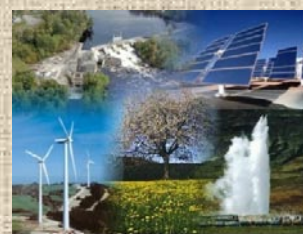
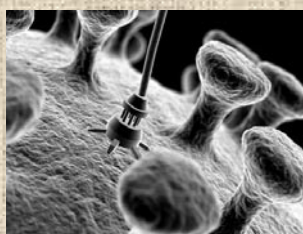
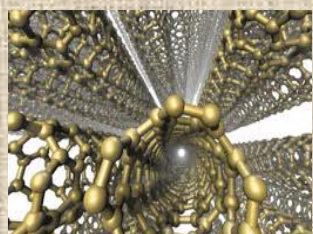


**International Conference on Renewable
Energies and Nanotechnology
Impact on Medicine and Ecology**



Book of Abstracts



ICREN 2013

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EXPANDED GRAPHITE, CARBON NANOTUBES AND ITS COMPOSITES

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Introduction : Exfoliated (expanded) graphite (EG) is a group of materials with a graphite-like structure, which is obtained by rapid heating (thermal shock) graphite intercalation compounds and their hydrolyzed forms. Decomposition and evaporation of the intercalant leads to a strong expansion of the particles along the axis perpendicular to the graphene plane. EGs are characterized by complex structure of the developed surface and the presence of extended slit-like and cylindrical defects with midships from 0.7 to 20 nm and more due to torsion of group or few atomic layers (Fig. 1).

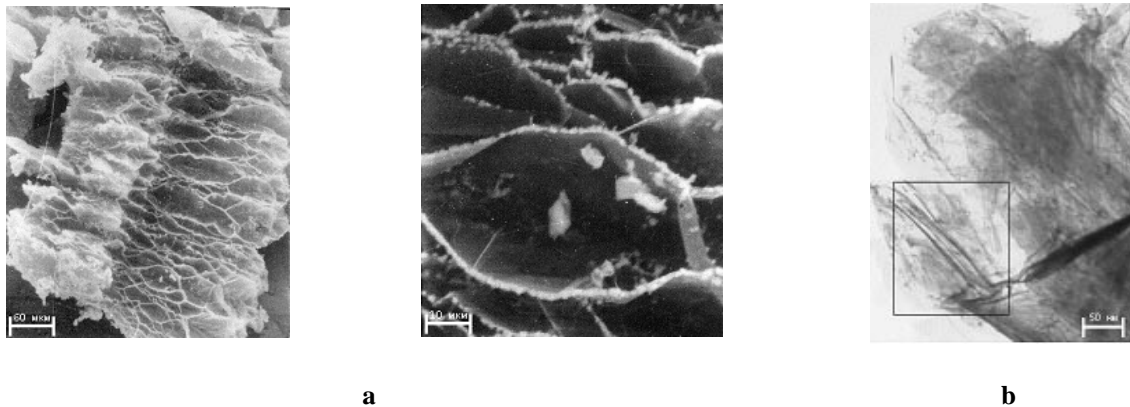


Fig. 1: Appearance of EG: a) SEM; b) TEM.

They appear in the Raman spectra, positron annihilation, low-temperature nitrogen adsorption, and it confirms nanoscale structure of EG [1]. EG retains all properties of natural graphite and acquires the ability to pressing and rolling without any binders. Rolled and pressed materials from EG with a density of 1.0-1.8 g/cm³ is inherent, in addition, the unique set of elastic-plastic properties (Fig. 2).

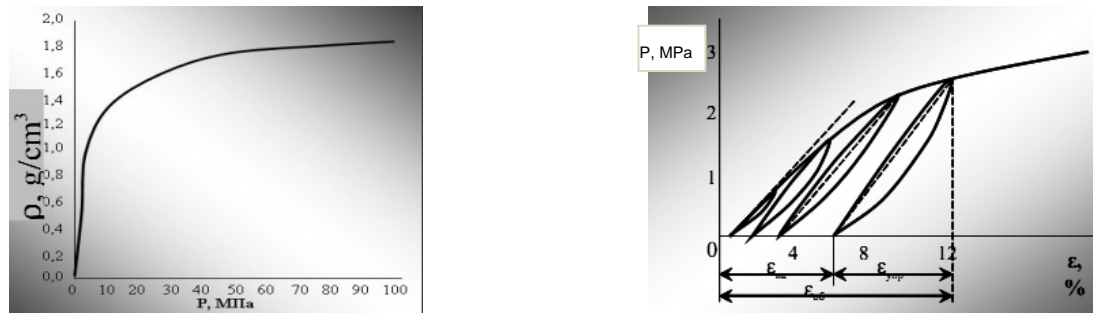


Fig. 2: EG: left – dependence of density from compaction pressure; right – compression diagram for restatic loading.

Therefore, they are widely used as sealing materials in modern engineering. The increase in wear resistance and elastic component of deformation provides the improvement of reliability and service

life of such seals. The aim of this research was to obtain a composite material EG/multiwall carbon nanotubes (MWCNT) (Fig. 3) and to study its mechanical characteristics.

Carried out by us researches of several nanocomposites showed that the introduction of MWCNT in the polymer, liquid metal, ceramic matrixes influenced on the supramolecular organization, in particular, the degree of crystallinity of filled polymers (γ) (Fig. 4), which is a nonmonotonic function of nanotubes concentration [2]. The system of liquid selenium - 50% vol. MWCNT solidifies almost completely into amorphous structure, in contrast to the polycrystalline structure in the absence of MWCNT. The introduction of MWCNT in an amount up to 1% wt. into hydroxyapatite at the synthesis stage orders the porous structure of matrix. Structural features clearly manifest in the concentration range up to and in the percolation threshold. Reinforcement by MWCNT leads to an increase in strength properties, particularly yield strength and elastic modulus of composite PTFE-4 (F4) / 15% MWCNT

increased by 2-3 times, its wear resistance increased by 100-200 times, abrasion of elastomer decreased by more than 3 times with partial replacement of carbon black on the MWCNT. MWCNT-filled rubbers have significantly increased resistance to solvents, oil, petrol and mineral acids.

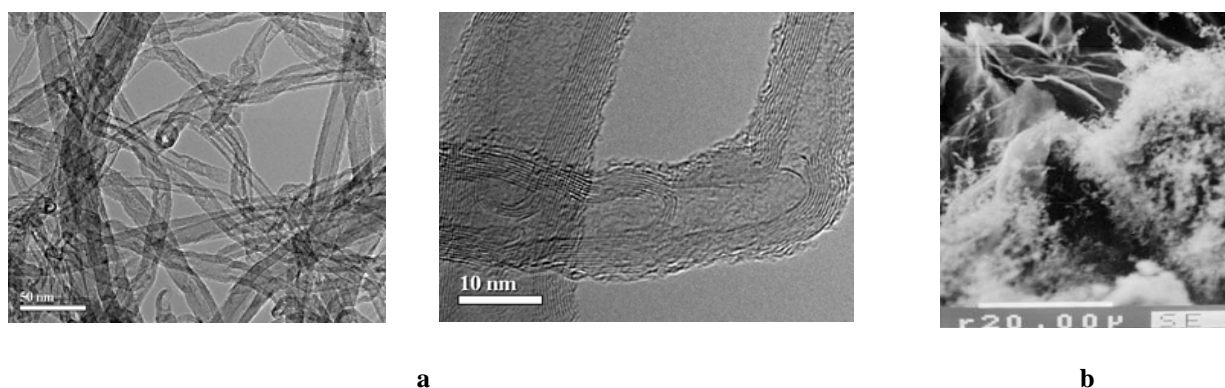


Fig. 3: a) - TEM of MWCNT; b) - SEM of composite EG / MWCNT;

Experimental : The method of obtaining multiwalled CNTs and their characterization are described in [3]. The average diameter of CNT was 10–20 nm, specific surface area determined by argon desorption was 200–400 m²/g, and bulk density was within 20–40 g/dm³. According to TEM, X-ray diffraction, Raman spectroscopy data, the noticeable amount of amorphous carbon presence was not detected. Large-scale production of MWCNT, as a rule, the method of vapor deposition (CVD), gives the MWCNT agglomerates in the form of tubes entangled with each other, with the size of 20-500 microns. At the same time, high performance composite materials filled with MWCNT can be obtained under the condition of uniform distribution in the polymer matrix. This leads to the need to find an effective method of dispersing the agglomerates of MWCNT.

We investigated the possibility deagglomeration of MWCNT in a homogenizer based on the cavitation effect in ethanol and its aqueous solutions, depending on the concentration of MWCNT, as well as in 3-5% aqueous solutions of glucose, handling in an ultrasonic disperser UZDN-2, universal homogenizer, using shear deformation together with the effect of cavitation in an aqueous dispersion of polymer in the presence of surfactants. Analysis of the status of the agglomerates was carried out by means of laser correlation spectroscopy. Function of particle size distribution was determined by laser correlation spectrometer «ZetaSizer-3» (Malvern Instrument, UK) with the correlator (multi computing correlator type 7032 ce).

Results and Discussion : Stable aqueous suspensions of MWCNT were obtained in the water-soluble polymer and ionic surfactant system with the simultaneous effect of shear deformation and cavitation mixing. The distribution of the agglomerates size was from 150 nm to 450 nm with an average size of 360 nm. EG is received by quick heating of hydrolyzed graphite bisulfate obtained by anodic oxidation in a reactor of continuous action. EG modified by MWCNT is rolled in foil, which received the thread, then weave in a pinch (stuffing). The results of mechanical tests on the compressibility and recoverability are given in Table.

Sample	Density, g/cm ³	Compressibility, %	Relative standard deviation, %	Recoverability, %	Relative standard deviation, %
foil EG	-	50.7	3.2	9.8	14.9
foil EG/MWCNT	-	53.4	3.0	11.5	2.8
packing EG	1.64	53.8	1.4	8.9	10.7
packing EG/MWCNT	1.66	46.8	2.7	12.4	2.4

As it is evident from the data presented, the recoverability of products is growing: for the foil by 17%, and for printing at 39%, with the introduction of only 0.1% wt. MWCNT in the composite. Also notable is the reduction of deviation from the average characteristics that are very important for industrial production.

Conclusion : It is shown that the MWCNT, along with the other matrices, are highly effective filler for carbon-carbon composite materials.

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LUMINESCENT AND MICROSCOPY CHARACTERIZATION OF THE GeO₂:Eu FILMS DOPED WITH GOLD NANOPARTICLES

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The investigated series of films comprise the samples of undoped germanium oxide films, films doped only with gold, films doped only with europium, and the films co-doped with gold and europium. Concentrations of activators were 3% or 5% and 10% for the gold and europium dopants respectively.

The films were deposited by sol-gel method on substrates using centrifugation of film-forming solution prepared from a GeO₂ sol (pH = 8.0, concentration 5 wt %) and aqueous solutions of HAuCl₄ and a europium tartrate complex. After drying, these films were annealed in air at different temperatures (T_{ann}). Structure of the films surfaces were studied using the optical microscope (OM) atomic force microscope (AFM). This investigation reveals formation in the films doped with gold of fractal aggregates whose sizes depend on annealing temperature. In particular, sizes of the most of aggregates are small $\leq 30\text{--}50$ nm for $T_{\text{ann}} = 800$ °C. The films without gold are not characterised by formation of a large amount of aggregates, this is confirm that observed aggregated are the gold nanoparticles (Fig. 1).

Thermal annealing and concentration effects on the spectral-luminescent properties of gel-films based on the GeO₂ co-doped with europium and gold were carried out. The favourable conditions of thermal annealing of the films and concentrations of the co-dopants, which give multiple rise of intensity of the Eu³⁺ ions luminescence, were founded [1]. It has been established that samples of the 87GeO₂–10Eu₂O₃–3Au composition annealed at $T_{\text{ann}} = 800$ °C show multiple increase of the Eu³⁺ luminescence intensities compared with samples of the 90GeO₂–10Eu₂O₃ composition.

Study of the excitation spectra and effects of irradiation on spectral-luminescent properties of the films were carried out in order to establish whether plasmon resonance of gold nanoparticles are responsible for increasing of the Eu³⁺ emission intensity or no. Excitation spectra were studied in the maximums of luminescence of the each sample: 615 nm for the films doped with the Eu³⁺ ions, 690 nm for film doped only with gold and 550 nm for the undoped film [2].

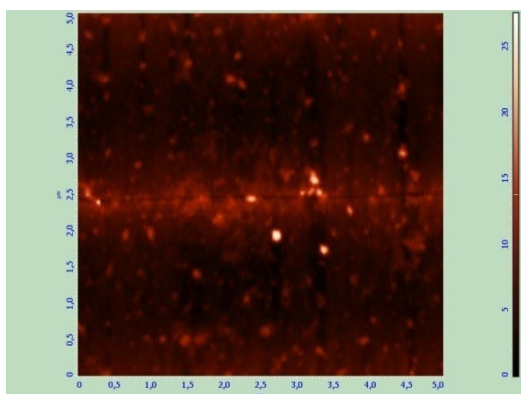


Fig. 1. The AFM (*d*) image of the 87GeO₂–10Eu₂O₃–3Au film.

We are able to suppose that for all types of emission main excitations take place with participation of processes in the matrix and the gold nanoparticles increase transfer of the excitation energy to emission centers. Various

positions of maximum of the long wave length band and its shape also reveal its complex characters and presence of some additional components caused by gold nanoparticles those increase intensity of the Eu^{3+} ions emission.

High resolution thermal imaging of the film's surfaces was made using scanning luminescent procedure developed by Lionel Aigouy in Institut de Physique, Paris, France. Obtained data confirmed mentioned above supposition about structure of the films.

Experiments with synchrotron radiation were carried out at SUPERLUMI station at HASYLAB, DESY, Hamburg, Project II-20080221. Fundamental Researches State Fund of Ukraine (Project # F29.1/038) also supported the work.

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GREEN NANOTECHNOLOGY AND INDUSTRIAL MODULAR LINES FOR MANUFACTURING OF ULTRA CLEAN LIQUID DISPERSIONS OF THE NOBLE METALS NANO PARTICLES - SILVER, GOLD, PLATINUM

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A new proprietary physical technology of ion-plasma sputtering of noble metals in vacuum (Localized Ion-Plasma Sputtering – LIPS) is described. Highly productive “dry-wet” one-step manufacturing cycle of nano metal particles implantation into various liquids in vacuum was invented [1] The new “dry-wet” LIPS technology allows to overcome known disadvantages of chemical (“wet”) and physical (“dry”) nano particles synthesis and to produce extremely clean highly concentrated nano metals colloidal solutions - no traces of any additional chemical reagents or wastes. Ability to implant nano metal particles to various carrier liquids allows to use concentrated nano colloids for modification of common ingredients in thousand end products (glycerin, oils, glucose, polysaccharides, etc.) creating a possibility to upgrade easily end product's consumable properties without changing traditional technology of their production.

Custom tailored metals nano particle colloidal solutions have been developed and certified, including particle size, distribution shape and carrier liquid for various applications. Multiple research methods as high resolution SEM (Ukraine), Dynamic light scattering (DLS) measurements (USA), Photon cross correlation spectroscopy method (Germany: device NanoPHOX NX-i009), High-speed centrifugation method (Shanghai University, China: device CPS DC 2400) have been provided for nano metals colloidal solutions studies. The results of this study suggest creating a reproducible technology of nano metals colloidal solutions manufacturing with controlled nano-sized particles of noble metals, stable colloidal solutions [2]. Various microbiological studies by leading microbiology and virology Institutes in Ukraine demonstrated the bactericidal, fungicidal and antiviral properties of nano metals colloidal solutions under specific concentrations. Toxicological passport for concentrated Nano Silver colloidal solution in food Glycerin (SS-1000) has been created by the State Institute of Toxicology and Ecohygien of Ukraine demonstrated no toxicity to human and pets [3]. The concentrate can be used as sanitized liquid dissolved with water (10 times) for treatment water and air, for cleaning of surfaces in hospitals, hotels, in transportation means, for cleaning of government buildings, homes, prisons, schools, restaurants, manufacturing sites, commercial buildings, so on.

A number of technical solutions have been integrated by the semi industrial prototype unit to assure high repeatability of the nano metal colloids. All the units is driven and controlled by a software that manages automatic process adjustments and in-line measurement of the characteristics of the produced colloids. LIPS Modular Unit with productivity 6 000 Liters of concentrated (100 mg/L and up) Nano Silver colloids per year is presented.

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FIGHTING THE CLIMATE CHANGE: THE PROTOCOL OF KYOTO OR HOW TO SAVE THE PLANET

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There has been an unprecedented awakening of the risks of the climate changes since the earth summit held in Rio de Janeiro in 1992. The wealthiest states and those mainly responsible for the most important emissions took their liabilities to reduce their greenhouse gas emissions by adopting in 1997 the Protocol of Kyoto. It succeeded to the United Nations Convention of 1992 on the climate changes, and is the most important International Judiciary Covenant aiming to fighting against the climate changes. It encloses obligations taken by industrialized countries to reduce their greenhouse gas emissions responsible for the planet climate warming-up. The developed countries total emissions had to be reduced to at least, 5% over the period 2008-2012, comparatively to the level attained in 1990. This period being over, there has been another agreement, negotiated in Doha in order to extend the protocol up to 2020, taking effect temporarily on January 1st, 2013 till its entry into force officially. This second period of the engagement under the Protocol of Kyoto preserving, hence, the unique constraining agreement under the disposal of International community, will be pledged for eight years (2013-2020) by state parties to bring to a successful and global reduction of the greenhouse gas emissions at less than 25 to 40% with regards to the levels of 1990 up to 2020.

Unfortunately, the Protocol of Kyoto is a constant disagreement matter between Europe and the United States of America because the latter refuse to ratify it while they are responsible at the origin of more than a quarter of the world greenhouse gas emissions. In the meanwhile, emerging countries such as China and India are not included in this Protocol despite their high rate growth and their important provisional pollution as important as those of the United States of America if not more. Moreover, in adapted to the new world economic deal, the Protocol of Kyoto is contested by several countries and some have even completely left the "Ship" because it does not engage the United States of America and the emerging countries. As a result, this protocol cannot save the climate even if its act II is already signed. In Doha, the negotiators did not cut off the subject; they will have to re-open the debate from now to 2015, expected date for the signature of the future 2020 treaty.

Nevertheless, its contents will not be fully rejected to build a new and more ambitions tool. To understand this International mechanism for the protection of the environment and the fight against climate warming-up, it is important to be acquainted with it through its functioning, its objectives and its stakes.

EFFECT OF DISPERSION AND PARTICLES MORPHOLOGY ON PERCOLATION PROCESS OF TRIFLUOROCHLOROETHYLENE AND CARBON POWDER MIXTURES DURING THEIR COMPRESSION AND SINTERING

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The development of physical principles of production and investigation of conducting polymer nanocomposites (PNC) is currently an urgent problem of modern material science. The optimization of significant characteristics of those materials advance them to the front among the materials of the electric destination. They can be used in the making the elements of electrical heater, electromagnetic shields, strain sensors, electrostatic precipitators etc. In comparison with products which are fabricated from metals and ceramics they have a lot of advantages. PNC possess higher corrosion resistance and low density. They are easy workable, elastic and fatigue-resistant. The manufacturing cost of polymer nanocomposite materials (PNCM) is also low. Traditionally, conductive fillers, such as metallic powders, natural graphite, carbon black etc. are used in PNCM fabrication. The considerable changes of the percolation threshold (C_c) (C_c is the concentration of filler in which the "infinite" cluster is form in polymer matrix and composite material becomes conductive) could be caused by dispersion degree and morphology of the filler particles. Particularly, $C_c \approx 34$ vol.% for conductive compositions filled with equiaxial particles of micron sizes Usually, the addition of large amounts of fillers to polymers results in low mechanical performance of composites. Meanwhile, in a case of PNCMs the value of C_c does not exceed 6 vol.%. Such concentration and nanodimensionality of a conductive component provide even the improvement rather worsening of the mechanical characteristics.

Besides the morphology and dispersion of the powder particles, the uniformity of their distribution in mixture, adhesive ability, compacting conditions and their influence on the structural changes in the matrix are the important factors in fabrication of PNCM from powder mixtures. The effect of such parameters on the characteristics of fluoroplastic (FP) – thermo-exfoliated graphite (TEG) PNCMs are here reported.

The shape of TEG obtained from the natural graphite by thermal shock is vermicular (Fig.1 a). These worms consist of ordered flakes, the distance between which being varied from 10 nm to 10 μm . The size of the separate fragments is ranged within several to hundreds nanometers. The surface area of TEG is about $50 \text{ m}^2/\text{g}$. Mechanical grinding changes the morphology of the particles. In a result the density of TEG increases from 15 to about 150 kg/m^3 with the decrease of the particles size to $40 \mu\text{m}$. The resistivity of the cell with FP-TEG powder mixtures measured longitudinally to the pressure direction decreases with the reducing of the dispersion degree (the cross-section of TEG particles) to $40 \mu\text{m}$, while the percolation threshold increases from $(4,9 \pm 0,1)$ to 15 vol.%.

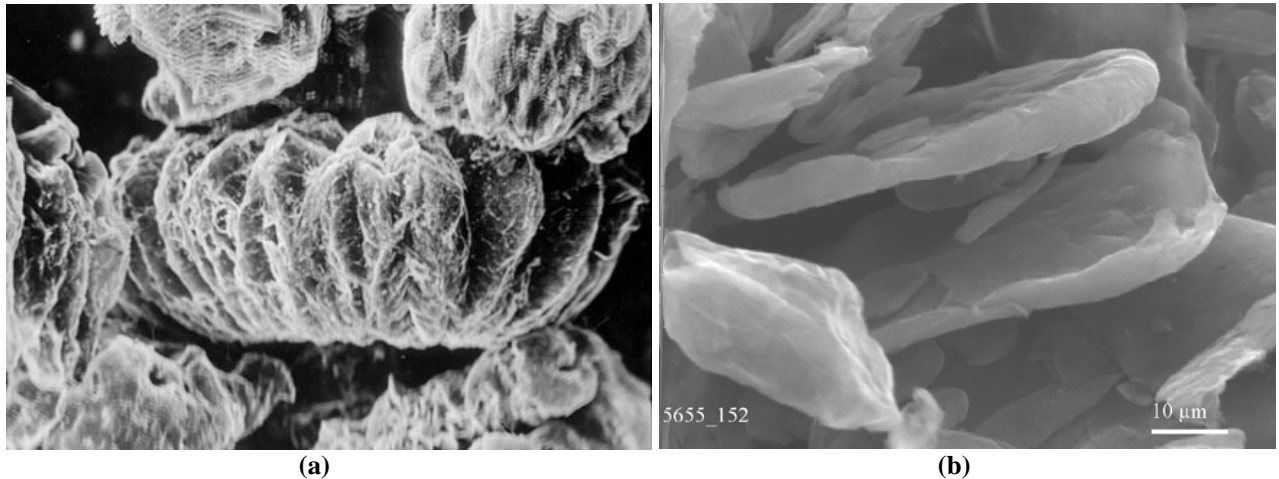


Fig. 1. The microstructure of thermally exfoliated graphite: (a) – initial, (b) - after dispersion.

Such behavior of composite mixtures is caused by a decrease of the TEG ability to form the “infinite” conductive clusters with the rising of the dispersion degree of TEG particles. Besides, the rising of graphite dispersion increases the contribution from the particles interfaces to the total resistivity. Due to the fact that the dispersion of TEG powder brings the particles form closer to equiaxial, the anisotropy of ρ longitudinally and transversally to the powder compacting direction decreases. The increase of the compression degree of such powder makes the value of the ρ anisotropy low, dependent on the compaction pressure, in the range from 5 to 45 MPa. Compressive strength (σ_{pr}) of mixtures compacted at $P = 45 \text{ MPa}$ decreases with the decrease of the size and content of TEG particles. The pure TEG has $\sigma_{\text{pr}} = 18 \text{ MPa}$, while in a case of FP+TEG PNCMs with the content of TEG $C = 5 \text{ vol.}\%$ it drops to $2,5 \text{ MPa}$. At the same time almost twice increasing of both the tensile and compressive strength of sintered PNCMs was observed in a case of specimens containing the higher dispersed TEG and the optimal concentration of filler about 20 vol.%.

PTB, SPIN COATING, OPTICAL PROPERTIES, THIN FILMS, ORGANIC SOLAR CELLS CAN WE ADDRESS THE CLEAN ENERGY CHALLENGE WITH NANOTECHNOLOGY ?

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In order to limit green-house-gas emissions, 10 TW of carbon-emission-free power should be produced by the year 2050. To achieve this target, a country should push forward for Research and Development more than one advanced technology in order to stay in the front line and achieve and fulfill its national energy policy drivers. Talking about solar energy production, numerous technologies based solar cells are currently coexisting, where some technologies are already commercialized (like Si-PV cells) and others are still under research and development and optimization. However, the high cost of silicon based solar energy production, because of high

cost of material and fabrication development, has posed an intrinsic limitation and has helped emerging new technology based on nanostructured materials ending to efficient devices and cheap fabrication process. Nanotechnology based new materials are also going to develop and improve actual Si-PV solar cells by using silicon nanoparticles.

Yet, no single technology based solar cell can claim the general superiority over other, but a basket of technologies is likely to be preferable to a single technology in order to meet the demand in energy.

DSSC (Dye Sensitized Solar Cells) and Quantum-Dots based solar cells become validated competitors to silicon conventional solar cells, having power efficiency as high as 12.3% for DSSC (Science 2011).

In addition, this contribution will highlight on two very promising and cheap, **a good and a bad** nano-structured based solar cells. The **good** one (Ruthenium complex and/ or a free-metal organic based DSSC, which has reached an efficiency of 12.3%), is a candidate for a large scale application. A second one as a **bad** (FeS_2) based nanostructured solar cell, is under a very limited research study but could be a far future favorable candidate because of its abundance, environmental compatibility, high stability toward photo-corrosion as well as its very good absorption in the visible region.

In order to achieve the national energy policy drivers of a country namely, Energy security, Economic growth and Environmental protection, a national solar energy project or any similar project should consider only a basket of the most promising technologies with an efficient cost-quality ratio 10 to 15% of all solar modules should be based on other competitor technologies, more specifically those based on nanotechnology fabrication.

Keywords: DSSC, Quantum-Dots, Nanotechnology, FeS_2 , Environment.

MICROSTRUCTURAL STUDY OF SOME KAOLINS BY WARREN-AVERBACH AND WILLIAMSON-HALL METHODS

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In this work, we have studied two kaolins which have been obtained from different places. The first one denoted M1 consists of two main phases (kaolinite and halloysite) and the other M2 whose main constituents are kaolinite, quartz and mica. Our choice was set on the component that is Kaolinite because of the existence of the latter in both kaolins. Lorentz-Polarization correction was carried out prior to the diffraction data, which has been achieved using LWL program. The true profile was extracted using this program. The methods used for the micro structural analysis of the constituents in the two kaolins are the Warren-Averbach and the Williamson-Hall methods. Scherrer's relationship has been applied in cases where the compound is devoid of strains.

The study revealed that the Kaolinite of M1 is devoid of micro constraints, while similar analysis has shown that the Kaolinite in M2 incorporates the strains. This was confirmed by the Williamson-Hall method as well as Fourier analysis. The evaluation of strains in the kaolinite of M2 has been done by the method of Warren-Averbach and the Williamson-Hall diagram. The average value of this constraint found by the first method gave us 0.15 and 0.21 by the second method. The average size of crystallites of the Kaolinite in M1 was found to be in the range 115-145 Å using the method of Warren-Averbach and about 118 Å by the method of Williamson-Hall, while, the size of crystallites in M2 was respectively 98 Å and 130 Å using the two methods.

The study of the size distribution showed that the dominant size of kaolinite in M1 and M2 is about 40 Å (42%) and 58 Å (32%) respectively.

Keywords: XRD, LWL method, crystallites size, micro constraint, Williamson-Hall methods, Warren-Averbach method.

MANAGEMENT TRAITS OF THE PROJECTS CONCERNING POWER GENERATION AND WASTE RECOVERY

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Nowadays a large number of motivations and a growing interest exist for the development of renewable sources of energy, like energy systems based on biomass. Organic waste recovery as a component of the environmental protection is widely recognized to be a preemptive trend in the innovation development all over the world.

The aerobic and aerobic-anaerobic fermentation of the organic feedstock including those based on modern nano-biotechnologies are considered currently as prospective technologies that permit to exclude the using of conventional lagoon and to reduce significantly the emission of the greenhouse gases (carbon dioxide, methane etc.). These technologies are realized in a form of the integrated bioenergy complexes (IBCs). So, the principal advantages of IBCs are the total waste recovery, production of biogas, biofertilizers and fuel palletes and low amount of the greenhouse gases.

The integrated bioenergy complex for organic waste recovering, through the production of several different co-products (Fig.1), provides the profitability of the enterprise activity.

Summarizing the scheme presented at Fig.1 it should be noted:

1. The enterprise could cover 40 to 160% of energy needs due to the produced electric energy. So, it is possible to get benefits in term of “feed-in tariff”.

2. The proceeds from the AAU sales should be “greened”, i.e. channeled to the development and implementation of the projects either acquiring the greenhouse gases emission reductions (hard greening) or building up the necessary framework for this process (soft greening).

3. Heat energy is consumed in the fermentation process and for after heating the business premises.

4. Biofertilizer as a final product of the integrated bioenergy complex operation could totally substitute the mineral fertilizers since it contains an optimal combination of the macro- and microelements and also the plant growth stimulants.

The engagement of the project management technologies in the fulfillment of the innovation projects in the field of power generation and waste recovery is now recognized to be of great significance. Here, peculiar work and organization breakdown systems (WBS and OBS) are required, since a number of different specialists (building experts, field and power engineers, environmentalists, etc.) should be mobilized for the project realization being successful. Besides, the seasonal aspects that influence technological conditions of the biofertilizer operation should be also taken into account in order to reduce of the heating expenses at the initial stage providing the maximal vital activity of methane-oxidizing bacteria.

Here, the project of the biofertilizer construction at the chemicals plant is considered. The appropriate WBS structure and the algorithm of its strategic evaluation have been proposed.

Selected characteristics of the considered project are presented below.

Raw materials – household and industrial waste water, ensilage rush.

Technology – aerobic-anaerobic fermentation.

Operation mode – thermophile (55° C).

The tentative economic indexes of the project on the power generation and waste recovery are presented in Table.

The data of strategic evaluation permit to select the relevant technology, to define the risk assessment and resource requirements in accordance with business and operational plans and to compose network diagrams and Gantt chart of the project.

DSC STUDY OF FLUOROPLASTIC CONTAINING 20% OF THERMALLY EXPANDED GRAPHITE

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The expansion of polymer blends for the acquisition of new associations with interesting physical features and minimizing technical sales ratio are current. Many researchers routinely work to improve and make competitive this new class of materials and replace natural products which become scarce and expensive.

The aim of this work is the study of the calorimetry (DSC) behavior according to the variation of the heating rate of fluoroplastic containing thermally expanded graphite.

We have used fluoroplastic with a concentration of thermally expanded graphite of 20% by weight and dispersion between 60-100 μm . Three heating rates 5, 10 and 15°C/min were considered.

The results show that the heating rate greatly affects the behavior of the material. It varies the shape of the DSC curves of the compound when going from 5, 10 and 15°C/min.

The behavior of the mixture presents a calorimetric curve containing a peak located at about 230°C. Its intensity varies from single to double by the heating rate, the temperature also changes its emergence depending on the heating rate. The intensity of the peak is twice large when the heating rate is 15°C/min compared to the other two rates. From either sides of this peak, the DSC values fell sharply.

At 10°C/min, the peak is at around 220°C. In the low temperature range, DSC varies monotonously while on the right of this anomaly, the DSC increases sharply.

At the rate of 5°C/min, the peak is less intense compared to the two other rates and the temperature of its emergence is the lowest at 210°C. In the low temperature range, the values of the DSC reduce from ambient to 200°C. Alternatively, in the interval 220-350°C, the DSC values are almost constant.

Thus the peak intensity depends on the heating rate. It also increases with increasing heating rate. The temperature of the occurrence of the calorimetric anomaly also increases with increasing heating rate.

Keywords: fluoroplastic, expanded graphite, dispersion, DSC.

RBS CHARACTERISTIC OF Cd_{1-x}Zn_xS THIN FILM FABRICATED BY VACUUM DEPOSITION METHOD

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In recent years, group II–VI compounds (e.g., CdS, ZnS, CdSe, ZnSe) have been often used for the preparation of light emitting diodes because of their good luminescence properties. combination of the two films CdS and ZnS produce an Cd_{1-x}Zn_xS thin film which has properties between those of ZnS and CdS, it has a larger energy gap than CdS, thus becoming transparent to practically all wavelengths of solar spectrum, which makes the material much more attractive for the fabrication of solar cells (e.g. CdTe solar cell), it have been widely used as a broad band gap, window material in hetrojunction photovoltaic solar cells with minimum lattice mismatch in the devices.

In this work, Cd_{1-x}Zn_xS thins films have been fabricated from ZnS/CdS/ZnS multilayer thin film systems, by using the vacuum deposition method; chemical treatment in CdCl₂ and thermal treatment at 400°C for 15min have been used to achieve homogeneous Cd_{1-x}Zn_xS thin films, then we have applied the Rutherford backscattering (RBS) technique in order to investigate the: structure, the composition, depth profile, and stoichiometric of these films. The RBS spectra of the films showed that homogenous Cd_{1-x}Zn_xS can be synthesized with x=0.45.

PROPERTIES AND NATURE OF SOME BI-CONTAINING PHOSPHATE/MOLYBDATE COMPOUNDS LUMINESCENCE AND ITS POSSIBLE APPLICATIONS

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Bismuth phosphates/molybdates and alkali metal both undoped and doped with luminescent ions have attracted much attention last decade due to their practical applications as effective components for white light emission diodes and laser materials [1, 2]. Due to close ionic radii, the Bi³⁺ cations can be easily substituted by the RE³⁺ dopants, so a lot of types of RE-doped compounds from the mentioned families were synthesized so far (particularly, in form of micro and nano-sized powders) and studied by spectroscopic methods. While the luminescence properties of the RE-doped Bi-containing oxide compounds were studied intensively, lesser attention was paid to study their electronic structure, origin of intrinsic luminescence and mechanisms of excitation energy transfer. However understanding of the luminescence mechanisms of undoped hosts is an indispensable condition for elaboration of effective luminophores on the base of the RE-doped crystals. In this work we used the luminescent and optical spectroscopy studies under various types of excitations together with electronic structures calculations for pure and RE-doped Bi-containing compounds in order to establish the origin of intrinsic emission centers in mentioned compounds.

The polycrystalline samples of undoped and RE-doped BiPO₄, K₃Bi₅(PO₄)₆, K₂Bi(PO₄)(MoO₄), K₂Bi(PO₄)(WO₄) and K₅Bi(MoO₄)₄ (RE = Eu, Tb, Pr, Tm, Ce) crystals were synthesized by spontaneous crystallization method. The PL emission and excitation spectra were measured under excitation with synchrotron radiation (4 – 25 eV) at SUPERLUMI station at HASYLAB (DESY), Hamburg, Germany. Dependencies of luminescence intensities and decay times on temperature were obtained under N₂-laser excitation (λ_{exc} = 337.1nm) in 4.2 – 300 K temperature region. Diffuse reflectance spectra of fine-grained powdered samples were measured at

300 K using double-beam spectrophotometer. Absorbance spectra were calculated from the diffuse reflectance using the Kubelka-Munk relation. The electronic structures of the perfect crystals were calculated by the FLAPW method realized in Wien2k program package [3].

PL emission spectra of all undoped compounds obtained under synchrotron excitation are characterized by complex emission bands in 400-850 nm spectral region. The temperature quenching of emission intensity occurs well below 300 K for all these samples. Luminescence excitation spectra of all studied RE-doped samples registered in emission bands inherent to corresponding RE³⁺ ion, reveal excitation bands clearly identified as the band-to-band excitations. Calculated partial densities of states indicate that the Bi cations, as well as MoO₄ groups in the molybdate hosts, play a dominant role of in the processes of luminescence excitation. Analysis of diffuse reflectance and luminescence excitation spectra allows estimation of the energy gap (E_g) parameters of the studied compounds. Temperature dependencies of decay time constants and emission intensities show that “blue-violet” emission components have the Bi³⁺-related origin whereas emission components of the molybdate crystals in the red spectral region are related to transitions in MoO₄ groups.

Obtained data were used to observe possibility to develop new tips for luminescent nano thermometers, especially concerning scanning nano resolution thermal imaging.

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THIN FILMS PREPARATION, UV-VIS ABSORPTION AND PHOTOLUMINESCENCE PROPERTY OF CDSE NANOPARTICLES DISPERSED IN PMMA MEDIUM.

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The content of this work deal with the preparation method, the effect of dimensional confinement and the influence of the nanoscale size on the optical properties of materials compared to those of bulk phase. CdSe nanoparticles have been prepared by mecanosynthese route then dispersed in PMMA medium to elaborate nanocomposite material CdSe/PMMA in thin film form by spin coating process the sample was characterized by X-ray diffraction, UV-vis optical absorption, and photoluminescence spectroscopy analyses. XRD patterns showed that CdSe nanoparticles have hexagonal unit cell structure. The UV-vis absorption spectrum of these dispersed NCs exhibit excitonic peaks at 2.67eV resulting from the electron-hole coupling transitions, attributed to optical gap energy and corresponding to a blue shift of the band edge equal to 0.93 eV due to nanosized CdSe .From UV-Vis absorption spectrum and by using the effective mass approximation model (EMA) the average particle size can be estimated to be 2.92 nm. Photoluminescence spectrum exhibits three emission peaks one at 538nm corresponding to band gap excitonic emission and another located at 581nm and at 699 nm.

Keywords: PMMA, Optical gap energy, EMA, NCs, quantum confinement, exciton.

ATOMIC FORCE AND TUNNEL MICROSCOPY OF ALUMINUM NANOISLANDS

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Scanning atomic force microscopy (AFM) and scanning tunneling microscopy (TM) were proven to be extremely useful experimental techniques for characterization of thin films on metal or semiconductor substrate. The technique allows obtaining the films' valuable characteristics on interatomic distance spatial resolution level. The goal of this research is to study aluminum island films deposited on silica by atomic force microscopy and scanning tunneling microscopy techniques. Aluminum and alumina film's properties are especially interesting because the aluminum together with copper, gold and aluminum-copper alloys is an essential part of most modern electronic devices.

Aluminum islands films on silica substrate were thermally deposited in vacuum. The equipment is directly installed in the vacuum chamber which allowed controlling of the aluminum temperature, deposition speed and substrate temperature. The deposition time interval was a few seconds, and the pressure in the vacuum chamber reached 10^{-5} torr during the deposition process. A microscope INTEGRA NT-MDT, allowed measurements conducting in atomic force microscopy and tunneling microscopy regimes was used for precise surface topology study. Spatial resolution was determined by cantilever tip curvature and reached 40 nm in lateral plane. Scanning tunneling microscopy spatial resolution reached up to 1 nanometer.

Aluminum nanoislands film surface topography obtained by atomic force microscopy semicontact measurements are presented in Fig. 1 (The film was obtained by thermal deposition during 20 seconds). The size of islands varies distinctly from tens to a few hundred nanometers and this data points out a complicated island nanoscaled topology.

In order to study the islands' structure more carefully we applied scanning tunneling microscopy technique. Typical scan results with space resolution of 1 nanometer are presented in Fig. 2.

The dark background on the picture, which has lower electric conductivity, comparing with neighboring regions, is originated from silica substrate. Secondly, the distinct rhomboidal gray structure (additionally marked by four white straight lines) with the height above the substrate roughness seems to be formed by alumina thin layers. The porous aluminum monoatomic layers exist just near the substrate surface and its' rhomboidal shape is influenced by silica face centered cubic lattice. Finally, the film structure in the places with higher thickness has nonrhomboidally.

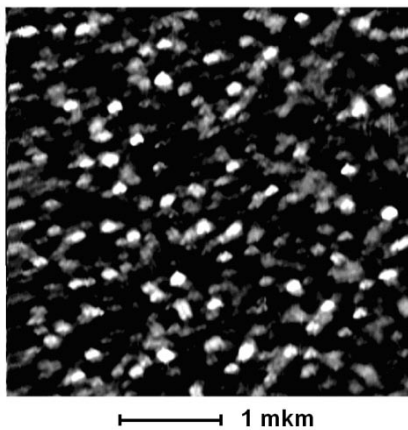


Fig. 1. AFM scan of surface of aluminum islands films on silica substrate.

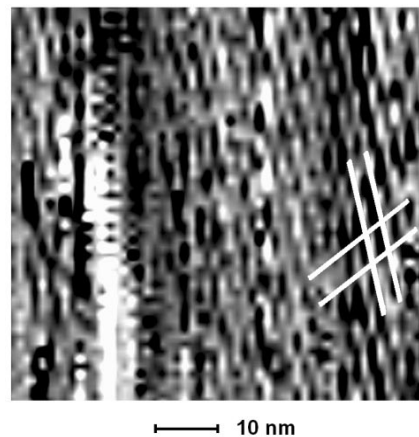


Fig. 2. Scanning tunneling microscopy scan of surface of the aluminum island on silica substrate. Spatial resolution is 1 nm.

Despite of relative experimental complicatedness scanning tunneling microscopy techniques demonstrated a high effectiveness for aluminum nanoislands characterization. The presented results describe properties of an interface layer in the islands near the substrate surface. The layer has an ordered structure which was influenced by the substrate crystal lattice symmetry. Given results can be used for design of nanoscaled integration level chips.

MORPHOLOGY, STRUCTURAL AND OPTICAL STUDY OF NANOCRYSTALLINE ZnS THIN FILMS PREPARED BY CBD AND SILAR METHODS

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The Zinc sulfide belongs to group II-VI compound semiconductor materials. ZnS is a very important semiconductor material with a large optical gap (> 3.5 eV), a large utility in thin-film devices, such as photoluminescent devices. In addition, the ZnS is an important material in the small emitting diodes in wavelength and in solar cells based layers as thin buffer layer heterojunctions. In this work, we became interested in the development of thin layers of a semiconductor type II-VI: Zinc sulphide (ZnS), and the study of optical and

structural which were prepared by two techniques the chemical bath CBD (Chemical Bath Deposition) and SILAR (Successive Ionic Layer Adsorption and Reaction). Our goal is to provide a comprehensive study on the effect of deposition time and the number of cycles on the physical properties of thin films of ZnS. In the first part of this work we have developed deposition techniques, the second part, relates to the development of a series of films with different deposition conditions for a process optimization in order to obtain films with good optoelectronic properties to be applied optionally in photovoltaic. We then conducted analyses of samples prepared by different characterization techniques: XRD and optical measurements.

Keywords: ZnS buffer layer, SILAR, CBD.

INVESTIGATION AND QUANTIFICATION OF MONOATOMIC DOPINGS ON BINDING ENERGY OF NANO-SILICON CLUSTERS

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Physical and chemical properties of atomic clusters of group-IV elements are receiving a lot of research investigations due to their potential applications in several modern nanotechnological devices. Particular research interest is shown in fundamental and applied aspects of nanosilicon clusters whose properties lie between those of individual atoms and the properties of bulk materials. Therefore, such properties would greatly be affected by the number of atoms, n , constituting these clusters and the binding energy, E_b , between atoms. In this context, we study the variations of E_b as a function of n for small sized clusters ($2 \leq n \leq 20$ at) of intrinsic nano-Si as well as monoatomic doping effects with (i) transition metals: Ag, Au, Co, Cu, Fe, Mn, Ni, Ti, (ii) rare earth: Eu, Gd, La, Lu, Tb, (iii) non metals: C, P & (iv) alkali metals: Na. To do so, we selected the most widely reported computing methods: (a) Hartree-Fock (HF) and Post HF, (b) Density functional theory (DFT) with Local Density Approximation (LDA), Generalized Gradient Approximation (GGA) and functional hybrids. Finally, the results are quantified semi-empirically in order to deduce relations between binding energy and cluster sizes for different doping elements. The obtained curves of E_b versus n_{Si} showed similar behaviors for all dopants and with various methods; these curves can be divided into three regions: an initial sharp increase ($2 \leq n \leq 5$ at), followed by a transition region ($5 \leq n \leq 10$ at) and ending by a saturation region ($n > 10$ at). A close analysis of regions I and II, i.e., for ($2 \leq n \leq 10$ at) led to the following observations: (i) similar variations (E_b increases with n), but not sensitive to the choice of neither the dopant nor the method, (ii) the variation of E_b versus n takes an exponential form whose quantification was found to be of the form: $E_b = C + \alpha \exp(-n_{Si}/\beta)$ with C , α and β being characteristic constants which we deduced for each method and its variants (iii) similar variation for doped nano-Si clusters calculated by the same method: the increase in atomic radius, R_{at} , of the dopant atom causes a decrease in E_b and (iv) the E_b for doped nano-Si clusters put into evidence the great effect of the doping element. This effect may provide a useful way of controlling the binding energy by choosing an impurity atom to dope Si clusters. Moreover, the importance of the above deduced formulas lies not only in their applicability to all dopants and methods but also in the possibility of predicting binding energies for known atom numbers in clusters and vice versa.

Keywords: Doping, Nanosilicon, Clusters, Binding energy.

CHEMICAL KINETIC MODELING OF HYDROGEN-ENRICHED NATURAL GaS BLEND OXIDATION

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Natural Gas Vehicles fueled with a new fuel made of a hydrogen/natural gas blends (HCNG) is being considered as initial step towards hydrogen economy. Small percentage of hydrogen mixed into compressed natural gas (CNG) is known to improve emissions performance of Internal Combustion Engine (ICE) powered compressed natural gas vehicles (CNGVs). Indeed the chemical kinetics effect of hydrogen addition on methane or natural gas chemical reaction process was not well understood. Although the chemical kinetic mechanism of both methane and

hydrogen are reasonably well understood, but the combination of methane and hydrogen in goal to form a new fuel may demonstrate different behavior. In the same vein, the objective of this study is to clarify the behaviors of engine fueled with HCNG mixtures blend of 8 % hydrogen in natural gas by volume, to analyze the influence of chemical kinetics on the combustion efficiency, other to confirm the feasibility of using blends of hydrogen and natural gas to improve the performance, controllability and emissions of CNG engines.

The chemical kinetic modeling of combustion in the presented blended Fuel, we enabled us to examined the possibility of increases of the natural gas blend reactivity with this proportion auditing and his effect on reducing the ignition delay of the mixture in comparison with higher proportions of hydrogen addition in the mixture, and to calculate the reaction order to determine the species and intermediate radicals involved in this reaction mechanism.

Keywords: *Internal Combustion Engine, Compressed Natural Gas Vehicles, Hydrogen, Methane, Hydrogen/Natural Gas Blends, HCNG, Chemical Kinetic Modeling, Intermediate.*

OPTICAL PROPERTIES OF PLASTIC SHEET WITH EMBEDDED VOLUMETRIC LASER ENCODING

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It is important to improve methods for laser-marking and identification of physical objects. Earlier the volumetric laser marking of objects was developed [1]. The practical results and samples created with the different methods and approaches for volumetric laser marking and recording of digital information require rigorous analysis and interpretation. For successful accomplishment of this a task an appropriate experimental protocol incorporating adequate inspection methods and measurement techniques is essential.

It is important to improve methods for laser-marking and identification of physical objects. Earlier the volumetric laser marking of objects was developed [1]. The practical results and samples created with the different methods and approaches for volumetric laser marking and recording of digital information require rigorous analysis and interpretation. For successful accomplishment of this at ask an appropriate experimental protocol in corporating adequatein section methods and techniques measurements are essential.

We present experimental measurement results obtained by multiple-angle-of-incidence, single-wavelength ellipsometry, employed for inspection of a transparent flat 2 mm thick plastic sheet sample with embedded volumetric laser encoding. The marking layer was formed in the bulk of the sample by recording a pattern of energy levels ($J = 7 \mu\text{J}$, $J = 14 \mu\text{J}$, and $J = 22 \mu\text{J}$) were established for the individual laser pulses and each pair of marks was created by double-pulse laser irradiation. The optical polarization parameters of the examined sample were evaluated using a laser ellipsometer with light wavelength $\lambda = 632 \text{ nm}$. The ellipsometric parameters as the phase shift Δ between the p- and s-components of the polarization vector and the azimuth Ψ of the restored linear polarization were obtained as dependencies on the light incidence angle φ (Figure 1).

The angular dependencies $\Delta(\varphi)$ and $\Psi(\varphi)$ are plotted in Figure 1 for a range of angular values bracketing the Brewster's angle ($\varphi_B = 57.7^\circ$ as defined at $\Delta = 90^\circ$) denoted by vertical dashed lines. The value of φ_B turns out to be practically the same for the unmarked area (curve 1) and for the area marked by laser pulses with energy of $J = 22 \mu\text{J}$ (curve 2). The position of the minimum of $\Psi(\varphi)$ (Figure 1(b), curve 2) is slightly raised and shifted to the right of the Brewster's angle (dashed line) that is, toward higher angles.

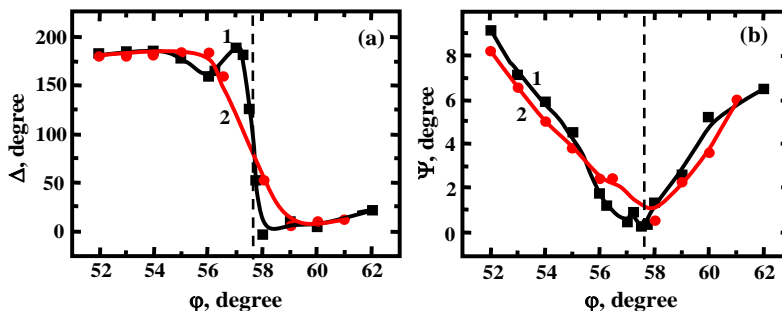


Figure 1: Angular dependences of the ellipsometric parameters Δ (a) and Ψ (b) for the unmarked (initial) area of the plastic sheet (curve 1) and for the area with laser-induced marks (curve 2). Horizontal positions of the dashed vertical lines correspond to the value of Brewster's angle.

Observed invariability of φ_B and only negligible changes in the angular dependence of Ψ constitute strong evidence that the laser-induced formation of small marks conducted within the scope of our experiment caused no significant global disturbance in respect to the total encoded area. The formation of local damage spots in a plastic sheet by employing laser pulses with different energies does not, therefore, change the state of the plastic matrix.

For characterization of the marked layer, a special *slope phase field* parameter $\delta\varphi_s$ can be used. The slope phase field is the range of light incidence angles φ (at the abscissa axis) within which the phase shift Δ sharply changes from 180° to 0° . In our case, $\delta\varphi_s$ is analyzed where $\cos\Delta$ sharply increases i.e. from -0.9 to 0.9 (Figure 1(a)). As seen, the slope phase field value for the marked area irradiated with $J = 22 \mu\text{J}$ (curve 2) is larger than the $\delta\varphi_s$ for the unmarked area (curve 1). The $\delta\varphi_s$ parameter can be employed for estimating average sizes and surface densities of laser-induced marks in encoding layers created in other experimental setups and with different methods.

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CANCER BIOMARKERS: EMERGING ROLE OF NANOTECHNOLOGIES.

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Introduction: Cancer is a world-wide health problem and the implication rate as well as the death rate increase year to year. Nanotechnology holds great potential for overcoming many of the problems that conventional methods face in the treatment, diagnosis and detection of cancer.

Materials and Methods: This paper highlights the properties of nanotechnologies in early detection, screening and diagnosis of different tumor types. So, we reviewed recent literature employing nanotechnology approaches in cancer research.

Results and discussion: Novel nanotechnologies can complement and augment existing genomic and proteomic techniques employed to analyze variations across different tumor types, thus offering the potential to distinguish between normal and malignant cells. Sensitive biosensors constructed of nanoscale components can recognize genetic and molecular events and have reporting capabilities, thereby offering the potential to detect rare molecular signals associated with malignancy. Another area with near-term potential for early detection of cancer is the identification of mutations and genomic instability in situ.

Conclusions: Nanotechnology has promising potential in enhancing early detection and present new ways of cancers diagnosis.

Keywords: Cancer; molecular diagnosis; nanoparticles; nanotechnologies.

PHYSICAL MODELING OF HIGHLY DENSE PERIODIC ARRAY OF CARBON NANOTUBES

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In 1991, Iijima discovered, carbon nanotubes (CNTs) that have since been an intensive research [1]. Given their exceptional intrinsic properties, they become very interesting in many fields of science and technology. Especially in the field of electronic structure their remarkable electrical and mechanical properties have attracted much interest in their application for nanoelectronics components, their one-dimensional (1D) and the nature of their carbon atoms makes very sensitive to the charge, chemical properties allow advanced chemical functionalization, and their mechanical properties make them compatible with most substrates.

Keywords: carbone nanotube, nanoelectronics, electronic structure, electrical properties, proprieties properties.

STUDY OF THE CHARACTERISTICS CURRENT-VOLTAGE AND CAPACITY-VOLTAGE OF GATE CONTACT IN AlGaN/GaN HETEROSTRUCTURES WITH DIFFERENT ALUMINIUM (Al) COMPOSITION

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The aim of our work is to study the effect of variation in aluminium (Al) composition ($x_{Al} = 0.24$ and $x_{Al} = 0.28$) over the characteristics IGS(VGS) and CGS(VGS) of Au/Mo/ Al_xGa_{1-x}N/GaN/SiC structures.

The current-voltage (I-V) and capacitance-voltage (C-V) of Au/Mo/ AlGa_xN/GaN structures were investigated at room temperature. The electrical

parameters such as ideality factor (1.6 and 1.45), barrier height (0.62 eV and 0.50 eV), series resistance (53.30 Ω and 72.72 Ω) were evaluated from I-V data for the structures with $x_{Al} = 0.24$ and $x_{Al} = 0.28$ and the doping concentration ($2.6 \times 10^{16} \text{ cm}^{-3}$ and $1.23 \times 10^{16} \text{ cm}^{-3}$), the 2DEG sheet carrier density n_s ($7.08 \times 10^{12} \text{ cm}^{-2}$ and $8.06 \times 10^{12} \text{ cm}^{-2}$) and the interface state density N_{ss} ($2.97 \times 10^{13} \text{ eV}^{-1} \text{ cm}^{-2}$ and $3.65 \times 10^{12} \text{ eV}^{-1} \text{ cm}^{-2}$) were evaluated from C-V data for the two structures Au/Mo/ Al_{0.24}Ga_{0.76}N/GaN/SiC and Au/Mo/ Al_{0.28}Ga_{0.72}N/GaN/SiC.

Keywords: AlGa_xN/GaN, HEMTs, Schottky contact.

SIMULATION OF IONS DOPING ON THE PROFILES IN POLYCRYSTALLINE SILICON BY MONTE CARLO METHOD

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The purpose of the present work is the study of the effect of some parameters which control the ion doping such as the energy and the dose of doping. In order to do this, we have used a computer program denoted "TRIM: Transport of Ion Matter". This program is written by Fortran 77, and checked in order to control the parameters of implantation in questions and then to simulate the profiles of doping of different ions in polycrystalline silicon. Comparing the experimental data with the obtained results of simulation, it seems that the Monte Carlo method of simulation is useful for the control of the different parameters of implantation.

Using a concentration of $7.9 \times 10^{20} \text{ at./cm}^3$ and energy of 10 KeV, results show a maximal thickness of penetration less in the case of simulation with nitrogen than these without nitrogen. The comportment doesn't change with the elevation of implanted dose. We note that the thickness is less than the first case.

Keywords : TRIM code, Monte Carlo, Implantation, Doping.

THERMAL ANALYSIS OF PRESSED GRAPHITE

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The samples studied are pure graphite whose preparation method includes a step of pressing. Graphite is a material with properties covering a wide range of values. These properties may differ qualitatively, and depending on the material source and also the process of its development. Graphite is characterized by a dense stacked layered structure but weakly linked. Graphite polycrystalline properties are often isotropic, because of the random orientation of grains. Recently, it has been developed processes of production that have resulted in macroscopic samples that exhibit anisotropic properties. Therefore, the scope of use of this material has become very large.

The pressed graphite has an anisotropic expansion behavior. Whether the pressing in the direction of strong bonds (basic plan) or the weak links, the behavior of our samples is characterized by an anisotropy that is not found

in pure graphite that was used as a reference. The anisotropy established in the pressed samples is due to the presence of a preferential orientation of the grains in the polycrystalline graphite.

The analysis of DSC curves of our samples allowed us to highlight an acceleration of the kinetics of the reaction identified in single graphite in the temperature range studied; namely, the dissolution of oxygenated compounds. This acceleration is probably due to the high density of structural defects in our samples, which was also evidenced by XRD analysis. Scanning calorimetry has confirmed the X-ray diffraction analysis.

Keywords: *Pressed graphite, anisotropy, dilatometry, DSC, XRD.*

EVALUATION OF DIAMETER EFFECTS OF INDIVIDUAL COAXIAL SiC/SiO₂ NANOWIRES ON THEIR ACOUSTIC PARAMETERS

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Nowadays, nanostructures, characterized by their excellent mechanical, electronic, optical and thermal properties as well as the advantages from their extremely small feature size, are worldwide investigated. Particular interest is shown for one-dimensional semiconductor nanostructures, such as nanowires (NWs), due to their potentially innovative applications in nanoelectromechanical systems. Consequently, several approaches and diffraction techniques (TEM, STM, AFM, etc.) have been developed to study experimentally and theoretically their mechanical behavior. However, few data were reported on such properties via nondestructive methods. In this context, we consider the scanning acoustic microscope technique, SAM, based on the propagation of ultrasonic waves to predict their elastic properties. To do so, we chose individual coaxial SiC(core)/SiO₂(sheathed layer) nanowires to investigate the effects of sheath diameters (D_s) and core diameters (D_c) on several acoustic parameters. The calculation methodology consists of several steps: determination of longitudinal and transverse wave velocities, calculation of reflection coefficients, calculation of acoustic signatures, $V(z)$, and Rayleigh velocity determination. Qualitatively, the usual oscillatory behavior of acoustic signatures was clearly obtained due to constructive and destructive interference between different modes. Quantitatively, it was found that changes in SiC/SiO₂ NW diameters over the ranges: $51 \text{ nm} \leq D_s \leq 200 \text{ nm}$ and $12 \text{ nm} \leq D_c \leq 100 \text{ nm}$ lead to variations of (i) critical angles of longitudinal mode from 8.3° to 6.2° , transversal mode from 15.6° to 11.5° and Rayleigh mode from 16.1° to 12.0° , (ii) acoustic impedances of longitudinal mode from 11.9 Mrayl to 15.5 Mrayl and transversal mode from 6.6 Mrayl to 8.5 Mrayl, (iii) space periods in periodic $V(z)$ curves varies from 59.8 μm to 118 μm , and (iv) longitudinal velocity from 5166 m/s to 6947 m/s, transverse velocity from 2793 m/s to 3756 m/s and Rayleigh velocity from 2597 m/s to 3493 m/s. For comparison, elastic parameters of both bulk pure SiO₂ and SiC are also computed to find that the acoustic values deduced for bulk pure SiO₂ are in good agreement with those obtained for the highest diameters of SiC/SiO₂ nanowires. Furthermore, to enrich this investigation, all the above variations were quantified via curve fitting to deduce semi-empirical relations that can be used to predict elastic properties of such nanomaterials by just knowing their diameters and vice versa.

Key words: *Nanowires, SiC/SiO₂, elastic properties, $V(z)$, reflection coefficient, semiconductors.*

SILICON NANOSTRUCTURES FORMATION BY V₂O₅ AND HF STAIN ETCHING

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In recent years, much effort has been devoted to the manufacture of one dimensional nanostructured materials for application in micro and nanodevices. Silicon is the basic material in microelectronics, and in recent years, low dimensional silicon structures like nanowires and nanopillars are object of extensive studies. Both of these nanostructures have attracted much attention for their application as nanoscale biosensors. Recently, Metal Assisted Etching and vanadium oxide stain etching have renewed the attention towards these chemical methods of nanostructures fabrication.

In this work we report the fabrication of silicon pillar array by a simple chemical etching of silicon in vanadium oxide/fluorhydric acid solution. Different etching parameters including the solution concentration, temperature and orientation of Si substrates and thin metal catalyst film deposition (Pd) on the Si surface were studied. The etched surfaces characterized by Scanning Electron Microscopy are shown in fig.1. It has been found that the morphology depends on both etching time and the presence of the catalyst. The results show a different morphology in each case. As shown in the figure below, the attack, on the surfaces with a Palladium deposit, begins by creating circular pores on silicon in which we distinguish the formation of nanopillars of silicon. After several minutes of etching, silicon pillars appear, but the morphology seems strongly conditioned by drying, like in metal assisted etched SiNWs and highly porous silicon. Finally, taking into account the obtained results, a mechanism of the chemical etching is proposed.

TEXTURE ETCHING OF MONOCRISTALLINE SILICON IN SODIUM HYPOCHLORITE SOLUTIONA.

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The anisotropic etching of monocrystalline silicon is often used in the processing of silicon devices [1]. In the fabrication of solar cells, silicon wafers are generally etched in an anisotropic alkaline solution. Pyramidal structures are then formed on the surface to reduce the reflection loss from the front surface. Different etching solutions have been reported in the literature to texture the silicon surface. In the case of monocrystalline silicon, mixed alkaline solutions of sodium hydroxide (NaOH) or potassium hydroxide (KOH) with higher concentrations of isopropyl alcohol (IPA) are the most used solutions to texture the silicon surface [2, 3]. Other alternative solutions were used to texture the silicon surface such as sodium carbonate (Na₂CO₃), potassium carbonate (K₂CO₃) and sodium phosphate (Na₃PO₄). Recently, a strong oxidizing reagent NaOCl has been used successfully by several authors to texture the silicon surface [4, 5]. Moreover, NaOCl is cheaper than other etchants and is also largely used in industry. However, the most important inconvenient of NaOCl is its instability, it decomposes in solution. In this work, the effect of the etching parameters such as solution composition, solution temperature on the silicon surface morphology is studied. The surface of etched samples was characterized by Scanning Electron Microscopy (SEM), Spectrophotometry and Secondary Ion Mass Spectroscopy (SIMS). The results clearly show that the presence of ethanol in the solution leads to the formation of pyramids while the absence of ethanol induces the formation of micro-sized cubic structures which evolve to nanowire or nanoneedle structures with etching time. SIMS analysis of these structures indicates that they are mainly composed of Si, O, and Cl.

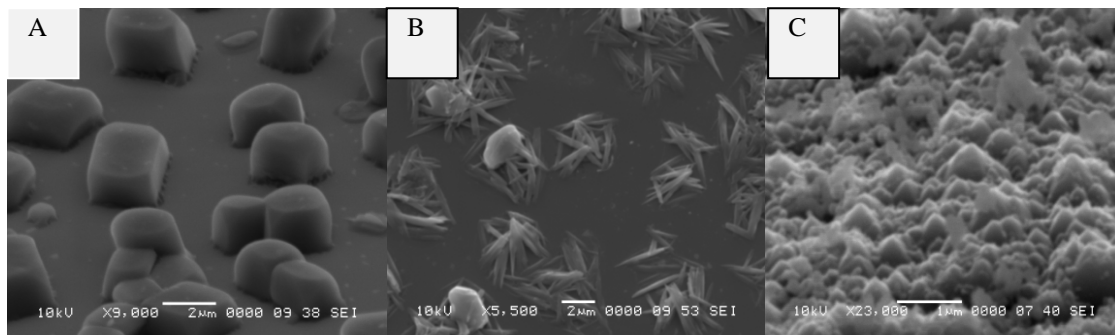


Fig. 1: SEM images of silicon surface etched with NaOCl: (a,b) without Ethanol, (c) with Ethanol

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ADSORPTION OF FATTY ACIDS AND AMINES ON PRINCIPAL MINERALS CONTAINING IN PHOSPHATE ORE

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Phosphate rock needs processing to reduce the content of gangue minerals such as carbonates, quartz to meet the requirements of the phosphate industry. In this paper the relationship between the flotation performance of the phosphate ore collectors and their adsorption behavior was evaluated using analytical techniques and more advanced techniques. The adsorption of the collectors on the surfaces calcite, dolomite, phosphate and quartz was evaluated via zeta potential, FTIR, spectrophotometry and microscopy analyses. The flotation performance of the collectors was evaluated using laboratory mechanical flotation cell at different process parameters such as pH, collector dosage.

Keywords: Phosphate rock, analytical techniques, flotation performanc, adsorption, FTIR, pH, spectrophotometry.

DEPOSITION AND CHARACTERIZATION OF UNDOPED ZINC OXIDE THIN FILMS BY SPD TECHNIQUE DESTINED FOR OPTOELECTRONIC APPLICATIONS

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Transparent and conducting Zinc oxide (ZnO) thin films have been deposited on glass substrate by spray pyrolysis deposition (SPD) process, taking starting material an aqueous solution of zinc acetate dehydrate with 0.025, 0.05 and 0.1M at various growth temperature (150, 250, 350 and 450°C) in order to investigate the structural and electro-optical properties of the films. The XRD results shows that all deposits were a polycrystalline having a hexagonal wurtzite type cristal structure with (100), (101) and (002) textured orientation. Thus, the grain size of ZnO thin film was found 25 nm as calculated by DRX diagrams using Debye Scherrer formula. The spectrophotometry UV-Vis studies confirmed that it is possible to obtain transparent ZnO thin films in the visible region, the average transmittance is around 75%, the optical gap estimated from optical absorption data is 3.2 eV . The electrical conductivity of these templates measured by using 2 points technique is of the ordre of 10⁻⁵ (ohm.cm)⁻¹.

Keywords: ZnO thin film, SPD, polycrystalline, transparent and conductor, band gap energy.

BIOLUBRICATION FROM PHOSPHOLIPID MEMBRANES: CORRELATION BETWEEN NANOMECHANICAL RESISTANCE AND TRIBOLOGICAL PROPERTIES

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The analysis of joint molecular interfaces has led to the identification of lipid bilayers adsorbed on the joint rubbing surfaces.

Nanostructural physical techniques such as lipid deposition by vesicle fusion method or by co-adsorption of lipid-detergent micelles and atomic force microscopy are used to reproduce and characterize the nano-mechanical resistance of supported phospholipid bilayers forming biological rubbing surfaces.

We have studied the mechanical and tribological properties of DOPC fluid bilayers in different solutions. We observed a clear correlation between membrane resistance (probed by AFM force spectroscopy) and the tribological

properties of lipid bilayers (using our homemade biotribometer). The latter allows simultaneously the measurement of the friction coefficient and the visualization of surface degradation by fluorescence microscopy.

In both buffered and buffered saline solution, phospholipid bilayers are more resistant and present better lubricant properties. The addition of salt improves the resistance to indentation but not to shear.

Our study thus showed that good mechanical stability of the bilayers is essential and suggested that the low friction coefficient is ensured by the hydration layers between adjacent lipid bilayers, with an important role of ions.

SPIN POLARIZED TRANSPORT IN 1D SPIN-FET

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In this work, we focus on the transport of spin-polarized currents in semiconductor materials and the quantum modeling of this transport taking into account different mechanisms acting on the spin. More specifically, we describe how are introduced in the equations relaxation mechanisms due to the spin-orbit coupling and interactions with spin flip. We study theoretically the spin polarized transport in the case of a 1D channel of a transistor with spin rotation called (spin FET). We determined the relationship of the transmission function of the longitudinal wave vector of the electron. And we also established the variation of the drain current in a transistor channel 1D spin-FET in the case of a ballistic or non-ballistic projectile

Keywords: Spin polarized transport, spintronic, spinfet, Semiconductor.

NUMERICAL SIMULATION OF EFFECTS OF DEEP DEFECTS IN THE PERFORMANCES OF SOLAR CELLS BASED ON GaAs

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The solar cells used in orbit are exposed to radiation environment consists mainly of electrons, protons and neutron. These particles degrade the electrical performance of cells and varying characteristics (current-voltage, form factor, performance ... etc...) phenomenon created by the recombination of defects. The main purpose of this work is to characterize the effects of deep defects induced by electron irradiation on the IV characteristic of the solar cell and external to its parameters by numerical simulation of a solar cell p-i-n GaAs.

MACROMODELING OF POWER MOSFET TRANSISTOR INCORPORATING SELF-HEATING EFFECT

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An empirical self-heating SPICE MOSFET model which accurately portrays the vertical DMOS power MOSFET electrical and thermal responses is presented. This macromodel implementation is the culmination of years of evolution in MOSFET modeling. This new version brings together the thermal and the electrical models of a VDMOS MOSFET. The existing electrical model is highly accurate and is recognized in the industry. Simulation responses of the new self-heating MOSFET model track the dynamic thermal response independently of SPICE's global temperature definition. Existing models may be upgraded to self-heating models with relative ease.

Keywords: Device characterization, device modeling, high power discrete devices, modeling, MOS device, power semiconductor devices, semiconductor devices, simulation, Spice, thermal design.

THE DRAIN TRANSCONDUCTANCE g_m OF MESFET GaAs

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The component elements of the field effect transistors can be grouped into two distinct categories. Extrinsic elements representing different access structures such as parasitic resistances R_s and R_d . Among the intrinsic elements, the transconductance g_m is cited, which reflects by its nature the localized behavior of the physical structure of the transistors.

The transconductance g_m represents the control mechanism of the transistor; it is the variation of the drain current I_{ds} depending on the gate voltage for a constant drain voltage. In this work we studied:

- Transconductance variation g_m according to the gate length L and voltage V_{ds}
- Transconductance variation g_m according to the resistance R_s and voltage V_{ds}

Keywords: Transconductance, parasitic resistances, gate length, MESFET GaAs.

VOCS SENSING PROPERTIES OF QUARTZ CRYSTAL MICROBALANCE COATED WITH A MIXTURE OF HEXAMETHYLDISILOXANE/OXYGEN

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Volatile organic compounds (VOCs) are found in ambient air due to human activities and natural sources. The exposure to some VOCs for a long time may causes diseases or serious irreversible effect, which makes their monitoring a serious task. Quartz crystal microbalance (QCM) has been attracting increasing attention as a mass sensitive device, owing to their capability of potential applications in detection. For this purpose, the surface of the QCM electrode is coated with sensitive material capable of interacting selectively with analyte of interest. In this study, thin sensitive layers were deposited using plasma enhanced chemical vapor deposition technique from a mixture of HMDSO and O_2 . Fourier transform infrared spectroscopy (FTIR), contact angle measurements and atomic force microscopy (AFM) were used to study, respectively chemical, physical properties and surface morphology of the QCM coating. Gas responses characteristics showed that the QCM frequency shift (Δf) increases gradually with time then reaches a steady state. In addition, Δf versus analytes concentrations exhibited satisfactory linear relationship. FTIR analysis revealed the presence in the film structure of $Si-(CH_3)_3$ groups, which make the film more hydrophobic by consequence the reversible adsorption/desorption will be easily achieved. AFM images showed the growth of relatively rough surface with uniformity of the thin film. The surface roughness was in the order of 5.11 nm for film elaborated from 50% of HMDSO and 50% of O_2 . All of these factors are responsible for the sensitivity improvement of the QCM coating.

Keyword: Sensor; QCM; VOC; porous material; HMDSO; plasma polymerization mixture;

THE BEHAVIOR OF CdTe NUCLEAR DETECTOR SUBJECTED UNDER PRESSURE CONDITIONS

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In this work, we have conducted a theoretical study on the nano-scale at the base of the simulation of phase transitions and the corresponding pressures as well as the volume discounts, the rigidity and the stability of the cadmium telluride CdTe with the Full Potential Linear Muffin Tin Orbitales FP-LMTO method. This study gave new results to verify the behavior of a solid detector in the base of semiconductor material submitted under the constraints of different pressure for change under normal operation of CdTe nuclear detector.

This study was followed by a comparable study of the rigidity between CdTe and silicon Si.

Key words: CdTe detector, transition pressure, stability, rigidity, volume discounts, bulk modulus.

STRUCTURE AND PROPERTIES OF Cu₂O QUANTUM DOTS/ZnO NANOROD

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Photoelectrochemical Cells (PECs) utilize solar energy to produce hydrogen gas, a useful combustible resource. Along with photovoltaics, PECs will contribute to the effort of meeting global energy demand. Nanorods provide several benefits over conventional planar structures such as: greater light absorption, greater surface area for increased chemical reaction rates and larger junctions for increased photo currents. We have developed visible sensitive heterojunction consisting of p-type Cu₂O colloidal quantum dots (CQDs) (low bandgap) anchored on the ZnO (n-type ZnO, high-bandgap) nanorods. In these kind of heterojunctions, an n-type ZnO layer acts both as a host that chemically binds to the Cu₂O CQDs and as an electron carrier with Cu₂O QDs. The number of Cu₂O QDs loaded onto the n-type ZnO layer increases the sensitivity in the visible region. The structure and the morphology of these films were studied by X-ray diffraction (XRD), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray (EDX). The optical property was investigated by UV-Vis absorption spectroscopy and Cathodoluminescence (CL) techniques.

Keywords: Photoelectrochemical Cells (PECs), ZnO nanorods, Quantum dots, Cu₂O CQDs.

STRUCTURAL AND OPTICAL CHARACTERISTICS OF SPIN-COATED POLY [(THIOPHENE-2,5-DIYL)-CO-(BENZYLIDENE)] PTB THIN FILMS AND THEIR PHOTOVOLTAIQUE APPLICATION

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In this work thin films of PTB polymer : poly [(thiophene-2,5-diyl)-co-(benzylidene)], which is soluble in various organic solvents such as CH₂Cl₂, CHCl₃, THF, acetone, and ethyl acetate were deposited onto glass substrates by spin-coating method, from a solution containing polymer powder and solvent with an appropriate concentration. After deposition, the films were heated at a temperature of 90°C in order to remove all traces of solvent and unwanted materials. Several polymer solutions of PTB with different solvent were prepared and deposited, the solvent giving the best morphological characteristic examined by Scanning Electron Microscope was chosen as the ideal solvent for the rest of our work. Optical and structural characteristics of the polymer thin films were studied using UV-vis spectroscopy, cyclic voltametric (CV) measurements, Fourier transform infrared absorption (FTIR) spectroscopy and x-ray analysis. SEM images showed that CH₂Cl₂ is the best solvent for the PTB deposition by Spin Coating root. XRD patterns reported shows that our PTB films are amorphous because of the inexistence of crystalline peak. The spectrophotometric measurements of absorbance (A) and reflectance (R) spectra were carried out in the wavelength range 350–1200 nm. There are two main absorption bands: QI at about 445 and QII at about 445 nm. The energy levels corresponding to the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) of the PTB have been determined from the first oxidation and reduction potential respectively, using cyclic voltametric (CV) measurements. From CV curves, PTB in dichloromethane showed a one electron reversible reduction and oxidation waves. The values of its HOMO and LUMO have been estimated to be 5.71 eV and 3.83 eV respectively. Such values show that PTB could be probed as a material donor in organic solar cells. The absorption properties of PTB and its low cost disposition make the material suitable for photovoltaic applications. For that organic solar cells made from bi-layer thin-film heterojunctions having PTB as an electron donor and C₆₀ as an electron acceptor were investigated.

EFFECT OF AN ATMOSPHERIC AIR MICROPLASMA JET ON INACTIVATION OF E-COLI BACTERIA

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An atmospheric pressure plasma jet (APPJ) generated in open air using a homemade pseudo-pulsed high voltage power supply has been used to inactivate *Escherichia coli* (*E-coli*) bacteria. Effects of the plasma jet exposure time and the distance between the jet plasma source and the sample on micro-organism's inactivation efficiency have been investigated using optical microscopy observations. It has been shown that the decrease in the distance between the plasma jet source and the sample as well the increase of plasma treatment time induce a significant decrease in the bacterial population.

Mn INCORPORATION INDUCED CHANGES ON MICROSTRUCTURE AND OPTICAL PROPERTIES OF ZnO

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In this work, we deposited Mn doped ZnO films by a simple method: ultrasonic spray pyrolysis, under atmospheric pressure. The concentration ratio of [Mn]/ [Zn] was kept at 1at%, 3at% and 5at%. Structural and optical properties were characterized by Raman spectroscopy, infrared spectroscopy (FTIR) and UV-VIR-NIR spectroscopy. Thickness of the films was in the range of 200-300 nm. Compared with the Raman spectra for ZnO pur films, the Mn-doping effect on the spectra is revealed by the presence of additional peak around 524 cm⁻¹ due to Mn incorporation. With increasing Mn doping the optical band gap increases, indicating the Burstein-Moss effect.

Keywords: Ultrasonic spray pyrolysis; ZnO:Mn; Raman spectra; UV-VIS-NIR spectra.

DETERMINATION OF MECHANICAL PROPERTIES OF A DENTAL CERAMIC NANOSTRUCTURED BASED OF LITHIUM DISILICATE Li₂Si₂O₅

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The study and use of nanostructured materials experiencing considerable growth due to their special properties. All major types of materials are concerned: metals, ceramics, dielectrics, magnetic oxides, polymers, etc. Due to their stability in the oral environment and almost perfect imitation of a natural tooth, dental ceramics microstructured proven for decades. However, in the context of research on new dental materials and still no metal in order to improve their intrinsic properties, new dental nanostructured ceramics are currently the subject of much research due to their physical and mechanical properties. In this context we have worked on a glass-ceramic to basis of lithium disilicate (Li₂Si₂O₅) using IPS E-Max system to determined the mechanical properties of this nanomaterial. For this, we have been used in the first party (party experimental) the diffractometer (XRD) and the apparatus of the differential scanning calorimetry (DSC), in order to identify the crystalline phase and measured the particle size. In the second part we have calculated some mechanical properties such as elastic constants Cij, Young's modulus E, shear modulus G, bulk modulus B and Poisson's ratio ν, using a calculation software based on the theory of functional density, referred to as "DFT" (density functional theory) with the LDA and GGA approximation.

Keywords : Nanomaterial; Dental ceramic; Lithium disilicate; IPS E-Max System.

STRUCTURAL AND OPTICAL PROPERTIES OF ELECTRODEPOSITED Cu_2O THIN FILMS

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Cuprous oxide (Cu_2O) is an attractive material for photovoltaic devices because it is a direct-gap semiconductor with a band gap energy of 2.0 eV.

Semiconducting Cu_2O thin films were deposited on FTO coated glass substrates through potentiostatic electrodeposition. The as-deposition were p-type and the XRD analysis revealed the formation of single phase cubic Cu_2O films. The thickness of the film was calculated from the interference fringes in the transmittance spectra. The effect of deposition potential, solution pH and bath temperature on the structure is studied.

DILATOMETRIC BEHAVIOR OF FLUOROPLASTIC CONTAINING CARBON NANOTUBES

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Nanomaterials and nanocomposites are current issues and the challenge of the near future. Several specialists are working hard to develop and improve the physicochemical characteristics of these new associations for their integration in the industry.

The purpose of this paper is the dilatometric study of fluoroplastic containing carbon nanotubes.

The resulting material has a disk shape with 3 mm thickness. Samples for dilatometry were collected from two different regions of the disk (center and periphery) to study the anisotropy. Then, from each region two samples were taken one in the radial direction and the second is oriented in the vertical direction of the disk (pressing axis). Measures of thermal expansion coefficient $\alpha_R(T)$ (radial direction) and $\alpha_Z(T)$ (pressing direction) as a function of temperature were carried out.

The curves obtained in the radial direction and the pressing direction of samples cut on the periphery of the disk give different results. According to the radial direction $\alpha_R(T)$ varies monotonically over a wide temperature range. Around 210°C, appears a peak of low intensity. At 250°C, another dilatometric anomaly very intense appears extending over 40°C. The value of the thermal expansion coefficient $\alpha_R(t)$ exceeds $2500 \cdot 10^{-6} \text{ C}^{-1}$. From 260°C, $\alpha_R(t)$ becomes monotonous. The variations are practically nil.

Curve $\alpha_Z(T)$ has a completely different behavior compared with $\alpha_R(T)$. From room temperature to 160°C, $\alpha_Z(T)$ is almost constant. Between 180-220 ° C, appears a relatively intense dilatometric anomaly extending over 40°C. Around 290°C, a second peak very intense appears. It is twice as intense as the first. Its intensity is about $2000 \cdot 10^{-6} \text{ C}^{-1}$. The expansion behavior of the material varies greatly from the radial direction to the vertical direction. This shows that the compound is anisotropic.

Keywords: fluoroplastic, carbon nanotubes, anisotropy, dilatometry

THE EFFECT OF ULTRAVIOLET ON THE MECHANICAL PROPERTIES OF GLASSES $\text{As}_x\text{Se}_{100-x}$

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The As-Se chalcogenide glasses is subject to extensive research thanks to the various properties they exhibit. These glasses have a good stability against crystallization and a wide transparency range in the infrared. In terms of these properties, As-Se binary glassy systems are special because they show photoinduced changes in their structures and properties when they are irradiated by energies below or above their gap; hence their applications. These changes can be both reversible and irreversible.

In this article, the effect of ultraviolet on the mechanical properties of binary chalcogenides glasses of the As-Se system is studied by microindentation before and after irradiation. Diverse changes of mechanical properties were observed on the various compositions of this binary system. There are two objectives, the first is to link the change in hardness and Young's modulus to the concentration of Arsenic or Selenium in the $As_x S_{100-x}$ binary glasses system then they are bound to the change of phase in these materials. The second objective is to invest the various changes that occur in the Young's modulus and hardness after exposure to ultraviolet light for several compositions.

Keyword: *microindentation, chalcogenide glasses, AsSe, mechanical properties, photo-induced phenomenon, bandgap energy, ultraviolet.*

ELECTRONIC PROPERTIES AND YOUNG'S MODULUS OF HYPOTHETICAL ZINC BLEND $Sc_x IIIA_{1-x}N$ (IIIA= GA AND IN): CANDIDATES FOR PHOTOVOLTAIC DEVICES

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Binary nitrides of the III-V group elements, such as wide band gap materials: GaN and AlN and the InN which is not wide band gap material, are technologically of interest. Especially, they are promising materials for solar cells, blue/ultraviolet light emitting diodes (LEDs) and lasers as well as for sensors for UV-light.

Therefore, the synthesis of new nitrides is, thus, a field of growing interest in solid-state chemistry and physics in the search for new materials with promising properties and applications. However the incorporation of transition metals can be reduce the band gap and strengthen the use of photovoltaic cells. The experience has shown that semiconductor based scandium $Sc_x IIIA_{1-x}N$ (IIIA=Ga and InN) are stable in the wurtzite phase, but to our knowledge, the zinc blend phase which is more recommended for the photovoltaic applications has not been synthesized yet for these ternary alloys.

For this, The electronic and elastic properties of hypothetical zinc blend $Sc_x IIIA_{1-x}N$ (IIIA= Ga and In) ternary alloys have been investigated by using the empirical pseudopotential method (EPM) under the virtual crystal approximation combined with the Harrison bond-orbital model, which takes into account the effects of compositional variations in the calculations. The resulting band structures at various Sc concentrations x show quite nonlinear variations for the main band gap energies and have been used to calculate some elastic properties such as the three elastic constants C_{11} , C_{12} and C_{44} and young's modulus Y. They found to be generally in good agreement with the available experimental data and ab initio calculations. A direct to indirect band gap crossover is found to occur at $x = 0.463$ for $Sc_x Ga_{1-x}N$ and $x=0.39$ for $Sc_x In_{1-x}N$. In the absence of experimental data, no conclusion can be reached at the present time for the accuracy of this latter result. We have deduced that these ternary compounds can be considered as good candidates for solar cells applications.

Keywords: *Semiconducting alloys $Sc_x IIIA_{1-x}N$ (IIIA=Ga and In), hypothetical zinc blend Structure, Electronic properties, elastic properties and Young's modulus, EPM.*

MANAGEMENT TRAITS OF THE PROJECTS CONCERNING POWER GENERATION AND WASTE RECOVERY

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Electric resistivity ρ of graphite (including thermoexfoliated one) are mainly governed both by its structure and morphology. The analysis of electric properties in this case is strongly complicated by the presence of the high anisotropy of ρ for graphite crystal and peculiar conductivity mechanism in the disordered areas at the boundaries of the ordered graphite crystals. That is why, the mechanisms determining the transport properties of the graphite-based structures remains still discussible. Here, several speculations concerning the interpretation of $\rho(T)$ dependencies for nanocomposite materials (NCM) on the base of thermoexfoliated graphite (TEG) containing different metal constituent are thoroughly analyzed.

The specimens for investigation were prepared by the compacting of the source materials under the pressure ranging from 60 to 450 MPa. Metal modifier has been involved into NCM structure by chemical deposition. The $\rho(T)$ dependencies within 77-450 K temperature range were investigated by the routine four-probe method.

Electron microscopy investigation shows that the metal modifier particles 100-300 nm in size are located at the surface of the graphite platelets (Fig.1). The size of these platelets along a axis is much greater that along c axis. The X-ray diffraction studies evidence for high extend of texture of the compacted specimens. Since c axis was oriented along the compacting axis, the electric current in our experimental geometry flowed in the basis plain for the majority of the graphite crystallites. The size of the graphite crystallites L along c axis was determined by the width of (002) and (004) TEG reflections) It is ranged within 70-120 nm (see Table). The values of L were reduced down to 40-50 nm in a result of impregnation by mineral-organic composition with the subsequent thermal shock at 800°C.

High preferable orientation of the graphite particles allows to consider the electric resistance containing two terms: the resistance of graphite along the basis plane ($R_1=R_{01}+\beta T$) and the contribution due to disordered interparticle boundaries ($1/R_2=\sigma_{02}+\sigma_M \exp(-E_a/kT)$). Considering the total resistance being equal to R_1+R_2 , in a case $\sigma_{02} \gg \sigma_M \exp(-E_a/kT)$ $R(T)$ dependence could be expressed as:

$$R = R_0 + \beta T - R_M \exp(-E_a/kT), \quad (1)$$

Where $R_M = \sigma_M / \sigma_{02}^2$ and $R_0 = R_{01} + 1 / \sigma_{02}$.

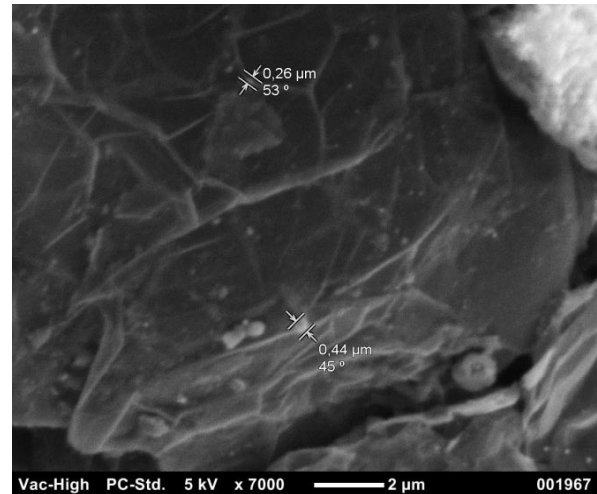
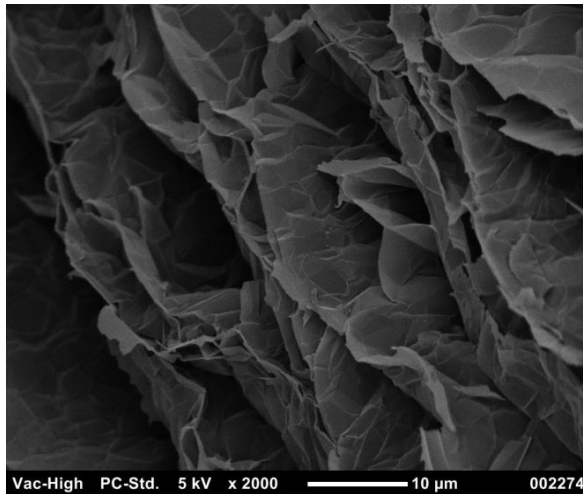


Fig.1. SEM images of the source TEG (a) and NCM on its base containing cobalt nanoparticles (b).

Besides the fabrication conditions and structural characteristics, the Table contains the parameters of the approximation of the normalized electric resistance $R(T)/R_{300}$ by Eq.(1) for three specimens. The value of β was found to be equal to zero within the accuracy $\pm 5 \cdot 10^{-5} K^{-1}$. This testifies that the resistivity in this case is determined mainly by the disordered constituent of graphite. It should be emphasized that $R_0 = 1 / \sigma_{02}$ if $R_1 = 0$. Just under this

condition Eq.(1) is valid. This approach under consideration is somewhat similar to that described in [1], the difference being consist in a sign of the exponential term. Unfortunately, it gives only rough approximation of our experimental results. The values of E_a occur to be quite reasonable. Nevertheless, zero contribution from the second term in Eq.(1) promotes to involve the alternative scattering mechanisms. The analysis of $R(T)$ curves showed that this dependence exhibits a linear region being plotted in logarithmic scale (see Fig.2 for illustration). Such behavior proceeds from the general dependence in a form:

$$R=R_{0L}+\beta_1T-R_LT^\alpha. \quad (2)$$

Specimen	P , MPa	L , nm	R_0	R_M	E_a/k , K
T1	600	114	1,68	1,27	188
T5	600	117	1,42	0,92	234
T14	450	50	1,74	1,37	188

The latter term is conditioned by the weak localization (WL) effect with $\alpha=1/2$ [2]. This mechanism of scattering is known to be related with the quantum effects of conductivity in the disordered systems and commonly occurs at low T . However, WL effect may be also significant at higher temperatures [3]. The nature of the second term in (2) was also discussed in Ref.[3]. The existence of this term is clearly seen from Fig.3, in which the dependence of dR/dT on $T^{-1/2}$ for specimen T14 is presented. For the linear part of this dependence one can obtain $\beta_1=3,2 \cdot 10^{-3}K^{-1}$ that is typical for metallic type of conductivity. The deviation of $dR/dT(T^{-1/2})$ dependence from linear behavior was considered in [3] within the model of incipient localization as a result variation of the inelastic scattering free path.

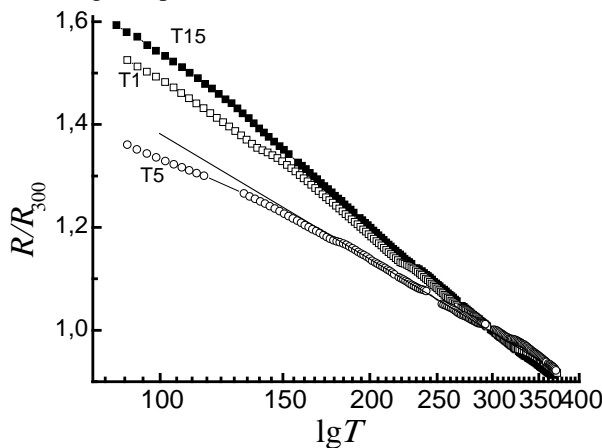


Fig.2

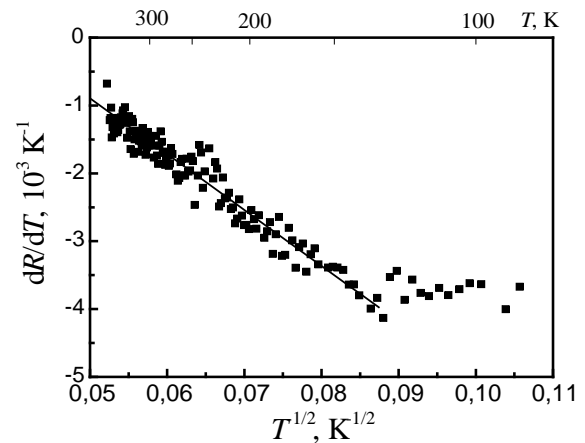


Fig.3

The considered mechanisms of scattering allow to analyze the transport properties of TEG-Co(CoO) NCMs. These NCMs were synthesized by chemical method through impregnation of TEG by water solution of cobalt acetate or cobalt nitrate with the subsequent thermal shock (800-900°C for 3-5 min.). In a case of Co acetate being used for impregnation the final NCMs contain either pure Co or the mixture of Co and Co oxides. In a case of Co nitrate the synthesized NCMs contain only Co oxides. Nevertheless, the additional impregnation of TEG-Co nitrate powders by mineral-organic solution allowed to synthesize NCMs containing small (according to XRD data) particles of pure Co. The contributions to the total resistance being analyzed, the difference in phase composition and morphology of the synthesized NCMs permit to ascertain the dominant mechanisms of the conductive electrons' scattering in these materials.

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STUDY OF ABSORPTION IN REFRIGERATION SYSTEMS

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The energy and global warming crises have drawn renewed interests to thermally driven cooling systems from the air conditioning and process cooling fraternities. The early development of an absorption cycle dates back to the 1700's. It was known that ice could be produced by an evaporation of pure water from a vessel contained within an evacuated container in the presence of sulfuric acid. In 1810, ice could be made from water in a vessel, which was connected to another vessel containing sulfuric acid. As the acid absorbed water vapor, causing a reduction of temperature, layers of ice were formed on the water surface. The major problems of this system were corrosion and leakage of air into the vacuum vessel. In 1859, Ferdinand Carre introduced a novel machine using water/ammonia as the working fluid. The lithium bromide-water absorption chiller is one of the favourite due to the following specific reasons: (a) it can be thermally driven by gas, solar energy, and geothermal energy as well as waste heat, which help to substantially reduce carbon dioxide emission; (b) its use of water as a refrigerant; (c) it is quiet, durable and cheap to maintain, being nearly void of high speed moving parts; (d) its vacuumed operation renders it amenable to scale up applications. The internal operation of a lithium bromide-water absorption chiller is intimately influenced by the pressures and concentrations of its working fluid. In its most basic form, there are four intrinsic components to a lithium bromide-water absorption chiller: an evaporator, a generator, an absorber and a condenser. In the generator refrigerant vapour is thermally desorbed from the solution, which is then condensed in the condenser. The liquid refrigerant in the condenser is throttled and sent to the evaporator where cooling is provided. In the evaporator, the liquid refrigerant vaporizes and the vapour is absorbed by the solution which is actively cooled in the absorber. The refrigerant rich solution is pumped to the generator for generation, while the resultant refrigerant-weak solution is throttled back to the absorber to absorb the refrigerant vapour coming from the evaporator. To improve the system efficiency, a solution heat exchanger is introduced into the solution circuit to recover the energy of the refrigerant-weak solution when it is throttled from the generator to the absorber. The performance index of an absorption chiller is termed the Coefficient of Performance (COP) and is generally defined as the ratio of cooling output at the evaporator to the heat input to the generator. The aim of this paper is to study the absorption refrigeration. A number of absorption refrigeration systems are examined and discussed. The study shows that double-effect absorption systems using lithium bromide/water seem to be the only high performance system which is available commercially. It must be noted that, when the number of effects increase, COP of each effect will not be as high as that for a single-effect system. Moreover, the higher number of effect leads to more system complexity.

NUMERICAL SIMULATION OF SOLAR-POWERED ADSORPTION REFRIGERATION SYSTEMS USING TRNSYS FOR CLIMATIC CONDITIONS OF GHARDAÏA (SOUTH ALGERIA)

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Energy consumption is continuously increasing in Algeria and this situation yields research to find sustainable energy solutions. Demand for cooling is one of the reasons of increasing energy demand. This research is focused on one of the sustainable ways to decrease energy demand for cooling which is the solar-powered adsorption cooling system. The geographical location of the country lends it to the opportunity of harvesting part of its vast wealth of renewable energy resources. In this study, general theoretical performance trends of a solar-powered adsorption cooling system are investigated using TRNSYS 16 under Ghardaïa climate conditions. Effects of different cycle enhancements, working pairs, operating and design conditions on the performance are analyzed through a series of steady and seasonal-transient simulations. Furthermore, a normalized model is presented to investigate the effects of size of the system, need for backup power, collector area and mass of adsorbent. Results are presented in terms of values and ratios of cooling capacity weighted COP. High evaporation temperatures for example produced the highest COP values. Moreover, the heat capacity of the adsorbent bed and its covering should be low for the simple and heat recovery cycles and the adsorbent bed should be cooled down to the

condensation temperature for all cases to achieve the highest possible COP. The selection of working pair should depend on the temperature of the available heat source (solar energy in this study) since each working pair has a distinct operating temperature range. The data gathering and analysis processes will enable our team to explore/evaluate pertinent system components and optimize the equipment to specific environments and load requirements.

Keywords: *Adsorption, Cooling, Modeling, Simulation, Solar energy.*

STUDY AND SIMULATION OF SOLAR CELL CRYSTALLINE SILICON STRUCTURES WITH LUMINOUS CASCADE SYSTEM (PHOTON CONVERTER)

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Luminous cascade systems is a new system applied in the design of photovoltaic module with low cost and high efficiency, They consist of a transparent plate of polymethyl methacrylate (PMMA) doped with luminescent dyes, the sides of this last are attached with mirrors to concentrate the light to the solar cell which mounted on the rear face of the plate. The solar spectrum cross the PMMA wafer is absorbed by the luminescent molecules optically active and remitted in high wavelength more suitable for the spectral response of solar cell. A validation model of crystalline silicon solar cells is studied taking into account the reflection losses for two configurations. Approximately, an increasing in conversion efficiency of 9% is achieved. And stronger results can be obtained in experimental conditions and improved measurement.

Keywords: *Luminous cascadesystems, photovoltaic modules, polymethyl methacrylate (PMMA), solar cells, conversion efficiency.*

BUILDING MODEL OF PHOTOVOLTAIC CELL/MODULE WITH MATLAB/SIMULINK

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In this paper a photovoltaic (PV) module in renewable energy conversion system is simulated. The simulation of the system is developed using MATLAB/Simulink environments, which can be representative of PV cell, module, and array for easy use on simulation block. The PV model is developed using basic circuit equations of the photovoltaic solar cells including the effects of irradiation and temperature. The output current and power characteristics of PV model are simulated. The results are provided and presented here.

Keywords: *photovoltaic model, developed, simulation, MATLAB.*

PERFORMANCE AND APPLICABILITY OF DC REFRIGERATOR INCLUDING PHASE CHANGE MATERIAL AND POWERED BY SOLAR PHOTOVOLTAIC ENERGY.

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This paper describes the design and the experimental investigation of converted conventional refrigerator to a solar power one. A local conventional refrigerator was chosen and some changes were introduced on it to reduce the power requested. Tests were carried out to study the distribution of the inside air temperature and its effect on

the load, and also they present the electric performance of the photovoltaic (PV) modified refrigerator under Bou-ismail (Algeria) climate. The tests revealed that this refrigerator uses a low daily power while employing the eutectic evaporator (PCM). This work enables our team first, to save the cost of a photovoltaic system, by opting for a thermal storage cooling to reduce the operating time of the compressor. Second, use environment-friendly product. It can be concluded that the performance of the eutectic refrigerator is very stable and it can serve for perishable food storage, vaccine, and drug depositing at low temperature in remote areas using half energy and a low number of battery.

Keywords: *Solar photovoltaic (SPV), Refrigeration, Compression, phase Change material PCM.*

LOCUST SWARM OPTIMIZATION FOR OPTIMAL SIZING METHOD OF AUTONOMOUS HYBRID SYSTEM PV/WIND

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The two main objectives to size a hybrid system are that, the system ensures a constant supply of the load and it takes a minimum cost of energy delivered. To achieve an optimum design, we need a modeling system that depends on climatic conditions, the load profile and optimized parameters of this system; in this case the optimization is very difficult because of the complexity of the system. In the literature, we find that the stochastic techniques give better results as compared to deterministic. In this paper, we propose a new optimization approach is based on the behavior of migrating locusts; it's a combination of particle swarm optimization and Nelder-Mead method. The population of this method depends on the dimension of the problem; this property gives us a fast computation time to find an optimal solution. This approach was developed to calculate the optimum system configuration that can achieve the customers required loss of power supply probability (LPSP) with a minimum annualized cost of system (ACS). The decision variables included in the optimization process are the PV module number, wind turbine number, battery number, PV module slope angle and wind turbine installation height.

NEW HYBRID NANOCARRIERS BASED ON CHITOSAN, CYCLODEXTRINS AND HYDROXYAPATITE FOR SUSTAINED DRUG DELIVERY OF POORLY DRUGS USED ON THE TREATMENT OF CANCERS BY PHOTODYNAMIC THERAPY (PDT)

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Encapsulation of hydrophobic porphyrin derivative as photosensitizers (PS) into different forms of nanoparticles (NP) is of a concern in this study for drug delivery and targeting in cancer photodynamic therapy (PDT) applications. New formulations have been developed in this work for the sustained release of the active agent by increasing the solubility. Entrapment of the PS in anionic cyclodextrin (CD) structure was our first alternative. The resulting complex is then included in chitosan (CS) and hydroxyapatite (HAP) nanoparticles according to ionotropic gelation method in the presence of a crosslinking agent and biomimetic media. UV-Vis, FTIR spectroscopies, X-ray diffraction (XRD) and SEM (scanning electron microscopy) are, among others, the methods used to characterize the prepared systems. The UV-Vis and FTIR results showed that the concentration of CD may play a significant effect on the complexation phenomenon and morphology of each NPs. Indeed, the solubility of PS from CD structure was found to be very significant. Both, the hybrid CS NPs and HAP NPs containing the PS-CD active factor were able to be prepared in spherical form (300- 900 nm and 400- 956 nm respectively) which provide a good interest for drug delivery in PDT technique.

Keywords: *photodynamic therapy, nanocarriers, photosensitizer, cyclodextrins, chitosan, hydroxyapatite.*

SIMULATION OF PHOTOVOLTAIC SYSTEM INTEGRATED IN BUILDING

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The production of electricity by using solar photovoltaic energy is one of the solutions for reduction of gas emission in the atmosphere and prevent against greenhouse effect. In addition of a rural application, the growth of using this energy is becoming more interesting in industrial countries. The advantage of such integrated photovoltaic systems in buildings is to have the required energy at the appropriate time and place, where place is saved rather than using batteries to save energy. In this study, we present the performance of façade photovoltaic system. This analysis is based on, first the estimation of solar radiation on the buildings and secondly the characteristics of the photovoltaic module used in the system. The simulation is performed in Saad Dahleb University at Blida in Algeria, building number 13; performance was possible and reached by theoretical study and some recent mathematical models to estimate the solar radiation and the modeling of using this photovoltaic module.

Keywords: component; photovoltaic systems, facades, inverter, modeling, simulation.

VIBRATION ANALYSIS OF PRE-TWISTED CANTILEVER BLADE BY USING THE FINITE ELEMENT METHOD

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This study aims to carry out vibration analysis of a wind turbine blade. The finite element method is used to analyse the coupled bending-torsion vibration. The blade is modeled as an Euler-Bernoulli beam. The governing partial differential equations of motion and the associated boundary conditions are derived using the Hamilton's principle. Transformed equations are coded in the computer package Matlab. The effects of pretwist angle and the taper ratio on the natural frequencies and forced vibration are investigated and the results are compared with the results in literature. In order to validate the calculated results, the blade is also modeled in the finite element program, Comsol.

Keywords: twisted blade, finite element, vibration, Comsol.

NUMERICAL AERODYNAMICS OF AN URBAN WIND TURBINE BLADE

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The majority of energy and particularly electricity is consumed in urban areas where most population is concentrated. The integration of wind turbines in towns close to prime consumers, will reduce the energy cost if the wind turbines are well optimized to be adapted to such urban environment. The relatively small wind speed, the restricted space reserved to wind turbines installation and the undesirable noise produced by the rotation of blades, are the main problems facing the urban wind turbines. Small wind speed and reduced blade size will effect substantially the amount of energy produced since the generated power is proportional to wind speed cubed and blade dimension squared. But all these problems can be handled if a suitable aerodynamic blade shape is well chosen.

In this study, a numerical simulation was carried out to study the aerodynamic performances of an FX63-137 airfoil at a low Reynolds number regime. This low Reynolds number regime is considered since the flow speed is low and the airfoil section is small. The airfoil surface and the mesh around, are generated using a conformal mapping method. The curvilinear equations of the mathematical model in the computational domain, are discretized using finite volumes formulation. For the numerical resolution, a Fortran program has been elaborated.

The flow pattern, the pressure coefficient and the skin friction are plotted for different values of Reynolds number and different angles of attack. The comparison of the aerodynamic coefficients obtained for the FX63-137

airfoil with those of a typical NACA0012 airfoil, indicates that the chosen airfoil show better aerodynamic performances at low Reynolds number conditions and can be selected for urban wind turbine blades design.

CONTROL OF TWO-DIMENSIONAL INCOMPRESSIBLE LAMINAR BOUNDARY LAYER BY BLOWING

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A laminar, two-dimensional, incompressible boundary layer around a profile and its control using blowing is studied numerically. The study is based on the Prandtl boundary layer model using the finite differences method and the Crank-Nicolson scheme. The study concerns the flat plate case, NACA 66,012 and the NACA 0012 profile. The velocity distribution, the boundary layer thickness and the friction coefficient distribution are determined and presented with and without control. The application of the control technic, has demonstrated its positive effect on the transition point and the friction coefficient. The control procedure is compared for different porosity lengths, blowing speeds and blowing angles.

Keywords: *boundary layer, laminar, two-dimensional, incompressible profile, control, blowing, friction coefficient.*

THERMODYNAMIC STUDY AND ANALYSIS OF HEAT RECOVERY ADSORPTION REFRIGERATION CYCLE

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The basic cycle of adsorption refrigerating machines presents two main drawbacks: the production of cold is intermittent and the efficiency is low. To attain higher efficiencies and to achieve continuous production of cold, it is necessary to use advanced cycles. Several kinds of advanced cycles have been proposed and tested. Two main technologies have been developed: regenerative processes with uniform temperature adsorbers and regenerative processes with temperature fronts (or thermal waves). The basic idea is to use the heat discarded by one adsorber under cooling to pre-heat another adsorber under heating. In so doing, the COP is enhanced and the production of cold is continuous.

In this paper, we interest to the uniform temperature adsorbers. A numerical analysis was carried out, studying the influence of the main parameters on both of regeneration and performance coefficients of the machine. A detailed thermodynamic and parametric analysis of a double adsorptive cycle is given. The basic fundamentals of the adsorption process are discussed, where the Dubinin-Astakhov equation is used to describe the isotherm of adsorption.

DEVELOPMENT OF A SPHERICAL SOLAR COLLECTOR WITH A CYLINDRICAL RECEIVER

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Solar energy can be used for substitution of the depleting fossil fuels in thermal applications and electricity generation through thermal route. For medium and high temperature applications, a system for collecting solar energy at high temperatures was developed and built in this research work. The system, built at the center of development of renewable energy of the Algiers, consists of a 68.45° included angle, 0.9 m diameter spherical reflector with a cylindrical receiver filled with water, tracking reflector which moves into the focus following the sun's movement. The system is capable of heating water or other fluids to temperatures above 350°C, thus making

it possible to obtain process heat for domestic use and to store solar energy in a compact and economical way. An analysis of the system's optical characteristics was performed to aid in the design of the spherical reflector and cylindrical receiver. The thermal performance of the system was analyzed. The effects of mirror reflection, concentration ratio, heat transfer to the fluid (water), incidence angle, size and form of the cylindrical receiver, environmental conditions (wind, ambient temperature), have been studied by means of thermal model. The performance of the spherical reflector was tested by the temperature of the water. Total efficiencies (solar to thermal) of 60%-70% were obtained for a wide range of temperatures up to 350°C. The results of the present study show that it is possible to use the spherical reflector for systems requiring process heat and make possible substantial utilization of solar energy and considerable savings relative to fossil energy in the sunny countries of the world.

CONTROL OF A DOUBLY FED INDUCTION MACHINE FOR A WIND APPLICATION

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The wind energy systems using a doubly-fed induction generator (DFIG) have some advantages due to variable speed operation and four quadrant active and reactive power capabilities compared with fixed speed induction. In this article, a new vector control intended for an induction motor in double fed mode is proposed. It is based on the principle of a double flux orientation of stator and rotor at the same time. Therefore, the orthogonality created between the two oriented fluxes, which must be strictly observed, leads to generate a linear and decoupled control with an optimal torque. The obtained simulation results show the feasibility and the effectiveness of the suggested method.

Keywords: *Doubly fed induction machine, PWM inverter, wind energy, flux orientation control*

GEOMETRICAL OPTIMIZATION STUDY OF A TUBULAR ADSORBER OF A SOLID ADSORPTION SOLAR COOLING MACHINE

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Ecological problems and energy crisis in a globalized world have motivated scientists to develop energy systems more sustainable, having as one of the possible alternative the use of solar energy as source for cooling systems. In the field of the sorption cooling, there are three kinds of system: liquid absorption, solid absorption (chemical reaction) and adsorption. The great advantage of adsorption systems over absorption ones is that they can operate without moving parts, having then lower costs of maintenance. Other advantages in comparison with the compression systems are: simple construction, environmentally benign and noiseless. A lot of applications for adsorption cooling systems have been viewed in both developed and developing countries such as: storage and conservation of vaccine, medical products, food conservation (vegetable, meat, fish, etc), refrigeration, air conditioning, chillers and ice production.

This paper presents the modelization of heat and mass transfer in tubular adsorber of solar adsorption cooling machine. The modelling and the analysis of the adsorber are the key point of such studies, because of the complex coupled heat and mass transfer phenomena that occur during the working cycle. The adsorber is heated by solar energy and contains a porous medium constituted of activated carbon AC-35 reacting by adsorption with methanol.

The developed model is based on the energy equation of the adsorbent layers, the energy balance equation of the adsorber tube wall and the state equation of the bivarient solid- vapour equilibrium using the Dubinin-Astakhov model to describe the adsorption phenomena.

The simulation technique takes into account the variation of ambient temperature and solar intensity along a simulated day, which corresponds to a total daily insolation of 26,12 MJ/m² and to an average ambient temperature of 27.7 °C. A FORTRAN computer program is written to solve the proposed numerical model using an implicit finite difference technique.

The obtained solution allows to know the daily thermal behaviour of the tubular adsorber.

The performance of the machine has been discussed in the studied case of 1m^2 surface area of flat plate collector integrated with an eight copper tubes containing the activated carbon AC35/methanol pair, where the thickness adsorbent bed in each tube is 55.5 cm.

The dimensioning of the solar reactor (internal adsorber radius and collector surface area) is done after an optimization study, which is discussed in the present work. It has been found that the solar and the thermal performance coefficient of the system are 0.135 and 0.308, respectively.

COMPARATIVE STUDY OF A PREHEATING AND NON-PREHEATING SOLAR-STILL PRODUCTION

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Over 70 of the planetary surface are covered by water and from which 97.5% is salted water and thus is improper for human, in industrial and agriculture use. Soft water represents only, 2% of existing water. Solar desalination may be considered as an alternative to the drinking water production, which seems interesting for some areas of the planet, but represent disadvantage in terms of daily production which is still low.

The efficiency of solar still depends on the temperature gradient existing between the water temperature in the basin (Evaporation surface) and the glass cover (Condensation surface), in our case we have chosen a solar collector as a pre-heating system in order to increase the temperature of the basin water.

The obtained results highlight the effect of the performance parameters such as the water thickness, the ambient temperature, the inclination angle as well as the effect of pre-heating system (thermal solar collector) on the system performance (distiller production). In this optic we carry out a comparison, in terms of production; between pre-heating and non-pre-heating solar stills.

Keywords: solar desalination; solar collector; solar still; Performance.

DETERMINATION OF OPTIMUM DEPOSITION CONDITIONS OF ZINC OXIDE THIN FILMS ELECTRODEPOSITED FOR PHOTOVOLTAIC SOLAR CELLS

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The thin films of zinc oxide (ZnO) have been grown by electrodeposition technique onto tin oxide-coated glass (ITO/glass) substrates from a simple aqueous zinc nitrate electrolyte. The electrodeposition mechanism was investigated by cyclic voltammetry. The optimum deposition conditions like potential, pH and bath temperature are found to be -1 V (SCE) , 6 ± 0.1 and $65\text{ }^\circ\text{C}$, respectively.

Keywords: Electrodeposition, thin film, zinc oxide, cyclic voltammetry, photovoltaic solar cells.

THE INVESTIGATION OF THE PRANDTL NUMBER EFFECT ON MIXED CONVECTION IN THERMAL DEVELOPMENT IN A CYLINDRICAL DUCT

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This study concerns a numerical simulation of three-dimensional conjugate heat transfer in a horizontal pipe heated by Joulean effect through its entire thickness. The mixed convection in the fluid domain is combined with heat conduction in the thickness of the solid duct. The physical properties of the fluid are heat dependent and thermal losses, the outer surface of the conduit to the environment, are taken into consideration. At the entrance of the pipe, the fluid is presented with a constant temperature equal to $15\text{ }^\circ\text{C}$ and a parabolic velocity profile. The numerical method of finite volume is used for solving the equations of conservation of mass, momentum and

energy. The results of this study are performed for four different fluids (water, Butanol, Syltherm800, Ethylene Glycol) which correspond to the Prandtl, Reynolds and Grashof numbers which are calculated from the temperature entrance ($Pr = 8.0820, 80.5, 140, 305$), ($Re = 143.2836, 39, 128.6, 20$), ($Gr = 257534, 102336, 47802, 9300$) respectively. The electric intensity is considered $I = 40$ Amperes, and the geometric aspect ratio is equal to 104.17. The results produced were conducted so as to show the influence of the Prandtl number on the dynamic fields and the Nusselt number in forced convection modes ($Gr = 0$) and mixed convection. An empirical correlation expressing the Nusselt number depending on the number of the Prandtl and the number of the Richardson

$$Nu_{moy} = f(Pr, Ri),$$

$$Nu_{moy} = 19.543 * Ri^{0.1598} * Pr^{-0.0539}$$

DEVELOPMENT OF A MINI-PYRANOMETER

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In this paper, we present a detailed description of a mini pyranometer 8-bit 2-input. This device is dedicated to the measurement of incident solar radiation directly in the visible and near infrared (with two photodiodes broad-spectrum, respectively, a BPW21, and BPW34. This device is often coupled with an automatic register (datalogger), to establish a taking of measurements for a long period, to make a good dimensioning of a photovoltaic system on a region under solar electrification. The realization of this circuit is based on the use of the smallest microcontroller 8-bit existing in today's market, a 6-pin PIC10F222 only the baseline range of Microchip. This microcontroller is responsible for all functions provided in this device (measures, controls and management of a LUT for each sensor at stake), through specialized integrated modules such as analog to digital converter 8-bit two-channel measurement and one 8-bit timer with pre-divider. It's very low power consumption ($<170\mu A$ under 2V, 4 MHz) makes it particularly recommended for the design and construction device of long-range energy, particularly, products and accessories dedicated to the measurement, the control and regulation in the various fields of solar energy.

Keywords: *Pyrometer; solar radiation; visible; near infrared; photovoltaic panel.*

LABVIEW INTERFACE DRIVING MICROCONTROLLER DATA ACQUISITION SYSTEM: APPLICATION TO MEASUREMENT AND MONITORING OF SOLAR ENERGY DATA

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Estimation of solar energy potential of a region requires detailed solar radiation climatology, and it is necessary to collect extensive radiation data of high accuracy covering all climatic zones of the region. In this paper, a data acquisition system would help to estimate solar energy potential considering the remote region's energy requirement. This article explains the design and implementation of DAS for assessment of solar energy. The proposed system consists of a set of sensors for measuring meteorological parameters. The hardware part of our system conditioned firstly the collected data, using precision electronic circuits. This part is interfaced to developed LabView software using RS232 connection. The developed GUI is used to further process, display and store the collected data locally (in SD card or the PC disk) or far away (by email or FTP connection). The proposed architecture permits the rapid system development and has the advantage of flexibility and it can be easily extended for controlling the renewable energy systems like photovoltaic system. The DAS with executive information systems and reporting tools helps to tap vast data resources and deliver information.

Keywords: *Data acquisition, Photovoltaic, PV curve, PIC microcontroller, LabView.*

THERMAL CHARACTERIZATION OF DATE PALMWOOD

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This study focuses on an experimental investigation of thermophysical properties of date palm wood (*Phoenix dactylifera*) from Biskra oasis in Algeria. The goal is to use this natural material in the manufacture of thermal insulation for building. Certain parts of these palms were tested. The effect of fibers orientation was also studied. Furthermore, a comparison of its properties with those of other materials known in the literature is performed. As results, the renewable parts of date palm are the most insulating and lightest, compared with the trunk wood. The effect of fiber orientation on thermal conductivity is not significant. Although, the date palm wood is a good candidate for the development of efficient insulating materials when compared to the other natural materials.

Keywords: *Thermal insulation, natural materials, renewable energy, insulation materials, thermal characterization.*

VOF INTERFACE CAPTURING METHOD APPLIED TO THE SIMULATION OF BUBBLES COALESCENCE

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The diphasic flows are present in multiple applications. Those as well relate to the problems arising from the genius of the processes (agitation, mixture, separation, flotation) that by the propulsion (injection, atomization, and cavitation) or by the ocean-atmosphere exchanges, such as the surge. With the traditional difficulties raised by the resolution of the Navier-Stokes equations the crucial problem of the follow-up of the interfaces and their change of topology is added.

This work deals with the uses of the open source CFD code OpenFOAM in the simulation of the coalescence of bubbles rising in a fluid at rest. The calculations were conducted by using an interface capturing method without interface reconstruction. The code is able to treat the interaction of several liquid phases with presence of capillary actions between each one of them. Its principal limitation, like that of the other codes based on the same family of methods, lies in the progressive erosion of the stiffness of the interfaces progressively with the advance of simulation.

The results of our simulation conducted on Cartesian and axisymmetric coordinates illustrate the effect of the spurious currents on the surface region, especially the film drainage zone.

Keywords: *Two-phase Flows, Bubbles, Coalescence, Interface Capturing, VOF Method.*

EFFECT OF BATH PH ON THE ELECTRODEPOSITION OF CUPROUS OXIDE AND COPPER THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS

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The electrodeposition of cuprous oxide (Cu_2O) and copper (Cu) thin films at 29 °C on the ITO/glass substrates from cupric acetate aqueous solution is reported. The electrodeposition mechanism was investigated by cyclic voltammetry. The effect of pH on the electrodeposition of cuprous oxide and copper thin films was studied. The X-ray diffraction (XRD) analysis shows that Cu_2O films has a cubic structure and the preferred growth orientation is the (111) direction. The photocurrent characterization indicated that the films deposited at pH = 6.2 has n-type electrical conductivity.

Keywords: *Electrodeposition, thin film, cuprous oxide, copper, cyclic voltammetry, photovoltaic solar cells.*

HEAT TRANSFER QUANTIFICATION IN SOLIDE OXIDE FUEL CELL

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The study of the heat transfer in a SOFC based on mathematical modeling has attracted significant interest in recent years. Detailed CFD based models predict the current density, the species and the temperature distribution as well as the mass transfer within a SOFC. The inclusion of the heat radiation transfer in the analysis of the heat transfer entails a number of challenges which are not considered in the case of an analysis based only on the heat convection and the heat conduction.

In the present work, the heat radiation transfer effect on the temperature distribution in a PEN-SOFC is studied. The energy dissipation due to the Joule effect is the dominant source responsible for the heat release in the studied SOFC configuration. A two-dimensional numerical model based on the finite volume method is developed. The approximation methods are used in order to examine the heat flux within each compartment of the PEN-SOFC. The studied parameters are: the gas temperature, the current density and the SOFC dimensions.

Keywords: PEN – SOFC, temperature, SOFC configuration, radiation.

EXPERIMENTAL REALIZATION AND MODELING OF AN ELECTROSTATIC FILTER WIRE-CYLINDER

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Some electrostatic applications, in particular the electrostatic filter, or the electrostatic precipitator, it is a typically fuzzy system, or a great number of factors affect its performances in a complicated way. The objective of this work consists in studying the feasibility of this method for purification of environments charged in fine dust, this via an experimental and theoretical study on an electrostatic precipitator of geometry wire-cylinder of the Cottrell type. Our goal is to include understand the mechanisms influencing the collection of the particles in particular the electric and physical parameters.

Keywords: pollution, filter, electrostatics.

DC-DC SEPIC LOW COST SOLAR CELL CURVES TRACER

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This paper presents the design, construction and test of a low cost and high flexibility I-V/P-V curve tracer for photovoltaic modules. The curve tracer gives the possibility to obtain the significant parameters for the design and for the start-up of a photovoltaic installation (the operation point, the short-circuit current I_{sc} , the open-circuit voltage V_{oc} , the maximum power point MPP and the Fill Factor FF). The curve tracer is based on the so-called virtual instrumentation, based on LabVIEW software. The developed easy handling Graphical User Interface (GUI) is interfaced, via serial port, to single chip microcontroller driving a DC-DC buck-boost converter, the Single-Ended Primary Inductance Converter (SEPIC) used as electronic load. The implemented system realizes a complete sweep of the voltage and the current given by a photovoltaic panel, including V_{oc} and I_{sc} . Simulation and experimental tests have been carried out, in order to verify the behaviour and performance of the designed I-V curve tracer.

Keywords: Photovoltaic, PV curve, SEPIC converter, LabView.

PERFORMANCE OF MAXIMUM POWER POINT TRACKING MPPT CONTROLLER IN PHOTOVOLTAIC SYSTEM

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Modeling and simulation of a photovoltaic system for improving and optimizing the performance of its control, by the method of continued maximum power point tracking (MPPT) is presented in this work. For this characterization of the photovoltaic system including the MPPT based on the method of perturbation and Observation "P&O", the power interface is the boost converter (DC-DC) is carried. Of that same, their models are developed in MATLAB/Simulink. The results obtained under different conditions confirm the proper functioning of the MPPT Controller for photovoltaic systems with the algorithm of perturbation and observation "P&O".

Keywords: Photovoltaic system, MPPT, Perturbation and observation, boost.

POLYIMIDE SURFACE TREATMENT BY PLASMA DEPOSITION OF ORGANOSILCON NANO-THIN LAYERS

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Plasma enhanced chemical vapor deposition (PECVD) technique has been used to deposit organosilicon nano-thin layers on polyimide (PI) films substrates from hexamethyldisiloxane (HMDSO) precursor. The nano-thin layers chemical structure was analyzed using Fourier Transform Infrared (FTIR) spectroscopy and the surface wettability was characterized by contact angle measurements. FTIR analysis showed that the chemical formula of all deposited nano-thin layers were SiO_xC_yH_z-like. Increasing deposition time leads firstly to the increase of the treated PI films hydrophobicity and then to a quasi-saturation of the contact angle value when the discharge time increases beyond 2 min. Ellipsometry measurements showed that the refractive index measured on nano-thin layers elaborated from pure HMDSO with a discharge time of 30 s was found higher than that measured on films deposited with discharge time of about 420 s. Increasing time deposition leads to the decrease in the porosity of the nano-structure coating, leading to denser structure.

Keywords: Plasma polymérisation, organosilicon, nano-thin layers, wettability, FTIR, refractive index.

NEW ELECTROLYTES FOR SOLAR BATTERY BASED ON IMIDAZOLIUM AND PIPERIDINIUM CATIONS

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For electrochemical applications at high temperatures, a series of imidazolium and piperidinium -based cations with different anions were synthesized and studied as electrolytes for solar battery. The syntheses are based on a dialkylation reaction of methylimidazole and N-alkylpiperidine followed by anion exchange. The structures of ILs, were identified by using ¹H, ¹³C, ¹⁹F, ³¹P NMR and FT-IR spectroscopy. Their physicochemical and dielectric properties, including melting point, thermal stability, conductivity, and activation energies are determined. The thermal investigations have revealed that the melting points were slightly higher than 100°C, which may be interest for solid electrolyte applications. The obtained results encourage us to use the imidazolium with other anions in view to synthesis ILs with better dielectric properties for electrochemical application.

Keywords: electrochemical applications; electrolytes; solar battery; dielectric properties.

MAXIMUM POWER POINT TRACKER (MPPT) FOR PV SYSTEMS USING NEURAL NETWORK AND FUZZY LOGIC CONTROL

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Maximum power point tracking (MPPT) must usually be integrated with photovoltaic (PV) power systems so that the photovoltaic arrays are able to deliver the maximum power available. This paper proposes two methods of maximum power point tracking using a fuzzy logic and a neural network approach for photovoltaic (PV) module ATERSA75 using MATLAB software. The two maximum power point tracking controllers receive solar radiation and photovoltaic cell temperature as inputs, and estimated the maximum power point and the current and voltage corresponding to it as outputs. The new method gives a good maximum power operation of any photovoltaic array under different conditions such as changing solar radiation and PV cell temperature. From the simulation and experimental results, the Neural Network approach can deliver more power than the fuzzy system and can give more power than other different methods in literature.

Keywords: *PV Module, ATERSA75, Maximum Power Point Tracking MPPT, Artificial Neuronal Networks, Fuzzy System.*

POLYIMIDE SURFACE TREATMENT BY PLASMA DEPOSITION REACTOR OF THEORETICAL ANALYSIS OF GRADED BAND GAP MULTIJUNCTION SOLAR CELLS

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In this work some results of theoretical analysis on the selection of optimum band gap semiconductor absorber graded band gaps for application in multijunction solar cells are presented.

A detailed theoretical analysis of graded band-gap multijunction solar cells yields air mass 1.5 energy conversion efficiencies higher than for multijunction conventional cells. The improved efficiencies are mainly due to built-in electric fields in both layers, caused by band-gap gradations cells. The adoption of multijunction solar cell with band gap gradient can overcome several problems inherent in these systems.

Keywords: *band gap gradient ; multijunction solar cells*

SOLAR SPECTRUM INFLUENCE ON THE PERFORMANCE PARAMETERS OF DIFFERENT SOLAR CELLS TYPES

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The electrical current generated by the solar cells is very sensitive to the incident spectral distribution and intensity. This distribution varies greatly during the day due to changes in the sun's position or weather conditions. This work investigates the feasibility of using a solar spectral radiation model SMARTS2 to estimate the global solar irradiance and assess the influence of solar spectrum on the conversion efficiency of the organic thin film solar cells (PBDTTT) (poly[4,8-bis-substituted-benzo[1,2-b:4,5-b₀]dithiophene-2,6-diyl-alt-4-substituted-thieno[3,4-b]thiophene-2,6-diyl]), and CIGS solar cells. The variation of the common performance indicators such as short circuit current, fill factor, open circuit voltage, and efficiency are shown and discussed for each month. The results show that the variations in the solar spectrum affect the different materials to different extent. The maximum efficiency is obtained in the summer months; however the lower efficiency is obtained during winter.

Keywords: *organic solar cell, CIGS, solar cells, efficiency, spectral effects, performance.*

MAGNETO-CONVECTION IN SQUARE CAVITY CONTAINING Al_2O_3 +WATER NANOFLUID: HORIZONTAL MAGNETIC FIELD

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The phenomenon of natural convection in enclosures is not new problem for research. A rich and variety of numerical results have been published for last three decades due to this phenomenon often affects the thermal performance in many engineering and science applications. The study of magnetic field effects has important applications in physics and engineering. The heat transfer problems in the presence of magnetic field effects have attracted great interest of engineers and scientists for decades.

In this paper, we study by numerical simulation magneto-convection in square cavity containing Al_2O_3 -water nanofluid in natural convection. In this cavity, the horizontal walls are isothermal, maintained at cold (T_c) and hot (T_h) temperatures. The vertical walls are adiabatic. An external horizontal magnetic field is imposed. The basic equations describing the flow driven by natural convection consist of mass conservation, momentum and energy. These equations are solved numerically by finite element method. A numerical simulation of the problem was performed using the software Comsol Multiphysics. For the physical parameters of Al_2O_3 +water nanofluid, we use the Brinkman and Wasp model. Numerical results are presented for wide range of Hartmann number ($Ha=0$ to 100), with a value of Grashof number $Gr=10^4$ and volume fraction $\phi=0.1$ in terms of streamlines, isotherms and the flux ratio. The results show that the magnetic field has effects on the flow and heat transfer.

Keywords: Nanofluid; Free convection; Magneto-convection; Heat transfer; Finite element method; Square cavity.

WIND ENERGY RESOURCE ASSESSMENT AT CONSTANTINE REGION, NORTH-EASTERN ALGERIA

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In this paper, with the help of two-parameter Weibull distribution, the monthly, seasonal and annual assessment of wind energy potentiality was made using the wind speed data collected in last decade at the meteorological station of Constantine region, location situated in north-eastern Algeria. After the study of temporal Weibull parameters, the vertical extrapolation of mean wind speed at a height of 50m was made. The results show that Constantine has a low wind potential with an annual mean wind speed $V=2.43$ m/s, the annual wind power density is equal to 22.77 W/m², while the better seasonal and monthly wind energy potential is given in Winter and February respectively, unlike the shape parameter which increases in summer months.

Keywords: Wind resource, assessment, Weibull parameters, north-eastern Algeria, Constantine.

ANALYSIS AND COMPARAISON OF SOLAR ASSISTED HEAT PUMP SYSTEMS FOR HEATING

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Heating systems and solar-heat pump are innovative technologies to support the production of ecological heat. They are becoming more important due to the acceleration of climate change and the rising cost of fossil resources.

The most promising source of energy for Algeria is solar energy because of its climate. Therefore the use of solar energy for space heating is an alternative future and very important for the Algerian economy. For the

economical design of solar heating system, a theoretical study is required before installation. In this context a comparative study of performance of heating systems combining solar and heat pump as well as by conventional heating systems using solar or heat pump was undertaken. The building considered is located in Algiers.

Solar energy can be incorporated with the heat pump systems in a variety of configurations that can be classified into series and parallel arrangements.

In the parallel system of solar energy is used directly to supply the load when the solar gain is unable to satisfy the requirement often air to air heat pump type is used to provide the auxiliary energy necessary. In the series arrangement the solar energy is pumped through a heat transfer loop to be used on the evaporator side of the heat pump.

To study and optimize these heating systems, mathematical models have been developed and several simulations were performed, the influence of various parameters on system performance were identified, which collector efficiency, solar fraction and COP were determined, the collection area and the volume of heat storage were considered dominant parameters for the design of systems.

The results show that the parallel system is the most convenient and these systems can save conventional energy and be competitive with traditional heating systems.

Keywords: COP, Heat Pump, Solar Heating, Solar Fraction.

MONTHLY AND SEASONAL ASSESSMENT OF WIND ENERGY POTENTIAL AT MSILA REGION - ALGERIAN HIGHLANDS

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The aim of this paper is to investigate the monthly and seasonal variation of the wind resource in term of wind energy potential using the wind speed data collected between 2008 and 2010 for the meteorological station at Msila location situated in Algerian highlands. The vertical extrapolation of Weibull parameters and mean wind speed at a height of 50m with the analysis of temporal energy efficiency was made using a wind turbine of 600kW rated powers from Fuhrländer manufacturer. The results show that Msila situated in Algerian highlands between Tell in North and Sahara in South has an annual mean wind speed $V=4\text{m/s}$ and the annual wind energy production is equal to 2.4GWh/year, while the highest monthly energy produced may be reached in March, and the better seasonal wind energy potential is given in Winter.

Keywords: Wind energy production, Temporal assessment, Weibull parameters, Algerian highlands, Msila.

THERMAL CHARACTERIZATION OF DATE PALMWOOD

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This study focuses on an experimental investigation of thermophysical properties of date palm wood (*Phoenix dactylifera*) from Biskra oasis in Algeria. The goal is to use this natural material in the manufacture of thermal insulation for building. Certain parts of these palms were tested. The effect of fibers orientation was also studied. Furthermore, a comparison of its properties with those of other materials known in the literature is performed. As results, the renewable parts of date palm are the most insulating and lightest, compared with the trunk wood. The effect of fiber orientation on thermal conductivity is not significant. Although, the date palm wood is a good candidate for the development of efficient insulating materials when compared to the other natural materials.

Keywords: Thermal insulation, natural materials, renewable energy, insulation materials, thermal characterization.

THE NUMERICAL STUDY OF THE CONVECTIVE HEAT TRANSFER BETWEEN TWO HORIZONTAL ECCENTRIC CYLINDERS

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convective heat transfer in eccentric horizontal annuli situated between two cylinders with isothermal wall conditions are studied numerically using two-dimensional finite-difference and finite-volumes models. The annular space is filled by a Newtonian and incompressible fluid. The effects of various parameters such as the radius ratio of the annulus, the eccentricity of the annulus, the Grashof number are investigated at the Prandtl number of 0.701. By using the approximation of Boussinesq and the vorticity-stream function formulation, the flow is modeled by the differential equations with the derivative partial: the equations of continuity and the momentum are expressed in a frame of reference known as "bicylindrical", to facilitate the writing of the boundary conditions and to transform the curvilinear field into a rectangular one.

Keywords: convective heat transfer /eccentric annuli/ bicylindrical coordinates / vorticity-stream function formulation.

AN EXPERIMENTAL STUDY OF MINTS SOLAR DRYING SYSTEMS

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Many research studies have been performed on forced convection (active) solar dryers for fruit, vegetables and plants. A short survey of these showed that applying the forced convection solar dryer not only significantly reduced the drying time but also resulted in many improvements in the quality of the dried products.

The objective of this study was to investigate the drying kinetics of mint was dried using a cabinet –type convective dryer. Air temperatures of 40, 50 and 60°C were used for the drying experiments. The key parameters for suitable drying are temperature, humidity and flow rate levels. These parameters determine the moisture removal rates which are important to evaluate the appropriate drying duration for a particular food product.

Keywords: Solar energy, Solar system, Energy conversion, Mint drying, Forced convection solar dryer.

NATURAL CONVECTION IN RECTANGULAR ENCLOSURE WITH HEATING AND COOLING BY SINUSOIDAL TEMPERATURE PROFILES ON TWO VERTICAL SIDES

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We propose in this work, the numerical study of the natural convection laminar and permanent, in rectangular enclosures whose vertical walls are active and horizontal one are adiabatic. The active walls are heated and cooled by sinusoidal temperature profiles, three cases of heating and cooling have been considered. Steady state heat transfer by laminar natural convection has been studied numerically by solving equations of mass, momentum and energy. The enclosure is filled by a Newtonian and incompressible fluid. The number of Prandtl is fixed at 0.702(case of the air),but the number of Rayleigh varies. By using the approximation of Boussinesq and the vorticity-stream function formulation, the flow is modeled by the differential equations with the derivative partial.

A computer code was developed, it uses finite volumes, for the discretization of the equations, and in order to show its reliability, we compare results resulting from the latter with other similar results existing in the literature, and we examine the effect of the Rayleigh number, and the parietal thermal conditions, on the results obtained, that it is qualitatively or quantitatively.

Keywords: Fluid Mechanic, Heat Transfer, Natural Convection, Closed enclosures,

CHARGING ALGORITHM FOR INCREASING LEAD-ACID BATTERY CYCLE LIFE IN PHOTOVOLTAIC SYSTEMS

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A new charging algorithm for lead-acid batteries in photovoltaic systems is presented. For increasing lead-acid battery cycle life, it is necessary for each discharge, recharge it to the maximum state of charge, and simultaneously protect it from the excessive gassing phenomenon. This algorithm provides these functions by using DC-DC converter, which differs from the traditional "ON/OFF" regulator. In fact, it can complete the final portion of the charge process (the most complex) and decreases the plate sulphation through matching the batteries characteristics to the photovoltaic performances. The simulation results show that, using the proposed algorithm, the battery would reach its maximum state of charge compared with the conventional charging algorithms.

Keywords: *Charging algorithm, lead-acid battery, cycle life, photovoltaic system, DC-DC converter, thermal compensation.*

PSPICE SIMULATION BASED STUDY OF PHOTOVOLTAIC CELLS/MODULES AND THEIR EXPERIMENTAL VERIFICATION

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A Pspice simulation based study of photovoltaic's cells/ modules using circuit simulator PSpice is presented in this paper. The PSpice is an analogue/digital circuit simulator which calculates voltage and current in a circuit under variety of different circumstances. This feature of PSpice is used to simulate a circuit based model for PV cells/ modules and then to conduct behavioral study under varying conditions of solar insolation including shading effect, temperature, diode model parameters, series and shunt resistance etc. The study is very helpful in clearly outlining the principles and the intricacies of PV cells/modules and may surely be used to verify impact of different topologies and control techniques on the performance of different types of PV system. To put the simulation study on firm footing an experimental verification is also carried out in the Lab by developing a PC based data acquisition system, which is also briefly discussed here as subsidiary.

MODELING AND NUMERICAL SIMULATION OF SOLAR CHIMNEY COLLECTOR

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The solar chimney Power plant system (SCPPS) is a simple solar thermal power plant that is capable of converting solar energy into thermal energy in the solar collector. In the second stage, the generated thermal energy is converted into kinetic energy in the chimney and ultimately into electric energy using a combination of a wind turbine and a generator. The purpose of this study is to conduct a more detailed numerical analysis of a collector of the SCPPS. A mathematical model based on the Navier–Stokes, continuity and energy equations was developed to describe the solar chimney power plant collector mechanism in detail. The governing equations were solved numerically using an iterative technique. The temperature, velocity and pressure distributions in the solar collector are illustrated for the city of 'Adrar' – Algeria – to examine the effect of varying ambient temperature and solar radiation on the flow in the collector. Reasonably good quantitative agreement was obtained between the experimental data of the Manzanares prototype and both the numerical results.

Keyword: *Solar chimney collector; Mathematical modeling; Numerical simulation; Southern Algeria.*

IMPROVING THE PRODUCTIVITY OF WATER BY COUPLING A SOLAR STILL WITH FLAT PLATE COLLECTOR

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The last statistics show that within the next fifty years, the world population will increase by 40 to 50 %. This population growth, coupled with industrialization and urbanization will result in an increasing demand for water and will have serious consequences on the environment. To confront these problems, several techniques of desalination of brackish or waste water have been developed around the world.

Among the techniques used especially for arid and deserted area, solar distillation is characterized by being simple and easy. Moreover, solar still does not require an expensive and complex installations unlike other techniques used for the desalination of water, because the solar distillation depends entirely on solar energy to raise the water temperature.

Unfortunately, the solar distillation remains limited to the individual use. Where the experiments have shown that the productivity of traditional solar still estimated at about 3 liters per day, this result is not satisfactory, and in order to improve the production of the solar still, our work focuses on the coupling of a still with a flat plate collector. This study was conducted various types of solar stills: single slope, double slope and spherical solar still.

After having established the thermal balances of the various solar stills at instationary regime, the equations are solved by using 4th order Runge–Kutta method. The numerical results obtained show clearly the effect of coupling a solar still with a flat plate collector. The improvement of production resulting by preheating water for all types of solar stills studied was estimated.

Key words: *solar still, flat plate collector, preheat, productivity*

IMPROVEMENT OF THERMAL STRATIFICATION IN SOLAR STORAGE TANKS USED IN INDIVIDUAL AND COLLECTIVE SOLAR PLANTS

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The objective of this work is the study using a CFD code of thermal stratification in two solar storage tanks, the first one, called traditional with no devices promoting stratification, while the second equipped with injector having a modified shape. In this work the influence of the injection flow rate is highlighted.

The results obtained show that increasing the injection flow rate leads to a faster delamination of both solar storage tanks. Thus, for high flow rate of injection, the stream creates along both sides in the case of tank with an active stratification leads to a faster delamination compared with traditional tank where the circulation of the fluid along the tank wall creates a dead zone. A comparison of the temperature profile at the mid-plane of the solar tank shows that for high flow rates, the traditional solar storage tank is more efficient than that equipped with injectors, whereas for lower flow rates, the influence of the injectors is positive. The solar tank equipped with injector preserves the stratification longer, which leads to an increase in the efficiency of the solar plant.

Keywords: *CFD code, thermal stratification, injector, solar storage tanks, injection flow rate, efficiency.*

ENERGETIC BEHAVIOR OF HYBRID WATER PV/T COLLECTORS INTEGRATED IN ALGERIAN BUILDINGS

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The integration of active solar components in the building appears as a key element that reduces energetic and environmental impact of the building sector. However, the market for solar equipments in Algeria remains to this day relatively modest and their distribution is well constrained.

The aim of our work is to study and estimate the production and performance of hybrid water PV/T collectors and to assess the impact of integrating solar devices on energy and environmental balances of existing building.

The results show the positive influence of the integration of this component in the building on the economic and environmental balance. In addition to the electric production, heat productivity obtained is important, the solar fraction is satisfactory, and the efficiency is high.

Keywords: *Performance, hybrid water PV/T collectors, heatProductivity, solar fraction, Efficiency.*

SIMULATION OF THERMAL BEHAVIOR OF A SOLID POROUS MEDIUM BED USED IN HEAT STORAGE

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The thermal energy storage (TES) is not a new concept, but the novelty consists to develop an efficient and inexpensive thermal storage devices.

The present work has been undertaken to study the feasibility of storing solar energy using porous medium (Sand) during the diurnal period and utilizing this energy at the nighttime and overcast periods.

The device is composed by solar plan heater, storage tank and application. The thermal transfer between the storage medium and the energy-carrying fluid heated in the solar cell is assured by an exchanger imbedded into a storage material. The heat energy stored during day is restored at night through the second circuit.

The storage is based on sensible heat concept. The simulation of the thermal behavior of the storage medium shows that the temperature increases during the sunlight period to reach maximal values then it decreases. It corresponds to charge/discharge cycle in storage system.

The realization of this device will be interesting then.

Keywords: *Sensible heat storage, Porous medium, Solar energy, Simulation, Design.*

NUMERICAL STUDY OF THE EFFECT OF DIAMETER INTERN ANT EXTERN ON THE ESTABLISHMENT OF THE TURBULENT REGIME IN A COAXIAL EXCHANGER

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This work aims to study the effect of changing diameter intern and extern on the length and temperature of the establishment of a turbulent flow in a coaxial heat exchanger with a counter current flow. The study is based on a numerical simulation using fluent software. For better illustration, this study presents a mathematical model governing a flow in the presence of a heat transfer (continuity equation, Navier-Stokes equation and energy equation).

Keyword: *coaxial exchanger, fluidvelocity, diameter, fluent, lengthof establishment.*

EFFECT OF EDTA ON THE ELECTRODEPOSITION OF SNS THIN FILMS FOR SOLAR CELLS

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Thin film materials are being studied to harvest light as a component in advanced photovoltaics. The requirements of any new absorber materials are such that they are inexpensive, environmentally benign, and help to improve energy conversion efficiencies in solar cell devices. Tin sulfide (SnS) has great potential in all of these respects and, hence, is a material of interest in advanced photovoltaic devices.

In this work, SnS thin films were deposited onto Cu substrates from an aqueous solution bath containing tin chloride and sodium thiosulfate and EDTA at pH 2 and room temperature. Prior to the deposition, a cyclic voltammetry experiment was carried out between two potential limits (+1000 to -1000 mV versus SCE) to probe the effect of the applied potential and to determine the most likely suitable electrodeposition potential for the deposition of tin sulfide.

Keywords: *Solar cells, electrodeposition, EDTA, SnS.*

FAULT-TOLERANT CONTROL OF PHOTOVOLTAIC PANELS

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In this work we present a fault-tolerant control strategy to extract the maximum power from photovoltaic (PV) panels. The performance of PV panels is affected with different type of faults such as mismatch, shading, cell degradation, different type of panels, soiling.... This faults result in multiple local maximum points in the P-V characteristic where the classical P&O MPPT algorithm is unable to achieve the global maximum power point. The proposed method is based on the use of a hybrid Particle Swarm Optimization and a classical PI controller to achieve the maximum performance in the presence of different type of faults.

NUMERICAL PREDICTION OF A TURBULENT SEPARATED FLOW USING CFD CODE

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In the present study, the subsonic flow in an asymmetrical diffuser was simulated numerically using code CFX 11.0 and its generator of grid ICEM CFD. Two models of turbulence were tested: K- ϵ and K- ω SST.

The results obtained showed that the K- ϵ model singularly over-estimates the value speed close to the wall and that the K- ω SST model is qualitatively in good agreement with the experimental results of Buice and Eaton 1997. They also showed that the separation and reattachment of the fluid on the tilted wall strongly depends on its angle of inclination and that the length of the zone of separation increases with the angle of inclination of the lower wall of the diffuser

Keywords: *Asymmetric diffuser, Separation, Reattachment, Tilt angle, Separation zone.*

THE EFFECT OF POROUS MEDIA THICKNESS AND THE AIR VELOCITY INLET ON THE TEMPERATURE DISTRIBUTION INSIDE A SOLAR TOWER VOLUMETRIC RECEIVER

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In order to investigate the steady heat transfer characteristics of a porous media solar tower receiver, this paper applies the steady heat and mass transfer models of the porous media to solar receivers, chooses the preferable volume convection heat transfer coefficient model, solves these equations by using the numerical method of finite volume, and analyzes the typical influences of the thickness and the air velocity inlet, on the temperature distribution.

The paper can provide a reference for this type of receiver design and reconstruction.

Finite volume method was used to solve the governing equations. Upwind scheme was applied to governing equations, and solution was obtained using the Gausse-Seidel iterative method. The computational domain was discretized by (50 x1) grids. The convergence criterion was to be 10^{-3} relative error between consecutive iterations

for the grid points in the calculation domain. The inlet air temperature was set to 293 K and a uniform solar radiation flux, q_w , was set to 1 MW/m². Constant properties of the fluid and porous media were assumed for air and SiC matrix.

Keywords: *Numeric investigation, finite volume method, porous media, solar tower.*

NUMERICAL STUDY OF THE MIXED CONVECTION HEAT TRANSFER ENHANCEMENT BY USING OF THE LONGITUDINAL AND TRANSVERSAL INTERNAL FINS IN A HEATED HORIZONTAL PIPE

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In this work, we numerically study the three-dimensional mixed convection heat transfer in a horizontal pipe equipped by longitudinal and transversal attached fins on its internal surface for the solar application such as the water or air heating with solar panel. The pipe and fins are heated by an electrical intensity passing through their small thickness. The longitudinal fins studied number is: 2 vertical, 4 and 8 fins, while the number of transversal fins is 8 fins. The considered heights fin are $H=0.12$ cm and $H=0.24$ cm. The convection in the fluid domain is conjugated to thermal conduction in the pipe and fins solid thickness. The physical properties of the fluid are thermal dependant. The heat losses from the external pipe surface to the surrounding ambient are considered. The model equations of continuity, momenta and energy are numerically solved by a finite volume method with a second order spatiotemporal discretization. As expected for the longitudinal fins, the axial Nusselt number increase with increasing of number and height of fins. For $Gr= 5.1 \cdot 10^5$, the average Nusselt number without fins is equal to 13.144. The introduce of longitudinal fins gives an average Nusselt number equal to 16.83, 22.523 and 32.066 for 2 vertical, 4 and 8 fins respectively. The participation of fins located in the lower part of the tube on the improvement of heat transfer is higher than the participation of the upper fins. On the other hand, the longitudinal fins participate directly on increase of the heat transfer; this is justified by the large local Nusselt number along the interface of the fins. This participation is moderate in the case of transverse fins, these latter are used to mix the fluid for increased the local Nusselt number to the interface in the cylindrical axial sections following the transversal fins.

Keywords : *Conjugate Heat Transfer; Mixed Convection; Internal Fins; Numerical simulation.*

MODELISATION OF PHOTOVOLTAIC GENERATOR

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The photovoltaic generator is the only direct converter to convert light into electricity, the aim of this paper is to provide mathematical models of each element of the PV system under actual operating conditions. First we present the models then determine their different parameters and were simulated using MATLAB software.

Keywords: *Energy solar, generator photovoltaic, monetization, simulation.*

PHOTOVOLTAIC ARRAY MODELING AND MPPT USING ARTIFICIAL NEURAL NETWORK

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The good operation of a photovoltaic system depends on weather conditions such as illumination and temperature, because for example in a mobile station powered by a photovoltaic source, power supplied by the photovoltaic generator fluctuates when changing direction or during passage in poorly sunny.

In other words, a good photovoltaic system is where the power delivered by the photovoltaic generator is maximum whatever the conditions.

In the present work, we will precede first time modeling of solar cells by neural networks, then, we will use this approach to track the point of maximum power regardless of the location of use and operating conditions.

Keywords: Photovoltaic array, signal diode model, artificial neural networks, P&O, MPPT

MODELLING AND PEAK POWER CONTROL FOR WIND SYSTEM OF GRAND POWER USING SYNCHRONOUS GENERATOR

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The aim of this work is to analyze the theoretical conception of great wind model. The model consists of wind turbine model, generator synchronous model, converter model (DC-DC converter), and MPPT controller.

First of all, we see the influence of wind speed on the turbine power Deliver. Then, we use algorithm to find maximum power point for better exploit of wind turbine system and enhance the performance of power production.

Finally, MPPT algorithm used with DC-DC converter the simulation show that performance of the proposed method increase performance of system.

Keywords: wind turbine –MPPT- generator synchronous-modeling.

SIMULATION OF TUNNEL JUNCTION IN CASCADE SOLAR CELL (GAAS/GE) USING AMPS-1D

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The development of the tunnel junction interconnect was key to the development of the first two-terminal monolithic, multi-junction solar cell. In this paper describes a simulation for the tunnel junction (AlGaAs) between top cell (GaAs) and bottom cell (Ge). This cascade solar cell was simulated using the one dimensional simulation program called analysis of microelectronic and photonic structures (AMPS-1D). In the simulation, the thickness of the tunnel junction layer was varied from 5 to 50 nm. By varying thickness of tunnel junction layer the simulated device performance was demonstrate in the form of current-voltage(I-V) characteristics and quantum efficiency (QE).

Keywords: AlGaAs, AMPS-1D simulation, conversion, efficiency, quantum efficiency.

COMPARATIVE STUDY BETWEEN TRADITIONAL MPPT ALGORITHMS AND FUZZY LOGIC MPPT (MODELLING AND SIMULATION)

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This paper describe comparative study between traditional MPPT method and fuzzy logic MPPT controller , we begin by modeling photovoltaic panel two diode model and show impact of different level of solar irradiation ,then we take two traditional MPPT algorithms perturb and observe and incremental conductance for research maximum power of photovoltaic panel , after that we use fuzzy logic controller for control of dc-dc cuk converter, all this models are implemented in Matlab/simulink , The results show that the method of fuzzy logic can quickly and correctly track change of MPP in different light intensity and the system has excellent stability performance.

Keywords: photovoltaic panel – MPPT –P&O-incremental conductance –fuzzy logic.

CARACTERIZATION OF AlGaAs/GaAs NANOSTRUCTURE BY MONTE CARLO CALCULATION

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We have measured the signal cathodoluminescence CL of the multiple quantum wells nanostructure of $\text{Al}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ by cathodoluminescence technic and Monte Carlo method across of the GaAs quantum wells, this model describe the interaction of electron beam with $\text{Al}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ nanostructure by simple method and it can resolved the difficulty of high spatial resolution of the low-dimensional structure[1]. The CL signal is the emission intensity for the multi-quantum wells (MQWs) of GaAs as a function of the tip position X. This model takes into account the confinement phenomenon in the quantum wells. The influence of different parameters such as the Al mole fraction (x) and the diffusion length (L_D) are studied. The carrier excess generated during the collision of the incident electron with the atoms of the material (random walk) is calculated taking into account the confinement phenomenon within the quantum well [2]. The radiative recombination of electron-hole pairs is collected as a light (CL signal). Some distinct constants were evaluated by comparing the experimental results with our Monte Carlo simulations, we identified these constants like diffusion length L_D of the injected electrons.

Keywords: cathodoluminescence; Monte Carlo; nanostructure; AlGaAs/GaAs; quantum wells.

SIMULATION OF THIN FILM CdTe SOLAR CELLS

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In this work, CdTe solar cells are studied by means of simulation using PC1D program. CdTe material has been selected because of its interesting properties in renewable energies field, especially for photovoltaic applications cases.

The PC1D simulation has been run for a solar cell constituted of a thin film CdTe homojonction. Thus, several parameters have been taken into account. In particular, the effects of the p-CdTe thickness layer (TL) and its concentration (c) have been investigated. It was noticed that the CdTe solar cell presented the best performances for optimum values of (TL) and (C) parameters. Indeed, for $TL=4\mu\text{m}$ a conversion efficiency (η) of 16,49% has been obtained. Moreover, for $C=1\times 10^{16}\text{cm}^{-3}$, a value of $\eta=18,01\%$ has been achieved.

Key words: CdTe, solar cell, homojonction, PC1D simulation.

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