AY 2020-21: Collaborative quality initiatives with other institution(s)

The following are the list of publications and MoU's for Qualitative Assurance Initiatives of the Institutions during the academic year 2020-21:

S. No.	Details	No of Publications /MoU's
1	Publications	32
2	MoU's	34

28/1/22

(Prof. Dr. V. Rajendran)
Principal

Prof. Dr. V. RAJENDRAN
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Publications

S. No.	Publication Details	Collaborative Institute	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISBN/ ISSN number
1	Polymorphism induced magnetic transitions in Ni(OH)2 nanostructures	Kongunadu Arts and Science College, Coimbatore, King Khalid University, Abha, Saudi Arabia, Yeungnam University, Republic of Korea	Dr.V. Gopalakrishnan	Physics	Journal of Magnetism and Magnetic Materials	2020-2021	0304-8853
2	ZnO nanoparticles as efficient sunlight driven photocatalyst prepared by solution combustion method involved lime juice as biofuel	Government Arts and Science College, Avinashi, KSR College of Technology, tiruchengode	Dr.S.S. Kanmani	Physics	Biomolecular Spectroscopy	2020-2021	9780598002846
3	Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO2films for sensing devices	Government Arts College, Coimbatore	Dr.V. GopalaKrishnan	Physics	New Journal of Chemistry	2020-2021	1144-0546

4	Investigation on temperature-dependent structural, dielectric and impedance characteristics of Cu-doped CaFexTi1-xO3-δ nanotitanates	KSR College of Technology, tiruchengode	Dr.V. Rajendran	Physics	Journal of Materials Science: Materials in Electronics	2020-2021	0957-4522
5	Trust level evaluation based asymmetric cryptography protocol for flexible access control in fog computing	PSG College of Arts and Science college, Coimbatore	Dr.R. Kousalya	Computer Applications	International Journal of Computer Networks & Communications	2020-2021	0975-2293
6	Influence of anionic precursors on electrochemical properties of tin oxide nanoparticles: a comparative analysis	Natonal institute of materials sciecne, Japan	Dr.S.S.Kanmani	Physics	Journal of Materials Science: Materials in Electronics	2020-2021	0957-4522
7	Effects of processing parameters on green synthesised ZnO nanoparticles using stem extract of Swertia chirayita	University of West bengal, KSR college of Technology, tiruchengode	Dr.S. Karthik	Biochemistry	Biocatalysis and Agricultural Biotechnology	2020-2021	1878-8181
8	Effect of vacuum annealing on structural, optical and magnetic properties of Sn	Vellore institute of Technology	Dr.Deepannita Chakraborty	Physics	Optical Materials	2020-2021	0925-3467

	doped ZnS thin films						
9	Efficient photocatalytic degradation of 2,4-dinitrophenol over mesoporous zr and ce co-doped tio2 under visible light	Kongu Engineering College, Perundurai	Dr. M. Myilsamy	Chemistry	Desalination and Water Treatment	2020-2021	1944-3994
10	Impact of double-stratification on convective flow of a non-Newtonian liquid in a Riga plate with Cattaneo-Christov double-flux and thermal radiation	King Abdulaziz University, Saudi Arabia, Kongunadu Poltechnic College, Dindugal	Dr.S. Eswaramoorthi	Mathematics	Ain Shams Engineering Journal	2020-2021	2090-4479
11	A Flexible Access Control with User Revocation in Fog-Enabled Cloud Computing	PSG College of Arts and Science college, Coimbatore	Dr.R. Kousalya	Computer Appplications	International Conference on Inventive Computation Technologies	2020-2021	1728185025
12	Mixed Convection and Thermally Radiative Flow of MHD Williamson Nanofluid with Arrhenius Activation Energy and Cattaneo-Christov Heat-Mass Flux	Princess Nourah Bint Abdulrahman University, Saudi Arabia, Bolu Abant Izzet Baysal University, Turkey,	Dr.S. Eswaramoorthi	Mathematics	Journal of Mathematics	2020-2021	23144629

		Jigme Namgyel Engineering College, Royal University of Bhutan					
13	Impact Of Double-Diffusion And Second Order Slip On Convection Of Chemically Reacting Oldroyd-B Liquid With Cattaneo-Christov Dual Flux	King Abdulaziz University, Saudi Arabia, Kongunadu Polytechnic College, Dindigul	Dr.S. Eswaramoorthi	Mathematics	THERMAL SCIENCE	2020-2021	0354-9836
14	Numerical and Analytical Investigation for Darcy-Forchheimer Flow of a Williamson Fluid over a Riga Plate with Double Stratification and Cattaneo-Christov Dual Flux	Princess Nourah Bint Abdulrahman University, Saudi Arabia, Jigme Namgyel Engineering College, Royal University of Bhutan	Dr.S. Eswaramoorthi	Mathematics	Advances in Mathematical Physics	2020-2021	16879120
15	Impact of stratifications and chemical reaction on convection of a non-Newtonian fluid in a Riga plate with thermal radiation and	King Abdulaziz University, Saudi Arabia, Kongunadu Polytechni	Dr.S. Eswaramoorthi	Mathematics	Ain Shams Engineering Journal	2020-2021	2090-4479

	Cattaneo-Christov flux	c College, Dindigul					
16	Balanced Rank Distribution Labeling of Ladder Graphs, Complete Graphs and Complete Bipartite Graphs	Vellalar College for Women, Erode	Dr.S. Gokilamani	Mathematics	TWMS Journal of Applied and Engineering Mathematics	2020-2021	2146-1147
17	Structural, optical and magnetic properties of vacuum annealed Fe, Mn doped NiO nanoparticles	Vellore Institute of Technology Vellore, VEMU Institute of Technology Andhra Pradesh	Dr.Deepannita Chakraborty	Physics	Applied Physics A: Material Science & Processing	2020-2021	14320630
18	TEMPERATURE DEPENDENCE of HOMOGENEOUS ANATASE-PHASED TiO2FILMS CHARACTERIZATION and GAS-SENSING BEHAVIORS	Government Arts College Coimbatore	Dr.V. Gopala Krishnan	Physics	Surface Review and Letters	2020-2021	021862 5X
19	Genetic risk factors for lumbar disc disease	KMCH institute of Health Sciences and Research, karpagam Faculty of Medical Sciences and	Dr.S.Balasubramanian	R&D, Biochemistry	Clinical Anatomy	2020-2021	1098-2353

		Research (KFMSR), Coimbatore,					
20	Development of CuAlO2-Encapsulated Reduced Graphene Oxide Nanocomposites: An Efficient and Selective Electrocatalyst for Detection of Neurodegenerative Disorders	Tamilnadu Agricultural University, Coimbatore	Dr.K.Girija	Physics	ACS Applied Biomaterials	2020-2021	2576-6422
21	Technical efficiency estimates of stochastic production frontier model using Rayleigh distribution	Kumaraguru College of Liberal Arts and Science, Coimbatore	Dr.S.Kannaki	Mathematics	AIP Conference Proceedings	2020-2021	0094-243X
22	Solving LPP with stochastic neutrosophic Pythagorean Z numbers	Nirmala College for Women, Coimbatore	Dr.M. Revathy	Mathematics	AIP Conference Proceedings	2020-2021	0094-243X
23	Molecular descriptors of dodecagonal network with python program and bounds based on new parameters for some topological indices	Nirmala college for women, coimbatore	Mrs.S. Manimekalai	Computer Technology	AIP Conference Proceedings	2020-2021	0094-243X

24	Upgradation of maize stalk waste as an alternate agrarian raw material for the production of amorphous silica composites	Addis Abbaa Science and Technology University, Ethiopia	Dr.P. Chidambararajan	Biuotechnology	Journal of Analytical and Applied Pyrolosis	2020-2021	0165-2370
25	Comparison of Eosin yellowish dye–sensitized and CdS-sensitized TiO2 nanomaterial–based solid-state solar cells	Natonal institute of materials sciecne, Japan	Dr.S.S. Kanmani	Physics	Journal of Solid State Electrochemistry	2020-2021	14328488
26	Molecular Insights on the Dihydrogen Bond Properties of Metal Borohydride Complexes upon Ammoniation	PSGR Krishnammal College for women,	Mrs.A. Saravanapriya	Physics	ECS Journal of Solid state science and Technology	2020-2021	2162-8769
27	Secure and Efficient Fire-fly Data Routing Algorithm for Wireless Sensor Networks in IoT Monitoring Systems	PSGR Krishnammal College for women	Dr.B. Rosiline Jeetha	Computer Science	Jounal of Physics – Conference series	2020-2021	1742-6588
28	Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating	King Abdulaziz University, Saudi Arabia, Kongunadu Polytechnic College,	Dr.S. Eswaramoorthi	Mathematics	International Journal of Nanotechnology	2020-2021	1475-7435

29	Enhancement of Corrosive-Resistant Behavior of Zn and Mg Metal Plates Using Biosynthesized Nickel Oxide Nanoparticles	Government Arts College, Uthgamantalam, KSR College of Technology	Dr.S.S.Kanmani	Physics	Journal of Bio and Tribo corrosion	2020-2021	
30	Does epigenetics have a role in age related macular degeneration and diabetic retinopathy?	SN ONGC Department of genetics and Molecular biology, Chennai	Dr.S.Gowri	Biochemistry	Genes & Diseases	2020-2021	2352-3042
31	Computation of eccentricity associated topological descriptors through Python for comb tree	Nirmala College for Women, Coimbatore	Ms.S.Manimekalai	Mathematics	Journal of Physics: Conference series	2020-2021	1742-6588
32	Photocatalytic degradation of Bisphenol-A in water under sunlight irradiation over ZnO nanoparticles fabricated by Ethiopian cactus pear fruit peel infusions	Addis Ababa Science and Technology University, Addis Ababa, 16417, Ethiopia	Dr.P.Chidambararajan	Biotechnology	Optik	2020-2021	0030-4026

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Research articles

Polymorphism induced magnetic transitions in $Ni(OH)_2$ nanostructures

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ARTICLE INFO

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Nickel hydroxide
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Complexing agent
Magnetic properties

ABSTRACT

The article describes the impact of complexing agent on the phase changing property of $Ni(OH)_2$ nanostructures (NSs). $Ni(OH)_2$ was prepared by facile hydrothermal method and polymorphism have been obtained by employing two different complexing agent while keeping other parameters constant during synthesis. The α-and β-$Ni(OH)_2$ NSs phase was formed confirmed by XRD and FTIR. FESEM and TEM images reveals that the 3D-flower like α-$Ni(OH)_2$ nanostructure and formation randomly oriented nanopetals of β-$Ni(OH)_2$ NSs. Magnetic features of both α-and β-$Ni(OH)_2$ phases were studied using SQUID magnetometer. α-and β-$Ni(OH)_2$ exhibit blocking temperature at 6 K and 25 K, correspondingly and irreversible hysteresis behavior below blocking temperature. α-$Ni(OH)_2$ shows paramagnetic to superparamagnetic transition whereas β-$Ni(OH)_2$ shows paramagnetic to antiferromagnetic transition as temperature varies from 2 to 50 K.

1. Introduction

Multifunctional properties of layered double hydroxide nanomaterials generate much interest due to its potential applications. The physical and chemical properties of these layered double hydroxide materials were determined by its structure. Among Layered double hydroxides, $Ni(OH)_2$ find potential applications in Ni-based rechargeable batteries, electrochemical supercapacitors, as magnetic material, etc. [1]. $Ni(OH)_2$ is a isostructural compound which can exist in two polymorphism via α- and β phase. Both α- and β phases crystallizes in hexagonal structure with stacked layers and usually forms as thin flakes/platelets [2]. α-$Ni(OH)_2$ (will be referred as ANH) has hexagonal hydrotalcite-like structure with intercalated anions and water molecules, however β-$Ni(OH)_2$(will be referred as BNH) crystallizes in hexagonal structure without intercalated anions and water molecules [3]. Compared to BNH phase, ANH has disordered stacking layers with large C-axis size 7.5–32 Å [4]. To date, different solution methods has been employed to synthesis both ANH and BNH nanostructures (NSs). In the typical synthesis of $Ni(OH)_2$ NSs, no precipitation occurs when simply the Ni ion precursors are used [5]. To induce the nucleation of $Ni(OH)_2$ complexing agent is necessary. Hence complexing agent playing a significant role in construction and phase confirmation of $Ni(OH)_2$ NSs. Control over the phase transformation can be easily obtained by using different complexing agent and also by varying its concentration. This would lead us to prepare highly stable $Ni(OH)_2$ NSs that would not undergo instant phase transformation. Complexing agents like NH_3 [6], urea [7], NaOH [8], ethylenediamine [9], hexamethylenetetramine [10] has been used to synthesis both ANH and BNH nanostructures. Polymorphism also induced by varying the synthesis temperature and by addition of extra co-ordination agents and its influence on the electrochemical properties of $Ni(OH)_2$ were studied [11]. To the best of our knowledge no report is available on the complexing agent induced polymorphism. Extensive amount of work is reported on electrochemical properties of $Ni(OH)_2$ but magnetic features of $Ni(OH)_2$ are rarely reported. The reports are also controversial to each other that Tiwari *et al.* [12] reported that BNH exhibits paramagnetic to ferromagnetic behavior. Rall *et al.* [13] reported that BNH show metamagnetic behavior and ANH possess paramagnetic to ferromagnetic transition. In the report published by Liu *et al.* [14] magnetic property of ANH was determined as transition from paramagnetic to

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ZnO nanoparticles as efficient sunlight driven photocatalyst prepared by solution combustion method involved lime juice as biofuel

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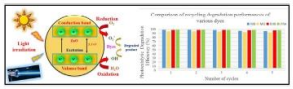
HIGHLIGHTS

- ZnO nanoparticles synthesised by solution combution method with lemon juice extract.
- Samples were characterized by XRD, UV–Vis, PL, FESEM, TEM, XPS, PDS.
- Structural and morphological characterizations confirmed the formation of wurzite hexagonal structure.
- XPS and PL analysis confirms that the synthesized ZnO will offer effective photocatalytic action.
- Exhibits excellent photocatalytic degradation of various organic dyes under UV and sun light (Vis) illumination.
- The maximum photocatalytic degradation efficiency was observed about 98.8% for PRA dyes under75 minutes of sunlight irradiation duration.

GRAPHICAL ABSTRACT



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Hexagonal wurzite structure
Photocatalytic activity

ABSTRACT

We have prepared high purity Zinc oxide (ZnO) nanoparticles (NPs) by solution combustion synthesis (SCS) method with the aid of lime juice extract. From powder X-ray diffraction (XRD) spectra, it is observed that the ZnO NPs possess single phase, hexagonal wurzite structure with sharp intense peak at (101) plane, agrees with the planes of SAED pattern. Further, the crystallite size is found to be around 18 nm. UV–Vis analysis shows strong UV absorbance band at 381 nm and PL measurements reveals the presence of strong UV emission at 347 nm along with few weak visible emissions. Optical studies infer the existence of lower recombination rate of electron-hole pair, influence the photocatalytic activity of ZnO. From XPS measurements, presence of oxygen rich states on surface are also confirmed (O 1 s states). The degradation performance and reusability of four different dyes (methylene blue (MB), methyl orange (MO), rhodamine B (RhB), Pararosaniline (PRA)) under UV and sunlight irradiations are carried out to illustrate the photo-catalytic activity in presence of a catalyst like ZnO NPs. Comparatively, about 98.8% of PRA and MB dyes are photodegraded at 90 and 75 min of sunlight irradiation, respectively. Among these two, PRA dye shows maximum degradation performance with shorter irradiation time

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Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO_2 films for sensing devices

V. Gopala Krishnan,*[a] P. Elango,[b] K. Ravikumar,[c] R. Marnadu,[d] Omar M. Aldossary[e] and Mohd Ubaidullah *[f]

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Zn-doped TiO_2 films were deposited on ultrasonically treated alumina substrates *via* the automatic nebulizer spray pyrolysis method. In this study, the thickness of the as-prepared films was gradually reduced, and their Brunauer–Emmett–Teller (BET) surface area and pore volume results were notably improved; in addition, values for the blue-shifted sharp edge absorption with an enlarged bandgap (E_g) were revealed in the deposited films. The agglomerated granular form has evolved into tiny grains with porous brighter particles scattered over the surface of the coated films. The sensing performance to reducing gases for combustible gas of ammonia (NH_3) and volatile organic compounds of methanol (CH_4O) and formaldehyde (HCHO) with the function of operating temperature and gas concentration were studied, and the highest sensing response of the hazardous formaldehyde (HCHO) reducing gas was noticed.

1. Introduction

In recent years, the amount of toxic and dangerous gases has been increasing dramatically due to the rapid technological impact on the medical, automotive, infrastructure and industrialization sectors, causing enormous outdoor and indoor pollution and numerous undesirable health effects.[1] Gas leak measurements play an important role in the area of nuclear power plants,[2] soil/wastewater treatment,[3] food and cosmetics,[4,5] and in the pharmaceutical industry[6] to monitor and alarm the dangerous gas levels. Toxic and dangerous matrices have been tested *via* calorimetric, conductive, gravimetric, optical, and numerous other sensing methods.[7] Of all, conductive metal oxide sensors are considered efficient due to their ability to operate at low humidity levels. Furthermore, they can detect environmental pollutant gases, including combustibles, because of the abundant adsorption of oxygen and the good catalytic effects.[8]

The most promising metal oxides sensors such as ZnO, WO_3, SnO_2, In_2O_3, and TiO_2 are used to detect combustible and volatile organic compounds (VOCs) as a function of change in resistance to the target gases.[9] Among them, TiO_2 and TiO_2-derived materials are significant for emerging environmental refinement.[10] TiO_2 has been extensively used in numerous applications such as a water treatment material, photocatalyst and gas sensor.[11–14] Despite numerous features, gas sensor-related parameters such as gas concentration, high operating temperature, sensor response, and selectivity are the main concerns that need to be improved. They can possibly be improved by doping the metal into metal oxides.[15] As with numerous combinational metal oxides, the metal-doped TiO_2 is a potential composition to improve the gas detection response, selectivity, stability, and even TiO_2 properties, such as Fermi level (E_f), electrical conductivity, and forbidden gap (E_g) value. Numerous studies have been devoted to the metal ion-doped TiO_2 gas detection such as Ag–TiO_2,[13] Sn–TiO_2, Nb–TiO_2 and Cr–TiO_2,[16] but no specific results are available for the stabilized anatase phase of additive mixed TiO_2 for the detection of combustible and volatile organic compounds. This report shows the characterization and gas sensing performance of anatase-phased Zn-doped TiO_2 for the combustible gas ammonia (NH_3), and volatile organic compounds methanol (CH_4O) and formaldehyde (HCHO) as the function of operating temperature and gas concentration.

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J Mater Sci: Mater Electron

Investigation on temperature-dependent structural, dielectric and impedance characteristics of Cu-doped $CaFe_xTi_{1-x}O_{3-\delta}$ nanotitanates

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ABSTRACT

In recent days, the development of low-cost, sustainable, efficient electrode materials for energy storage applications is of great interest. Herewith, Cu-doped $Ca(Ti_{0.9}Fe_{0.1})O_{3-\delta}$ (Cu:CTF) double-perovskite electroceramic, heat-treated at diverse temperatures (800–1100 °C) were prepared using sol–gel technology. X-ray diffraction pattern confirmed the orthorhombic structure of the prepared Cu:CTF perovskites. Significant traces of TiO_2, CuO vanishes at elevated temperatures, which is evident from the XRD pattern. Further, the secondary phase traces were also observed in XRD, but without changing its crystal structure of Cu:CTF nanotitanate. The crystalline nature of the Cu:CTF ceramic was identified around 750 °C employing TG/DTA. UV–visible spectroscopy demonstrates the poor visible absorbance region towards the red shift with the bandgap variation of 5.28–5.42 eV. The nature of the Cu:CTF particles were analyzed using electron microscopes with the estimated particle size between 52 and 190 nm. Considering the action of temperature and frequency, complex impedance spectroscopy was utilized to analyse the inter- and intra-grain inclusions. Complex impedance spectroscopy study confirms the existence of dipole–dipole relaxation and Maxwell–Wagner (MW) polarisation for the samples heated above 900 °C. However, the a.c. test reveals the presence of conduction due to the addition of Cu^{2+} ions to $CaTi_{1-x}Fe_xO_{3-\delta}$ perovskite, which enhances oxygen vacancies and is strongly dependent on the inhibition of the hopping conduction mechanism.

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TRUST LEVEL EVALUATION BASED ASYMMETRIC CRYPTOGRAPHY PROTOCOL FOR FLEXIBLE ACCESS CONTROL IN FOG COMPUTING

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ABSTRACT

The foremost problems in the fog-enabled cloud computing model are security guarantees and data Access Control (AC) because of the imitation of data by invaders. To enhance the security of this system, an Extended Communication Latency-based Authentication Scheme (ECLAS) that solves the mobility and similar locality legitimate login failures via applying two-factor authentication and a keystroke dynamics computation with obfuscated Round Trip Latency (RTL) of each users. But, the data need to accessed by other user should fulfill an be expected authentication and defend against dishonest access or login. So, data AC at cloud or fog nodes is greatly essential in many applications of fog-enabled cloud systems. Therefore in this article, a Flexible AC (FAC) protocol is introduced with the ECLAS for controlling the data access in fog-enabled cloud systems according to the trust estimated by the user in the cloud and reputations created by the amount of fog nodes in a flexible way via applying the Elliptic Curve Cryptography (ECC) and Proxy Re-Encryption (PRE). In this scheme, multi-dimensional controls are proposed on cloud and fog data access according to the strategies set by the user. The user encrypts its information with asymmetric secret key and this key is split into many segments for supporting different control policies. So, the user encrypts various segments of secret key with different encryption keys which are accordingly handled by the user and an amount of fog nodes regarding various reputation characteristics in different scenarios. Then, the user or fog nodes manage the data access using data encryption by the user. Finally, the experimental results exhibit the effectiveness of the proposed FAC as compared to the state-of-the-art AC schemes.

KEYWORDS

Fog computing, Cloud computing, Extended CLAS, Access Control, Trust, Reputation, Elliptic curve encryption.

1. INTRODUCTION

Fog computing is typically a decentralized paradigm to process and accumulate the data between the origin and a cloud structure. Based on this paradigm, the necessity of processing and accumulating a vast amount of unwanted information is prevented. As a result, the data transfer overhead is minimized and the efficiency is maximized. Chiefly, this is motivated via the significant development of Internet-of-Things (IoT) systems. But, there are many issues in scalability and consistency because of high overload in the data server while a common client-server model is accounted. Such issues are tackled by this novel framework which offers the accessible decentralized result. It is realized via the novel hierarchically shared fog paradigm between the cloud and end-user systems [1-3].

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J Mater Sci: Mater Electron

Influence of anionic precursors on electrochemical properties of tin oxide nanoparticles: a comparative analysis

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ABSTRACT

A cost-effective chemical precipitation method has been adopted to synthesis tin oxide (SnO_2) nanomaterials with the help of two different anionic sources (NH_3OH and NaOH). Initially, the X-ray diffraction (XRD) studies confirm the formation of regular rutile tetragonal crystal structure of SnO_2. The functional group analysis by Fourier transform infra-red (FTIR) spectroscopy identifies the presence of Sn-OH stretching mode of vibration. The morphological with elemental confirmation by HRSEM with EDAX analysis observes the formation of SnO_2 agglomeration in appropriate ratio (Sn and O) without showing any other impurities. The particle size analysis (PSA) reveals that the synthesized SnO_2 nanomaterials are in a nano-sized range of 10 nm to 33 nm. The optical analysis using UV–Visible (UV) and photoluminescence (PL) spectroscopy reveals that the bandgap energy of synthesized materials is found to be 4.12 eV and 4.14 eV, blue-shifted from bulk materials. The electrochemical behavior of synthesized tin oxide nanomaterials as working electrodes are examined by a conventional three-electrode system with analyzed parameters such as cyclic voltammetry (CV), galvanostatic charge–discharge (GCD) and electrochemical impedance spectroscopy (EIS). This study exposes the highest specific capacitance C_{sp} value of 405.15 F g^{-1} at a scan rate of 1 mV s^{-1} and 403.72 F g^{-1} at a current density of 0.5 Ag^{-1}. The highest energy density and power density value of 27.48 Wh kg^{-1} at 0.5 Ag^{-1} and 145.83 W kg^{-1} at 1 Ag^{-1}, respectively, presents a promising positive working electrode material for supercapacitor applications.

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Effects of processing parameters on green synthesised ZnO nanoparticles using stem extract of *Swertia chirayita*

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ABSTRACT

This study focuses on the effective synthesis of ZnO nanoparticles from the stem extract of *Swertia chirayita* via the use of zinc acetate as precursor. Three different synthesis methods namely Sonication, Wet-chemical and Hydrothermal methods were used in the development of ZnO nanoparticles, due to its simple and easily scalable attribute. A comparative assessment was subjected over the prepared ZnO nanoparticles to evaluate the influence over the nanoparticles physico-chemical property and also to determine the most effective processing method to green synthesise ZnO nanoparticles. The ZnO nanoparticles synthesised demonstrates retainment of spherical crystalline structure, even though the processing parameters of the ZnO nanoparticles were varied during its synthesis. ZnO nanoparticles synthesised using hydrothermal process exhibits smaller particle size (17 nm), better photocatalytic activity (88.67%) and antibacterial activity against *Escherichia coli* (26 mm) and *Staphylococcus aureus* (28 mm) compared to the other ZnO nanoparticles. These results could be strongly attributed to the smaller particle size due to the controlled pressure and temperature employed during the production of ZnO using hydrothermal process. The observed result revealed the calibrable nature of the ZnO nanoparticles property in virtue of its processing parameters and also its high affectivity in biomedical application.

1. Introduction

Materials controlled to the nano regime (less than 100 nm), shows unique behaviour because, because of its higher surface/volume ratio and wider band gap between valence and conduction band resulting in unique property (García Marín et al., 2013; Kathirvelu et al., 2009). Over the decade, metal oxides and semiconductors having nano dimensions have attracted considerable interests in many fields such as optical sciences (Liu et al., 2004; Smith et al., 2013), Electronics (Meyer et al., 2012; Robertson, 2005), Medical science (Choi et al., 2008; Hao et al., 2010), Target drug delivery (Faraji and Wipf, 2009; Son et al., 2005) and Textiles (Karthik et al., 2018; Becheri et al., 2008).

Nano ZnO is considered as one of the most versatile materials due to its direct wide band gap of (3.3eV) and a large excitation binding energy (60 meV) at room temperature (Alivov et al., 2003; Ohta et al., 2000). Hence, it has seen a wide range of applications in fields such as catalytic science (Seo et al., 2017), energy devices (Belliard et al., 2001), chemical sensors (Ahmad et al., 2014) and opto electronic devices (Chen et al., 2015). ZnO nanoparticles are formed due to the intertwinning of hexagonally packed sublatices (Owolabi et al., 2016). The crystalline arrangement of the ZnO nanoparticles shows wurtzite structure which matches with GaN, hence, extensively used in various semiconductor application (Minimala et al., 2014). Researchers over the past decade had extensively studied the antibacterial activities of ceramics such as ZnO so as to substitute the conventional organic powder for the treatment of various diseases (Sirelkhatim et al., 2015; Saha et al., 2018; Khan et al., 2020). Metal oxides such as ZnO are preferred more than the conventional organic powder as mineral elements such as Zinc are essential to humans, and can exhibit effective antibacterial activity devoid of sunlight (Zhao et al., 2017; Dhandapani et al., 2020; Hilty et al., 2014). Recently, researchers have also reported about incorporating ZnO nanoparticles in polymeric matrix to enhance the effective mechanical and antibacterial activity of the nanocomposite material for bioengineering applications (Augustine et al., 2014; Díez-Pascual et al., 2014; Sharmin et al., 2015). Therefore, ZnO is one of the

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Effect of vacuum annealing on structural, optical and magnetic properties of Sn doped ZnS thin films

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ABSTRACT

Tin doped Zinc Sulphide ($Zn_{1-x}Sn_xS$) thin films at $x = 0.00, 0.02, 0.05, 0.08$ were prepared onto Corning 7059 glass substrates using electron beam evaporation technique and then subjected to vacuum annealing at 300 °C for 2 h. The effect of vacuum annealing on structural, optical and magnetic properties of the thin films were studied in detail. From XRD studies, it was found that the vacuum annealed thin films were in cubic structure and have finer crystallite size compared to the unannealed thin films. All the films exhibited high transmittance (85%) in the visible region. The vacuum annealing led to narrowing of band gap compared to the unannealed thin films. The presence of surface defects in vacuum annealed thin films were confirmed by the observation of two broad emission photoluminescence peaks at 420 nm and 440 nm. But the reduction in the intensity of photoluminescence emission peaks correlate to the decrease in the concentration of sulphur vacancies. Also, the vacuum annealed Sn doped ZnS thin films were found to exhibit paramagnetic behaviour with lesser maximum magnetization value compared to that of the unannealed Sn doped ZnS thin films.

1. Introduction

Dilute magnetic semiconductors are prepared by doping a non-magnetic semiconductor with any kind of small quantity of impurities (DMS). The influence of the dopants makes them exhibit different magnetic behaviour which will be useful in spintronic devices [1,2]. Also, a detailed first study about DMS materials were already reported by Dietl et al. [3]. Among the DMS families, II-VI DMS thin films are rising in recent trends. Earlier reports showed the exhibition of different magnetic behaviours such as ferromagnetism, paramagnetism and spin glass behaviour in different II-VI DMS compounds [4–6]. The metal sulphides show the most efficient behaviour among the other groups in II-VI semiconductors. And if the metal is considered as Zinc, then zinc sulphide (ZnS) is known as one of the most important wide band gap semiconductors. The uniqueness of ZnS is that it can be influenced by very small number of dopants to show enhancement in magnetic, electric and optical properties.

The origin of the magnetic property in a non-magnetic semiconductor by doping a transition metal is still not clearly stated. The magnetic property in DMS compounds can be intrinsic and extrinsic in nature. The efficient DMS will be those which inherit intrinsic magnetic properties [7]. Earlier reports published some dopants originating intrinsic and some dopants originating extrinsic magnetic properties in the host semiconductors [8]. The research is going on to develop more intrinsic magnetic property exhibiting DMS compounds for applications such as magnetic sensors, photoconductors, light emitting diodes, buffer layer in heterojunction solar cells, flat panel display, injection lasers, etc [9–13]. As these applications are used in room temperature, the compound to be used in them should attain magnetic and electrical properties at room temperature only. So, research is focused on developing room temperature magnetic property exhibiting DMS compounds in nanoscale. For an example InAs exhibited ferromagnetism at above room temperature [14]. The other features of ZnS is that it is a direct band gap semiconductor with a band gap (>3.5 eV) and it expected room temperature ferromagnetism. It exhibited half metallicity when doped with Cr, Fe and Ni [15]. Recent studies indicated that Fe doped ZnS nanoparticles exhibited room temperature ferromagnetism whereas the Cr doped ZnS exhibited both ferromagnetism and anti-ferromagnetism [16,17]. From the DFT studies it was found that the transition metal ions doped ZnS will exhibit ferromagnetism and half metallicity. It was also reported that the magnetic moments developed in them were due to delocalization of 3d orbitals of the transition metal

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Efficient photocatalytic degradation of 2,4-dinitrophenol over mesoporous Zr and Ce co-doped TiO_2 under visible light

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ABSTRACT

In the present study, zirconium and cerium co-doped mesoporous TiO_2 photocatalysts were prepared by sol–gel technique using Pluronic P123 as the structure-directing agent. The prepared catalytic materials were characterized by X-ray diffraction, high-resolution transmission electron microscopy, N_2 sorption studies, diffuse reflectance UV-vis absorption spectroscopic analysis and X-ray photoelectron spectroscopy. Zirconium and cerium co-doping on TiO_2 induces visible-light absorption and decreases the bandgap energy. Zirconium and cerium co-doped mesoporous titania exhibit a high surface area with a large pore diameter. The photocatalytic activity has been evaluated for the photodegradation of 2,4-dinitrophenol under visible light illumination. The optimum loading of Zr^{4+} and Ce^{4+} to TiO_2 was found to be 0.5 wt.%. Ce^{4+} and Zr^{4+} active sites are good electron scavengers, which can easily trap the excited electrons and shift the electrons to the adsorbed oxygen molecules and therefore efficiently extending the lifetime of the electron-hole pair. Moreover, Zr^{4+}/Ce^{4+}-TiO_2 showed excellent photocatalytic activity towards the degradation of 2,4-dinitrophenol under visible light irradiation due to the formation of a large quantity of $^{\bullet}OH$ and $O_2^{\bullet-}$ radicals.

Keywords: Nanomaterials; Mesoporous; Zr^{4+}/Ce^{4+}-TiO_2; Photocatalytic degradation; 2,4-dinitrophenol

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Engineering Physics and Mathematics

Impact of double-stratification on convective flow of a non-Newtonian liquid in a Riga plate with Cattaneo-Christov double-flux and thermal radiation☆

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ABSTRACT

The intention of the paper is to find the outcome of thermal radiation of a second grade fluid over a Riga plate with Cattaneo-Christov (CC) double flux and double stratification's. The governing mathematical models are changed into an ordinary differential equations (ODE) using suitable transformations. These resultant models are analytically solved with homotopy analysis method. The impact of pertinent parameters on velocity distribution, temperature distribution, concentration distribution, skin friction coefficient, local Nusselt number and local Sherwood number is analyzed graphically. We found that the skin friction coefficient suppresses with enhancing the injection/suction parameter. The energy transfer gradient suppresses with rising the thermal stratification parameter. Also, we found that the mass transfer gradient decreases with increasing the solutal stratification parameter.

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1. Introduction

The electrically conducting liquids, like, electrolytes, plasma, fluid metals, etc, are controlled by employing magnetic field and these fluids have vast applications in geophysics, magneto-hydro-dynamic (MHD) generators and MHD sensors, etc. These liquids are less electrical conductivity, nevertheless employing the electric force over an external agent to enhance their conductivity. MHD flow of a nanofluid was examined by Mahabaleshwar et al. [1]. MHD non-orthogonal flow of a nanofluid with thermal radiation was delineated by Jalilpour et al. [2]. They seen that the larger values of magnetic field parameter leads to downturn the fluid velocity. Sudarsana Reddy and Chamkha [3] performed the MHD convective flow of Al_2O_3- & TiO_2 - water based nanofluids on a porous stretching sheet with Soret and Dufour effects. From this study, they proved the fluid temperature enriches with higher values of magnetic field parameter. Few significant studies on MHD flow for various physical problems were found in Ref. ([4–15]). Riga plate (RP) is one of the external device which is used to enhance the electrical conductivity. This plate contains the electrodes and magnet pairs in definite form. Gailitis and Lielausic [16] was first initiated this plate and this plate produces the Lorentz force which is parallel to the wall and control the flow. Aiding and opposing Blasius fluid stream over a Riga plate was described by Magyari and Pantokratoras [17]. The nanoliquid flow of a RP was portrayed by Ahmad et al. [18]. They proved that the liquid temperature suppresses on growing the modified Hartmann number. Ayub et al. [19] discussed the nanoliquid flow over a RP. Effects of partial slip and viscous dissipation of a tangent hyperbolic nanofluid over a RP was explored by Nayak et al. [20]. They found that the skin friction coefficient increases with rising the values of modified Hartmann number. Rasool et al. [21] reported the salient features of SG nanoliquidic flow past vertical Riga plate with convective heating condition. They proved that the fluid velocity reduces with enhancing the modified Hartmann number.

In recent days, energy transfer mechanism is very significant in industrial processes, such as, cooling devices, power production, energy generation, etc. In general, most of the energy transfer features are examined by Fourier's heat conduction law. However, this

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A Flexible Access Control with User Revocation in Fog-Enabled Cloud Computing

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Abstract **- The major challenging task in the fog-enabled cloud computing paradigm is to ensure the security for accessing the data through cloud and fog nodes. To solve this challenge, a Flexible Access Control using Elliptic Curve Cryptography (FAC-ECC) protocol has been developed in which the user data are encrypted by multiple asymmetric keys. Such keys are handled by both users and fog nodes. Also, data access is controlled by encrypting the data through the user. However, the main problem is to guarantee the privacy and security of resources after processing of User Revocation (UR) by data owners. The issue of UR is needed to consider for satisfying the dynamic change of user access in different applications like healthcare systems, e-commerce, etc. Therefore in this article, a FAC-UR-ECC protocol is proposed to control the data access and realize the UR in fog-enabled cloud systems. In this protocol, a revocable key aggregate-based cryptosystem is applied in the fog-cloud paradigm. It is an extension of the key-aggregate cryptosystem such that a user is revoked if his/her credential is expired. First, the subset-cover model is combined into FAC-ECC protocol to design an efficient revocable key-aggregate encryption depending on multi-linear maps which realizes the user's access control and revocation. It can simplify the user's key management efficiently and delegate various clients with decryption permission. Also, it can accomplish revocation of user access privileges and the FAC efficiently. By using this protocol, both the user's secret key and the ciphertext are preserved in a fixed size. The security of accessing the data is highly enhanced by updating the ciphertext through the data owners successfully. At last, the experimental results exhibit the efficiency of FAC-UR-ECC compared to the FAC-ECC protocol.**

Keywords—fog-enabled cloud computing; flexible access control; elliptic curve cryptography; user revocation; key management

I. INTRODUCTION

Fog computing is usually a distributed model to transfer and aggregate the information between the source and a server model. Using this model, the need for transmitting and aggregating a massive amount of unnecessary data is avoided. So, the communication burden is lowered and the performance is significantly enhanced. Principally, it is driven by the substantial growth of Internet-of-Things (IoT) platforms. However, due to the increased workload on the cloud database, there are several problems with interoperability and compatibility when a common client-server paradigm is taken into consideration.

This new paradigm, which provides an open distributed solution, deals with these problems. This is achieved by a new fog model that is hierarchically communicated between the cloud and the target client [1-3]. Typically, a fog system has limited information storage data centers and big data distribution centers. Due to fewer demands of resources, it faces great challenges in detecting and defending threats by introducing the whole community of integrated solutions. However, for a fog-enabled cloud system, there are no flawless protections and measures. Similarly, authentication and consensus solutions cannot be applied since fog services were provided on the edges of the network. The fog systems have been designed with several risks that cannot be accessed in the data center. Fog networks usually contain a variety of access types to the protected data center to transmit verification information and collect audit logs. However, it is approximated in a particular scenario e.g., smart grid.

A control device such as the isolated customer support authentication dial or compact AC directory is maybe not known for this communication [4]. Besides, it is difficult to understand whether authentication must be carried out centrally for client systems when isolated authentication data transmission would be missing. The basic access control requirements are necessary, but it defines an audit authentication through forwarding common AC. Many effective threats use authentication recommendations. Most confidential keys are not secure but are essential in authentication recommendations for system services. In contrast, attackers frequently improve hidden key negotiation techniques. The problems in these hidden keys are solved by multifactor authentication [5]. It usually requires other encrypted data for authentication with normally hidden messages. However, it has several restrictions and new threats. The intruder will possibly be the customer with a bogus device to enter his/her additional code which will be configured by the intruder to mimic the legitimate users.

Thus, CLAS was recommended to use the RTL between customers and authenticators to ensure security in regular multifactor authentication methods [6]. It allows RTL and customer's normal permissions and implements them for securing the compromise of the hidden key. Besides, the login is limited to profile sites whenever extra data is

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Research Article

Mixed Convection and Thermally Radiative Flow of MHD Williamson Nanofluid with Arrhenius Activation Energy and Cattaneo–Christov Heat-Mass Flux

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In this paper, we explored the impact of thermally radiative MHD flow of Williamson nanofluid over a stretchy plate. The flow in a stretchy plate is saturated via Darcy–Forchheimer relation. Cattaneo–Christov heat-mass flux theory is adopted to frame the energy and nanoparticle concentration equations. Additionally, the mass transfer analysis is made by activation energy and binary chemical reaction. Activation energy is invoked through the modified Arrhenius function. The intention of the current investigation is to enhance the heat transfer rate in industrial processes. The non-Newtonian nanofluids have more prominent thermal characteristics compared to ordinary working fluids. The governing models are altered into ODE models, and these models are numerically solved by applying the MATLAB bvp4c algorithm. The graphical and tabular interpretations have scrutinized the impact of sundry distinct parameters. The fluid speed escalates for enhancing the Richardson number, and it falls off for higher values of the Weissenberg number. It is noticed that the fluid temperature declines for higher values of the Brownian motion parameter and it grows for larger values of the thermophoresis parameter. The activation energy enriches the heat transfer gradient and suppresses the local Sherwood number. Additionally, the more significant heat transfer gradient occurs in heat-absorbing nonradiative viscous nanofluid and a smaller heat transfer gradient occurs in heat-generating radiative Williamson nanofluid. Also, we noticed that a higher heat transfer gradient appears in the Fourier model than in the Catteneo–Christov model. In addition, the comparative results are confirmed and reached an outstanding accord.

1. Introduction

Cooling and heating procedures are essential in many industries, and fluids make this process. The effectual cooling techniques are essential for cooling a higher thermal system in a short time. However, ordinary fluids such as ethylene glycol, engine oil, and water have poor thermal conductivity and do not fulfill the demand for powerful heat transfer cooling agents. Considering the needs of modern industry, including microelectronics, chemical production, and power generation plants, we need to establish a new type of fluids that will be efficient in cooling thermal systems. Nanofluid is a fluid consisting of nanoparticles (nanosized particles) such as oxides, nitrides, carbides, and metals stably and uniformly suspended in a base fluid. These fluids overcome the difficulty of the base fluids and act as an agent of efficient cooling.

IMPACT OF DOUBLE-DIFFUSION AND SLIP OF ORDER 2 ON CONVECTION OF CHEMICALLY REACTING OLDROYD-B LIQUID WITH CATTANEO-CHRISTOV DUAL FLUX

by

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Abstract

This article express the outcomes of mixed convective flow of a chemically reacting Oldroyd-B liquid (OBL) with Cattaneo-Christov double flux (CCDF) under the consequence of second order slip (SS), heat absorption (HA)/heat generation (HG) and Newtonian cooling (NC)/Newtonian heating (NH). The governing PDEs are converted into ODEs using suitable variables. The homotopy analysis method (HAM) is employed to solve these resultant equations. The outcomes of diverse physical parameters, like, relaxation time, retardation time, Richardson number, buoyancy ratio, Prandtl number, radiation, heat absorption/generation, Schmidt number, chemical reaction, suction/injection, slip and Newtonian heating are discussed.

Keywords: *Oldroyd-B liquid; Cattaneo-Christov double flux; Newtonian heating; Homotopy analysis method; heat generation; Second order slip.*

1 Introduction

The non-Newtonian liquids play a vital role in industry, engineering, pharmaceuticals etc. Example of such liquids are shampoos, sugar solutions, polymeric liquids, blood, inks and it cannot illustrated as a linear constitutive model. Many liquid models were developed to exhibit the features of non-Newtonian liquids. Usually non-Newtonian liquids can be segregated as liquids of rate, differential and integral types. Among these classification, rate type liquids were considered for memory and elastic effects. One of the simplest rate type of liquid is OBL and this liquid predicts the retardation and relaxation time characteristics. This liquid was initiated by Oldroyd [1] in 1950. It is useful in chemical and process industry when they encounter both the elastic and memory effects exhibited by most biological and polymers liquids. Rajagopal and Bhatnagar [2] derived the exact solution of simple OBL. Analytical solution of 3D OBL with Soret and Dufour effects were derived by Farooq et al. [3]. Several studies about OBL flow are found in under different conditions are Fetecau et al. [4], Liu et al. [5], Jamil et al. [6] and Motsa and Ansari [7].

Heat transfer mechanism is a natural phenomenon and it occurs due to variations of temperature within the same object or between bodies and this is very useful in many industrial processes, like, cooling of nuclear reactor, power generation, electronic devices cooling and magnetic drugs targeting. Fourier [8] initiated “Fouriers law of heat conduction" and there is no material satisfy this law. Then, Cattaneo [9] made some modification by including a relaxation time parameter for heat flux in order to avoid the paradox of heat conduction. After that, Christov [10] improved the Cattaneo model by introducing the thermal relaxation

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Research Article

Numerical and Analytical Investigation for Darcy-Forchheimer Flow of a Williamson Fluid over a Riga Plate with Double Stratification and Cattaneo-Christov Dual Flux

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The Darcy-Forchheimer flow of a Williamson fluid over a Riga plate was analyzed in this paper. Energy and mass equations are modeled with Cattaneo-Christov theory and double stratifications. The governing PDE models are altered into ODE models. These models are numerically solved by MATLAB bvp4c and analytically solved by the homotopy analysis method. The impact of governing flow parameters on fluid velocity, fluid temperature, fluid concentration, skin-friction coefficient, local Nusselt number, and local Sherwood number is scrutinized via graphs and tables. We acknowledged that the speed of the fluid becomes diminishes for more presence of porosity parameter. Also, we noted that the thermal and solutal boundary layer thicknesses are waning due to their corresponding stratification parameters. In addition, the maximum decreasing percentage of skin friction is obtained when the suction/injection parameter varies from 0.0 to 0.4 for Williamson and viscous fluids. The maximum increasing percentage of local Nusselt number occurs when the suction/injection parameter varies from 0.4 to 0.8 for Williamson and viscous fluids.

1. Introduction

Non-Newtonian fluids are extensively implemented in diverse industrial processes such as petroleum drilling, drawing of plastic films, fibre spinning, and food production. The Williamson fluid model is one of the simplest non-Newtonian models to replicate the viscoelastic shear-thinning attributes, see Williamson [1]. The flow of thermally radiative Williamson fluid on a stretching sheet with chemical reaction was disclosed by Krishnamurthy et al. [2]. They proved the fluid temperature falling off due to the presence of the Williamson parameter. Khan et al. [3] demonstrated the impact of slip flow of Williamson nanofluid in a porous medium. They exposed that the surface drag force suppresses due to rising the Williamson fluid parameter. The 2D unsteady radiative Williamson fluid flow on a permeable stretching surface was deliberated by Hayat et al. [4]. They noticed that the fluid speed becomes slow when the Williamson parameter is high. Nadeem et al. [5] examined the Williamson fluid flow past a stretching sheet, and they found that the skin friction coefficient decreases with enhancing the Williamson parameter. Make use of the Keller box procedure to solve the problem of MHD flow of Williamson fluid over a stretching sheet by Salahuddin et al. [6]. Their outcome shows that the Williamson fluid parameter leads to suppress the fluid velocity. Few significant analysis for this area is seen in Refs. [7, 8].

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Engineering Physics and Mathematics

Impact of double-stratification on convective flow of a non-Newtonian liquid in a Riga plate with Cattaneo-Christov double-flux and thermal radiation☆

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ABSTRACT

The intention of the paper is to find the outcome of thermal radiation of a second grade fluid over a Riga plate with Cattaneo-Christov (CC) double flux and double stratification's. The governing mathematical models are changed into an ordinary differential equations (ODE) using suitable transformations. These resultant models are analytically solved with homotopy analysis method. The impact of pertinent parameters on velocity distribution, temperature distribution, concentration distribution, skin friction coefficient, local Nusselt number and local Sherwood number is analyzed graphically. We found that the skin friction coefficient suppresses with enhancing the injection/suction parameter. The energy transfer gradient suppresses with rising the thermal stratification parameter. Also, we found that the mass transfer gradient decreases with increasing the solutal stratification parameter.
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1. Introduction

The electrically conducting liquids, like, electrolytes, plasma, fluid metals, etc, are controlled by employing magnetic field and these fluids have vast applications in geophysics, magneto-hydro-dynamic (MHD) generators and MHD sensors, etc. These liquids are less electrical conductivity, nevertheless employing the electric force over an external agent to enhance their conductivity. MHD flow of a nanofluid was examined by Mahabaleshwar et al. [1]. MHD non-orthogonal flow of a nanofluid with thermal radiation was delineated by Jalilpour et al. [2]. They seen that the larger values of magnetic field parameter leads to downturn the fluid velocity. Sudarsana Reddy and Chamkha [3] performed the MHD convective flow of Al_2O_3- & TiO_2 - water based nanofluids on a porous stretching sheet with Soret and Dufour effects. From this study, they proved the fluid temperature enriches with higher values of magnetic field parameter. Few significant studies on MHD flow for various physical problems were found in Ref. ([4–15]). Riga plate (RP) is one of the external device which is used to enhance the electrical conductivity. This plate contains the electrodes and magnet pairs in definite form. Gailitis and Lielausic [16] was first initiated this plate and this plate produces the Lorentz force which is parallel to the wall and control the flow. Aiding and opposing Blasius fluid stream over a Riga plate was described by Magyari and Pantokratoras [17]. The nanoliquid flow of a RP was portrayed by Ahmad et al. [18]. They proved that the liquid temperature suppresses on growing the modified Hartmann number. Ayub et al. [19] discussed the nanoliquid flow over a RP. Effects of partial slip and viscous dissipation of a tangent hyperbolic nanofluid over a RP was explored by Nayak et al. [20]. They found that the skin friction coefficient increases with rising the values of modified Hartmann number. Rasool et al. [21] reported the salient features of SG nanoliquidic flow past vertical Riga plate with convective heating condition. They proved that the fluid velocity reduces with enhancing the modified Hartmann number.

In recent days, energy transfer mechanism is very significant in industrial processes, such as, cooling devices, power production, energy generation, etc. In general, most of the energy transfer features are examined by Fourier's heat conduction law. However, this

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BALANCED RANK DISTRIBUTION LABELING OF LADDER GRAPHS, COMPLETE GRAPHS AND COMPLETE BIPARTITE GRAPHS

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Abstract. A balanced rank distribution labeling of a graph G of order n is a new kind of vertex labeling from $\{1, 2, 3, ..., k\}(n \leq k \in Z^+)$ which leads to a balanced edge labeling of G called edge ranks. In this paper, the balanced rank distribution labeling of ladder graphs $L_{n/2}$ for even $n \geq 6$, complete graphs K_n for $n \geq 3$ and complete bipartite graphs $K_{n/2,n/2}$ for even $n \geq 4$ have been investigated and obtained the results on balanced rank distribution number ($\mathbf{brd}(G)$) for the given graphs as follows:

(i) $\mathbf{brd}(L_{n/2}) = 3n - 15$, for even $n \geq 12$
(ii) $\mathbf{brd}(K_n) = n$, for $n \geq 3$
(iii) $\mathbf{brd}(K_{n/2,n/2}) = n$, for even $n \geq 4$

Keywords: Labeling of graphs, Balanced rank distribution labeling, Edge ranking, Balanced rank distribution number, Strongly and Weakly balanced rank distribution graphs.
AMS Subject Classification: 05C78

1. Introduction

All graphs $G(V, E)$ considered here are finite, simple and undirected. Let P_n and K_n denote a path and a complete graph on n vertices respectively. The cartesian product $G\Box H$ of graphs G and H is a graph such that (i) the vertex set of $G\Box H$ is cartesian product $V(G) \times V(H)$ and (ii) two vertices (u_1, u_2) and (v_1, v_2) are adjacent in $G\Box H$ if and only if either $u_1 = v_1$ and u_2 is adjacent to v_2 in H, or $u_2 = v_2$ and u_1 is adjacent to v_1 in G. The ladder graph L_p is a planar graph with $2p$ vertices and $3p-2$ edges. It is the cartesian product of two path graphs, one is P_2 and other one is P_p. For positive integers p and q, $K_{p,q}$ denotes the complete bipartite graph with vertex partitions of cardinality p and q. For a real x, $\lfloor x \rfloor$ and $[x]$ respectively denote the floor function and greatest integer function that gives the greatest integer less than or equal to x as the output and $\lceil x \rceil$ is the ceiling function that gives the least integer greater than or equal to x as the output. A graph labeling is an assignment of values to the vertices or edges subject to specific constraints. The three significant features of most interesting graph labeling problems are

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Applied Physics A
Materials Science & Processing

Structural, optical and magnetic properties of vacuum annealed Fe, Mn doped NiO nanoparticles

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Abstract
Iron (Fe) substituted nickel oxide ($Ni_{1-x}Fe_xO$) and manganese (Mn) substituted ($Ni_{1-x}Mn_xO$) nanoparticles at $x = 0.05$ were prepared using solid-state reaction. The synthesized $Ni_{1-x}Fe_xO$ and $Ni_{1-x}Mn_xO$ nanoparticles were annealed in vacuum at a pressure of 1×0^{-3} mbar at two different temperatures of 473 K and 673 K for 1 h. The influence of vacuum annealing on the physical properties of $Ni_{1-x}Fe_xO$ and $Ni_{1-x}Mn_xO$ nanoparticles were studied. The vacuum annealed nanoparticles were characterized by XRD, SEM, EDS, UV–Vis-NIR and VSM instruments to study their structural, surface, chemical, optical and magnetic properties, respectively. From the XRD results it was found that $Ni_{1-x}Fe_xO$ nanoparticles were in cubic structure with Fe impurity phases whereas the $Ni_{1-x}Mn_xO$ nanoparticles exhibited cubic structure without any impurity phases. The crystallite sizes of the nanoparticles were in the range of 25–30 nm. From the EDS spectra, it was found that the elements such as Fe, Ni, Mn and O were in almost stoichiometric ratio. An increase in optical band gap for $Ni_{1-x}Fe_xO$ and $Ni_{1-x}Mn_xO$ nanoparticles were observed with an increase of annealing temperature. The pure NiO and doped NiO nanoparticles exhibited ferromagnetism at room temperature. The strength of magnetization decreased in NiO with a rise in annealing temperature. The $Ni_{1-x}Fe_xO$ and $Ni_{1-x}Mn_xO$ nanoparticles were ferromagnetic at room temperature and the magnetization increased with increase in vacuum annealing temperature. The highest magnetization of 1.4 emu/g, 0.85 emu/g and 0.76 emu/g were observed for NiO, $Ni_{1-x}Fe_xO$ and $Ni_{1-x}Mn_xO$ nanoparticles, respectively at 673 K. The nanoparticles will be suitable for storage device applications.

Keywords X-ray diffraction · Semiconductor · Transparent conducting oxides · Solid-state reaction

1 Introduction

Currently, high importance is given on nanostructured metal oxide such as indium oxide (In_2O_3), tin oxide (SnO_2), zinc oxide (ZnO), titanium dioxide (TiO_2), etc. These metal oxides exhibit high electrical conductivity, optical transmittance with wide band gap (> 3.0 eV). In addition to these existing properties, if these oxide nanostructures exhibit magnetism, they will find more applications in future. Generally, magnetic nanoparticles are widely studied because of their fundamental and technological interest as they exhibit novel structural, chemical, optical, electrical and magnetic properties [1–4]. A considerable research work has been carried out on ferrites as they possess above all properties. Ferrites such as cobalt, nickel, manganese, zinc will exhibit good thermal stability, poor conductivity, low cost, high dielectric and magnetic properties. The ferrites find in many applications such as lithium-ion battery, high-density data storage, magnetic recording, magnetic fluids, etc. A detailed investigation has been made on nanoferrites by Dippong et al. [5–7]. They have extensively studied the physical properties of pure and doped cobalt ferrites. The magnetic nanoparticle plays an important role in disease diagnosis, magnetic refrigeration, microwave absorber, drug delivery for cancer treatment, antibiotic, etc. [8–10]. Due to

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TEMPERATURE DEPENDENCE OF HOMOGENEOUS ANATASE-PHASED TiO_2 FILMS CHARACTERIZATION AND GAS-SENSING BEHAVIORS

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Anatase-phased TiO_2 films were prepared at different temperatures (350, 400, 450 and 500°C) using automated nebulizer spray pyrolysis (ANSP) method. The structural study (XRD) revealed the amorphous nature at 350°C and remaining samples (400, 450 and 500°C) show the tetragonal structure with $2\theta^\circ = 25.78$, 38.43, 48.49 and 55.54 corresponding to (101), (004), (200) and (105) reflected planes and it is well fitted with standard data. The compositional XPS analysis confirmed the core level primary element of Ti 2p, O 1s and valance band (VB) of Ti 3p, Ti 3s, O 2s peaks in the prepared samples. The 3D optical profilometer has shown that the thickness of the prepared films was decreased by increase in temperature. The AFM study exhibited average roughnesses (Ra) of the prepared films such as 0.058, 0.147, 0.176 and 0.194 nm, respectively. The surface morphological study of FESEM has shown the cracked uneven distributed nature (350°C) turn into evenly distributed closed packed agglomerated particles by the influence of temperature. The oscillating nature of transmittance (%) with redshift of the sharp absorption edge was observed in UV–Vis–NIR spectrophotometer and found the bandgap value about 3.58 eV to 3.33 eV through Tauc's relation. The gas-sensing behavior has shown better response to C_2H_6O reducing gas at 300°C operating temperature with 150 ppm gas concentration.

Keywords: ANSP method; XRD and XPS study; 3D optical profilometer; AFM and FESEM study and gas-sensing behavior.

1. Introduction

Synthesis and physical properties of comprehensive TiO_2 films have been extensively considered in current research, but detailed studies of the electrical properties toward gas-sensing analysis of anatase-phased TiO_2 films are rare. The sensing gas molecules are immense consequences in pollution monitoring the environment, control of chemical processes, space missions and agricultural and medical applications. Naturally, titanium is constantly bonded to other elements, and

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Genetic Risk factors for Lumbar Disc Disease

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Accepted Article

Abstract:

Aim & Background: Lumbar disc degeneration (LDD) is thought to be multifactorial in origin.

Very recently the focus has shifted to the involvement of a family of candidate genes in the

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Development of $CuAlO_2$-Encapsulated Reduced Graphene Oxide Nanocomposites: An Efficient and Selective Electrocatalyst for Detection of Neurodegenerative Disorders

Thirumalairajan Subramaniam,* Girija Kesavan, and Ganesh Venkatachalam

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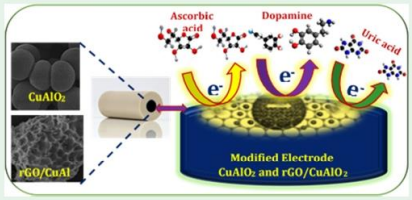
ABSTRACT: Carbon-based nanomaterials continue to simulate wide interest in diverse disciplines including electrochemical biosensors, which have great ability to function as next-generation clinical diagnostics. Motivated by this point, we for the first time developed a $CuAlO_2$-encapsulated reduced graphene oxide (rGO) nanocomposite by a facile wet-chemical process to modify a glassy carbon electrode for dopamine detection with high selectivity and good sensitivity. The size, shape, phase purity, chemical composition, and surface area were investigated for the samples through transmission electron microscopy, scanning electron microscopy, high-resolution transmission electron microscopy, X-ray photoelectron spectroscopy, X-ray diffraction, and Brunauer–Emmett–Teller analysis. The electrocatalytic performance was studied using cyclic voltammetry and amperometric technique. The modified rGO/$CuAlO_2$ nanocomposite electrode showed an enhanced electrochemical performance compared to other electrodes and pure $CuAlO_2$ electrodes due to the strong promoting effect between rGO and $CuAlO_2$. Both the oxidation current and concentration were proportional and show a linear range of 9.2×10^{-8} to 1.6×10^{-7} M having a detection limit of 15 nM at S/N = 3. Further, the biosensor successfully neglected the interference of ascorbic and uric acid and exhibited enhanced selectivity, improved sensitivity, and stability toward dopamine formulations. Most obviously, the real-time analysis of the electrochemical biosensor may be proved using the clinical diagnostics in the near future.



KEYWORDS: *rGO/$CuAlO_2$, electrochemical, biosensor, shape, size, dopamine*

1. INTRODUCTION

Neurotransmitters are the most significant messengers of the nervous system, and any deviation in their activities and balances can cause serious neurological, psychiatric, and cognitive disorders.[1,2] Among them, neurological disorders such as depression, schizophrenia, stress-related disease, and addiction are caused because of the abnormal function of the dopaminergic system.[3] Dopamine (DA) occurs in the highest amounts of 50 nmol g^{-1} in the portion of the human brain called caudate nucleus. However, DA occurs in low concentrations for a healthy individual, and it completely becomes null for persons affected with neurological disorders, especially, Parkinson's disease.[4] Detection of DA has been most favorably accomplished using electrochemistry with the ultimate task being the existence of high sensitivity and good selectivity toward DA detection. Several technologies including electrochemistry, chemiluminescence, spectrophotometry, and so forth have been used to detect DA.[5−8] These were designed for *in vivo* observation of DA at its physiological equivalent levels of 900−600 nM in Parkinson's patients medicated with L-dopa, and in the human brain, it changes in the range of 100 nM to 1 μM on DA release.[9−12] However, the release of DA and the following changes all happen in less than a few seconds, and hence the small changes in the concentration can be misestimated due to time-based resolution of these methods.[13]

Electrochemical biosensor-modified electrode can sense DA from the cerebral system at the nanomole level.[14−17] However, these biosensors have poor selectivity toward DA as these were designed with no recognition unit or molecular recognition. Ascorbic acid (AA), uric acid (UA), and DA have similar oxidation potentials, and hence discrimination of DA from AA and UA remains a challenge.[18] In the detection of DA, poor selectivity and sensitivity occurs as the surface of the electrodes is fouled by the products obtained during AA and UA oxidation.[19] This can be improved by choosing an appropriate

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Technical Efficiency Estimates of Stochastic Production Frontier Model using Rayleigh Distribution

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Abstract. The present study is attempted to estimate the Technical Efficiency level of paddy farmers in Thiruvarur District of Tamil Nadu, India using Stochastic Production Frontier Model to know the variations in efficiency among the farmers and to analyse the policy making decisions for improving the efficiency. A Cobb-Douglas Production function was considered in which the technical inefficiency effects are defined by a model with Rayleigh distribution. Primary data from 300 households in Thiruvarur district during the year 2015-16, Tamil Nadu were used. The results show that the Technical Efficiency of paddy farmers in the study area ranged from 11 to 85 percent with an average of 55 percent. The average Technical Efficiency level implied 55 percent of the farmers in the study area realised their technical abilities. Based on the technical efficiency score, the average potential to increase the paddy production was 35 percent and if the minimum efficiency farmer can reach the maximum level then the cost can save up to 87 percent. The MLE result shows that Farm Yard Manure and Chemical fertilizers are positively related to the Technical Efficiency. The socio economic factors influencing Technical Efficiency was identified using linear regression model and the result shows that sex of the farmer, education and credit are the important factors to increase the Technical Efficiency.

Keywords: Rayleigh distribution, Cobb-Douglas production function, Stochastic Production Frontier Model, Technical Efficiency, Maximum Likelihood Estimates, Linear regression.

INTRODUCTION

Usually, the efficiency production function analysis focuses on estimating average and frontier production functions (Farrell, 1957). The main pioneers of the Stochastic Production Frontier Model (SPFM) were Aigner, Lovell and Schmidt (1977), Meeusen and van den Broeck(1977) and Battese and Corra (1977) in which they were the first to introduced additional random variables, representing noise and technical inefficiency, in the production models.

In Stochastic Production Frontier Model, the component of noise follows a normal distribution with mean 0 and variance σ^2 .so, the two sided distribution models risk factors not directly controlled by the firm. On the contrary, the distribution, followed by technical inefficiency terms, may vary in relation to the assumptions made on the model, but it is always one-sided: this depends on the production that must lie from a same part with respect to the frontier. Meeusen and van den Broeck (1977) assigned an exponential distribution, Battese and Corra(1977) -half normal distribution, Aigner et al. (1977)-exponential and half normal, Greene (1990) - Gamma distribution and Stevenson (1980)-truncated normal distribution to the inefficiency error term. In this paper, uniform distribution is assigned for u. In this study, the technical inefficiency component follows a Rayleigh distribution.

Firm efficiency represents a relationship between output units that the firm produced with a given set of inputs. Efficiency can be decomposed into Technical and Allocative Efficiencies. Mathematical models that relate

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Solving LPP with Stochastic Neutrosophic Pythagorean Z numbers

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Abstract. This document gives the idea of Neutrosophic Pythagorean Z numbers, operations on neutrosophic Pythagorean Z numbers which helps us to overcome the situation where the truth membership function, indeterminacy membership function and non- membership function is greater than one in uncertainty and reliability. Also stochastic LPP is used to solve the Numerical Example.

INTRODUCTION

In the real world, uncertainty is a pervasive phenomenon. Much of the decisions taken are based on uncertainty. Humans have a remarkable capability to make rational decisions based on information which is uncertain, imprecise and/or incomplete. Formalization of this capability, at least to some degree, is a challenge that is hard to meet. When an easily solved problem ends up with difficult optimization problems, there one may consider the new concept called Z numbers. The concept of Z numbers has been recently introduced in decision making analysis. Zadeh [5] defined Z numbers related with an uncertain variable. Smarandache [2] proposed the concept of neutrosophic set which is generalization of fuzzy set theory and intuitionistic fuzzy sets. Pythagorean set theory is a documented technique to manage uncertainty in the optimization problem. Yager [3, 4] generalized Pythagorean fuzzy set, which is a new tool to deal with vagueness considering the membership and non-membership satisfying the Pythagorean condition. It may be used to characterize the uncertain information more sufficiently and accurately than intuitionistic fuzzy set. Pythagorean fuzzy set has attracted great attention of many scholars that have been extended to new types and these extensions have been used in many areas such as decision making, aggregation operators, and information measures was given by Beliakov, James [1]. Because of such a growth, one may present an idea on Pythagorean fuzzy set with aim of offering a clear perspective on the different concepts. In particular, one may provide neutrosophic Pythagorean Z environment to deal with uncertainty and reliability. This technique is considered as a standard decision making procedure, mainly when NPZNs are functional in real decision making problems. In this paper, the researcher defines Neutrosophic Pythagorean Z numbers (NPZNs) where some of its mathematical operations are defined and various theorems are also stated to show the combination of NPZNs. The researcher proposes θ – cut of NPZN and considers the real time example in this chapter to show the value of the work. The data is collected from fifty different persons and were consolidated as neutrosophic numbers for various restrictions. And the same is formulated as LPP and solved using NPZLPP and SNPZLPP to give the suggestions for customer in choosing better bike to get maximum profit with the utilization of available resources.

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Molecular Descriptors of Dodecagonal Network with Python Program and Bounds Based on New Parameters for Some Topological Indices

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Abstract. Dodecagonal network with m rows and n columns are analysed by its topological indices. Tetrahedron, hexahedron, octahedron, dodecahedron and icosahedrons are known as platonic solids. These shapes are mainly in outer protein shell of many viruses especially HIV and herpes. Characteristics, Bounds and relation between some topological descriptors are analyzed in this work, for the above platonic solids and their Plane embeddings to study their properties.

INTRODUCTION

Platonic solids are very special because of every face is regular polygon (whose side lengths are equal and angles are equal)with same shape and size. There are only five regular polyhedrons and all its faces are regular polygons and same number of faces meet at each corner. We know about crystals and their formation in nature. Also many microscopic organism includs algae and many species. These molecules have many applications in nanotechnology and biomedical research.

A connected graph without loop is called network. Chemical reaction network theory is dealing with modelling the real chemical systems. It is one of the applied Mathematical area. Mathematical Chemistry is a branch which deals with the structure of Chemical Compounds. It also attract pure Mathematicians for the problems arise from the mathematical structure of the Chemical compounds. It depicts the Biomedical and chemical properties of nano particles. Topological descriptors used to predict chromatographic retention times, Vapour pressure, Heat of formation, surface tension etc. In last 50 years, degree based indices are widely studied [1]. Reads can visit https://repl.it/@Manimekalai/dodecagon-M1 , https://repl.it/@Manimekalai/Hyper-and-multiple for python program.

DEFINITIONS

The 1st and 2nd Zagreb indices presented by Gutman and Trinajstic in [7] are.

$$M_1(A)= \sum_{uv\in E(A)} (\deg(u)+\deg(v))$$

$$M_2(A)= \sum_{uv\in E(A)} (\deg(u)\deg(v))$$

Furtula and Gutman [5] presented the forgotten topological index as:

$$F(A)= \sum_{v\in V(A)} \deg(v)^3 = \sum_{uv\in E(A)} (\deg(u)^2+\deg(v)^2)$$

Ghorbani and Azimi [6] defined the two multiple Zagreb indices of a graph A as

$$PM_1(A)= \prod_{uv\in E(A)} \deg(u)+\deg(v)$$

$$PM_2(A)= \prod_{uv\in E(A)} \deg(u)\deg(v)$$

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A review of the evidence on smoking bans and incidence of heart disease

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ABSTRACT

We update an earlier review of smoking bans and heart disease, restricting attention to admissions for acute myocardial infarction. Forty-five studies are considered. New features of our update include consideration of non-linear trends in the underlying rate, a modified trend adjustment method where there are multiple time periods post-ban, comparison of estimates based on changes in rates and numbers of cases, and comparison of effect estimates according to post-ban changes in smoking restrictiveness. Using a consistent approach to derive ban effect estimates, taking account of linear time trends and control data, the reduction in risk following a ban was estimated as 4.2% (95% confidence interval 1.8–6.5%). Excluding regional estimates where national estimates are available, and studies where trend adjustment was not possible, the estimate reduced to 2.6% (1.1–4.0%). Estimates were little affected by non-linear trend adjustment, where possible, or by basing estimates on changes in rates. Ban effect estimates tended to be greater in smaller studies, and studies with greater post-ban changes in smoking restrictiveness. Though the findings suggest a true effect of smoking bans, uncertainties remain, due to the weakness of much of the evidence, the small estimated effect, and various possibilities of bias.
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1. Introduction

Sargent et al. (2004) published the first study of the effects of smoking bans on heart disease, reporting a 40% reduction in hospital admissions from acute myocardial infarction (AMI) in Helena, Montana, USA following the introduction of a local law banning smoking in public places and workplaces. In 2011 we reviewed the evidence then available, based on twenty-four studies (Lee and Fry, 2011). We noted "major weaknesses in many studies and meta-analyses, including failure to consider data from control areas or existing trends in AMI rates, incorrect estimation of variability, and use in some meta-analyses of results for population subsets or estimates apparently unrelated to the data reported". Using a consistent approach to derive estimates of the ban effect, and taking account of time trends and control data, our analyses indicated a much smaller reduction in risk of heart disease following a ban than the reductions of 10–19% claimed in some other meta-analyses (Glantz, 2008; Lightwood and Glantz, 2009; Mackay et al., 2010; Meyers et al., 2009), reductions which we demonstrated were implausibly large considering likely changes in smoking habits and passive smoke exposure. Preferring national to regional estimates where available, we estimated a 5% reduction (95% confidence interval [CI] 3–8%), which became 2.7% (2.1–3.4%) when we omitted estimates where trend adjustment was not possible.

Since our review (Lee and Fry, 2011), publications have proliferated, the current review being based on about twice as many publications as considered earlier. Our updated review has some new features. First, we restrict attention to admissions from AMI, or near equivalent endpoints. Evidence relating to mortality will be considered later in a separate publication based on work currently ongoing.

Secondly, as a recent paper (Barr et al., 2012) reported that estimates of the ban effect adjusted for pre-ban non-linear trends in rates may substantially differ from those adjusted only for linear trend, we also derive study-specific estimates adjusted for non-linear trend. This can only be attempted where the run of data pre-ban is sufficiently long.

Third, we modify the method used to adjust for trend where data are available for multiple periods post-ban. Earlier (Lee and Fry, 2011), we derived the ban effect estimate by comparing the total numbers of deaths observed post-ban with that predicted at the midpoint of the post-ban periods based on the underlying trend pre-ban. Here, we fit a model that incorporates information from both the pre-ban and post-ban trend, inference being based

Abbreviations: ACE, acute coronary events; ACS, acute coronary syndrome; AMI, acute myocardial infarction; CHD, coronary heart disease; CI, confidence interval; ETS, environmental tobacco smoke; RR, relative risk; SCA, sudden circulatory arrest.

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ORIGINAL PAPER

Comparison of Eosin yellowish dye–sensitized and CdS-sensitized TiO_2 nanomaterial–based solid-state solar cells

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Abstract
In the present work, Eosin yellowish (EY) dye–sensitized and CdS-sensitized TiO_2 photoanodes prepared by doctor blade technique, for dye (DSSC)- and semiconductor-sensitized solar cell (SSSC) by engaging different forms of solid-state electrolyte. To begin with, the TiO_2 and CdS/TiO_2 nanomaterials are synthesized by the solvothermal method and the changing of physical properties is examined from structural, optical, morphological, and chemical composition measurements. The formation of anatase tetragonal phase TiO_2 and hexagonal phase CdS are investigated from XRD. UV-vis and photoluminescence studies expose that the nanomaterials loaded with different amounts of CdS on TiO_2 extend the absorption wavelength region from ultraviolet to visible. The photovoltaic performances of pure and CdS-added TiO_2 nanoparticle have studied by current-voltage measurement and impedance spectral response. We have achieved the highest solar conversion efficiency of 2.89% with the aid of the CdS-sensitized TiO_2 photoanode. CdS-sensitized TiO_2 photoanode shows good stability as inferred from transient photocurrent and photovoltage measurements. Overall investigation describes that the inclusion of CdS into the TiO_2 photoanodes gradually increase efficiency and stability.

Keywords TiO_2 · Nanoparticles · CdS sensitizer · Solid-state electrolyte · Impedance spectra

Introduction

Nowadays, nanomaterials and its various forms of nanostructures have attracted great attention as fundamental building blocks for the development of next-generation solar energy devices and those have high performance with novel functionalities such as flexibility and mobility [1]. The solar conversion efficiency of wide bandgap semiconductors is not enough to satisfy social needs since only 3% of solar light lies in the ultraviolet range. Many research groups have made considerable efforts to extend the solar conversion response up to visible region from UV by using organic dyes and narrow bandgap semiconductors as a sensitizer.

Already different types of dye-sensitized solar cells (DSSC) have been worked out by employing various forms of photoanodes like TiO_2 and ZnO nanostructures, making a composite of TiO_2 with ZnO and doping with different periodic elements like Ti, Sn, Mg, Zn, and also with various dyes (Ru N719, N3, eosin yellowish (EY), etc.) [2]. Along with new features and progress remarks made for last few decades in the area of DSSC and bulk heterojunction polymer solar cell using organic chromophores like dyes and polymers, respectively, called semiconductor-sensitized solar cells (SSSC) have attracted greater attention due to its superior visible light harvesting efficiency [3]. The solar conversion efficiency of SSSC is low as ~ 3% when compared with ruthenium dye-sensitized TiO_2-based DSSC (12%) [4]. A quite different approach is required for making a metal oxide semiconductor (MOS) matrix with quantum dot (QD) deposition, since the size of QD is higher than dye molecules [5]. Hence, the good coupling and favorable band alignment between MOS (TiO_2) and semiconductor sensitizer (CdS) for efficient charge separation are the key requirement factors for further improving the cell performance [6].

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Molecular Insights on the Dihydrogen Bond Properties of Metal Borohydride Complexes upon Ammoniation

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+ Article information

Abstract

The dihydrogen bond (DHB) that exists between BH···HN containing systems is known for the improved thermodynamic properties of complex hydrides. This study explores the stability and electronic properties of dihydrogen bonds ($H^{\delta-}\cdots H^{\delta+}$) that exist between the protic hydrogen, $H^{\delta+}$ in NH_3 and hydridic hydrogen, $H^{\delta-}$ of BH_4 in AMgB···MB and AMgB···AMB complexes (where M = Li, Na, K, Mg and Zn; and A = Amino group) using second order Moller-Plesset perturbation theory (MP2). The effect of metals and ammoniation in varying the nature of the DHB was revealed in quantum theory of atoms in molecule (QTAIM) analysis with the identification of non-covalent interactions. The calculated values of interaction energies were correlated well with the topological results. Furthermore,

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Secure and Efficient Fire-fly Data Routing Algorithm for Wireless Sensor Networks in IoT Monitoring Systems

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Abstract. In the Electronics world the sensor is used in IoT applications. The sensed data need to be transfer to the appropriate devices as input for further processing. Clustering used to group the sensors which could form cluster and select the nodes head from the cluster. The head of each cluster receives the forwarded data through the cluster member and pass on to nearest permanent fixed station. Identifying cluster head and shortest route identification is a major challenge. This paper proposed a novelty on hybrid decision making algorithm with firefly routing algorithm (HDMFRA) for Cluster Head selection. This research work focusing of three main criteria which could save the energy and extend the life activation of the node, through the usage of energy, amount of nodes adjacent and energy consumption from permanent fixed station. To aggregate the data in optimized manner and to transfer the data in efficient manner Fire Fly routing algorithm was used. Simulation results show that proposed algorithm HDMFRA network in homogeneous environment is effective and prolonging the life time of the node by 25%.

1. Introduction

IoT is a networks which connects the object together. In urban areas for promoting new developments and functions IoT related applications were developed as it is technological revolution which connects the real world of physical devices in which wireless sensor plays a vital role to communicate and response according to the needs of the applications [1][12]. Sensor are very small and consumes very low-power. Inorder to transfer the data quickly the cluster head was needed which could decreases the utilizing of energy will be less and effective [2][14]. The active time of the sensor node will be more when the node utilized in the short network or by the non-hazardous areas. Replacing the battery of sensor in hazardous areas was very difficult. During sensor nodes in active stage at each moment there will be depletion of energy. Activating the data in the sensor and passing the data towards base station will consume more energy, Failure of single sensor nodes destruct whole networks [15]. As the Network lifetime depends on each node design the network in such a manner that energy should be efficiently used by the network. Huge amount of nodes and permanent fixed station [17] will form wireless sensor networks. More energy will be consumed when there was a communication between the sensor nodes every time with their neighbouring nodes.

The data sensed by the sensor of different application such room temperature monitoring system in intensive care unit called source networks and the base station called as the sink nodes. A sensor networks utilizes the limited energy supply in conventional sensor networks. Energy consumption will

Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating

S. Eswaramoorthi, M. Bhuvaneswari, S. Sivasankaran and H. Niranjan

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PDF | Abstract & Keywords | Tools | Share

Abstract

This research paper studies the impact of thermally radiative 3D viscoelastic nanofluid flow upon a stretchy paper with Newtonian heating. Appropriate similarity variables are used to remodel the governing non-linear PDEs to ODEs and they are analytically solved by adopting the homotopy analysis method (HAM). The disparity of fluid velocities, temperature, nanoparticle volume fraction, skin friction coefficients and local Nusselt number of various parameters is pointed out. It is noticed that, enhancing the Newtonian heating parameter increases the fluid temperature. Also found that the nanoparticle volume fraction enlarges with growing the thermophoresis parameter.

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Enhancement of Corrosive-Resistant Behavior of Zn and Mg Metal Plates Using Biosynthesized Nickel Oxide Nanoparticles

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Abstract

In this work, nickel oxide nanoparticles (NiO NPs) were synthesized using ultrasonic wave-assisted green synthesis route with *Delonix elata* leaf extract as a reducing and capping agent. The phase structure, crystallinity, thermal and physical stability, surface morphology, and surface area of the produced NiO NPs were investigated using X-ray diffraction, field-emission scanning electron microscopy high-resolution transmission electron microscopy, thermogravimetric/differential thermal analysis, and Brunauer–Emmett–Teller analysis. The surface properties such as roughness and hardness of NiO NP-coated plates were determined using atomic force microscopy and nanoindentation techniques. The electrochemical corrosion behavior of NiO NPs was studied in the presence of an aqueous electrolyte medium, that is, 3.5% NaCl, 6 M KOH, 1 M HCl, and 1 M H_2SO_4. The Tafel plot showed that the corrosive nature of Zn and Mg plates significantly decreases when the plates were coated with the prepared high surface area and mesoporous NiO NPs under all electrolytes, especially in acidic medium, that is, 1 M H_2SO_4.

Keywords Green synthesis · NiO NPs · Nanoindentation · Linear sweep voltammetry · Tafel plot · Anticorrosive behavior

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1 Introduction

Corrosion is one of the essential research regions that have been attracting the attention of researchers for over 10 years. Long-term durability of commercial product applications such as pigments, heat exchangers, and boiler tubes mainly depends on the rate of corrosion of the materials [1, 2]. Corrosion is the retrogression of the metals due to their response to a corrosive element in their surroundings, including oxygen, carbon dioxide, chlorine, and fluorine [3–5]. Corrosion of metals has extreme fiscal effects and is an enormous problem all over the world. Various strategies have been used to protect metals from corrosion.

Zinc (Zn), magnesium (Mg), and their alloys have been

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REVIEW ARTICLE

Does epigenetics have a role in age related macular degeneration and diabetic retinopathy?

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KEYWORDS
Age-related macular degeneration (AMD);
Diabetic Retinopathy (DR);
Epigenetics;
Gene expression

Abstract Epigenetic mechanisms play an important part in the regulation of gene expression and these alterations may induce long-term changes in gene function and metabolism. They have received extensive attention in bridging the gap between environmental exposures and disease development via their influence on gene expression. DNA methylation is the earliest discovered epigenetic alteration. In this review, we try to examine the role of DNA methylation and histone modification in Age related macular degeneration (AMD) and Diabetic Retinopathy (DR), its vascular complications and recent progress. Given the complex nature of AMD and DR, it is crucial to improve therapeutics which will greatly enhance the quality of life and reduce the burden for millions of patients living with these potentially blinding conditions.

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Computation of eccentricity associated topological descriptors through Python for comb tree

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Abstract. Topological manifestation of a graph G is a numerical value which reveals it's topological properties. The eccentricity of one node u ∈ V (G)(that is $\epsilon_G(u)$), is the greatest distance between u and also any other vertex of G. The degree of a In this paper, we are using Python program to compute eccentricity related Topological indices for Comb tree with any number of vertices, relation between descriptors and the bounds for indices also.

Keywords: Comb tree; eccentricity; Python; topological index;

1. Introduction

An chemical compound's molecular structure can be represented by a graph in which we represent atoms of molecule as vertex of that graph and bonds between atoms as edges of the graph. This type of graph is called molecular graph or chemical graph. In Recent days inter discipline research is has high impact, especially mathematical chemistry is highly influencing in drug manufacturing, medicinal chemistry and bio chemistry etc.

We present bounds and comparison of various greatest distance based index of widely used chemical structures which often appear in mathematical chemistry.

Using Python we can compute all topological descriptors in minimum ravage of all resources. Python is dynamic language. Now a days python is highly influencing language in all fields. Readers who are having significance can test out the program in the net repl.it

https://repl.it/@Manimekalai/eccentricity-based-index
https://repl.it/@Manimekalai/Total-Eccentricity-index

Various indices was introduced in various periods of time for a graph A ,

Eccentric connectivity descriptor [4,8,9,10] , $\xi(A) = \sum_{v \in V} d(v)\varepsilon(v)$

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Photocatalytic degradation of Bisphenol-A in water under sunlight irradiation over ZnO nanoparticles fabricated by Ethiopian cactus pear fruit peel infusions

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Cactus pear

ABSTRACT

Bisphenol-A (BPA) is found as a persistent endocrine disruptor chemical in most environmental monitoring. Hence, in this research degradation of BPA was carried out under irradiation of sunlight in the presence of zinc oxide nanoparticles (ZnO-NPs) synthesized using cactus pear fruit peel (CPFP) infusions. The fabricated ZnO-NPs exhibited greater photocatalytic efficiency of BPA under sunlight irradiation and near-complete mineralization of BPA was achieved. The degradation percentage was steadily reliant on factors such as the catalyst size (10 – 50 nm) and structure (hexagonal), BPA concentration (10 mg L^{-1}), catalyst load (25 mg L^{-1}) and irradiation time (8 h) and pH (6.5). This study proposed that the cactus pear fruit peel mediated ZnO-NPs (CP-ZnO-NPs) photocatalytic degradation is an adaptable, pecuniary, environmentally beneficent and proficient method for BPA deduction in the aqueous phase.

1. Introduction

Zinc Oxide nanoparticles (ZnO-NPS) have attracted much attention in nanotechnology research among other metal oxides due since it is non-toxic, non-hygroscopic metal oxide with high photosensitivity, mainly in the degradation of various pollutants. ZnO has a huge excitation binding energy (60 MeV), wide bandgap (3.37 eV) and truncated threshold influence for optical impelling and thus reflected a less-cost substitute photocatalyst for removal of organic pollutants in aqueous phase [1]. Numerous methods are used to formulate ZnO nanoparticles, still, microwave-assisted green synthesis is known as an effective method as they are a single step, cost-effective and quick reaction and controlled morphology of particles, less thermal gradient problems and also less involvement of chemical agents, etc [2].

Research Article

Free radical scavenging activity of developed herbal formulation

Sasikala Subramani*, Kannikaparameswari Nachimuthu

ABSTRACT

Objective: Medicinal plants have played a key role in the prevention and treatment of diseases since ancient period. They are also potential sources of drugs and nutrients. *Boerhavia diffusa* and *Achyranthes aspera* are widely used medicinal plants in Ayurvedic treatment for a variety of ailments including kidney diseases. The present study was designed to assess the free radical scavenging capacity of herbal formulated medicinal plants, *B. diffusa* and *A. aspera*. **Materials and Methods:** Ethanolic extracts of herbal formulation were prepared and evaluated for their free radical scavenging capacity using various in vitro chemical assays such as 2,2-diphenyl-1-picrylhydrazyl, 2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid), ferric reducing antioxidant power, hydroxyl radical, and superoxide anion radical scavenging activities. **Results:** The ethanolic extract of herbal formulation showed potential radical scavenging activity against the radicals generated in vitro as the result was compared with the standard at the same concentration. **Conclusion:** The present research concluded that herbal formulated medicinal plants, *B. diffusa* and *A. aspera*, were found to be more effective due to the combined activity of the individual components. Hence, it is concluded that herbal formulation of these plants may provide efficient, supportive, or alternative treatment procedures for numerous health ailments.

KEY WORDS: 2, 2-Azinobis(3-ethyl benzoline-6-sulfonic acid), 2,2-Diphenyl-1-picrylhydrazyl, Ferric ion, Hydroxyl, Superoxide

INTRODUCTION

The traditional drugs all over the globe nowadays revealed by an extensive activity of researches on diverse plant species and their therapeutic values. Plants possess different bioactivities such as antioxidant anticancer and anti-inflammatory activities. Every biomolecule presents in the living cells is damaged by oxidative reaction with reactive oxygen species (ROS).[1]

ROS and their metabolites can direct consequences on cell injury and may stimulate the development of disease. Free radicals have been concerned on the basis of several diseases such as liver cirrhosis, atherosclerosis, cancer, and diabetes and compounds that can scavenge free radicals have immense effect in ameliorating these diseases.[1] Antioxidants thus play a key role to defend the human body against therefore, reducing its ability to damage. Natural products have served as a chief resource of drugs for centuries, and about half of the pharmaceutical in use today are derived from natural products. The use of natural products, mostly plants, to manage diseases, is a century-old practice that leads to the innovation of more than half of all recent pharmaceuticals.[2]

Boerhavia diffusa Linn. (Nictaginaceae) has been extensively studied for its therapeutic actions and chemical constituents. The roots are the source of a novel class of isoflavonoids known as rotenoids, flavonoids, glycosides, purine nucleoside, lignans, ecdysteroids, xanthones, and steroids. A variety of animal studies and their trials have confirmed the presence of potential therapeutic activities, such as immunomodulation, hepatoprotection, antidiabetic activity, anti-inflammation, antifibrinolysis, anticancer activity, and diuresis.[3]

MoU's

S. No.	MoU's Details	Activity on MoU	Supportive Documents Link
1	National Digital Library of India (NDLI) Club Team, IIT Kharagbur.	Reading Related Events	
2	Tourism and Hospitality Skill Council (THSC), New Delhi	Diploma Course	
3	New Technology Mobile Service and Training Institute, Coimbatore.	Training on Mobile Service	
4	LEDAA International, Coimbatore.	Foundation Coaching Classes for CMA & CSEET Foundation classes	
5	BEST Academy, Coimbatore.	CA Foundation Coaching Classes	
6	National Council of Vocational and Research(NCVRT), New Delhi	Skill Enhancement Training Programme	
7	Epic Coating Academy (ECA), Coimbatore.	Certificate Course	
8	No Disposal, Waste Value Chain, Coimbatore.	Waste Management	
9	AOSTA Software Technologies India Limited, Coimbatore.	Apprenticeship/Internship Embedded Degree Programme	

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15	Phoenix IT Consulting, Coimbatore.	Data Visualization and Big Data Analytics	
16	Dainey Education, Coimbatore.	Content Writing	
17	Energetic Byz Plus, Coimbatore.	Marketing and Selling Skills	
18	BFSI Sector Skill Council of India, Mumbai.	Outcome based Trainings, Assessments and Certification on Qualification Packs(QP) and National Occupational Standards(NOS)	

19	Accent Techno Soft, Coimbatore.	Python with Data Analytics	
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33	Ferns Charitable Trust, Coimbatore.	Skill based organic farming training and Education	
34	AOSTA Software Technologies, Coimbatore.	Skill Development & Placement	