamics simulations combined with the embedded atom method. To achieve our study, we have used a variety of analytical methods, such as the pair distribution function (1), the bond angle distribution (2), the Voronoi tessellation analysis (3), the coordination number (4), and the five-fold symmetry (5). Our simulation results confirm that the glass formation is proven by a splitting of the second peak in the PDF upon quenching. Via the Went-Abraham parameter, we found that a faster cooling rate results in a higher glass transition temperature and that a less relaxed glass has a lower density because of its larger amount of free volume and disordered structure. In the same context, the bond angle distribution indicates that the icosahedral short-range order in the quenched system is obviously influenced by the increase in cooling rate, and the Voronoi analysis revealed that the fraction of icosahedral-like and mixed-like clusters increases when the cooling rate increases. Moreover, the coordination number demonstrated that the topological structure and local environment of the amorphous Silver change when the temperature decreases during the cooling process. Lastly, we have also found that the five-fold symmetry governs the formation of the amorphous state, and the highest amount of icosahedral-like clusters in the glassy state is obtained for the highest cooling rate, which indicates that the fast cooling rate favours the formation of amorphous structures with icosahedral-like features.

Keywords: Key words: Silver monatomic metallic glass, Cooling rate, Voronoi tessellation analysis, Bond angle distribution, Five, fold symmetry.

*Speaker
†Corresponding author: tarik.elhafi@gmail.com
‡Corresponding author: y.lachtioui@gmail.com

Energy control and management in a hybrid system using renewable energy sources with hydrogen production;

Abdellah El Idrissi * [1], Mohamed Ajaamoum† [1], Azeddine Rachdy‡ [1], El Mahfoud Boulaoutaq§ [1]

[1] Laboratory of Engineering sciences and Energy Management (LASIME),ESTA Ibn Zohr University, Agadir – Morocco

The world is currently facing a shortage of electricity due to insufficient conventional energy sources and increased energy needs in almost all sectors of human life. A hybrid renewable energy system (HRES) can efficiently produce clean energy to meet the energy demand. Thus, it is widely used to improve the quality, reliability and economy of the power system, rather than relying solely on nonrenewable energy sources, on the other hand. One of the most crucial aspects to be addressed is the reduction of CO2 emissions from transport, power generation, heating and industrial sectors. Hydrogen offers a great potential for greenhouse gas reduction, as well as a significant economic windfall, it can be used in vehicles, especially for heavy long-distance transport such as trucks, ships and aero planes, it can be used as an additive to natural gas for heating, and it can be used to replace the use of fossil fuels in industrial processes. The present work focuses on the use of hydrogen in electricity storage. Our work presents a new approach to the Power Management System (PMS) based on uncertainty. It integrates the expected electrical power flow from renewable energy sources photovoltaic panels (PV) and Wind Turbine (WT) as well as the consumption of the load in an autonomous HRES with hydrogen production. This PMS responds to our problem that it guarantees an adequate supply of the load while reducing the number of start/stop cycles of the FC and the electrolyzer in order to increase their lifespan. The PV and the WT are considered as main sources in the HRES. The electrolyzer and the fuel cell (FC) are considered as secondary sources. Excess energy from renewable energy sources is transformed into hydrogen by the electrolysis of water and subsequently stored in a tank. The fuel cell is responsible for providing electrical energy from stored hydrogen when renewable energy sources do not produce enough energy to meet demand. We have proposed the method of pursuit of the maximum point of efficiency based on fuzzy logic and on the method of perturb and observe (P and O) applied to a FC. The objective of the PMS-FC is to improve the performance of the FC system during operating conditions at temperatures close to the freezing point of water and to respond quickly to fluctuations in the power demand.

Keywords: energy management, hybride system, storage system, hydrogen production

*Speaker
†Corresponding author: m.ajaamoum@uiz.ac.ma
‡Corresponding author: a.rachdy@uiz.ac.ma
§Corresponding author: elmahfoud.boulaoutaq@edu.uiz.ac.ma

Exploring the Feasibility of Regenerating High-Performance Cathode Active Materials from Recycled Lithium-Ion Batteries Using Low-Temperature Molten Salt Process

Nabil El Mounafia * [1]

[1] 1Innovative Materials, Energy and Development Laboratory (IMED-Lab), chemistry department, Cadi Ayyad University (UCA), Marrakech, Morocco – Morocco

The demand for lithium-ion batteries (LIBs) has risen significantly in recent years due to their advanced performance and versatility, as a result of ongoing innovation in energy storage. Data from the International Energy Agency (IEA) shows a 700% increase in demand for LIBs between 2015 and 2021 (1). This surge in demand has placed significant pressure on the market of LIBs, leading to the intense exploitation of raw materials. Furthermore, the persistent growth of LIBs utilization will result in a huge amount of end-of-life (EoL) batteries, posing an environmental threat due to the presence of hazardous elements in their composition, such as heavy metals, electrolytes, and organic additives. To address the environmental and sustainability concerns associated with the increasing demand for lithium-ion batteries, sustainable recycling processes such as hydrometallurgical and pyrometallurgical methods have been implemented. One promising method is the use of molten salt assisted roasting, which combines the advantages of both processes while reducing treatment temperatures, energy consumption and promoting the use of non-toxic leaching agents for a more eco-friendly and safe process (2). This method of recycling is expected to play a crucial role in the circular economy of lithium-ion batteries. This study aims to investigate the feasibility of regenerating various cathode active materials from recycled precursors obtained from an EoL battery provided by a local e-mobility company. To achieve this, an eco-friendly, low-temperature recycling process of multiple-metal cathodic material (Li, Mn, Ni, Co, and Al) using ammonium sulfate is applied to the EoL cathodic materials. The process employs Hydro-to-Cathode co-precipitation to regenerate different cathodic phases, namely LiNi0.6Mn0.2Co0.2O2, LiNi0.5Mn0.3Co0.2O2, and LiNi1/3Mn1/3Co1/3O2. The leaching efficiencies of Li, Mn, Ni, and Co were found to be 95.3%, 94.8%, 93.4%, and 92.6%, respectively. The Lithium carbonate obtained through ion-exchange exhibited a pure phase. The X-ray diffraction patterns of new NMC phases (i.e. NMC622, NMC532, and NMC111) revealed structural properties similar to commercial materials, displaying high crystallinity and low ionic disorder. The electrochemical performance of the regenerated cathode active materials was evaluated by performing charge-discharge cycling within the voltage range of 2.8 V to 4.4 V at a rate of 0.2C. The results of this analysis exhibited a reversible high discharge capacity of over 150 mAhg-1 after 50 cycles, with a coulombic efficiency exceeding 98%. Currently various methods are being explored in order to enhance the regeneration process and achieve a high discharge capacity at faster rates. These efforts aim to optimize the recycling process and improve the performance of regenerated cathode active materials.

*Speaker

Keywords: End, of, life Li, ions batteries, Recycling, Molten salt assisted roasting, Electrochemical performance

FOUR SOLAIRE POUR DESSALMENT DES EAUX SAUMÂTRES

Hamid El Omari * [1]

[1] Laboratoire des Energies Renouvelables – Environnement Développement FST de Settat – Université Hassan Premier – Morocco

A cause des changements climatiques et les retards de la pluie que connait le Maroc, l'eau devient de plus en plus une denrée très rare ; et l'eau salée ou saumâtre devient une source potentielle d'approvisionnement permettant de combler cette insuffisance en eau douce. Le Maroc est connu aussi par son énorme potentiel en énergie solaire ; et marier eau saumâtre et énergie solaire est une nécessité absolue afin de réduire ce manque. Notre projet, démarré il y a plus d'une dizaine d'année, est un système breveté complet, composé de plusieurs éléments, dont un four solaire constitué d'un concentrateur sous forme d'un miroir-parabolique, un absorbeur, un évaporateur, une pompe, un condenseur, des sondes de thermocouples ...
L'eau saumâtre étant placée dans un premier réservoir servant aussi comme première partie du condenseur. Cette eau saumâtre est pompée pour être injectée dans un réservoir (alambic) placé au foyer du concentrateur. Ce dernier (four solaire) reçoit le rayonnement solaire et le concentre sur la surface de l'absorbeur qui contient de l'eau saumâtre. La chaleur ainsi concentrée est transmise par conduction de l'extérieur vers l'intérieur de l'alambic puis à l'eau saumâtre. Il y a plusieurs sondes de thermocouples et plusieurs évaporateurs. L'une des sondes est placée à l'intérieur pour suivre l'évolution de la température de manière instantanée ; alors qu'une autre connectée au fond du récepteur prend la température du rayonnement concentré par la parabole. Un des thermocouples est aussi disposé pour la prise de la température ambiante, alors que d'autres sont placés au niveau des condenseurs. Nous supposons évacuer l'eau par ébullition et évaporation pendant un certains temps puis évaluer la quantité de vapeur produite. La conduite vers le condenseur est isolée de manière à augmenter le rendement de condensation et éviter ainsi toute perte. Les premiers tests sont concluants mais reste encore la réalisation expérimentale complète pour une meilleure optimisation du système.

Keywords: Field empty!

*Speaker

Ab-initio study of lead-free double Perovskites Cs2AgBiZ6 (Z = Br, Cl and I) for Solar cells and other renewable energy applications

Mohamed Eddekkar *† [1]

[1] Laboratory of Condensed Matter Physics and Nanomaterials for Renewable Energy ; Ibn Zohr University,Agadir, Morocco – Morocco

In past years, organic-inorganic hybrid perovskites have appeared as high-performance semiconductors for optoelectronics. Even so, their stability and toxicity issues pose major issues. Double perovskites have recently been developed as a promising lead-free alternative, like Cs2AgBiBr6 composition, due to their high stability and non-toxicity. Lead-free double perovskites Cs2AgBiZ6 (Z = Br, Cl, and I) are investigated using ab-initio computations for solar cells and renewable energy. To compute the electronic, modified Becke and Johnson potential (TB-mbj), Heyd-Scuseria-Ernzerhof (HSE06), and generalized gradient approximations Perdew-Burke-Ernzerhof for solids (GGA-PBEsol) have been used. The calculated lattice constants agree closely with the experimental data. These compounds' band gaps are quantified as 1.265 eV, 2.056 eV, and 2.885 eV using Tb mbj, 1.526 eV, 2.322 eV, and 2.899 eV using HSE06, and 0.795 eV, 1.305 eV, and 1.666 eV using GGA-PBEsol for Cs2AgBiI6, Cs2AgBiBr6, and Cs2AgBiCl6 respectively, making them potential candidates for visible light solar cells. For the rest of the calculation, we continued using HSE06 functional, like the optics properties, phonons dispersion, density of states, and thermodynamic properties.

Keywords: double, Perovskites, optical properties, band structure, phonon dispersion, heat capacity

*Speaker

†Corresponding author: Mohamed.eddekkar@edu.uiz.ac.ma

Effect of sodium on bioactive glass for medical application

Halima El Bouami * [1]

[1] Laboratoire Génie de Procédés (LGP), Faculté des Sciences Appliquées - Ait Melloul, Université Ibn Zohr, Agadir, Morocco – Morocco

Bioactive glasses were developed for use in surgery because of their ability to form a layer of hydroxycarbonate apatite (HCA) on their surface that facilitates bonding with natural bone. However, the enormous energy cost associated with the manufacture of bioglass by the melting process in which the raw materials are melted and then tempered to obtain the final glass. In order to reduce this huge energy cost is to change the glass manufacturing process. The sol-gel process is an alternative to the conventional melting method, with the advantage of obtaining glass at lower temperatures. But this method requires very expensive raw materials. This is why the sol-gel process is only used for very specific materials such as bioactive glasses used in the medical field. Sol-gel processing offers a number of advantages, including low temperature processing and precise microstructural and chemical control. Sol-gel bioactive glass not only offers a good degree of biocompatibility, but also a high specific surface area which may be a key factor in the bioactivity of the glass. The objective of our work is to synthesize a SiO2-based bioactive glass with a controlled Na2O content using the sol-gel route.

Keywords: Bioactive glass, hydroxycarbonate apatite Sol–gel processing, Melting

*Speaker

Damage effect on glass/epoxy composite under slamming impact

Salwa Elgarouge * [1,2], Mostapha Tarfaoui [3], Omar Hashim Hassoon [4], Hassan Elminor [5], Amine Bendarma [6]

[1] Ecole Nationale des Sciences Appliquées [Agadir] (ENSA) – BP 1136 AGADIR, Morocco
[2] Ecole polytechnique d'Agadir- Universiapolis (Polytechnique) – Campus Universiapolis Bab Al Madina, Quartier Tillila Agadir 80000, Morocco
[3] ENSTA Bretagne de Brest – ENSTA Bretagne, CNRS UMR 6027, IRDL, 2 rue François Verny, 29806 Brest Cedex 9, France – France
[4] University of Technology, Bagdad, Iraq – Iraq
[5] Ecole Nationale des Sciences Appliquées [Agadir] (ENSA) – Morocco
[6] Ecole polytechnique d'Agadir- Universiapolis (Polytechnique) – Morocco

Materials and structures damage is always considered as an unwanted event, with consequences that can be most of time catastrophic. That's the case with slamming impact which is one of the most famous and important phenomenon in the hydrodynamique field, due to his important consequences on ships structures. The purpose behind this research work is to study the damage that slamming impact can cause by applying Hashin's failure criterion, on a glass/epoxy composite and analyse there mechanical behavior.

Keywords: Slamming, Composites Materials, Behavior, Damage, stacking sequence

*Speaker

Parameter estimation of photovoltaic modules using meta-heuristic algorithms: A comparative study

Abdelfattah Elhammoudy * [1], Mustapha Elyaqouti , Dris Benhmamou , Elhanafi Arjdal , Driss Saadaoui , Imade Choulli , Souad Lidaighbi

[1] Laboratory of Materials, Signals, Systems and Physical Modelling, Faculty of Science, Ibn Zohr University – Morocco

The solar radiation has been the source of energy since of beginning the life on the earth. Notwithstanding we found other sources of energy such as fossil energy and nuclear energy, the solar energy still the clean and the cheaper source of energy, we can exploit this energy to produce the electricity using the photovoltaic (PV) modules. Loads of studies is interested by the PV modules, such as maximum power point tracking (MPPT) (1), thermal modeling and electrical modeling (2)(3). The last one is very important for controlling a PV system, determining their I-V characteristics and optimize their production. There are many electrical models of PV cells, such as single-diode model with five unknown parameters and double-diode model with seven unknown parameters. The aim of this work is to compare three metaheuristics algorithms for determining the unknown parameters of a single-diode model, they are Flower pollination Algorithm (FPA) (4). Teaching–Learning-Based Optimization (TLBO) (5) and Honey Badger Algorithm (HBA) (6). The three algorithms are tested on Photowatt-PWP201 module. Tata solar power TP240 module and R.T.C. France solar cell. The results are evaluated by using the root mean square error (RMSE) values. The best error is *9.860746 e-04 A* is given by HBA for R.T.C. France solar cell and the worst one is *9.458277e-03 A* is given by FPA for TP240 module as shown in the table below.

Keywords: PV modeling, metaheuristics algorithms, Flower pollination Algorithm, Teaching–Learning, Based Optimization, Honey Badger Algorithm.

*Speaker

THE EFFECT OF SHADING ON THE MICROCLIMATE OF A CANARIAN GREENHOUSE IN THE CHTOUKA REGION

Younes Errami *† [1]

[1] 1 Laboratory of Thermodynamics and Energetics, Faculty of Sciences, Agadir, Morocco. – Morocco

Nowadays, the use of photovoltaic (PV) energy in greenhouses has become an important solution and an appropriate option to achieve the goals of environmentally sustainable agriculture, the integration of photovoltaic panels on the greenhouse structure is one of those applications of photovoltaic technologies in agriculture. However, the shading produced by the photovoltaic panels has good effects during the summer period on the microclimate of the greenhouse. In this sense, our study was conducted to evaluate the shading effects induced by photovoltaic panels on the microclimate of the Canary Islands greenhouse in which 40% of the roof surface was covered with flexible photovoltaic panels in a checkerboard format.

Keywords: Greenhouse, Photovoltaic panels, microclimate, Solar radiation

*Speaker
†Corresponding author: errami7younes@gmail.com

High-Selectivity Wideband Three Coupled-line Bandpass Filter based on Interference Technique

Maroua Firmli *† [1]

[1] Laboratory of Metrology and Information Processing (LMIP), Faculty of Science, Ibn Zohr University – Morocco

Since several decades ago, bandpass filters based on two parallel coupled lines have found an extensive range of applications due to its simple synthesis method, and low-cost fabrication. This type of filters can be implemented by using a variety of technologies such as Microstrip, Strip-line, Multilayer and Coplanar waveguide (CPW). For wideband applications, parallel two coupled resonators require a verry small coupling gape size that can be less than 0.1 mm, which can make a serious problem in the fabrication phase. Thus, when the gap size becomes a limitation in the production of wide-bande parallel coupled two-line filter with fractional bandwidth higher than 20%, three-line sections can provide an effective solution, which can realize a stronger coupling compared with the two-line structure. However, poor performances are distinguished. In this study, a modified wideband parallel three coupled-lines bandpass filter with high skirt selectivity and simple configuration while avoiding discontinuities among adjacent sections is presented. The structure performances are improved by including signal-interference filtering parallel transmission lines model with different impedance and electrical length in the input/output of the filter, which lead to generate multiple transmission zeros and enhancing in-band and out-of -band attenuation. For idea validation, a third order bandpass filter was designed and simulated using both ADS and HFSS simulators on microstrip RO3210 substrate with dielectric constant of 10.2, thickness of 1.27 mm, center frequency of 2.45 GHz and fractional bandwidth of 40%. The simulated results achieve a good performance with low insertion loss, hight return loss and four transmission zeros around the passband resulting in a good isolation.

Keywords: Bandpass filter, Transmission line model, Selectivity, Isolation

*Speaker

†Corresponding author: maroua.firmli@edu.uiz.ac.ma

Numerical investigation of free convection in two coaxial cylinders partially filled with porous layer and saturated by a nanofluid with a localized heater under LTE condition.

Youness Foukhari * [1], Mohamed Sammouda [1], Mohamed Driouich [1]

[1] Polydisiplinary faculty, Sultan Moulay Slimane university – Morocco

This paper investigated numerically the free convection in an annular space between two vertical concentric cylinders partially filled with porous layer saturated by (Al2O3-water) nanofluid under local thermal equilibrium (LTE) condition. The inner cylinder is subjected by a regular heat flux, whereas the side wall is kept at a constant cold temperature. The base walls are impermeable and isolated. The governing system of equations is solved using the finite difference method in conjunction with the S.O.R method. The numerical results obtained are presented in terms of streamlines, isotherms, and heat transfer rate expressed by the Nusselt number to demonstrate the effect of various control parameters such as Rayleigh number, heater location, stress jump coefficient, and nanoparticles concentration. According to the findings of this study, increasing the Rayleigh number, stress jump coefficient, and nanoparticle concentration optimizes thermal energy transmission over the active wall. otherwise the position of the heater has a crucial role in enhancing the heat transfer in which, if the heater is concentrated in the centre of the inner cylinder, the heat transmission rate will be larger than in any other position.

Keywords: Natural convection, Nanofluid, Porous medium, Finite difference method, LTE.

*Speaker

First-principal calculations and thermodynamic re-assessment of the Ce-Cu binary system

Bouchta Hamza *† [1], Amine Benderma , Najim Selhaoui , Mustapha Ait Boukideur , Said Kardellass

[1] Université IBN ZOHR [Agadir] – Morocco

A complete thermodynamic description of the Ce-Cu binary system has been carried out by calphad technique based on available experimental data in the literature. The liquid phase, Fcc-A1 (Ce), Bcc-A2 (Ce) ,and Hexagonal-A8 (Cu) phases where described by a simple substitutional model, their excess Gibbs energy is described using the Redlich–Kister expression . The system includes five intermetallic compounds, and the other four intermediates phases, Cu6Ce, Cu5Ce , Cu4Ce , Cu2Ce and CuCe are treated as stoichiometric phases . The optimization is carried out the thermos-calc package. The values of the enthalpies of formation that we obtained using two models are in good agreement with those calculated in this work using the

Keywords: Ab, initio calculations, Ce–Cu system, CALPHAD technique, VASP code, Thermodynamic assessment Redlich–Kister equation.

*Speaker

†Corresponding author: hamza.bouchta@e-polytechnique.ma

Comparison of different virtual inertia control methods for low inertia power systems

Belkasem Imodane * , Brahim Bouachrine† [1], El Mahfoud Boulaoutaq‡ [2], Kaoutar Dahmane§ [3], Mohamed Ajaamoum¶ [4]

[1] Brahim bouachrine – Morocco
[2] Elmahfoud Boulaoutaq – Morocco
[3] Kaoutar dahmane – Morocco
[4] Mohamed Ajaamoum – Morocco

The penetration of electronic power converters (EPCs) into the electrical grid is increasing at a significant rate, leading to a decrease in the number of conventional synchronous generators (SGs).. As a result, power systems dominated by PECs are lack damping and inertia. Consequently, grids based on renewable energy sources (RES) are susceptible to various transient instabilities.
Virtual inertia (VI) based on the swing equation appeared as the effective solution to this problem.The researchers came up with different equations with different terminologies and methodologies for implementing virtual inertia. In this work, the different methods of controlling virtual inertia are compared to understand the advantages and limitations of each method.

Keywords: Virtual inertia, Electronic power converters, Synchronous generators, Electrical grid

*Speaker
†Corresponding author: b.bouachrine@uiz.ac.ma
‡Corresponding author: elmahfoud.boulaoutaq@edu.uiz.ac.ma
§Corresponding author: kaoutartech@gmail.com
¶Corresponding author: m.ajaamoum@gmail.com

Thermodynamic description of the Hafnium-Palladium binary system supported by ab-initio calculations

Said Kardellass * , Antonio Augusto Araújo Pinto Da Silvab , Abdellah Bah [1]

[1] Laboratoire de Mécanique, Procédés et Process Industriels (LM2PI), ENSET, Université Med V-Rabat – Morocco

The thermodynamic properties of the Hafnium-Palladium binary system were optimized using the CALPHAD (CALculation of PHAse Diagram) approach. The solid solutions: body-centered cubic (βHf), hexagonal close-packed (αHf), and face-centered cubic (Pd)) are described by the solution model with the Redlich–Kister polynomial. The thermodynamic model with the best fit to the experimental data described the liquid phase as a solution of Hf, Pd and a HfPd3 associate. Both compounds HfPd2 and Hf2Pd having a tetragonal MoSi2-type structure were treated as one phase with the formula HfPd(Hf,Pd) by a three-sublattice model with Pd on the first sublattice, Hf on the second, and Pd and Hf on the third one, respectively. A three-sublattice model (Hf,Pd)0.5(Hf,Pd)0.5(Va)0.5 is applied to describe the compound HfPd in order to cope with the order–disorder transition between body-centered cubic solution (A2) and HfPd with CsCl-type structure (B2). Another three-sublattice model (Hf,Pd)0.75(Hf,Pd)0.25(Va)0.5 is applied to describe the compound HfPd3 in order to cope with the order–disorder transition between hexagonal close-packed (A3) and HfPd3 with TiNi3-type structure (D024). The Hf2Pd3 intermetallic compound in this binary system which has a homogeneity range was treated by a two-sublattice model as (Hf,Pd)0.75(Hf,Pd)0.25. A set of self-consistent thermodynamic parameters of the Hafnium-Palladium binary system was obtained.

Keywords: Thermodynamic description, Hf, Pd binary system, Associate model, CALPHAD

*Speaker

First-principles calculations of structural, electronic, and optical properties of the stibnite Sb2S3

Mustapha Madi * [1], Atmani1 Atmani [1], Ahmed El Manouni [1]

[1] 1NMAMT laboratory, Faculty of Sciences and Techniques, Hassan II University, Casablanca, Mohammedia – Morocco

The demand for cheaper, nontoxic and earth-abundant materials as an absorbing layer of solar cell is immensely needed to replace scarce, toxic and expensive one. In this regard, chalcogenide materials have attracted significant attention in the past few years as a next generation showing a great potential for different applications. Antimony sulphide (Sb2S3), a chalcogenide binary material is a potential candidate for alternative material in solar cell application, less toxic, abundantly available, stable and efficient.
In our present work, the structural, electronic and optical properties of Sb2S3 were studied using the Full Potential-Linearized Augmented Plane Wave (FP-LAPW) (1) and the Local Orbital (LO) Method, based on the Density Functional Theory as implemented in Wien2k code. The structural, electronic and optic have been calculated using Perdewe-Burkee-Ernzerhof generalized gradient approximation (PBE-GGA) and Perdew–Burke–Ernzerhof generalized gradient approximation for solids and surfaces approximation (PBEsol-GGA). Where the Trans-Blaha approximation of the modified Becke–Johnson (TB-mBJ) potential is used for electronic and optic properties to get more reliable results for the fundamental band gap energy value.

Our principles calculations show that PBE-GGA and PBEsol-GGA reproduces results for lattice parameters comparable to the experimental measurements. Band gap energy and optical properties with TB-mBJ potential are also very close to the experimental results, and approve its potentiality for the photovoltaics applications.

We have found that PBE-GGA and PBEsol-GGA provide results for lattice parameters comparable to the experimental data. Optical properties and band gap energy with TB-mBJ potential is also very close to the experimental results, and confirm its potentiality for the photovoltaics applications.

References

(1) P. Blaha, K. Schwarz, G. Madsen, D. Kvasnicka, J. Luitz, ViennaUniversity of Technology, Austria, 2001;

Keywords: DFT, Antimony sulphide, chalcogenide, Optical properties, Band gap.

*Speaker

Preparation and characterization of perovskite-type Ni-doped BaSnO3

Mohamed Youssef Messous* [1], Iliass El Amrani El Hassani † [1,2], Mohamed Charia [2], Imane Driouch [1,3], Zouhair Sadoune [3]

[1] National Center for Energy, Sciences and Nuclear Techniques -CNESTEN-, Rabat – Morocco
[2] Faculty of Sciences, Mohamed V University, Rabat – Morocco
[3] Faculty of Sciences, Ibn Tofail University, Kenitra – Morocco

Barium Stannate is currently the subject of intensive research due to its interesting chemical, electrical and optical properties. The aim of this work is to prepare nanoparticles of undoped and doped BaSnO3 powder with different proportions of Nickel. This perovskite material can eventually be used for photonic conversion in photovoltaic cells improvement (1).
The synthesis was performed by the co-precipitation method using Barium chloride, Tin chloride and Nickel nitrate as precursors, followed by heat treatment at a temperature of 450 ∘c. The undoped and (1, 2 and 4% Ni) doped samples were characterized using several techniques such as X-ray diffraction (XRD), thermogravimetric analysis (DTA/GTA) scanning electron microscopy (SEM), energy dispersive X-ray microanalysis (EDX), Fourier transform infrared (FTIR) spectroscopy and UV Visible spectroscopy.
The XRD patterns showed for all the developed samples the major peaks identified to be (110), (111), (200) and (211) (2) corresponding to the perovskite cubic phase (3) and the calculated crystallite size is in the nanoscale between 17 and 31 nm. Scanning electron microscopy coupled with EDX was used to observe the morphology of the synthesized nanoparticles and to detect the presence and proportion of different dopants. The FTIR spectra showed the peaks related to the vibration of Sn-O.

Keywords: Barium Stannate, cubic structure, perovskite, Photovoltaic cell.

*Corresponding author: messous@cnesten.org.ma
†Speaker

Control and management system of energy flows in a microgrid

Benydir Mohamed *† [1], Mohamed Ajaamoum‡ [1], Mhand Oubella§ [1]

[1] Laboratory of Engineering Sciences and Energy Management (LASIME), Ibn Zohr University, School National of Applied Sciences, 80000 Agadir Morocco – Morocco

The integration of renewable energy sources into the conventional distribution network can have some impacts on the network: impacts on the change of power flows that can be bidirectional, on the levels of electrical voltages, protection, stability, power quality and also on the management and planning of the grid itself. The proposed thematic will contribute to a better integration of the different conventional and renewable energy sources through Smart Micro-Grids.
The micro grid concept is a reduced version of a classical electrical network able to integrate the actions of different users, consumers and producers such as localized génrations, diesel generation systems, storage systems and others renewable energie systems in order to maintain an efficient electricity supply, and all these systems have to be coordinated and thats the job of microgrid controller.

The proposed topic will contribute to the evaluation of different strategies of intelligent control and monitoring of the micro-grid according to the following criteria: Stability, power quality, power management and synchronization.

Keywords: Renewable energy, Management, Micro Grids

*Speaker
†Corresponding author: mohamed.benydir@edu.uiz.ac.ma
‡Corresponding author: m.ajaamoum@uiz.ac.ma
§Corresponding author: m.oubella@uiz.ac.ma

Comparison of results obtained using two numerical methods to characterize a flat air solar collector destined to a drying process

M Mouh * [1], A El-Abidi† [1], S Yadir [1], H Bousseta [1], L Boukhatem [1], M Ouakarrouch [2], N Laaroussi [2]

[1] Laboratory of Materials, Processes, Environment, and Quality, the National School of Applied Sciences Safi, Cady Ayyad University Marrakech – Morocco
[2] Mohammed V University in Rabat, Material, Energy and Acoustics Team (MEAT), Higher School of Technology in Salé, Avenue Prince Héritier, B.P: 227, Salé Médina – Morocco

This work aims to discuss the numerical modeling of a one-step solar air-heating collector under several controlled operating conditions. A 3D simulation model was developed under COMSOL Multiphysics software using finite element method (FEM) to investigate the simultaneous convective and radiative heat transfer. We compare our simulation calculations with the experimental data measurements of a one-step solar air heating collector found by S.Singh and al1. The study was performed at tree operations air mass flow conditions (0.026, 0.017 and 0.009 kg/s) subjected to solar irradiance conditions that ranged from 300 to 800 W/m2. The results obtained were compared with those obtained by E.M. Orbegoso and al2 that are found through the use of ANSYS-Fluent software based on finite volumes method (FVM). In our calculations we have taken into consideration the same system inputs and we have chosen the same mathematical formalism concerning the transport equations, the turbulence model and the heat transfer. The first comparison between our constructed FEM model and the experience through the calculation of the relative error under the different operating conditions demonstrates a good agreement between the experimental and the calculated values of the outlet temperature. The second comparison between our results and those obtained by E.M. Orbegoso and al shows that the deviations between the two methods were more important for the low flow rate (0.009 Kg/s) and specially for the weaker solar irradiances, it achieved 2.2% of difference, but it was smaller in the two other cases (0.017 Kg/s and 0.026 Kg/s) specially when the solar irradiance is important (600, 750 and 800 W/m^2), it varies between 0 and 0.8%. The comparison shows that the simulation of the air solar collector with Comsol multiphysics gives satisfactory results such as those calculated with Ansys fluent software.

Keywords: Solar air heating collector, Numerical simulation, drying, Finite Element Method

*Speaker
†Corresponding author: a.elabidi@uca.ma

Thermodynamic reassessment of the Cerium-Copper binary system

Dris Moustaine *† [1]

[1] 1Laboratory of Thermodynamics and Energy, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco 2Higher School of Technology, Ibn Zohr University, Laâyoune, Morocco – Morocco

Based on the experiment information of phase equilibria and thermodynamic properties from the published literature data the Phase diagram and thermodynamic properties of the Ce–Cu binary system have been thermodynamically reassessed by CALPHAD approach through Thermo–Calc software package based. The Redlich–Kister polynomial was used describe the excess Gibbs energy functions of the solution phases including liquid, fcc_A1, hcp_A3 and bcc_A2. The intermetallic compounds CeCu6, CeCu5, CeCu4, CeCu2, and CeCuwere treated as stoichiometric phases. A set of self–consistent thermodynamic parameters formulating the Gibbs energy of various phases in the Ce–Cu binary system were then obtained. A much better agreement was achieved between the calculated results and the reported experimental data. The purpose of the present work is to reassess the Ce–Cu binary system for which the experimental phase diagram was re–investigated by Zhou et al. and to develop a precise thermodynamic description by means of the calculation of phase diagram (CALPHAD) technique described and presented by L. Kaufman and H. Bernstein and successfully applied in various computer programs in order to give a more complete and consistent description of the phases existing in the studied system and their stability. The thermodynamic optimization of the Ce–Cu system is part of a research program, actually carried out in our laboratory, and it focuses on the study of the interaction between rare earth and the noble metals.

Keywords: binary system, Gibbs energy, Thermo–Calc, phase equilibria, thermodynamic properties

*Speaker
†Corresponding author: mostainedris@gmail.com

MPPT-based on classical and intelligent control strategies for photovoltaic systems

Fatima Zahra Moustaine *† [1], Achraf Hani [1], Yassine Aidi [1], Lahoussine Elmahni [1], Ahmed Ihlal [1]

[1] Laboratory of Materials and Renewable Energies , Department of Physics, Faculty of Science, University Ibn Zohr, Agadir – Morocco

In this work, we studied and analyzed, by modeling under Matlab/Simulink, the functioning of a photovoltaic system. The latter has a load controlled by a Boost converter . MPPT techniques are classified into two large groups classic (Perturb and observes "P&O", Incremental Conductance "InCd") and intelligent (artificial neural networks "ANN", Fuzzy Logic "FL") (1). Our control is provided by the four MPPT techniques mentioned.
The P&O algorithm is widely used and simple. Its principle is the perturbation of the operating voltage or by acting directly on the duty cycle of the DC/DC converter, and the observation of the impact of this change on the system output power (2). The major drawback of this MPPT technique is the oscillations around the MPP and its dependence on the size of the duty cycle.

The InCd technique results by deriving the photovoltaic panel with respect to the voltage, and putting the result equal to zero (3). It is more stable; it has fewer losses compared to MPP but the execution time of the algorithm is longer because it is more complex (it is difficult to fulfill the condition (dP/dV=0).

The ANN is proposed in Multi-Layer Perceptron architecture (three layers of neurons: an input layer, a hidden layer, and an output layer). We have used the back propagation algorithm (4) to minimize the mean square error, and allowing a supervised training. It has a good estimation of maximum power without oscillations, and it is robust to the different variations of climatic conditions but it is complicated to implement.

The FL has the advantage of being a robust control and does not require the exact knowledge of the mathematical model of the system. The input variables are error E, and error change ΔE and the output is duty cycle variation ΔD. The operation of this algorithm is done in three blocks: fuzzification, fuzzy rules, and defuzzification (5). The results obtained clarify that the creatively designed fuzzy system provides faster performance than other methods. It is also less complicated to implement.

Keywords: MPPT, P&O, InCd, ANN, FL

References

(1) L. L. Jiang, R. Srivatsan, and D. L. Maskell, "Computational intelligence techniques for maximum power point tracking in PV systems: a review," Renewable and Sustainable Energy Reviews, vol. 85, pp. 14- 45, Apr. 2018.

*Speaker
†Corresponding author: fatimazahra.moustaine@edu.uiz.ac.ma

(2) N. Femia, G. Petrone, G. Spagnuolo, and M. Vitelli, "Optimization of perturb and observe maximum power point tracking method", IEEE Transactions on Power Electronics, Vol. 20, pp. 963-973, 2005.

(3) D.P. Hohm, M.E. Ropp, "Comparative Study of Maximum Power Point Tracking algorithms", Progress in Photovoltaics: Research and Applications, Vol. 11, pp. 47-62, 2003.

(4) Donald W. Marquardt, "An algorithm for least-squares estimation of nonlinear parameters", Journal of the Society for Industrial and Applied Mathematics, Vol. 11, pp. 1083-1112, 1989.
(5) P. Verma, R. Garg, and P. Mahajan, "Asymmetrical interval type-2 fuzzy logic control based MPPT tuning for PV system under partial shading condition," ISA Transactions, vol. 100, pp. 251-263, May 2020.

Keywords: MPPT, P&O, InCd, ANN, FL

Spectroscopic study of linear and nonlinear optical properties of a-Fe2O3:Ca thin films prepared by the spray pyrolysis technique

Mariam Moustaine * [1], Khadija Bahedi [1], Khalid Bouabid [1], Mohamed Addou [2], Sana Bayoud [2], Hajar Cherrad [2], Asma Mrigal [2], Fatima-Zohra Bouamrane [1]

[1] Laboratory of Materials and Renewable Energies. Ibn Zohr University, Faculty of Sciences Agadir – Morocco
[2] Laboratory of Optoelectronics and Physical Chemistry of Materials. Ibn Tofail University, Kenitra – Morocco

This work reports the linear and nonlinear optical spectroscopic study of Calcium doped iron oxide thin films (a-Fe2O3:Ca) with various dopant concentrations (0 at%, 2 at %, 5 at %, and 10 at %) grown by spray pyrolysis technique on pre-heated glass substrates at 500∘C. The XRD analysis showed that films possess a polycrystalline rhombohedral structure with a preferred orientation along the (104) direction. SEM micrographs show an agglomeration of spherical-shaped grains, inhomogeneously distributed on the surface of the undoped film and uniformly distributed for the Ca-doped films.
The linear optical properties of the material have been calculated from the UV-Visible spectra. The direct optical band gap values and refractive index values were calculated and discussed. The electronic polarizability was calculated from the refractive index values.
Third-order nonlinear optical properties were studied by using a spectroscopic method. Predicted third-order susceptibility values were interpreted. It was found that the nonlinear response is improved by the introduction of Calcium and that the best nonlinear optical susceptibility was obtained for films with 5 % Ca. The good non-linear result obtained by the doped thin films can be explained by the improvement of electronic polarizability. Our results indicate that Ca doped is a good material for nonlinear optical applications.

Keywords: a, Fe2O3:Ca, Spray, Linear optical, Nonlinear optical, electronic polarizability.

*Speaker

The three-dimensional mixed spin Ising model with multispin coupling in the presence of crystal field interactions.

Ghliyem Maria *† [1]

[1] faculté des sciences ain chock – Morocco

A Monte Carlo simulation is used to study the three-dimensional mixed spin-1/2 and spin-1 Ising model with multispin interactions J4 on the surface. The system includes the surface and the bulk single-ion crystal field interactions. The new parameter J4 strongly affects the surface transitions. We have found three physically different phases depending on the ration of the interactions. The obtained phase diagrams show some qualitatively interesting features (variety of phase transitions).

Keywords: Mixed spin, crystal fields, Monte Carlo simulation, Phase diagram.

*Speaker
†Corresponding author: m.ghliyem@gmail.com

Design Of an MPPT Using the Particle Swarm Optimization Method for A Photovoltaic System

Youssef Mhanni *† [1]

[1] 1Advanced Science and Technologies Laboratory, Polydisciplinary Faculty University of Abdelmalek Essaadi (UAE), Larache, Morocco – Morocco

The Maximum Power Point (MPP) Tracking (MPPT) mechanism is an essential part of photovoltaic (PV) systems, as it allows the system to extract the maximum amount of power from the PV panel or array, The maximum power point tracking (MPPT) control methods that are often used won't be effective because the power–voltage characteristic curve of photovoltaic (PV) arrays has several peaks while operating in settings. In this work we present the implementation of the algorithm, in this work, we present the implementation of the algorithm PSO: The particle swarm optimization (PSO) technique is an excellent candidate for use in the resolution of the multi-extreme optimization issue. The optimal control output from the inverter has been demonstrated by simulation and modeling in MATLAB/Simulink, and the system has been tested with a variety of loads to ensure its efficacy.

Keywords: MPPT, P PV systems, photovoltaic, Particle Swarm Optimization, MATLAB/ SIMULINK

*Speaker
†Corresponding author: ymhanni@uae.ac.ma

A new meta heuristic algorithm for tracking the maximum power point of PV systems under standard conditions

Agdam Mohammed * [1], Ahmed Ihlal , Assalaou Khalid

[1] Mohammed AGDAM – Morocco

The development of maximum power point tracking (MPPT) techniques to maximize the energy output of PV plants has in recent years been identified as the main area of research challenge. Furthermore, to tackle the unique operating conditions of PV plants, various bio-inspired meta-heuristics algorithms have been previously proposed in the research literature, but their application is frequently complicated and difficult. In the proposed controller, a DC/DC boost converter is utilized to extract the maximum available power from the PV resource. For the programming and modeling of the system, MATLAB/SIMULINK software is used. In this regard, a new algorithm to control the maximum power point (MPPT), using the newly developed meta-heuristic approach of herd horse optimization (HHO) (1), is proposed. This newly proposed MPPT, which is based on the HHO method, is utilized to obtain the global maximum power point (GMPP) of a single-junction solar panel that operates under standard conditions. This study investigates a 3S1P topography of single-junction solar panels. We compared the results obtained with the recent flower pollination (FPA) and cuckoo search (CS) algorithms. The results confirm the quality of the MPPT-based HHO algorithm for GMPP extraction, compared to the FPA and CS optimizers.

Keywords: MPPT techniques, bio, inspired meta, heuristic algorithms, DC/DC boost converter

*Speaker

Numerical investigation of Mixed Pb-Sn based perovskite solar cells

Haytam Mouhib * [1]

[1] laboratoire Matériaux et énergies renouvelables – Morocco

Mixed Pb-Sn perovskite solar cells are garnering scientific attention due to the promise of narrow bandgaps and minimal toxicity. However, there remains a lack of theoretical understanding of device performance such as Thickness and Acceptor concentration and the effect of interface defects in mixed Pb-Sn perovskite solar cells. A maximum efficiency up to 24% is obtained in this simulation of the hybrid perovskite-based solar cell. These results are obtained after layer thicknesses (0.400 μm), acceptor concentration of 1013 cm–3 for hybrid perovskite, absorber bulk defect density (1013 cm–3), and PEDOT: PSS/perovskite interface defect density (109 cm–2). This work improves our understanding of the numerical optimization of Mixed Pb-Sn perovskite-based solar cells.

Keywords: Mixed Pb, Sn perovskite, interface defect density, high power conversion

*Speaker

Simulation and analyses of BUCK converter using sliding mode controller

Sana Mouslime *† [1]

[1] 1 Electrical Engineering Department ESTA Ibnzohr University Agadir, Morocco – Morocco

The DC-DC converters are widely used in renewable energy conversion systems such as photovoltaic. They serve to adapt the input voltage of a system to the desired output voltage. The state space average model is used to analyze the behavior of DC-DC Buck converter to design the appropriate controller. Various techniques are commonly used to control these converters, such as linear controllers (PI, PID..) or non-linear controllers(fuzzy logic,SMC...). Our study is based on the dimensioning and modeling a Buck converter in continuous conduction mode. The nonlinear Sliding mode controller as shown in figure 1 is used to control our system, it's a control technique featuring remarkable properties of accuracy and robustness, it's designed to drive the system states onto a particular surface in the state space, named sliding surface. Once the sliding surface is reached, sliding mode control keeps the states on the close trajectory of the sliding surface.The simulation results are established in MATLAB Simulink environment and used to regulate the output voltage of a buck converter that is submitted to disturbances such as the variation of input voltage, load variation and internal variations of the converter. The results confirm the effectiveness of the sliding mode control under the parameter variations, moreover a comparative table is provided to evaluate different time-domain characteristics metrics, like settling time, rise time, overshoot... for the proposed technique.

Figure 1: The general structure of the control system for the BUCK converter.

Keywords: Field empty!

*Speaker
†Corresponding author: sana.mouslim@uiz.ac.ma

Morphological, Structural and Optical Properties of ZnO Thin Films Prepared by Spary Ultrasonic Method

H Najih *† [1]

[1] LMER, Faculty of science, Ibn Zohr University Agadir, Morocco – Morocco

Zinc oxide (ZnO) thin films were deposited on glass substrate using spary ultrasonic method. Zin acetate dehydrate and water were used as the precursor and solvent to prepare ZnO Thin-films.

The thickness of films was determined by cross section technique. The optical properties of the films were studied by UV Vis- Spectrphotometer. From transmittance and absorbance curve, the energy band gap of ZnO is found out. The crystal structure and orientation of the films were analyzed by XRD. The morphological were investigated using scanning electron microscopy (SEM), and EDAX techniques.
The XRD patterns show that the ZnO films are polycrystalline with wurtzite hexagonal structure.

Keywords: Zinc oxide, XRD, EDAX, SEM, optical band gap

*Speaker
†Corresponding author: hass00.najih@gmail.com

Effet de la floculation des argiles sur le comportement œdométrique

Hakim Naoui *† [1]

[1] 3Universiapolis–International University of Agadir, Laboratory for Sustainable Innovation and Applied Research, Agadir, Morocco – 1Université de Lorraine, CNRS, Arts et Métiers ParisTech, LEM3, F-57000 Metz, France 2Ecole Centrale de Nantes, Research Institute of Civil Engineering and Mechanics(GeM), Nantes, France – France

Les travaux de ces dernières années ont montré que le comportement mécanique des argiles est lié à leur
microstructure, et la compréhension du lien entre les mécanismes à l'échelle micro et ceux à l'échelle macro est
devenue essentielle. La complexité des milieux argileux réside dans l'existence d'interactions physico-chimiques,
entre les particules d'argile et le milieu environnant, et entre les particules elles-mêmes, qui peuvent jouer un rôle
parfois non négligeable dans comportement mécanique de ces sols.
L'objectif de cette étude est d'analyser l'influence de la microstructure sur le comportement mécanique des argiles.
Dans ces travaux, la microstructure des argiles de type floculée est assurée par une préparation spécifique
d'échantillons permettant d'obtenir des particules floculées lors de la sédimentation. Une série de tests
œdométriques sont réalisés sur ces échantillons puis comparés avec des résultats obtenus par Hammad et al. (2013)
sur le même matériau mais empruntant une démarche plus " usuelle " dans la préparation du matériau.
L'argile en question est un kaolin de type K13 riche en Kaolinite. L'état initial de l'échantillon, avant l'essai
œdométrique, présente une microstructure floculée des particules qui a été créée lors de la sédimentation en
utilisant un agent de floculation qui change l'équilibre des forces électrochimiques. Le comportement œdométrique
est investigué avec deux niveaux de contraintes verticales effectives : à 120 kPa et à 1000 kPa. Les résultats sont
confrontés à ceux de la littérature ayant une microstructure différente à l'état initial. On montre que le matériau en
floculation présente un indice des vides initial très important (de l'ordre de 3.13) à de faibles niveaux de
chargement, puis diminue à des chargements élevés pour atteindre une valeur de 0.62 à 1000 kPa de contrainte
effective verticale. Cette valeur enregistrée à s'v = 1000 kPa approche les résultats de Hammad et al. (2013). Ces

*Speaker
†Corresponding author: hakim.naoui@univ-lorraine.fr

résultats sont par ailleurs conformes à celles de (Pedrotti and Tarantino, 2018) qui ont également montré une
compressibilité importante de l'argile lorsque les particules sont floculées.

Keywords: Kaolinite, tissu argileux, floculation, comportement mécanique, orientation des particules, interaction électrochimique.

Structural and Optical Properties of the Nanocrystalline ZnO Films Prepared by SILAR

Abderrahman Nidlhadj * [1], Abderrahim Aithssi [1], Mohamed Taoufiq [1], Ahmed Soussi [1], Abdesalam El Fanaoui [1], Ahmed Ihlal [1], Khalid Bouabid * † [1]

[1] Materials and Renewable Energy Laboratory – Morocco

In this study, we present a simple and economical approach for the growth of thin films of zinc oxide (ZnO): Successive Ionic Layer Adsorption and Reaction (SILAR). The depositions were carried out at ambient temperature on inexpensive glass substrates. The influence of annealing temperatures on various features of ZnO films deposited by this sequential (SILAR) method has been carefully investigated in this study. Both scanning electron microscopy (SEM) and X-ray diffraction (XRD) characterizations revealed that the films completely covered the glass substrates and displayed the wurtzite hexagonal structure with a preferred growth orientation (002). The optical characteristics revealed high transmittance values (_˜70-90%), and the optical gap increases with increasing annealing temperature. The SILAR method offers opportunities to synthesize high quality ZnO films for several prospective applications.

Keywords: SILAR, ZnO films, Structural and Optical Properties.

*Speaker

†Corresponding author: k.bouabid@uiz.ac.ma

Structural and Optical Properties of the Nanocrystalline ZnO Films Prepared by SILAR

Abderrahman Nidlhadj * [1], Abderrahim Aithssi [2], Mohamed Taoufiq [2], Ahmed Soussi [3], Abdesalam El Fanaoui [3], Ahmed Ihlal [3], Khalid Bouabid†

[1] Materials and Renewable Energy Laboratory – Morocco
[2] Materials and Renewable Energy – Morocco
[3] Materials and Renewable Energy Laboratory – Morocco

In this study, we present a simple and economical approach for the growth of thin films of zinc oxide (ZnO): Successive Ionic Layer Adsorption and Reaction (SILAR). The depositions were carried out at ambient temperature on inexpensive glass substrates. The influence of annealing temperatures on various features of ZnO films deposited by this sequential (SILAR) method has been carefully investigated in this study. Both scanning electron microscopy (SEM) and X-ray diffraction (XRD) characterizations revealed that the films completely covered the glass substrates and displayed the wurtzite hexagonal structure with a preferred growth orientation (002). The optical characteristics revealed high transmittance values (_˜70-90%), and the optical gap increases with increasing annealing temperature. The SILAR method offers opportunities to synthesize high quality ZnO films for several prospective applications.

Keywords: SILAR, ZnO films, Structural and Optical Properties.

*Speaker
†Corresponding author: k.bouabid@uiz.ac.ma

A new approach to the bipotential for n-monotone materials

Slimane Ouhni * [1]

[1] Laboratory of Electronics, Signal Processing and Modelling Physics, Department of Physics, University Ibn Zohr – 80000 Agadir, Morocco

We consider an n-monotone material whose stress-strain relation is linear but not symmetrical. For this type of materials stored energy in the form of strain energy is not completely restored, a part is dissipated; therefore, it is need to calculate this dissipation.
The objective of this work is to calculate this dissipation energy based on the concept of bipotential (1). In the context of monotonous laws, convex analysis proposes to construct a series of Fitzpatrick functions; each of these functions turns out to be a bipotential in the sense of Géry de Saxcé (3). Then, the dissipation energy can be calculated by the difference between the proposed bipotential of a cyclically monotone material and an n-monotone material (2).

Key words: Non-associated constitutive law, Implicit standard materials, Fitzpatrick function, Bipotentials, Dissipation energy.

References

(1) *C. Vallée, C. Lerintiu, J. Chaoufi, D. Fortuné, M. Ban, K. Atchonouglo, A class of non-associated materials: n-monotone materials -Hooke's Law of elasticity revisited, J. Elast. 112 (2013) 111–138.*

(2) *A. El Hanafi, J. Chaoufi, C. Vallée, A. Germaneau, K. Atchonouglo, H. Fatmaoui, A. Ghafiri, Construction of a bipotential representing a linear non-associated constitutive law, C. R. Mecanique. 341 (2013) 667–671*
(3) *G. de Saxcé, L. Bousshine, Implicit standard materials, in: D. Weichert, G. Maier (Eds.), Inelastic Behaviour of Structures under Variable Repeated Loads, Springer, Vienna, New York. 432 (*2002) 59-76.

Keywords: Non, associated constitutive law, Implicit standard materials, Fitzpatrick function, Bipotentials, Dissipation energy.

*Speaker

Economic and Environmental Evaluation of a Solar Cooker

Rachid Oaddi * [1]

[1] Materials and Renewable Energies Laboratory, Department of Physics, Faculty of Sciences, Ibn Zohr University, 80000 Agadir, Morocco – Morocco

Solar cooker is a promising option of solar energy devices. It plays a crucial role in progressing life and making it healthier. Accurately, solar cooker has a significant influence and benefits that has to do with environment, economic and health. As well, for the success and commercialization of any new technology, it is necessary to know whether the technology is economically viable or not, whether it has environmental benefits and if it would be convenient for all economic levels of people in society.
The economic feasibility of any system is calculated through economic analysis of the studied system. A study is performed to evaluate the amount of saved money if a solar cooker is utilized instead of traditional LPG (Liquefied Petroleum Gas) cooker or fuel wood. Then, the payback period (PBP) is computed according to the capital cost of the solar cooker and the amount of saved money. Based on the number of solar meals that can be cooked in a year, an economic analysis of the solar cooker was carried out. Some financial parameters have been estimated for the solar cooker (1), which includes Cash Flow (CF), from other cooking fuels, namely; liquefied petroleum gas (LPG) and firewood. The annual energy savings and carbon dioxide (CO2) mitigation through the use of the solar cooker were also estimated.

The cost of the cooker is 2000 MAD. The payback period has been calculated by considering 5% annual maintenance cost, price of LPG and firewood in the Moroccan market which is 42 MAD/Cylinder and 1.37 MAD/kg respectively. The payback period is least, i.e. 1.26 yr, with respect to firewood and maximum, i.e. 7.29 yr, with respect to LPG. This observed difference was explained by the fact that the price of LPG is subsidized by the state. The short payback time compared to firewood is very attractive for going towards the use of solar cookers. Moreover, the cash flow over five years with respect to firewood was positive and negative with respect to LPG.

Table 1: Amount of fuel used, saved, and its energy content

Primary source

LPG

Fire-wood

Efficiency (%)

60

12

*Speaker

Energy Content (MJ/kg)

45.59

19.89

Primary energy consumed (MJ)

15

75

Amount consumed

0.027 Cylinder

3.77 kg

Fuel saved during solar cooker operation days (325 days)

8.91 Cylinders

1225.5 kg

Table 2: Amount of fuel used, its cost, PBP, CF and NPV

LPG

Firewood

Amount used per year

8.91 Cylinders

1225.5 kg

Cost

42 MAD/ Cylinder

1.37 MAD/kg

Si (MAD)

374.26

1679

PBP (Year)

7.29

1.26

CF (MAD) (5 years)

-628.7

5895

From an environmental point of view, the use of solar cooker instead of LPG and firewood leads to save about 307.58 kg and 2671.52 kg of CO2 emission respectively. Moreover, the amount of annual saved CO2 is very important in favor of firewood than LPG.

Burning firewood releases the greatest amount of CO2 into the atmosphere when used for cooking compared to LPG. Therefore, replacing wood with a solar cooker leads to preserving the ecosystem and thereby increasing the forest area.

Table 3: Annual CO2 emission saving of box type solar cooker for various types of fuel

LPG

Firewood

Calorific value (MJ/kg)

45.59

19.89

Annual used (kg)

106.92

1225.5

Annual saving (MJ)

4874.48

24375.195

CO2 emission (kg/MJ)

0.0631

0.1096

Annual CO2 emission (kg)

307.58
2671.52

Keywords: solar cooker, economic impact, enviromenetal impact, firewood, CO2 emission.

Performance optimization of a solar concentration plant based on Fresnel Mirrors-Stirling engine coupling and comparison with Fresnel Mirrors- Organic Rankine Cycle coupling

Louiza Rabhi * [1], Hind El Hassani [2], Noureddine Boutammachte [3], Ahmed Khmou [4], Amine Bendarma [1]

[1] Sustainable innovation and applied research laboratory (IDRA), Ecole polytechnique- Universiapolis, Agadir – Morocco
[2] Siger laboratory, University of Sidi Mohamed Ben Abdellah, Fes, Morocco – Morocco
[3] Energy department, Energetic and Renewable Energy team, Ecole Nationale Supérieure d'Arts et Métiers, Meknes – Morocco
[4] LP2MS Laboratory, Physics department, Materials and Renewable Energies team, Faculty of Science, Meknes – Morocco

This paper uses second-order software for evaluating the Stirling engine and Fresnel mirrors coupling efficiency by studying the working fluid average pressure effect and the ratio of the exchange surface of the engine heater to the absorber tubes concentrated rays collecting surface. The study is also the subject of a comparison between the Fresnel mirrors-Stirling engine coupling and Fresnel mirrors-Organic Rankine Cycle coupling. Results show that the plant efficiency increases with the increase in the working fluid pressure. In addition, it increases with the heater exchange surface; in other words, when the heater exchange surface (including the hot cylinder) approaches the absorbers collection surface the plant efficiency is improving.

Keywords: Stirling engine, Fresnel mirrors, Prosa Software, CSP plant

*Speaker

Al-doped ZnO Nanomaterials for a Photovoltaic Application : Synthesis and Characterization

Hajar Saadi * [1]

[1] Hajar SAADI – Morocco

Zinc oxide nanomaterials for photovoltaic applications have received considerable attention, mainly due to their broad application potential. ZnO nanostructures are very promising because it is an (n)-type semiconductor with a wide band gap of 3.37 eV. It is a multifunctional material and widely used in photovoltaic, optical and optoelectronic. The production of 3% Al-doped ZnO nanopowders is based on dissolving zinc acetate, aluminum nitrate and acetic acid in methanol using the sol-gel method. Different aluminum doped zinc oxide nanopowders were developed and put at calcination temperatures of 400∘C, 500∘C, 600∘C and 700∘C in order to evaluate the effect of calcination temperature and doping on the structural, crystalline, chemical and optical properties of nanoparticles. Our interest goals is the identification of the effect of doping and the optimal temperature of calcination of ZnO doped with 3% Al. The analysis by different characterization techniques made it possible to clearly indicate that the size of the nanoparticles is linked to the operating parameters and that the doping of the nanoparticles affects the structural and optical properties of Al-doped ZnO. The study shows the importance of synthesized nanoparticles for application in photovoltaic solar cells.

Keywords: Nanomaterials, Al, doped ZnO, Calcination température, Photovoltaic

*Speaker

Towards high efficiency of solar cell based on lead-free Cs2AgBixSb1-xI6 (x = 0, 0.25, 0.5, 0.75, 1) perovskite absorber layer through the numerical simulation

Mariyam Salmi * [1], Mohamed Ajamoum , Rachdy Azeddine , Abdesslam El Fanaoui†

[1] Mariyam Salmi – Morocco

Abstract Nowadays, the search for new, stable, and efficient lead-free perovskite for solar cells application has drawn the attention of many researchers. With the general formula ABB'X6, double perovskites have given rise to promising new materials. Their stability and non-toxicity endorsed them as potential substitutes for lead-based perovskite. Herein, we investigated the structural and optoelectronic properties of Cs2AgBixSb1-xI6 (x = 0, 0.25, 0.5, 0.75, 1) using the density functional theory (DFT). The obtained results performed with mBJ+SOC, showed a tunable band gap, with a value ranging between 1.65-1.12 eV. These materials exhibited an indirect band gap at various Brillouin zone symmetry points, which was consistent with earlier published experimental and theoretical investigations. However, the incorporation of Sb into the Bi site altered significantly the properties of the material. The pure structure based on Bi and Sb double perovskite crystalizes in the Fm3m space group, while Cs2AgBixSb1-xI6 (x = 0.25, 0.75) crystalize in the Pm3m space group, and for x = 0.5 the structure deformed from cubic to tetragonal P4/mmm space group. Although, we found that the bandwidth value of the components with Sb-alloying from 0.5 to 1 slightly decreases, which means that Sb-doping in this region does not considerably affect it. The Cs2AgBi0.75Sb0.25I6 obtained a small band gap of 1.45 eV near the Shockley limit, covering a wide range of visible light, making it an efficient absorber for photovoltaic application.

Keywords: Keywords: double Perovskite, Solar cell, Wien2k software, DFT calculation

*Speaker

†Corresponding author: a.eLfanaoui@uiz.ac.ma

Annealing effect on window layer CdS thin films

Almas Shaikh *† [1]

[1] 1Department of Physics, Haribhai V. Desai College, Pune, Maharashtra, India – India

Cadmium Sulphide (CdS) thin films were synthesized using the chemical bath deposition (CBD) technique. The films were annealed in air, at 350∘C, for different time intervals. The deposition films were characterized with X-ray diffraction (XRD), field emission scanning electron microscope (FESEM), Raman Spectroscopy, and UV-Visible Spectroscopy to study structural, morphological, and optical properties of as-deposited and annealed CdS thin films at different time intervals. XRD analysis showed the polycrystalline nature of all films. The crystalline structure of the as-deposited CdS thin film was cubic whereas the structure changed to hexagonal for annealed films. The various parameters such as crystallite size, microstrain, and dislocation density were calculated. FESEM study showed the distribution of spherical shaped grains over the complete substrate surface of CdS thin films however the agglomeration of particles was increased with an increase in annealing time. An optical transmittance study showed the transmission of CdS thin films varied between 60 to 90%. It also confirmed the presence of direct transition with band gap energy varied between 2.10 to 2.82 eV. Raman Spectroscopy showed the 1LO peaks in all CdS thin films.

Keywords: CdS, CBD, XRD, UV, Visible

*Speaker

†Corresponding author: dr.mehboobn@gmail.com

Study and design of a new hybrid solar cooker

Sofian Talbi *† [1], Elhadi Baghaz [2], Ahmed Alami Merrouni [1], Jamal-Eddine Salhi [1], Redouan Zarouk [3]

[1] Laboratory (LPTPME), Materials Science, New Energies and Applications Research Group, Department of Physics, Faculty of Sciences, Mohammed 1st University, 60000, Oujda, Morocco – Morocco

[2] Laboratory of Electronics, Instrumentation and Energetic, Department of physics, Faculty of Sciences, Chouaïb Doukkali University, El Jadida, Morocco – Morocco

[3] Laboratory of of Electronics and System, Faculty of Sciences of Oujda (FSO), University Mohammed Premier, Oujda, Morocco – Morocco

* Email : s.talbi@ump.ac.ma

Food is an essential element for the survival of every individual. This reality may now become a real problem in areas where food and basic necessities are difficult to access, especially since modern forms of energy used for cooking, such as electricity or fossil fuels, are either unavailable, scarce, too expensive or unreliable(1). This situation forces consumers to burn wood to cover their daily needs (2). This leads on the one hand to the degradation of forests (3), and consequently the increase of greenhouse gases (4) and on the other hand, exposure to health risks related to smoke: cardiac, cerebral, pulmonary, Alzheimer, Parkinson and cancerous (5-7). In this context, solar cooking is one of the best alternative solutions, ecological and environmentally friendly. It meets the needs of developing and developed countries(8).

The work presented in this paper concerns the modeling and simulation of the thermoelectric operation of a new prototype of solar cookers operating with hybrid energy. In this sense, the aim of this work is to design a device that responds to some shortcomings of current stoves, such as long cooking time, lack of homogeneity in the cooking box of food(9). Our study considers the exploitation of two solar energy sources. The heating resistor is powered by the energy produced by PV panels equipped with a matching stage. The thermal energy is based on the generation of heat through reflectors inside, outside and by the greenhouse effect.

Under an illumination of 1000 W/m2 and an ambient temperature of 25 ∘C, we have shown the performance of the developed prototype. It appears that after ten minutes of heating, the baking temperature and the temperature of the heating elements are respectively around 210 ∘C and 230 ∘C. After 3 hours of operation, these temperatures increase to 608∘C and 820∘C respectively. These results show remarkable progress compared to thermal cookers, in terms of speed, cooking temperature and heating resistance temperature. This improvement is represented by a successive increase of 91.42% and 78%, 83.19. En plus, une amélioration a été remarquée de la puissance et du rendement thermique avec une augmentation de 96.34 % et 58.63 %.

Keywords : Modeling, Simulation, Hybrid solar cooker, Power, Thermal efficiency.

References

*Speaker

†Corresponding author: s.talbi@ump.ac.ma

(1) A. Herez, M. Ramadan, M.J.R. Khaled, S.E. Reviews, Review on solar cooker systems: Economic and environmental study for different Lebanese scenarios, 81 (2018) 421-432.

(2) N. El Moussaoui, S. Talbi, I. Atmane, K. Kassmi, K. Schwarzer, H. Chayeb, N.J.S.E. Bachiri, Feasibility of a new design of a Parabolic Trough Solar Thermal Cooker (PSTC), 201 (2020) 866-871.

(3) A. Keith, N.J. Brown, J.L.J.R.E.F. Zhou, The feasibility of a collapsible parabolic solar cooker incorporating phase change materials, 30 (2019) 58-70.

(4) M. Tawfik, A.A. Sagade, R. Palma-Behnke, W. Abd Allah, M.J.J.o.E.S. Hanan, Performance evaluation of solar cooker with tracking type bottom reflector retrofitted with a novel design of thermal storage incorporated absorber plate, 51 (2022) 104432.

(5) J. Boczkowski, S. Lanone, The impact of air pollution on human health, Annales des Mines-Responsabilite et environnement, FFE, 2019, pp. 17-21.

(6) Y. Nikmanesh, M.J. Mohammadi, H. Yousefi, S. Mansourimoghadam, M.J.R.o.E.H. Taherian, The effect of long-term exposure to toxic air pollutants on the increased risk of malignant brain tumors, (2022).

(7) M.L. Block, L.J.T.i.n. Calderón-Garcidueñas, Air pollution: mechanisms of neuroinflammation and CNS disease, 32 (2009) 506-516.

(8) M. Aramesh, M. Ghalebani, A. Kasaeian, H. Zamani, G. Lorenzini, O. Mahian, S.J.R.E. Wongwises, A review of recent advances in solar cooking technology, 140 (2019) 419-435.
(9) F. Yettou, A. Gama, B. Azoui, A.y. Malek, N.J.J.o.T.A. Panwar, Calorimetry, Experimental investigation and thermal modelling of box and parabolic type solar cookers for temperature mapping, 136 (2019) 1347-1364.

Keywords: Modeling, Simulation, Hybrid solar cooker, Power, Thermal efficiency.

Identification of suitable storage materials for solar thermal power plant

Rachid Tiskatine *† [1]

[1] ESA Laboratory, ENSAH, Abdelmalek Essaadi University, Tetouan, Morocco – Morocco

Due to the intermittent nature of solar energy, there is a need to store heat to meet the needs when solar light is not available. Rock bed using air as heat transfer fluid (HTF) is being now used for thermal energy storage (TES) in concentrated solar power (CSP) plants. It is considered as a cost effective storage system. However, no detailed works have been published on selection and identification of rocks for high temperature storage applications. The scope of the present study is to choose the most suitable rocks for high temperature sensible heat storage (SHS) using a methodology based on laboratory measurements. Thus, experimental characterization of several rock types has been performed. The obtained results show that the gabbro rock is the best candidate material for CSP plants. Comparative study with some other conventional materials found in literature indicates that rock is an efficient filler material for high temperature TES.

Keywords: High temperature SHS, Rock bed, CSP plants, Experimental characterization, Selection methodology.

*Speaker
†Corresponding author: tiskatinerachid@gmail.com

Uncertainty analysis for the robust dimensioning of a gearbox of wind turbine

Hassen Trabelsi *† [1]

[1] 1Mechanics, Modelling and Production Research Laboratory, National School of Engineers of Sfax, University of Sfax, BP. 1173, Sfax 3038, TUNISIA 2QUARTZ EA7393, SUPMECA-Paris, 3 rue Fernand Hainaut, 93407 Saint-Ouen, France – Tunisia

The paper deals with the design approach of subdefinite Mechatronic system and focus on the sizing stage of a gearbox of wind turbine based on the interval computation method. Indeed, the gearbox design variables are expressed by intervals to take account of the uncertainty in the estimation of these parameters. The application of interval computation method allows minimizing the number of simulations and enables obtaining a set of solutions instead of a single one. The dynamic behavior of the gearbox is obtained using finite elements method. The challenge here is to get convergent results with intervals which reflect the efficiency of the applied method. Thus, several mathematical formulations have been tested and evaluated.

Keywords: Wind turbine, Uncertainty, Interval computation, Finite Element Method, Gearbox.

*Speaker
†Corresponding author: hassen.trabelsi@outlook.fr

Structural and morphological properties of Zn1-xCoxSe thin film deposited by electrodeposition technique

Mohamed Taoufiq * [1]

[1] laboratory of materials and renewable energies LMER, Faculty of Science-University Ibn Zohr- Agadir – Morocco

In this research, we studied the effect of cobalt doping on the Structural and morphological properties of ZnSe thin film deposited by electrodeposition. The films were deposited at room temperature and the deposition potential was fixed at (- 0.7V) for a duration of 30 min. The structural and morphological, properties of ZnSe and cobalt-doped ZnSe thin films were characterized by X-ray diffraction, scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX) respectively. SEM analysis shows that our thin films are homogeneous granular, XRD patterns demonstrate that all films were polycrystalline which corresponds to the cubic sphalerite structure of ZnSe.

Keywords: Thin films, electrodeposition, ZnSe

*Speaker

Performing Hybrid Procedure to Extract the Seven Parameters of the Double-Diode Model Serving for Photovoltaic Modules Simulating

Kawtar Tifidat *† [1], Noureddine Maouhoub‡ [1], Fatima Ezzahra Ait Salah [1]

[1] Laboratory of Materials, Signals, Systems and Physical Modeling, Physics Department, Faculty of Sciences, Ibn Zohr University, B.P. 8106, 80000 Agadir, Morocco – Morocco

This work introduces a novel performing procedure to model PV generators based on the calculation of the seven parameters of the two-diode circuit model. Aiming to avoid the approximate equations used in (1), the number of numerically extracted parameters is reduced in the current work. Indeed, the extraction is done by proceeding with two approaches. First, the parameters A1, A2, Rs, and Iph, which find obviously their approximate values, are computed numerically by considering the assumed values as the initial guesses of the numerical resolution. Second, Given that the remaining parameters are highly affected by the manufacturing technologies and structures, their initial values cannot be certainly determined and generalized. Thus, Is1, Is2, and Rsh are calculated analytically using the extracted values of the first four parameters. Unlike the methods in (2-3) based on multiple loops for the identification, the new approach uses only one fast iterative technic serving to increase the simulating accuracy. Moreover, the technic is constructed only on the available information about the PV modules on their datasheets. Hence, no experimental or additional parameters are required. The evaluation of the precision is done using PV modules of different technologies and the predicting accuracy is compared to the existing methods in the literature. As shown in Table1 summarizing the results for the KD245GH-4FB2 and the SM55 PV modules, the proposed approach provides the best estimation at the reference conditions by yielding the least RMSE for both PV panels when compared with the other selected methods from the literature. Figure 1 showing the measured and simulated I-V curves for the SM55 PV module and the corresponding absolute errors, confirms the effectiveness of the new simulating model.

Keywords: Parameter extraction, PV simulating, Two, diode model, PV modules

*Speaker
†Corresponding author: kawtartifidar@gmail.com
‡Corresponding author: n.maouhoub@uiz.ac.ma

Development and experimentation of an advanced Buck converter control for a DSP-based photovoltaic system

Bouachrine Brahim *† [1], Imodane Belkassem [1], Dahman Kaoutar *

[1], Oubella M'hand * ‡ [1], Ajaamoum Mohamed * § [1]

[1] ESTA IBN ZOHR – Morocco

Photovoltaic (PV) simulators are essential for the operational evaluation of the PV power components of the generation system (e.g. battery chargers, DC/AC inverters, etc.), in order to avoid time-consuming and expensive field tests.
In this work, we will present the development and experimentation of a photovoltaic system based on Digital Signal Processing (DSP). The proposed system will consist of a converter "BUCK" type DC / DC power converter, which is controlled by a DSP base unit, using the principle of pulse width modulation (PWM).

The simulation is done by Matlab software and it is proved by experimental tests carried out in the LASIM laboratory within the ESTG,
The results obtained in this work, proves the effectiveness of the advanced controls as well as the quality of the high-performance processing boards such as DSP

Keywords: DSP, photovoltaîque, Buck converter

*Speaker
†Corresponding author: b.bouachrine@uiz.ac.ma
‡Corresponding author: m.oubella@uiz.ac.ma
§Corresponding author: m.ajaamoum@uiz.ac.ma

Tribological characterization of Si3N4-MoSi2 nanocomposite ceramic

Amine Charfi *† [1], Mohamed Kharrat , Mohamed Farooq Wani , Maher Dammak

[1] Amine charfi – Tunisia

Tribological characterization of silicon nitride reinforced by molybdenum disilicide was studied. The nano-composite material was made by the means of spark plasma sintering process. Friction tests were carried out under dry conditions on a reciprocating ball-on-flat tribometer against silicon carbide balls. The goal of this work is to study the effect of molybdenum disilicide, sliding velocity and normal load on tribological behavior of silicon nitride ceramics. Experimental tests have shown that molybdenum disilicide improve tribological properties of silicon nitride composite. The results have shown also that friction coefficient decreases with the increase of frequency from 0.9 for 0.25 Hz as frequency to 0.35 for 1 Hz frequency but it increases with an increase of normal load. For 11 N as normal load, the friction coefficient is equal to 0.28, 0.36 for 33 N and 0.42 for 57 N. We also noted that the wear rate decreases when the frequency or the normal load increases.

Keywords: Silicon nitride nanocomposites, Molybdenum disilicide, Friction, Wear

*Speaker

†Corresponding author: charfiamin33@gmail.com

Development of Smart Meter System

Farid Douslimane *† [1], Lahoussine Elmahni * ‡ [1], Khalid Assalaou§ [1], Benachir Boukhris * ¶ [2]

[1] Université Ibn Zohr FSA – Morocco
[2] Ecole Nationale des Sciences Appliquées [Agadir] – Morocco

Smart Meter Systems (SMS) represent a significant position in the future smart network with several profits for power utilities as well as for consumers. SMS has been presented to the public as a substitute to conventional electricity meters. These systems can communicate real-time electricity utilization readings of the consumer to the utility. Besides, SMS can enable bidirectional communications of exact measurements and rapid reports between consumers and producers. Also, they evaluate and communicate consumption data at a high resolution in time. On the other hand, with the fast progress of smart grid structure in many countries, the coverage of SMS has been really enhanced and advanced metering structure is becoming a critical part of electrical grid permitting the advance of smart cities. In addition, it can play a main function in the digitalization of the conventional grid and can make easy market-oriented objectives. Consequently, SMS pose a number of defy to researchers and practitioners. In this context, this work consists in designing and carrying out an SMS based on an ESP32 card and an OLED screen in order to communicate consumption data in real time. The microcontroller programming is made with MicroPython. In addition, this system has Wi-Fi and Bluetooth, and available at low cost..

Keywords: Smart Meter System, ESP32 board, OLED display

*Speaker
†Corresponding author: fdouslimane@gmail.com
‡Corresponding author: l.elmahni@uiz.ac.ma
§Corresponding author: k.assalaou@uiz.ac.ma
¶Corresponding author: boukhrisbenachir@gmail.com

Evaluation of the energy performance of a glazed and unglazed hybrid PV/T collector using different heat transfer fluids

Mohamed Hissouf * [1], M'barek Feddaoui , Adil Charef , Abdellatif Dayf , Khadija Zabour

[1] Laboratoire Génie de l'Energie, Matériaux et Systèmes, ENSA, Agadir – Ibn Zohr University, ENSA B.P. 1136, Agadir, Morocco, Morocco

In the building sector, solar energy is converted into useful energy by the use of conventional small-scale solar collectors, which are often intended for the production of domestic hot water, or by photovoltaic panels to generate electric energy. However, for PV panels the conversion of light radiation into electrical energy is low (12% - 20%) (1). Thus, a large part of the solar radiation not converted by the solar cells into electricity is the cause of heating of the solar panel, which leads to a significant drop in its electrical efficiency. In addition, the operation of the PV panel at high temperature leads to its long-term degradation (2). One technique for cooling the solar cells of a PV module is to combine the latter with a thermal collector to form the hybrid photovoltaic thermal (PV/T) collector. This hybrid collector, in addition to the electrical power generated, also makes it possible to produce thermal energy by heating circulating heat transfer fluid. The aim of this paper is to evaluate the thermal and electrical energies produced by a hybrid PV/T collector for Agadir city climatic conditions. To achieve the goal a numerical model is developed based on energy balance equations applying on each collector component. The governing equations are discretized using the finite difference method and solved numerically by TDMA matrix algorithm. The validity of the computational model is tested by comparing our simulation findings with the experiment data available in the literature (Fig. 1). The thermal and electrical powers generated by the hybrid solar collector are evaluated during a typical day for Agadir city (Morocco) climatic conditions using different working fluids. It is found that the glazed collector produces a total energy of about 26% than the glazed collector. However, the electrical power of the unglazed collector exceeds that of that glazed collector. Furthermore, the results show that the use of Cu-water as working fluid leads to enhance the thermal and electrical energies generated by the hybrid collector. It is found that Cu-water improves the thermal energy produced during the simulation day by 3% and 12.5% higher than pure water and water-EG mixture respectively.

Keywords: Hydrid PV/T collector, Glass cover, Energy, Thermal, Electrical

*Speaker

Synthesis and electrochemical study of FePO4 material in aqueous electrolyte for rechargeable lithium battery

Elmahjoub Laouini * [1]

[1] University of Ibn Zohr – Morocco

Currently, our planet is threatened by environmental pollution. This is caused by human activity on earth. There are several aspects of pollution: pollution of water, soil, air, etc. Pollution is a universal problem. Scientists around the world must take the initiative to seek appropriate solutions to limit the progression of environmental pollution. The technological revolution of the last decades has been carried out using the fossil fuel: oil (1).Today, modern society remains dependent on this polluting energy. But the major problem that manages to use this energy is the generation of a high level of CO2 carbon dioxide emissions leading to global warming. To remedy this, research into clean and renewable energies is very important. Rechargeable batteries are an important device for the storage of electrical energy and more particularly, lithium batteries which have revolutionized the field of energy storage
The goal of our work consists of looking for new metal phosphate materials for improving the electrochemical performance of current lithium-ion batteries, developing new technologies that are more efficient, safer, more durable, setting up a recycling chain, etc.

Lithium-ion (Li-ion) batteries have been widely used in various kinds of electronic devices in our daily life. The use of aqueous electrolyte in Li-ion battery would be an alternative way to develop low cost and environmentally friendly batteries (2).

In our work, the iron phosphate (FePO4) cathode for the aqueous rechargeable Li-ion battery is prepared by co-precipitation method. The XRD results show that powder is composed of FePO4 grains with olivine structure and the average size of 100 nm. Charge-discharge measurements at current density of 100 μAh cm–2
Electrochemical Study is carried between -1 and 1 mV show that the FePO4 electrode is able to deliver an initial discharge capacity of 90 mAh g–1.

Keywords: FePO4, lithium, ion battery, energy storage, cyclic voltammetry, discharge capacity

*Speaker

Structural and optical properties of LaFeWO6 double perovskite-type oxide

Jihad Louafi * [1]

[1] LPMAT, Faculty of sciences Ain Chock, Hassan II University, Casablanca, Morocco – Morocco

The double perovskite type oxides (ABO6) form an outsized category of compounds with various physical and electronic properties and a simple crystal structure. For this, we have chosen to study the perovskite type oxides of LaFeWO6 . The samples were prepared by the solid-state reaction method. The mixtures were ground in an agate mortar and then heated at 300 ∘C for 2 h. The crystal structure was examined by X-ray diffraction (XRD), the morphology of the compounds was visualized by scanning electron microscopy (SEM), the thermal and gravimetric properties were examined by ATD-ATG and the optical properties were studied by UV-visible spectroscopy. The results obtained confirm the formation of solid solutions without secondary phases.

Keywords: Solid, state reaction, X, ray diffraction, Perovskite, type oxides, Optical Property.

*Speaker

Coupled heat transfers in real configurations subjected to a sinusoidal heating

Mourad Najjaoui * [1], Thami Ait-Taleb , Bouchaib Jamal , Abdelhalim Abdelbaki , Zaki Zrikem , Hassan Chaib

[1] najjaoui – Morocco

The present study aims to investigate the combined heat transfer by natural convection, conduction and surface radiation through two types of hollow blocks. these hollow blocks with one or two air cells deep in the vertical direction and three identical cavities in the horizontal direction which are typically used for building ceilings in Morocco. The outside horizontal face is submitted to a sinusoidal thermal excitation, while the inside horizontal face is maintained at a constant temperature. The vertical surfaces are assumed to be adiabatic, the governing equations for conservation of mass, momentum and energy are discretized by the finite volume approach and solved by the SIMPLE algorithm. The effects of the amplitude of the exciting temperature and the thermal emissivity on the global heat transfer through each structure are presented and examined. The results report that the hollow block of type 2 allows a good reduction of heat transfer from exterior to interior surfaces of the building roofs. The emissivity of the internal surfaces affect considerably the heat transfer through the hollow blocks.

Keywords: heat transfer, hollow blocks, sinusoidal thermal excitation, thermal emissivity.

*Speaker

Aqueous Starch Acetate/Glycerol/Polyvinyl Alcohol Dispersion as a Novel Biodegradable Coating Materials for Slow Release Fertilizers

Asma Sofyane * [1]

[1] Laboratoire des Matériaux Innovants, Energie et Développement Durable (IMED-Lab) - Université Cadi Ayyad (UCA) - Faculté des Sciences et Techniques (FSTG) - Av. A. El Khattabi, P.B.549, Marrakech, Maroc – Morocco

Recently many bio-polymers are used in agriculture, as coating resins of fertilizes to achieve controlled release of nutrients. In that case, the polymer acts as a physical barrier to slow down the release rate of nutrients and reduce their losses in the environment. The aim of the present research is to study the starch acetate bipolymer as encapsulating agent in the preparation of slow release DAP fertilizers provider by the OCP group. Hydrophobic starch acetate, as low coast and abundant resources, was mixed with glycerol as plasticizer and polyvinyl alcohol as reinforcing agent in aqueous dispersion, the corresponding films were obtained by casting (evaporation technique). Various batches were prepared employing starch acetate ratios. The coating films were analyzed by FTIR spectroscopic technique, the morphological structures of the films and coated fertilizers were characterized by SEM. The fertilizer release rate (N and P) from the matrix polymers was studied by UV-Vis spectrophotometer. The SEM revealed the formation of a cohesive film between DAP and coating film. The release results have approved a slow release of nutrients and depended on the percentage of starch acetate in different batches. The strategy adopted has successfully provided long-term availability of nutrients sources compared to un-coated fertilizer (DAP).

Keywords: Starch Acetate Polymers, Coating of Fertilizers, Characterizations, Slow Release Fertilizers.

*Speaker

Investigation of the Structural, electronic, optical and electrical properties of Co-doped ZnO.

Ahmed Soussi *† [1], Abdeslam Elfanaoui [2], Ait Hssi Abderahim [3], Taoufiq Mohamed [1], Abdellah Asbayou [1], Nabil Labchir [1], Rachid Markazi [1], Ahmed Ihlal [1], Khalid Bouabid [1]

[1] laboratory of materials and renewable energies LMER, Faculty of Science-University Ibn Zohr- Agadir – Morocco
[2] laboratory of materials and renewable energies LMER, Faculty of Science-University Ibn Zohr- Agadir – Morocco
[3] laboratory of materials and renewable energies LMER, Faculty of Science-University Ibn Zohr- Agadir – Morocco

In this study, we report the findings of Co-doped ZnO at various Co concentrations by using density functional theory (DFT) in the full potential linearized augmented plane wave (FP-LAPW). The calculations have been performed with a comparison between the Perdew, Burke, and Ernzerhof generalized gradient (PBE-GGA) and Tran-Blaha Modified Becke-Johnson (TB-mBJ) approximations. A comparison of the results is made with pure ZnO. The optimized structural parameters show that the doped ZnO with low Co concentration is not destructive to the ZnO hexagonal structure. The changes in these parameters are in good accordance with the experimental data. The calculated electronic structure results show that Co-doped ZnO is an n-type semiconductor, with an expanding band gap after Co-doping. Based on the optical properties study, we can observe that the transmittance was increased after the Co doping. Similarly, the electrical conductivity was enhanced. From this study, we have also been able to determine the appropriate range of Co concentrations to obtain promising transparent conducting oxides. The high static value of both the dielectric constant and the refractive index and a low reflectivity have been observed in the visible region, which are interesting for optoelectronic device applications.

Keywords: Doped ZnO, FP, LAPW, Band structure, Electronic properties, Direct gap.

*Speaker
†Corresponding author: soussi.lphea@gmail.com

investigation of the physical properties of simple perovskite ABO3

Abderrahmane Waqdim * [1], Mohamed Agouri [2], Bouzid Manaut† , Abderrahman Abbassi‡ , Souad Taj , Moha El Idrissi

[1] WAQDIM Abderrahmnae – Morocco
[2] AGOURI Mohamed – Morocco

The structural, electronic and thermoelectrical properties of the Simple Perovskite SrGeO 3 were investigated with several approximations, using the Full Potential Linearized Augmented Plane Wave method which is implemented in the Wien2K code. The method used is based on the Density Functional Theory approach. The obtained results present an opening gap for SrGeO 3 . Calculated absorption and transparency show also an interesting and stable optical behavior in the range of visible light. These results show the ability of this composite oxide to be exploited in many applications

Keywords: DFT, Wien2k, Semiconductor

*Speaker
†Corresponding author: bmanaut@gmail.com
‡Corresponding author: abbassi.abder@gmail.com

Review article: Application of precipitation estimates by satellite to crop yield forecasting.

A Abali Mohamed Amine *† [1]

[1] 1 Materials and Renewable Energies Laboratory, Physics Department, University of Ibn Zohr , Agadir, Morocco – Morocco

Ensuring food security should be a matter of great importance for developing countries where the majority of the population is considered to be absolutely poor. The importance of quantifying the amount of rainfall is well established in a country with a farmer-based economy like Morocco, where rain-fed agriculture is extremely important. Decision-makers rely on forecasting and monitoring the crop yield throughout the growing season. Although the estimation and assessment of crop production is carried out worldwide over a regional scale, the advance forecasting of yields in space and time is less popular, especially in Morocco. Unfortunately, the lack of real-time information from meteorological stations due to limited spread of observatories, and lack of infrastructure in the observatories prevents this forecast, and therefore the idea of using satellite remote sensing to estimate rainfall could solve this problem (1). In fact, advances in satellite tools are showing great promise in such areas with poor weather observation coverage. Satellite-based products become crucial to provide appropriate temporal and spatial resolution in regions with the scarcity in availability of surface weather observations (2). This work focuses on a synthesis study of the main crop yield estimation models that integrate satellite rainfall data for the different crops studied and the data calibration approach followed in these studies.

Keywords: Remote sensing, precipitation, crop yield.

*Speaker

†Corresponding author: aminmo.ab@gmail.com

A sustainable and low-cost vital strategy for recovering industrial effluent: a case study for a combined cycle power plant

Adam Abdeljalil *† [1], Saffaj Nabil [1], Mamouni Rachid [1]

[1] Laboratory of Biotechnology, Materials, and Environment, Faculty of Sciences, University IBN ZOHR, Agadir – Morocco

Depleted water supplies have forced the consumption of poor-quality water in business and agribusiness, especially in dry regions, including Africa. Both the ecosystem and the groundwater utilized by humans and businesses could be harmed by all of this.
This study simulates industrial effluent collection employing a thorough, structured methodology. The water is then released into an evaporation pond and kept there as a final release solution.

In this experiment, industrial effluent that is released into evaporation ponds is treated using a sustainable renewable power system. This approach is designed for straightforward systems in outlying areas with access to salted produced water with renewable energy.

Accordingly, wastewater reuse is without a doubt one of the best methods for supplying agricultural and businesses with the water they demand by saving the environment. using renewable solar stills that utilizing industrial effluent to reduce perspiration is studied in this research.

Desalination seems to be an ideal fit for effluent recovery since it takes advantage of the phenomenon of water vapor condensing in the atmosphere, as well as the solar still impact, the usage of salt effluent, and far more.
This original study's main objective is to examine how desalinating industrial effluent using renewable energy may produce clean water inside a solar still. This setup demands a close look at the layout of the solar still system that could be combined together

Keywords: Renewable energy, wastewater, effluent, solar still, ecosystem.

*Speaker
†Corresponding author: adam.abdeljalil@gmail.com

Simulation of heat transfer and airflow in multi-chapel agricultural greenhouses heated from the bottom.

Mustapha Ait Hssain *† [1]

[1] Laboratory of Mechanics, Processes, Energy, and Environment (LMPEE) National School of Applied Sciences, Ibn Zohr University, Agadir, Morocco – Morocco

A greenhouse is a simple shelter or enclosure designed for the cultivation and protection of plants by providing the immediate environment of the plant to improve its productivity and quality throughout the year. Among these conditions are the influence of the external environment, carbon dioxide levels, incident light, humidity and air temperature. In addition, the climatic conditions inside a greenhouse are highly dependent on heating systems and air circulation. For these considerations, several numerical and experimental works have been performed to study the greenhouse-heating problem.

The heating of agricultural greenhouses in winter climatic conditions is essential to control the temperature inside the greenhouses. In this sense, this study consists in analyzing the thermal exchanges and the distribution of the temperature inside the agricultural greenhouses heated by heating blocks at constant temperature. Two types of greenhouses are studied, single-hood and multi-hood greenhouses with two roof shapes, triangular and spherical (Figure 1). Simulations are performed by solving the governing differential equations using the finite volume method. The algebraic systems are solved using a change-of-variable method to account for the variable shape of the greenhouse roof. The results are presented in terms of isotherms, flow lines, and local and average Nusselt number for Rayleigh number ranging from to . The results showed that the dominant heat transfer regime for Rayleigh numbers less than is pseudo-conduction, and natural convection is for Rayleigh numbers greater than and for both cases treated. Also, we found that the total Nusselt number increases with the increase of Rayleigh number, this increase has a very small effect for a mono-chapel greenhouse with triangular roof, so that the difference between the two greenhouses does not exceed a percentage of 1%.

Keywords: Field empty!

*Speaker

†Corresponding author: m.aithssain@uiz.ac.ma

Contribution of the energy sector on atmospheric pollutant Emissions: Towards emissions inventory modeling in Morocco.

Amine Ajdour *† [1], Jamal Chaoufi [1], Ahmed Chirmata [2], Kenza Khomsi [3], Jamal Ouarzazi [4], Radouane Leghrib [1]

[1] Laboratory of Materials, Signals, Systems and Physical Modeling, Physics Department, Faculty of Science, University of Ibn Zohr, Agadir – Morocco
[2] Department of Environment, Wilaya of the Souss-Massa region, Agadir – Morocco
[3] General Directorate of Meteorology, Casablanca – Morocco
[4] Laboratory of Physical Chemistry of Materials and Environment, Chemistry Department, Faculty of science, University of Cadi Ayyad, Marrakech – Morocco

Morocco's rapid economic growth resulted in a significant improvement in the standard of living of its citizens (1). This economic growth depends on the consumption of many different energy sources (2), which have a significant environmental impacts (3). The energy sector is a critical contributor to the emission of polluting gases into the atmosphere and other types of pollution that harm human health and the environment. Air pollution measurements provide a lot of information about ambient concentrations and sediments. In contrast, they do not describe air quality only at specific locations and times without sufficient information about the principal causes of this pollution. Air pollution modeling is a numerical process used to describe the cause-effect relationships between emissions, meteorology, air concentrations, and other factors (4). The air pollution issue suffers from a lack of studies in Morocco, especially regarding the energy sector's effect on air pollution. This study aims, on the one hand, to present the results of the modeling of surface emissions using the EMI-SURF model (5) and to try to interpret them from the emission inventories which were carried out in Morocco, on the other hand, to determine the contribution of the energy sector to the emissions. This study can help develop an atmospheric emissions inventory, which requires significant resources at the local and regional levels. The energy sector's contribution to pollutant emissions will assist in understanding the primary sources of pollution and formulating sectoral strategies to reduce air pollution in the future.

References

(1) L. Côté-Roy and S. Moser, "A kingdom of new cities: Morocco's national Villes Nouvelles strategy," Geoforum, vol. 131, no. February, pp. 27–38, 2022, doi: 10.1016/j.geoforum.2022.02.005.

(2) M. K. Khan, M. I. Khan, and M. Rehan, "The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan," Financ. Innov., vol. 6, no. 1, pp. 1–13, 2020, doi: 10.1186/s40854-019-0162-0.

(3) F. Martins, C. Felgueiras, M. Smitkova, and N. Caetano, "Analysis of fossil fuel energy consumption and environmental impacts in european countries," Energies, vol. 12, no. 6, pp. 1–11, 2019, doi: 10.3390/en12060964.

*Speaker
†Corresponding author: amine.ajdour@edu.uiz.ac.ma

(4) Z. Ding, H. Chen, L. Zhou, and Z. Wang, "A forecasting system for deterministic and uncertain prediction of air pollution data," Expert Syst. Appl., vol. 208, no. January, 2022, doi: 10.1016/j.eswa.2022.118123.

(5) A. Ajdour et al., "A new hybrid models based on the neural network and discrete wavelet transform to identify the CHIMERE model limitation," Environ. Sci. Pollut. Res., 2022, doi: 10.1007/s11356-022-23084-8.

Keywords: Energy sector, EMI, SURF model, Air pollution modeling, Emission inventories .

Contribution à la commande vectorielle de la génératrice asynchrone dans une conversion de l'énergie éolienne

El Moudden Aymane * [1]

[1] ENSEM – Morocco

Aujourd'hui, le développement et la multiplication des éoliennes ont conduit les chercheurs à mener des investigations de façon à améliorer l'efficacité de la conversion électromécanique et la qualité de l'énergie fournie. C'est dans ce cadre que le présent travail que nous vous présentons décrit une étude sur l'utilisation efficace des machines asynchrones dans un système éolien.
La machine asynchrone est de plus en plus utilisée dans les systèmes éoliens vu sa robustesse, sa durée de vie élevée, son faible coût et son contrôle électronique des grandeurs précises.

Une étude sur la machine asynchrone nous a permis de développer un modèle mathématique simple en régime permanent, en se basant sur des hypothèses simplificatrices afin de contrôler la tension continue à la sortie de la génératrice asynchrone dans le cas d'une application de conversion d'énergie éolienne en fonctionnement isolé.

Le modèle mathématique simplifié nous a conduits à l'élaboration d'une technique de commande vectorielle simple avec capteurs, tout en réduisant la complexité du système et qui a l'avantage d'être facilement implantable dans une commande par calculateur.

Le fonctionnement du dispositif a été simulé sous l'environnement MATLAB-SIMULINK avec un pas de calcul de 10μs.

Les résultats de la simulation nous ont permis de juger les qualités de la stratégie de la commande vectorielle adoptée.
A travers les caractéristiques de réponse, on observe de bonnes performances même en présence des variations de consignes.

Keywords: Machine asynchrone, éolienne, modélisation, commande vectorielle, MATLAB, SIMULINK

*Speaker

Inventaire des émissions de GES pour le pompage dans le secteur agricole

Rachida Belaaribi *† [1], Rachid Safoui [1], Ahmed Ihlal [2]

[1] Materials and Renewable Energy Laboratory, Faculty of Sciences, Ibn Zohr University – Morocco
[2] Materials and Renewable Energy Laboratory, Faculty of Sciences, Ibn Zohr University – Morocco

Ce travail consiste à réaliser un inventaire des émissions des gaz à effet de serre pour le pompage agricole au Maroc afin de contribuer à l'atténuation de ces émissions. D'abord, nous avons collecté les données de consommation ainsi que les facteurs des émissions du butane, du gasoil et d'électricité. Ensuite, nous avons utilisé ces données dans un outil Excel qui permet de fournir une approche pour l'évaluation et la comptabilisation des émissions de CO2 entre 2006 et 2020 ainsi que des scénarios des émissions pour les années prochaines jusqu'à 2030. Enfin, la calculette Excel donne une idée sur les émissions à éviter si on remplace le butane, le gasoil et l'électricité par le solaire photovoltaïque dans les activités de pompage pour l'irrigation.

Keywords: Nexus, Energie, Agriculture, GES, Pompage solaire

*Speaker
†Corresponding author: rachida.belaaribi@edu.uiz.ac.ma

Inventaire des émissions de GES pour le pompage dans le secteur agricole

Rachida Belaaribi *† [1], Rachid Safoui [1], Ahmed Ihlal [1]

[1] Materials and Renewable Energy Laboratory, Physics Department, University of Ibn Zohr , Agadir – Morocco

Ce travail consiste à réaliser un inventaire des émissions des gaz à effet de serre pour le pompage agricole au Maroc afin de contribuer à l'atténuation de ces émissions. D'abord, nous avons collecté les données de consommation ainsi que les facteurs des émissions du butane, du gasoil et d'électricité. Ensuite, nous avons utilisé ces données dans un outil Excel qui permet de fournir une approche pour l'évaluation et la comptabilisation des émissions de CO2 entre 2006 et 2020 ainsi que des scénarios des émissions pour les années prochaines jusqu'à 2030. Enfin, la calculette Excel donne une idée sur les émissions à éviter si on remplace le butane, le gasoil et l'électricité par le solaire photovoltaïque dans les activités de pompage pour l'irrigation.

Keywords: Nexus, Energie, Agriculture, GES, Pompage solaire

*Speaker
†Corresponding author: rachida.belaaribi@edu.uiz.ac.ma

Volume of Fluid (VOF) Modeling of Liquid Film Evaporation in Mixed Convection Flow through a Vertical Channel

Hayat El Baamrani *† [1]

[1] 1Thermodynamics and Energetics Laboratory, Faculty of Science, Ibn Zohr University, BP8106, 80006 Agadir, Morocco – Morocco

The volume of Fluid (VOF) method in the OpenFOAM is used to investigate the coupled heat and mass transfer by mixed convection during the evaporation of water-thin film. The liquid film is falling down on the left wall of a vertical channel and is subjected to a uniform heat flux density, whereas the right wall is assumed to be insulated and dry. The gas mixture consists of air and water vapor. The governing equations in the liquid and in the gas areas with the boundary conditions are solved by using the finite volume method. The results which include temperature, velocity, and vapor mass fraction are presented. The effect of heat flux density, liquid inlet temperature, and mass flow rate on the heat and mass transfer are also analyzed. The obtained results for water film evaporation show good agreement compared to the results previously published in the literature which indicates that the interface tracking by the VOF method respects well the thermodynamic equilibrium at the liquid-gas interface.

Keywords: Evaporation, Heat and mass transfer, Mixed convection, Volume of fluid (VOF).

*Speaker

†Corresponding author: hayatelbaamrani92@gmail.com

Mixed Convection Heat Transfer in a Square Cavity Including a Square Heater

Mohamed El Hattab * [1,2], Soufiane Oukach [1], Mustapha Boumhaout [1]

[1] Research Team, Energy and Sustainable Development, ESTG, Ibn Zohr University, Guelmim, Morocco – Morocco
[2] Mechanics, Process of Energy and Environment Laboratory, ENSA, Ibn Zohr University, Agadir, Morocco – Morocco

A two-dimensional mixed convection heat transfer in a square cavity containing a heated block is investigated numerically by finite volume method with SIMPLE algorithm. The left and right vertical walls are cooled isothermally while the horizontal walls are assumed to be adiabatic. This study is carried out to predict the effect of Richardson number, Prandtl number and size of heat block on the flow and heat transfer rate. Detailed analysis of results reported in form of streamlines, isotherms and mean Nusselt number. The results obtained show that the heat transfer rate increases with increasing Prandtl number but it decreases with increasing Richardson number. In addition, heat transfer enhances with increasing size of the heated block.

Keywords: Mixed convection, Isothermal Heater, Finite volume method

*Speaker

Hydrogeochemical and isotopic characterization of groundwater in the Laayoune-Dakhla region (South of Sahara, Morocco)

Khalid Mizeb *† [1]

[1] 1Laboratory of organic chemistry, inorganic, electrochemistry, and environment, Faculty of Science, University Ibn Tofail, B.P 133, 1400, Kenitra, Morocco – Morocco

The evaluation of major elements and stable isotopes of groundwater in the Laayoune-Dakhla region was carried out with the aim of determining the different geochemical processes that contribute to the mineralization of these waters. A total of 30 groundwater samples were taken from wells located in the Laayoune-Dakhla region (South of the Sahara, Morocco). This study uses a hydrogeochemical assessment approach to account for general water characteristics in the study area.
The statistical results of the major cations (Na+, Ca2+, Mg2+, K+) of the major anions (Cl-, SO42-, HCO3-, NO3-), show that the abundant cations and anions are of the order of Na+ > Ca2+ > Mg2+ > K+ and Cl- > SO42- > HCO3- > NO3-, respectively. The EC value of the waters in the study area varies between 1290 and 6895 μS/cm with an average of 3341.53 μS/cm. The pH value of the water samples is between 6.88 and 7.75. It was determined that the waters of the study area are of hydrogeochemical facies Na-Cl (86.66%) and Ca-SO4 (13.33%). Their chemistry seems to be mainly controlled by sulphate, calcium, chloride and sodium and is explained by the dissolution of the evaporitic formations characteristic of the Saharan regions. Ionic ratios reveal that rock weathering and mineral dissolution and evaporation control the chemical evolution of groundwater. Moreover, a good correlation between calcium and sulphates suggests leaching of gypsum and anhydrite.
δ18O levels range from -6.96 to -8.93‰ while δ2H levels range from -51.5 to -65.56‰. The presence of evaporation was confirmed by the stable isotope contents (δ18O, δ2H). The variation in oxygen-8 contents can be interpreted in terms of altitude difference between recharge altitudes.

Keywords: Laâyoune, Dakhla, evaporitic, hydrogeochemical, mineralization

*Speaker
†Corresponding author: khalidmizeb.hi@gmail.com

Application Of the Optimization Algorithm in Solar System-Powered Monitoring and Control Making Use of The IoT for Mobile Robot Systems

Youssef Mhanni *† [1]

[1] Youssef Mhanni – Morocco

This research offers a solar-powered design for a mobile robot b, using **IoT** (Internet of Things) technology to reduce the need for human interaction. In order to provide more services for the linked things with the use of computing and analysis, IoT technology connects physical objects that are integrated with electrical components and software. The solar photovoltaic (PV) system is required for use in the development of PV systems. by using an optimization approach, **MPPT** (Maximum Power Point Tracking) to achieve high efficiency and rapid response. in this context, our suggested model seeks to develop and create a model that is capable of functioning in a manner that is highly adaptable, considerably durable, highly comfortable, powerful, and capable, which may be operated remotely using cloud server support, as well as communicate between data from Matlab and the cloud server. Matlab Script code and Simulink are utilized in the development of a model for a photovoltaic panel.

Keywords: MPPT, Internet of Things, PV systems, photovoltaic, MATLAB/ SIMULINK

*Speaker
†Corresponding author: ymhanni@uae.ac.ma

Numerical investigation of Mixed CH3NH3SnxPb1-xI3 based perovskite solar cells

Haytam Mouhib * [1]

[1] laboratoire Matériaux et énergies renouvelables – Morocco

Hybrid organic-inorganic halide perovskite solar cells (PSCs) have drawn a lot of research interest due to their great performance and inexpensive cost. In this research, a numerical simulation of the p-i-n configuration of Glass/ITO/PEDOT: PSS/ CH3NH3SnxPb1-xI3 /C60/Ag has been carried out by employing Solar Cell Capacitance Simulator (SCAPS-1D) software under AM 1.5G sun spectrum. It is investigated how varied active layer characteristics, as well as the electron affinity of the hole transport layer PEDOT: PSS, affect PSC functional parameters as open circuit voltage, current density, fill factor, and power conversion efficiency. For an optimal thickness of 500 nm, and defect density of 1013 cm-3 in the absorber layer, and electron affinity of 3ev in the hole transport layer. We obtained a power conversion efficiency of more than 21%.

Keywords: Mixed Pb, Sn perovskite, defect density, high power conversion

*Speaker

Object-Based Analysis and Verification of Predicted Rainfall by WRF Model in the North Africa

Rachid Moustabchir *† [1]

[1] 1LMER, Physics department, Faculty of Science, Ibn Zohr University, Agadir, Morocco 2Environment Department, Wilaya of Souss Massa Region, Agadir, Morocco – Morocco

The quality of daily rainfall forecast from the Weather Research and Forecasting model during 03 and 05 December, 2019 is verified against the corresponding data from the climate prediction center MORPHing technique (CMORPH) and the latest version of the Integrated Multi-SatellitE Retrievals for the Global Precipitation Mission (GPM) algorithm (IMERG-V06), over north Africa. We focus on the assessment of precipitation using spatial diagnostic techniques; The spatial verification scores were computed against various thresholds using model evaluation tools (MET) to calculate different metric statistics that compared the performance of WRF forecasts with observation. In this case, we apply Method for Object-based Diagnostics Evaluation (MODE) which is a feature based verification technique. The traditional scores suffer from the so-called "double penalty" issue and hence alone cannot provide a measure of spatial and temporal match between the forecast and observed rainfall patterns. Rather than comparing a single prediction to a single observation at each grid point, these methods compare observations features in a region of interest. Considering the strengths and weaknesses of each metric, the discrepancy in the spatial and temporal of model derived diurnal cycle of rainfall with respect to satellite dataset is then investigated quantitatively using the MODE component of the MET Tools.

Keywords: Field empty!

*Speaker

†Corresponding author: r.moustabchir@uiz.ac.ma

Evaluation of radioactivity levels and associated radiation hazards in groundwater in safi province, Morocco

Bouchra Samyh *† [1], Abdellatif Nachab [1], Abdel-Mjid Nourreddine [2]

[1] Laboratory of Fundamental and Applied Physics, Polydisciplinary Faculty of Safi, Cadi Ayyad University,Morocco – Morocco
[2] Institut Pluridisciplinaire Hubert Curien (IPHC), Université de Strasbourg 23 rue du Loess, 67037 Strasbourg Cedex, France – Institut Pluridisciplinaire Hubert Curien (IPHC), Université de Strasbourg 23 rue du Loess, 67037 Strasbourg Cedex, France – France

Les radionucléides naturels pénètrent dans le corps humain principalement par inhalation de particules d'air et par ingestion d'aliments et d'eau. La population urbaine au Maroc dispose d'un approvisionnement en eau potable provenant de barrages, de sources et de puits. Ces eaux potables contiennent des radio-isotopes dissous dans les roches et les sols et constituent donc une source d'exposition aux doses de rayonnement. Il est nécessaire de mesurer la teneur en radionucléides des échantillons d'eau souterraine pour évaluer les doses potentielles de rayonnement et, si nécessaire, prendre des mesures pour éviter l'exposition des consommateurs aux rayonnements. Le radon (222Rn) est un produit de désintégration gazeux chimiquement inerte et très mobile de l'uranium (238U) qui se trouve dans toutes les roches et tous les sols. Le radon est très soluble dans l'eau. Les mesures de concentration d'uranium (238U) et de radon (222Rn) ont été effectuées dans des échantillons d'eau souterraine prélevés dans la région côtière ABDA du Maroc, en utilisant des détecteurs de traces nucléaires à l'état solide de type LR-115. Les concentrations en 238U et 222Rn dans ces échantillons se situent respectivement entre 0,003 et 0,015 μg/l et 0,15 à 0,57 Bq/l. Les valeurs mesurées de concentration en 238U et 222Rn sont inférieures aux limites recommandées par l'Organisation Mondiale de la Santé (OMS) qui sont respectivement de 100 Bq/l et 0,015 mg/l (1). On observe également que les doses efficaces annuelles sont inférieures à la limite de dose prescrite de 0,1 mSv/an recommandée par l'OMS (2). Les valeurs mesurées de concentration en 238U et 222Rn sont inférieures aux limites recommandées par l'Organisation Mondiale de la Santé (OMS) qui sont respectivement de 100 Bq/l et 0,015 mg/l (1). On observe également que les doses efficaces annuelles sont inférieures à la limite de dose prescrite de 0,1 mSv/an recommandée par l'OMS (2). Les valeurs mesurées de concentration en 238U et 222Rn sont inférieures aux limites recommandées par l'Organisation Mondiale de la Santé (OMS) qui sont respectivement de 100 Bq/l et 0,015 mg/l (1). On observe également que les doses efficaces annuelles sont inférieures à la limite de dose prescrite de 0,1 mSv/an recommandée par l'OMS (2).

Keywords: Radioactivity, groundwater, radon, health, environment

*Speaker
†Corresponding author: samyhbouchra2017@gmail.com

Experimental investigation of atmospheric water harvesting using composite desiccant-based solar collector

Rachid Safoui * [1], Rachida Belaaribi [1], Omar Achahour [1], Ahmed Ihlal [1]

[1] LMER – Morocco

In recent years, freshwater scarcity has become a major worldwide issue. Many unconventional solutions are being tested to make water available to the population in remote areas. However, the ambient air is a renewable source of water and available everywhere on the Earth. In this investigation, a bed comprised a composite desiccant made of river sand impregnated with calcium chloride solution (CaCl2) has been used to absorb water vapour from ambient air. The experiments occurred under the climatic conditions of Agadir city, Morocco (latitude 30.406◦ N and longitude 9.544◦ W). The system collects water from atmospheric air through two steps; the first step involves water vapour absorption during the night by subjecting the composite desiccant material to surroundings air, and the second step involves desiccant regeneration and water vapour condensation during the day by using a solar glass collector. The sun rays increased bed temperature, evaporation occurred, and the vapour condensates on the internal surface of the glass cover. Then, water was collected in a graduated flask through a collecting pipe attached to the device. Many parameters were measured during the tests to evaluate the influence of atmospheric conditions on water productivity during regeneration. The amount of water produced from the system was 180 ml per kg of calcium chloride and the maximum efficiency during the experiments was 13 %.

Keywords: Water, Ambient air, Absorption, Solar energy, Desiccant, Regeneration

*Speaker

External exposure scenarios to ionizing radiation: Modeling with Geant4

Asmae Ettoufi * [1]

[1] laboratory of High Energy and Condensed Matter (PHEMaC) Hassan II University of Casablanca – Morocco

From a radiation protection perspectives, the availability of a database collecting dose factors for different types of exposure to radioactive sources is fundamental for the prediction and prevention against the harmful effects of ionizing radiation. In this context , the use of Monte Carlo codes in general and Geant4 in particular, whose basic principle is based on the random choice of the interaction of radiation with matter, seems at first sight, inconsistent with the rigor and precision asked for during metrology measurements. Nevertheless, the considerable benefits that they are supposed to bring, in particular the very comprehensive consideration of the elementary physical phenomena involved in each interaction and the possibility of a very precise description of the geometry and chemical composition of the detector or dosimeter in its real environment, allow us to expect a precise and targeted determination of the physical quantities required, in particularly those items that are inaccessible to the experiment.In this study, we introduce a scenario of external exposure to ionizing radiation simulated by Geant4 (Monte Carlo code C++ developed at CERN in the form of a data library and tools that the user can assemble according to his specific needs), where a human tissue (human phantom)will be exposed to different configurations of radioactive sources that may actually occur as mentioned in reference (1) (2). The objective is to evaluate the absorbed dose as well as the equivalent dose of each configuration adopted in this scenario.

Keywords: Geant4, radiation protection, dose

*Speaker

Photonic crystal-based biosensor for medical applications

Abdelkarim El Mouncharih *† [1]

[1] LaMEE, Department of Physics, Faculty of Sciences Semlalia, Cadi Ayyad University, P.O. Box 2390, 40000 Marrakech, Morocco – Morocco

In the last few decades, Photonic Crystals have emerged as interesting photonic structures and play a vital role in the biomedical sensing field. Photonic crystals have a major impact on designing a variety of photonic sensors due to their ability to control light propagation. In this work, we report the transfer matrix method to investigate the optical properties of light, under variable refractive indices of one-dimensional photonic crystal (PC). we build a ternary PC with the structure (ABC) containing defect, whose refractive index changes by injecting the medical sample, is the basis of an optical sensor for biosensing. Consequently, using resonance peaks located within the transmittance spectrum, we were able to identify glucose concentration in the urine or blood sample, cell type, and so on. Our results indicate a photonic bandgap with an FWHM of 1033 nm can be observed at wavelengths of 1933 nm and 2966 nm with sensitivity of 965 nm/RIU , a quality of factor of 1892.542, and a high figure of merit of 756.863 RIU-1. Therefore, the proposed biosensor can be a miniaturizated structure with extreme sensitivity in glucose concentration detection models or cancer cell detection.

Keywords: Photonic crystal, Biosensor, Refractive index, Transfer matrix method.

*Speaker

†Corresponding author: a.elmouncharih@gmail.com

Synthesis, characterization, and photocatalytic activity of hematite iron oxide/silver carbonate composite for the photo-degradation of orange G under visible light irradiation

Sara Ghazi * [1,2]

[1] IMED-Lab, FTSG-UCA Marrakech – Morocco
[2] CIRIMAT, INP Toulouse – CIRIMAT, INP Toulouse – France

In this work, the Ag2CO3/α-Fe2O3 composite was synthesized via the precipitation route. The as-prepared Ag2CO3/α-Fe2O3 was characterized using XRD, Raman, FTIR, MEB-EDS, BET, and UV-Vis DRS. The photocatalytic activity of the Ag2CO3/α-Fe2O3 composite was tested on the photo-degradation of orange G (OG) dye under visible light irradiation, and it showed good photocatalytic performance and completely decomposed OG dye within 60 min. In addition, the Ag2CO3/α-Fe2O3 photocatalyst's photocatalytic mechanism was proposed. As a result, this paper aims to shed light on Ag2CO3-based photocatalysts and their potential applications in the environmental elimination of pollutants.

Keywords: Ag2CO3, photocatalyst, α, Fe2O3, visible light, organic dye

*Speaker

PM10 concentrations forecasting in Agadir city (Morocco) using The Variable Selection Method (Stepwise Regression Analysis)

Karima Iraoui *† [1], Rachid Moustabchir [1], Hicham Charifi [1], Meriem Ouatab [1], Ahmed Chirmata [2]

[1] Laboratory of Materials and Renewable Energy, Physics Department, University of Ibn Zohr – Morocco
[2] Environment Department, Wilaya of Souss Massa Region, Agadir – Morocco

Many countries are preoccupied with the high concentrations of particulate matter PM10, due to the rapid industrialization which canbe harmful to people's health and the environment. The capacity to predict these particulate matters in advance allows for better planning to avoid and decrease their impact. This is possible and attainable if we have a good grasp of the contaminants present in the air and the factors that determine their patterns. A great deal of research indicates that pollutant pattern is influenced by meteorological parameters such as wind speed (WS), relative humidity (H), and temperature (T). Statistically, the correlation between these parameters is significant in most cases. The present study aims to use the stepwise regression method for forecasting ambient PM10 in the city of Agadir, Morocco, based on the data collected from a fixed station placed at a school, in Agadir city center during two years (2009-2010). The goodness of fit, which implies a comparison of the observed and the predicted values, is studied through performance indicators using the Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and coefficient of determination (R2).According to the obtained results, we were able to come up with satisfactory results in the evaluation of the used model (R2= 0.64, RMSE=9.224, MSE=85.088, MAE=6.687). This shows the ability of the stepwise regression model to predict the next day PM10 concentration.

Keywords: Air pollution prediction, PM10, Multiple regression, Selection variable method

*Speaker
†Corresponding author: karima.iraoui10@gmail.com

The Application Of Artificial Potential Fields And Fuzzy Logic To The Mobile Robot's System For Avoiding Obstacles

Youssef Lagmich * [1]

[1] ENSA Tétouan – Morocco

Wireless Power Transfer (WPT) systems are gaining increasing interest in various applications such as electric vehicles (EVs), wearable electronics, implantable medical devices, and underwater equipment. The essential principle of WPT is electromagnetic induction: an alternating current applied to a transmitter creates a voltage at the receiver and supplies electrical energy to the load. Early WPT systems were very similar to transformers with a space between the primary and secondary coils. In order to obtain a higher efficiency in energy transfer, a strong coupling between the transmitter and the receiver is required, which tended to relegate WPT systems to energy transfers over short distances.

Keywords: Wireless Power Transfer, Tesla Coil

*Speaker

Megasonic Cleaning and Particle Removal Efficiency

Taha Yassine Rhabi * [1], Mohamed Taha [1]

[1] Laboratory of Thermodynamics and Energy, Physics Department, University of Ibn Zohr , Agadir, Morocco – Morocco

The combination between physical forces megasonic energy and chemicals forces with solvent provides promising results. In semiconductor industry, this combination is used to make a better removal efficiency with eliminating contamination after etching. This research aims to provide the conversion from power I to pressure field Pa is liquid dependent in the cleaning process, the experimental data shows that more factors than acoustic impedance should be taken into account like the distance between piezoelectric transducer and wafer object of the cleaning process. This study seeks to ascertain whether there is a correlation between increase or decrease transient cavitation threshold and better removal efficiency, with realising some analytical and numerical simulations studies which proved a decrease in transient cavitation threshold relates to a better removal efficiency, by increasing bubble action with jetting, shock waves and drag force. The experimental trend lines versus simulation data show that increasing temperature in water effect on transient cavitation threshold and particle removal efficiency. Finally, we Show important trends that's lower vapour pressure and higher surface tension result in increased erosion rate.

Keywords: Threshold Cavitation, Megasonic, Erosion, Solvents, Bubbles dynamics.

*Speaker

Investigation of the gas sensing properties of SnO2 (110) layer through Density Functional Theory calculations

Mouad Soumane *† [1,2], El Houssine Atmani [2], Redouane Leghrib [1], Nejma Fazouan‡ [2], Houda Lahlou [1]

[1] Laboratory of Materials, Signal, Systems and Physical Modeling, Physics Department, University of Ibn Zohr , Agadir, Morocco – Morocco
[2] Laboratory of Nanostructures and Advanced Materials, Mechanics and Thermofluids, Physics Department, Faculty of Sciences and Technologies, Hassan II University of Casablanca, Mohammedia, Morocco. – Morocco

With the development of modern industry, the search for high performance harmful gas detection materials has become an emergency. Tin dioxide (SnO2) is among the most used industrially in the field of chemical gas sensors (1). This material has a set of advantages, including its interesting electrical and morphological properties. SnO2 is also a chemo-resistive material and its gas sensing is mainly controlled by the change in resistance of the sensor as gas molecules react on its surface.
Based on the Density Functional Theory (DFT) according to Ultra-Soft Pseudo-Potentials (USPP) method implemented in Quantum ESPRESSO code, the adsorption of three harmful gases (ethanol, acetone and NO) on different adsorption sites of the optimized (110) layer of SnO2 is analyzed. The studied layer is stripped of the optimized SnO2 bulk with a vacuum zone of 14 Å to prevent interaction between adjacent layers. The Brillouin zone (BZ) is represented by the set of 4x4x1 k-points using a Monkhorst-Pack for the geometry optimizations and for the static total energy calculations. All the properties were studied by the generalized gradient approximation parameterized by Perdew-Burke-Ernzerhof (GGA-PBE-sol).

In this study, we calculate and compare the adsorption energy, charge transfer, adsorption distance and other parameters for each gas molecule on the three sites of the SnO2 (110) layer. For the sensing behavior, we estimate the recovery time and the response degree of (110) SnO2 layer for the three gases at different temperatures. The results show that (110) SnO2 layer has a good adsorption effect on ethanol than the other target gases. Also the high recovery time and reasonable response of adsorbed ethanol indicate that (110) SnO2 layer has ideal sensing behavior for ethanol, while the very short recovery time indicates that (110) SnO2 layer is not suitable for detecting acetone and NO. This work shows that the (110) layer of SnO2 is promising as a 2D material of adsorption for the detection and the elimination of harmful gases.

Keywords: SnO2 (110) layer, Harmful gases, DFT, Adsorption, Recovery time.

References

(1) B. GHADDAB, "Développement d'un capteur de gaz à base de couche hybride dioxyde d'étain/nanotubes de carbone," 2012. Thèse doctorale, UFC.

*Speaker
†Corresponding author: mouad.soumane@edu.uiz.ac.ma
‡Corresponding author: fazouan@yahoo.fr

Keywords: SnO2 (110) layer, Harmful gases, DFT, Adsorption, Recovery time

Exploring the influence of processing parameters of ZnO thin film grown via an automated SILAR process

Brahim Ydir *† [1], Mouad Soumane [1], Amine Ajdour [1], Youssef Ait-wahmane [2], Ahmed Ihlal [2], Abdeslam Elfanaoui [2], Radouane Leghrib [1], Mohamed Bousseta [1], Houda Lahlou [1]

[1] Laboratory of materials, signals, systems and physical modeling, Department of Physics, Faculty of Science-Ibn Zohr University- Agadir, Morocco – Morocco
[2] Laboratory of Materials and Renewable Energy, Department of Physics, Faculty of Science-Ibn Zohr University, Agadir, Morocco. – Morocco

Zinc oxide (ZnO) has attracted a lot of interest as a semiconducting material for various application areas, especially in optoelectronics and protective systems(1–3), due to its membership in the transparent conducting oxide family and the abundance of its components.
The structural, optical and electrical properties of ZnO thin films are known to be highly dependent on the deposition conditions, namely the gas phase composition, deposition temperature, geometry, and specific growth technique.

ZnO thin films can be grown using different physical and chemical processes, among which the SILAR (successive ionic layer adsorption and reaction) technique has attracted a lot of attention to due its several advantages, such as simplicity, efficiency, and versatility in the deposition of several types of thin film materials of high technological interest on a variety of substrates, with tunable properties depending on the deposition parameters.

It should be mentioned that in most reported works, SILAR was applied following a manual process. In order to overcome its limitations, we have recently developed a low-cost automated SILAR system (4). This innovative system allowed us to develop and improve the quality and reproducibility of thin film deposition.

In this work, we present the synthesis and characterization results of nanostructured zinc oxide (ZnO) thin films successfully grown by using our home made automated SILAR equipement (1). The deposition was performed on glass substrates at room temperature by studying the effect of different processing parameters on the structural, optical, and electrical film properties (6).

X-ray diffraction (XRD), ultraviolet/visible spectroscopy, and scanning electron microscopy (SEM) characterizations are performed to evaluate the deposition parameters' effect on the film's properties.

References

(1) Ydir, B. et al. Mater. Today Proc. 52, 89–94 (2022).

*Speaker
†Corresponding author: brahim.ydir@edu.uiz.ac.ma

(2) Girija, K. G., Somasundaram, K., Topkar, A. & Vatsa, R. K. J. Alloys Compd. 684, 15–20 (2016).

(3) Shahzad, S., Usman, M., Asif, M. & Yasir, M. Front. Mater 8:613825, 1–16 (2021).

(4) Ydir, B. et al. Int. J. Adv. Manuf. Technol. (2022).

(5) Kannan, S. V. R. & Kim, S. V. H. Appl. Phys. A (2015).

(6) Ratnayake, S. P. et al. Micro and Nano. 2101666, (2021).

Keywords: ZnO, thin films, SILAR

3D Efficient HWSN Protocol for Water Quality Monitoring Using Firefly Algorithm

Chaimae Zouaki *† , Youssef Lagmich *

[1], Saad Chakkor * ‡ [2]

[1] ENSA Tétouan – Morocco
[2] Ecole Nationale des Sciences Appliquées [Tanger] – Morocco

The effective monitoring of water quality is now becoming a necessary and vital operation to
guarantee an important and sustainable source of supply and survival for many living beings. The integration of modern wireless network technologies and intelligent algorithms for proper management of said process increases its efficiency and accuracy considerably. Indeed, for heterogeneous wireless sensor networks (HWSN), several protocols have been proposed for routing: the most used is TDEEC due to its simplicity, its ability to handle large data sets and the extension of network lifetime. In this paper, we propose the application of a modified algorithm entitled FTDEEC in conjunction with the firefly algorithm to enable efficient and optimized routing of collected water quality data in three dimensions geometry. This is in order to make an appropriate decision in real time. This study is exploited and evaluated by simulation for the optical detection of peroxide pollutants via the fluorescence quenching mechanism. The use of the firefly algorithm allows the optimization of the energy of the network nodes in the group leader election (CH) step and the formation of hierarchical groups. This allow maximizing the data flow on the network and extends its life. The simulation results show the satisfactory efficiency of our modified firefly algorithm-based hierarchical data clustering and routing protocol, which provides high throughput with lower time complexity during collection and processing operations, compared to other protocols.

Keywords: FTDEEC, Energy efficiency, firefly algorithm, Water Quality Monitoring, HWSN, clustering, 3D geometry.

*Speaker
†Corresponding author: zouakichaimae52@gmail.com
‡Corresponding author: saadchakkor@gmail.com

A Theoretical Study of the Relationship between the Electrophilicity Index of nitriles derivatives

Sara Mokhtar * , Bouchra Saisi [1]

[1] sara mokhtar – oganisation : dela santé – France

The relationship between the electrophilic index and the Hammett constant (1,2) has been investigated for a series of para-substituted and meta-substituted phenylnitrile derivatives which participate in hydration reactions. The electrophilic (3) index - a descriptor of the functional theory of density of reactivity (DFT) evaluated at the ground state of molecules - shows a good linear relationship with the Hammett's substituent constant σp. The theoretical reactivity scale correctly explains the electrophilic activation / deactivation effects favored by the electron-withdrawing and para-electron releasing substituents of phenylnitrile derivatives.

Keywords: DFT, Hammett constant σp, Nitrile, Hydration

*Speaker

Author Index