3.4.5 Citation Index

The following are the bibliometric of the publications for the academic year 2020-21 based on average Citation index in Scopus and Web of Science.

Table 1: Citation Index for Publication in Scopus

S.No	Title of the paper	Name of the Authors	Title of the Journal	Year of the Publication	Citation Index
1.	ZnO nanoparticles as efficient sunlight driven photocatalyst prepared by solution combustion method involved lime juice as biofuel	Gowthambabu V., Balamurugan A., Dhivya bharathy R., Satheeshkumar S., Kanmani S.S.	Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy	2021	1
2.	Molecular Insights on the Dihydrogen Bond Properties of Metal Borohydride Complexes upon Ammoniation	Arumugam S., Angamuthu A., Gopalan P.	ECS Journal of Solid State Science and Technology	2021	0
3.	Investigation on temperature-dependent structural, dielectric and impedance characteristics of Cu-doped CaFexTi1-xO3-δ nanotitanates	Sridharpanday M., Brindha R., Vinoth M., Narthana K., Rajendran V.	Journal of Materials Science: Materials in Electronics	2021	1

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4.	Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO2films for sensing devices	Krishnan V.G., Elango P., Ravikumar K., Marnadu R., Aldossary O.M., Ubaidullah M.	New Journal of Chemistry	2021	0
5.	Secure and Efficient Fire-fly Data Routing Algorithm for Wireless Sensor Networks in IoT Monitoring Systems	Kowsalya R., Rosiline Jeetha B.	Journal of Physics: Conference Series	2021	0
6.	Enhancement of Corrosive-Resistant Behavior of Zn and Mg Metal Plates Using Biosynthesized Nickel Oxide Nanoparticles	Sudha M., Surendhiran S., Gowthambabu V., Balamurugan A., Anandarasu R., Syed Khadar Y.A., Vasudevan D.	Journal of Bio- and Tribo-Corrosion	2021	3
7.	Trust level evaluation based asymmetric cryptography protocol for flexible access control in fog computing	Nagarani C., Kousalya R.	International Journal of Computer Networks and Communications	2021	0
8.	Influence of anionic precursors on electrochemical properties of tin oxide nanoparticles: a comparative analysis	Gowthambabu V., Kanmani S.S., Rajamanickam N.	Journal of Materials Science: Materials in Electronics	2021	1

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9.	Effects of processing parameters on green synthesised ZnO nanoparticles using stem extract of Swertia chirayita	Saha R., Subramani K., Sikdar S., Fatma K., Rangaraj S.	Biocatalysis and Agricultural Biotechnology	2021	0
10	Does epigenetics have a role in age related macular degeneration and diabetic retinopathy?	Mohana Devi S., Mahalaxmi I., Kaavya J., Chinnkulandhai V., Balachandar V.	Genes and Diseases	2021	2
11	Effect of vacuum annealing on structural, optical and magnetic properties of Sn doped ZnS thin films	Kunapalli C.K., Chakraborty D., Shaik K.	Optical Materials	2021	0
12	Mechanism underlying the inhibitory effect of biosynthesized silver nanoparticle on TNF-α induced NF-κB nuclear translocation in prostate cancer cells	Rajathi K., Leneeygreen K.B., Suja S.	International Journal of Pharmaceutical Sciences and Nanotechnology	2021	0
13	Efficient photocatalytic degradation of 2,4-dinitrophenol over mesoporous zr and ce co-doped tio2 under visible light	Usharani T., Baskar R., Palanisamy B., Myilsamy M.	Desalination and Water Treatment	2021	0

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14	Tetraselmis indica Mediated Green Synthesis of Zinc Oxide (ZnO) Nanoparticles and Evaluating Its Antibacterial, Antioxidant, and Hemolytic Activity	Thirumoorthy G.S., Balasubramaniam O., Kumaresan P., Muthusamy P., Subramani K.	BioNanoScience	2021	2
15	Impact of double-stratification on convective flow of a non-Newtonian liquid in a Riga plate with Cattaneo-Christov double-flux and thermal radiation	Mallawi F.O.M., Bhuvaneswari M., Sivasankaran S., Eswaramoorthi S.	Ain Shams Engineering Journal	2021	10
16	A Flexible Access Control with User Revocation in Fog-Enabled Cloud Computing	Nagarani C., Kousalya R.	Proceedings of the 6th International Conference on Inventive Computation Technologies, ICICT 2021	2021	0
17	Mycofabrication of AgONPs derived from Aspergillus terreus FC36AY1 and its potent antimicrobial, antioxidant, and anti-angiogenesis activities	Vellingiri M.M., Ashwin J.K.M., Soundari A.J.P.G., Sathiskumar S., Priyadharshini U., Paramasivam D., Liu W.-C., Balasubramanian B.	Molecular Biology Reports	2021	0

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18	Rapid green synthesis of CuO nanoparticles and evaluation of its photocatalytic and electrochemical corrosion inhibition performance	Surendhiran S., Gowthambabu V., Balamurugan A., Sudha M., Senthil Kumar V.B., Suresh K.C.	Materials Today: Proceedings	2021	0
19	Enhancement of corrosion inhibition of mild steel in acidic media by green-synthesized nano-manganese oxide	Syed Khadar Y.A., Surendhiran S., Gowthambabu V., Halimabi Alias Shakila Banu S., Devabharathi V., Balamurugan A.	Materials Today: Proceedings	2021	0
20	Mixed Convection and Thermally Radiative Flow of MHD Williamson Nanofluid with Arrhenius Activation Energy and Cattaneo-Christov Heat-Mass Flux	Eswaramoorthi S., Alessa N., Sangeethavaanee M., Kayikci S., Namgyel N.	Journal of Mathematics	2021	0
21	Impact Of Double-Diffusion And Second Order Slip On Convection Of Chemically Reacting Oldroyd-B Liquid With Cattaneo-Christov Dual Flux	Mallawi F.O.M., Eswaramoorthi S., Bhuvaneswari M., Sivasankaran S.	Thermal Science	2021	1

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22	Numerical and Analytical Investigation for Darcy-Forchheimer Flow of a Williamson Fluid over a Riga Plate with Double Stratification and Cattaneo-Christov Dual Flux	Eswaramoorthi S., Alessa N., Sangeethavaanee M., Namgyel N.	Advances in Mathematical Physics	2021	0
23	Impact of stratifications and chemical reaction on convection of a non-Newtonian fluid in a Riga plate with thermal radiation and Cattaneo-Christov flux	Mallawi F.O.M., Eswaramoorthi S., Sivasankaran S., Bhuvaneswari M.	Journal of Thermal Analysis and Calorimetry	2021	1
24	Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating	Eswaramoorthi S., Bhuvaneswari M., Sivasankaran S., Niranjan H.	International Journal of Nanotechnology	2021	0
25	Balanced Rank Distribution Labeling of Ladder Graphs, Complete Graphs and Complete Bipartite Graphs	Hemalatha P., Gokilamani S.	Turkish World Mathematical Society Journal of Applied and Engineering Mathematics	2021	0
26	Structural, optical and magnetic properties of vacuum annealed Fe, Mn doped NiO nanoparticles	Bayappagari B., Shaik K., Chakraborty D., Kunapalli C.K.	Applied Physics A: Materials Science and Processing	2021	1

27	Temperature Dependence Of Homogeneous Anatase-Phased Tio2films Characterization And Gas-Sensing Behaviors	Gopala Krishnan V., Elango P.	Surface Review and Letters	2021	0
28	Genetic risk factors for lumbar disc disease	Doraisamy R., Ramaswami K., Shanmugam J., Subramanian R., Sivashankaran B.	Clinical Anatomy	2021	1
29	Polymorphism induced magnetic transitions in Ni(OH)2 nanostructures	Gokul B., Matheswaran P., Pandian M., Arun Paul C., Ravikumar K., Gopala Krishnan V., Shkir M., AlFaify S., Sreedevi G.	Journal of Magnetism and Magnetic Materials	2021	0

Table 2: Citation Index for Publication in Web of Science

S.No	Title of the paper	Name of the Authors	Title of the Journal	Year of the Publication	Citation Index
1.	Heart Diseases Prediction for Optimization based Feature Selection and Classification using Machine Learning Methods	Rajinikanth, N.; Pavithra, L.	International Journal Of Advanced Computer Science And Applications	2021	0

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2.	Molecular Insights on the Dihydrogen Bond Properties of Metal Borohydride Complexes upon Ammoniation	Arumugam, Saravanapriya; Angamuthu, Abiram; Gopalan, Praveena	Ecs journal of solid state science and technology	2021	0
3.	Genetic risk factors for lumbar disc disease	Doraisamy, Ravichandran; Ramaswami, Rashmi; Sivashankaran, Balasubramanian	Clinical anatomy	2021	2
4.	Temperature Dependence Of Homogeneous Anatase-Phased Tio2films Characterization And Gas-Sensing Behaviors	Krishnan, V. Gopala; Elango, P.	Surface review and letters	2021	0
5.	Improved Grasshopper Optimization Algorithm based Feature Selection with Evolutionary Outlay-Aware Deep Belief Network Classifier (IGOA-EOA-DBNC) for High Dimensional Datasets	Praveena, M.; Jaiganesh, V	Revista geintec-gestao inovacao e tecnologias	2021	0

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6.	Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO2 films for sensing devices	Krishnan, V. Gopala; Elango, P.; Ravikumar, K.; Marnadu, R.; Aldossary, Omar M.; Ubaidullah, Mohd	New journal of chemistry	2021	0
7.	Polymorphism induced magnetic transitions in Ni(OH)(2) nanostructures	Gokul, B.; Matheswaran, P.; Pandian, M.; Paul, C. Arun; Ravikumar, K.; Krishnan, V. Gopala; Shkir, Mohd; AlFaify, S.; Sreedevi, Gedi	Journal of magnetism and magnetic materials	2021	0
8.	Influence of anionic precursors on electrochemical properties of tin oxide nanoparticles: a comparative analysis	Gowthambabu, V; Kanmani, S. S.; Rajamanickam, N.	Journal of materials science-materials in electronics	2021	0
9.	Numerical and Analytical Investigation for Darcy-Forchheimer Flow of a Williamson Fluid over a Riga Plate with Double Stratification and Cattaneo-Christov Dual Flux	Eswaramoorthi, S.; Alessa, Nazek; Sangeethavaanee, M.; Namgyel, Ngawang	Advances in mathematical physics	2021	0

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10	ZnO nanoparticles as efficient sunlight driven photocatalyst prepared by solution combustion method involved lime juice as biofuel	Gowthambabu, V.; Balamurugan, A.; Bharathy, R. Dhivya; Satheeshkumar, S.; Kanmani, S. S.	Spectrochimica acta part a-molecular and biomolecular spectroscopy	2021	0
11	Investigation on temperature-dependent structural, dielectric and impedance characteristics of Cu-doped CaFexTi1-xO3-delta nanotitanates	Sridharpanday, Mathu; Brindha, Ramasubramanian; Vinoth, Murugan; Narthana, Kandhasamy; Rajendran, Venkatachalam	Journal of materials science-materials in electronics	2021	0
12	Mixed Convection and Thermally Radiative Flow of MHD Williamson Nanofluid with Arrhenius Activation Energy and Cattaneo-Christov Heat-Mass Flux	Eswaramoorthi, S.; Alessa, Nazek; Sangeethavaanee, M.; Kayikci, Safak; Namgyel, Ngawang	Journal of mathematics	2021	0
13	Balanced Rank Distribution Labeling Of Ladder Graphs, Complete Graphs And Complete Bipartite Graphs	Hemalatha, P.; Gokilamani, S.	Twms journal of applied and engineering mathematics	2021	0

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14	Effects of processing parameters on green synthesised ZnO nanoparticles using stem extract of Swertia chirayita	Saha, Raunak; Subramani, Karthik; Sikdar, Saheri; Fatma, Kaniz; Rangaraj, Suriyaprabha	Biocatalysis and agricultural biotechnology	2021	0
15	Impact of double-stratification on convective flow of a non-Newtonian liquid in a Riga plate with Cattaneo-Christov double-flux and thermal radiation	Mallawi, F. O. M.; Bhuvaneswari, M.; Sivasankaran, S.; Eswaramoorthi, S.	Ain shams engineering journal	2021	10
16	Impact Of Double-Diffusion And Second Order Slip On Convection Of Chemically Reacting Oldroyd-B Liquid With Cattaneo-Christov Dual Flux	Mallawi, Fouad Othman M.; Eswaramoorthi, Sheniyappan; Bhuvaneswari, Marimuthu; Sivasankaran, Sivanndam	Thermal science	2021	0
17	Effect of vacuum annealing on structural, optical and magnetic properties of Sn doped ZnS thin films	Kunapalli, Chaitanya Kumar; Chakraborty, Deepannita; Shaik, Kaleemulla	Optical materials	2021	0

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18	Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating	Eswaramoorthi, S.; Bhuvaneswari, M.; Sivasankaran, S.; Niranjan, H.	International journal of nanotechnology	2021	0
19	Efficient photocatalytic degradation of 2,4-dinitrophenol over mesoporous Zr and Ce co-doped TiO2 under visible light	Usharani, T.; Baskar, R.; Palanisamy, B.; Myilsamy, M.	Desalination and water treatment	2021	0
20	Structural, optical and magnetic properties of vacuum annealed Fe, Mn doped NiO nanoparticles	Bayappagari, Balaraju; Shaik, Kaleemulla; Chakraborty, Deepannita; Kunapalli, Chaitanya Kumar	Applied physics a-materials science & processing	2021	2
21	Extraction, Characterization and Enzymatic Degumming of Banana Fiber	Paramasivam, Suresh Kumar; Nallappagounder; Subbaraya, Uma	Journal of natural fibers	2021	5
22	Impact of stratifications and chemical reaction on convection of a non-Newtonian fluid in a Riga plate with thermal radiation and Cattaneo-Christov flux	Mallawi, F. O. M.; Eswaramoorthi, S.; Sivasankaran, S.; Bhuvaneswari, M.	Journal of thermal analysis and calorimetry	2021	1

Publications in Scopus for Academic Year 2020-21

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

V. Gowthambabu [a,1], A. Balamurugan [b,1], R. Dhivya bharathy [a,1], S. Satheeshkumar [c,1], S.S. Kanmani [a,1,*]

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HIGHLIGHTS

- ZnO nanoparticles synthesised by solution combustion 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 under 75 minutes of sunlight irradiation duration.

GRAPHICAL ABSTRACT

ARTICLE INFO

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 wurzine 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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ECS Journal of Solid State Science and Technology

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

Saravanapriya Arumugam[1,2], Abiram Angamuthu[1] and Praveena Gopalan[1] ⓘⒹ

✦ 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 ($H^{\delta-}—H^{\delta+}$) 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 Møller-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, energy decomposition analysis (EDA), interaction energy and Bader charge analysis were calculated in order to interpret the role of non-bonded interaction on decomposition process. The calculated structural, QTAIM and EDA analysis reveal the presence of non bonded interaction in all the complexes. Overall analysis of the study reported that the process of adding amine group in alkali metal borohydrides increases charge distribution around the dispersion interaction which plays a vital role in hydrogen evolution process.

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

Mathu Sridharpanday, Ramasubramanian Brindha, Murugan Vinoth, Kandhasamy Narthana & Venkatachalam Rajendran ✉

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

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Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO2 films for sensing devices

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

Zn-doped TiO2 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, WO3, SnO2, In2O3, and TiO2 are used to detect combustible and volatile organic compounds (VOCs) as a function of change in resistance to the target gases.[9] Among them, TiO2 and TiO2-derived materials are significant for emerging environmental refinement.[10] TiO2 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 TiO2 is a potential composition to improve the gas detection response, selectivity, stability, and even TiO2 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 TiO2 gas detection such as Ag-TiO2,[13] Sn-TiO2, Nb-TiO2 and Cr-TiO2,[16] but no specific results are available for the stabilized anatase phase of additive mixed TiO2 for the detection of combustible and volatile organic compounds. This report shows the characterization and gas sensing performance of

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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

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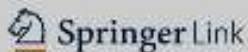**3rd Cycle**

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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

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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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.

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

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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_4OH 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 in green synthesise ZnO nanoparticles. The ZnO nanoparticles synthesised demonstrate attainment 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* (25 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 (Panyi and Wipf, 2000; Sen 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 (Aliyev et al., 2003; Ohta et al., 2000). Hence, it has seen a wide range of applications in fields such as catalytic science (Sen et al., 2017), energy devices (Belliard et al., 2001), chemical sensors (Ahmad et al., 2014) and opto electronic de-

vices (Chen et al., 2015). ZnO nanoparticles are formed due to the intertwining of hexagonally packed sublattices (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; Shamsi et al., 2015). Therefore, ZnO is one of the

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REVIEW ARTICLE

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

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

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ARTICLE INFO

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

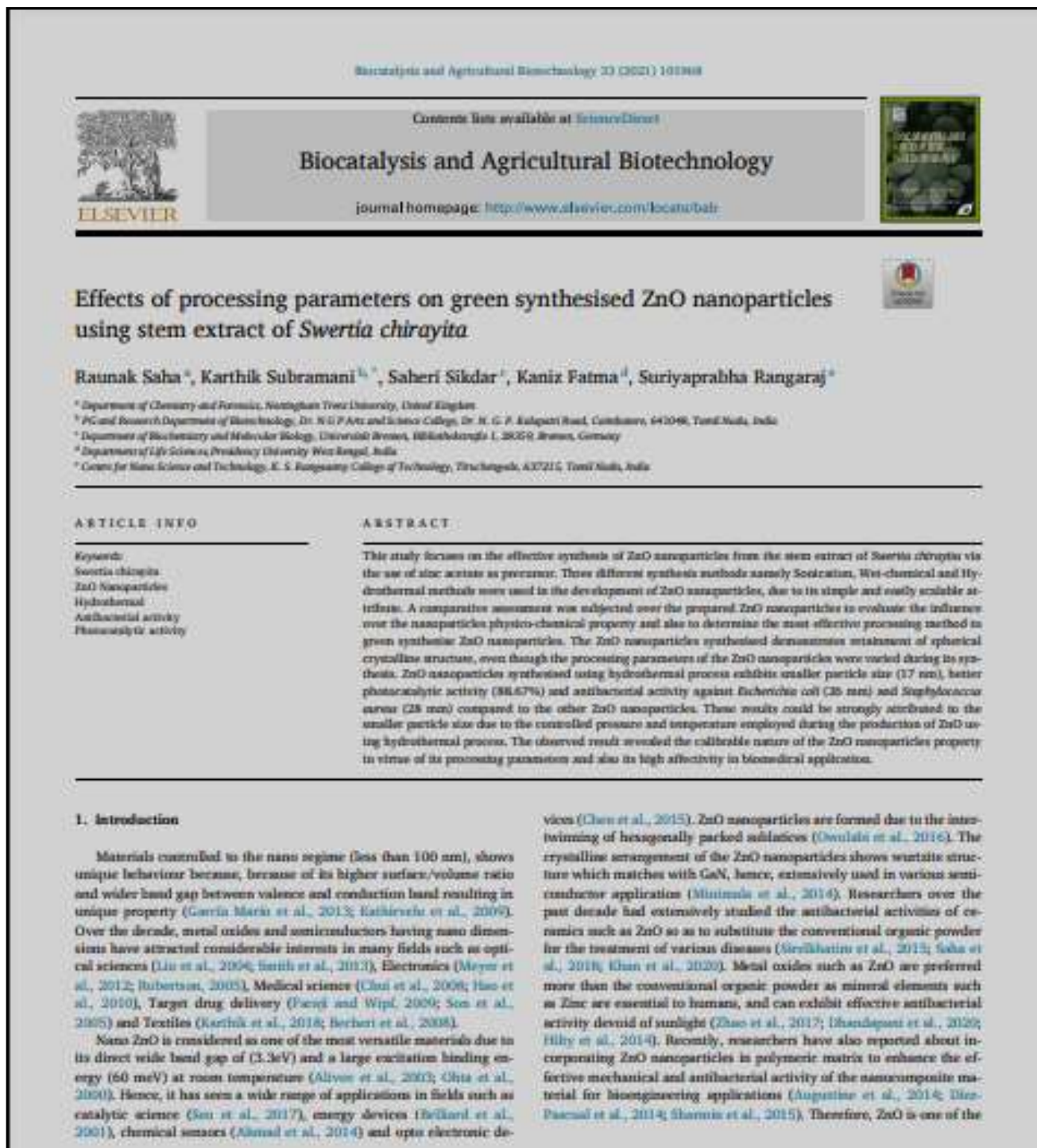| | | NAAC 3rd Cycle |
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Mechanisms of Inhibitory Effect of Biosynthesized Silver Nanoparticle on TNF-α induced NF-κB Nuclear Translocation in Prostate Cancer Cells

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ABSTRACT

Apoptosis, a physiological mechanism of highly orchestrated cell death, can be initiated by extracellular and intracellular mechanisms that trigger a complex machinery of proapoptotic proteases and mitochondrial changes, leading to the activation of specific endonucleases and DNA fragmentation. The present study was undertaken to elucidate a mechanism underlying the inhibitory effect of biosynthesised silver nanoparticle on TNF-α induced NF-κB nuclear translocation in prostate cancer PC- 3 cells. The cell cycle analysis of Prostate cancer PC-3 cells was examined by flow cytometry by using annexin V-FITC/PI staining. Effect of silver nanoparticles in oxidative stress ROS, Effect of biosynthesized silver nanoparticle on apoptosis in human prostate cancer cell line and apoptotic induction of TNF-α and NF-κB expression was studied by Flow cytometry in Prostate cancer PC-3 cell line. From the results it was observed that biosynthesized silver nanoparticle inhibits the cellular growth of human prostate cancer PC-3 cells and induces apoptosis. The ROS levels generated in response to silver nanoparticles were significantly higher in treated PC-3 cells than the control. The result indicates that cell death is mediated by ROS production, which might alter the cellular redox status, and it is a potential reason for cell death. Apoptosis of the silver nanoparticle treated PC-3 cells was accompanied by a reduction in the percentage of cells in G0/G1 phase and an increase in the percentage of G2/M phase cells, indicating cell cycle arrest at G2/M phase, and transcription factor NF-κB plays an essential role in inflammation and cancer. The activation of NF-κB in response to inflammatory cytokine such as TNF-α promotes nuclear migration to enable DNA-binding activity and facilitate target genes expression.

KEYWORDS: Apoptosis; Flow cytometry; TNF; Silver nanoparticle; NF-kB; Prostate cancer.

Introduction

Cancer induced or mutated cells of fast growing leads to one of the major causes of death worldwide (Selvarani et al., 2015). Prostate cancer is one of the most commonly diagnosed cancers in men (Soliman et al., 2017), and the second leading cause of cancer death in the European countries and United States of America. Several antitumor drugs have been developed against prostate cancer, but their intolerable systemic toxicity often limits

and age, diet is a prominent risk factor for prostate cancer (Sonn et al., 2005). Many studies suggest a link between high-fat diet and increased risk of metastatic prostate cancer (Venkateswaran et al., 2004). The consumption of low-fat diet along with the high intake of dark green leafy vegetables, fruits, and soy products has been linked to the low rate of prostate cancer. The dietary constituents found in plant-derived foods have been recognized for anticarcinogenic properties. The

Efficient photocatalytic degradation of 2,4-dinitrophenol over mesoporous Zr and Ce co-doped TiO₂ 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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Tetraselmis indica Mediated Green Synthesis of Zinc Oxide (ZnO) Nanoparticles and Evaluating Its Antibacterial, Antioxidant, and Hemolytic Activity

Gopi Shankar Thirumoorthy, Oviyashri Balasubramaniam, Punitha Kumaresan, Poongothai Muthusamy & Karthik Subramani ✉

Abstract

The indenture of the green approach in synthesizing metal oxide nanoparticles has resulted in greater stoutness and favorable dimensions of nanoparticles since they are synthesized using a single step process. In this study, using algae extract of Tetraselmis indica as precursor, Zinc acetate was reduced to obtain ZnO nanoparticles using green synthesis approach. Synthesized ZnO nanoparticles (ZnONPs) were characterized using UV spectrometer (UV-vis spec), X-ray diffractometer (XRD), scanning electron microscopy (SEM) and energy dispersive analysis of X-ray (EDAX), and Fourier transform infrared (FTIR) spectroscopy. The biomedical application of ZnONPs was further studied in understanding with antibacterial, antioxidant, and hemolytic assays. UV visible spectrophotometry at wavelength of 372 nm confirmed the synthesis of ZnONPs. The results from X-ray diffractometer (XRD) studies approve the crystalline spherical structure of nanoparticle and the mean size of the ZnONPs was calculated to be ± 27 nm by using Scherrer formula. Fourier transform infrared spectroscopy (FTIR) analysis distinguished the presence of the various functional groups at different peak range, and the absorption peak at 470 cm^{-1} exhibits the presence of ZnO nanoparticle. Scanning electron microscopy (SEM) images identified the zinc oxide nanoparticles ranging in size from 20 to 40 nm. Results of EDAX (energy dispersive analysis of X-ray) represented the elemental configuration of the zinc oxide (ZnO) nanoparticles. The biosynthesized ZnONPs had potential antibacterial property against pathogenic strains of bacteria which was confirmed by performing "Agar well diffusion method." Out of selected bacterial strains, the gram-positive organism S. aureus with the maximum zone (18.4 ± 0.5 mm) and the gram-negative organism E. coli with the minimum zone (12.3 ± 0.3 mm) were the most sensitive and resistant organisms. The hemolysis assay performed with horse blood exhibited the less toxicity of the
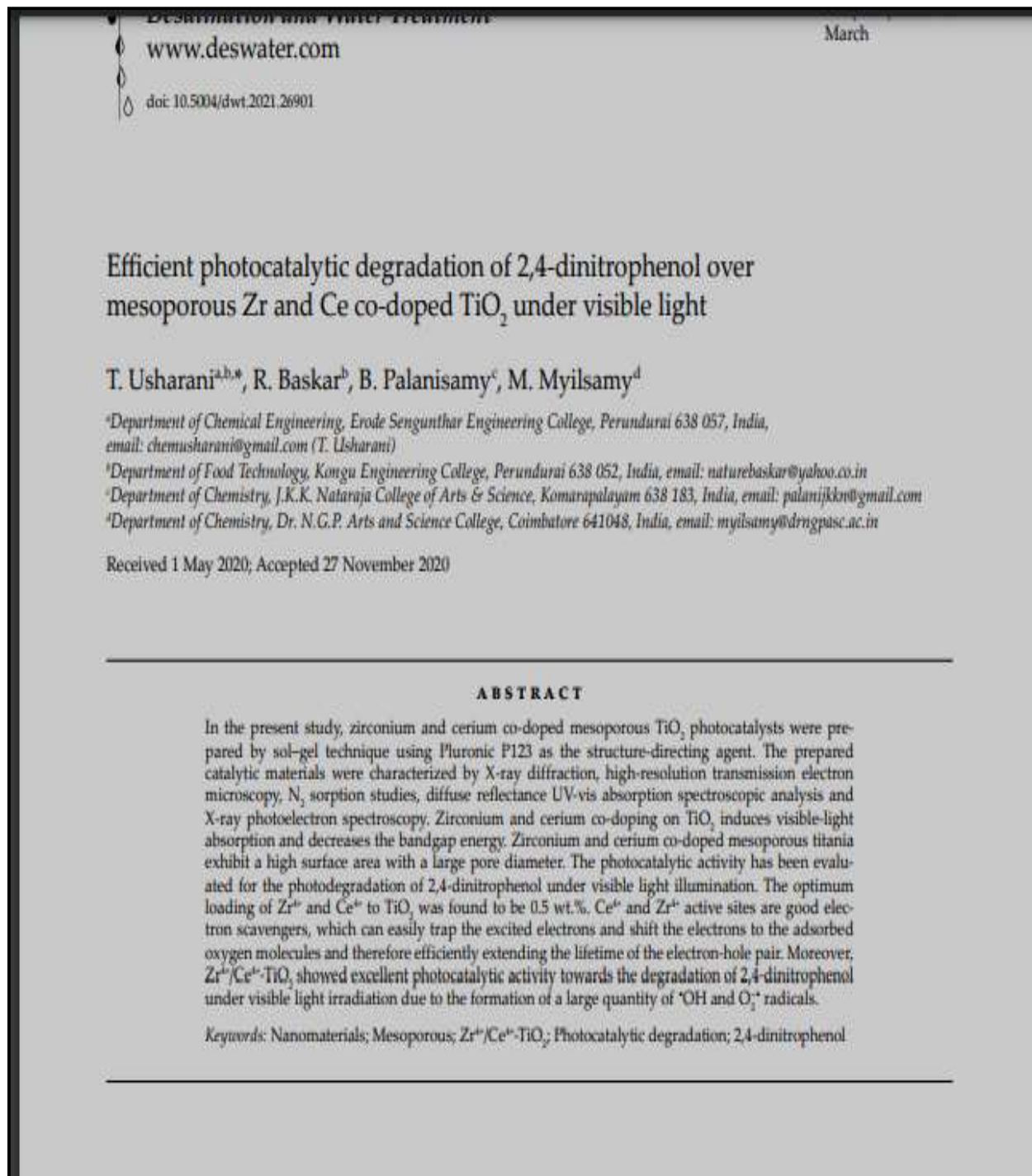
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IMPACT OF DOUBLE-DIFFUSION AND SLIP OF ORDER 2 ON CONVECTION OF CHEMICALLY REACTING OLDROYD-B LIQUID WITH CATTANEO-CHRISTOV DUAL FLUX

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

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

Publisher: IEEE   Cite This   PDF

C. Nagarani ; R. Kousalya   All Authors

Abstract

Document Sections

I. Introduction

II. Literature Survey

III. Proposed Methodology

IV. Experimental Results

V. Conclusion

Authors

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

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Mycofabrication of AgONPs derived from Aspergillus terreus FC36AY1 and its potent antimicrobial, antioxidant, and anti-angiogenesis activities

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Arockiam Jeyasundar Parimala Gnana Soundari [1 4], Swamiappan Sathiskumar [2],
Ulaganathan Priyadharshini [2], Deepak Paramasivam [5], Wen-Chao Liu [6],
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PMID: 34655404   DOI: 10.1007/s11033-021-06824-w

Abstract

Background: There is an emergency need for the natural therapeutic agents to treat arious life threatening diseases such as cardio- vascular disease, Rheumatoid arthritis and cancer. Among these diseases, cancer is found to be the second life threatening disease; in this view the present study focused to synthesize the silver oxide nanoparticles (AgONPs) from endophytic fungus.

Methods: The endophytic fungus was isolated from a medicinal tree Aegle marmelos (Vilva tree) and the potential strain was screened through antagonistic activity. The endophytic fungus was identified through microscopic (Lactophenol cotton blue staining and spore morphology in culture media) and Internal Transcribed Spacer (ITS) 1, ITS 4 and 18S rRNA amplification. The endophyte was cultured for the synthesis of AgONPs and the synthesized NPs were characterized through UV- Vis, FT- IR, EDX, XRD and SEM. The synthesized AgONPs were determined for antimicrobial, antioxidant and anti-

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Figures (3)

Tables (2)

⊞ Table 1
⊞ Table 2

Rapid green synthesis of CuO nanoparticles and evaluation of its photocatalytic and electrochemical corrosion inhibition performance

S. Surandhiran [a], V. Gowthambabu [b], A. Balamurugan [a ✉], M. Sudha [d], V.B. Senthil Kumar [e], K.C Suresh [f]

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Abstract

This research work demonstrates the photocatalytic activity and anticorrosive behaviour of Copper oxide nanoparticles (CuO NPs) which was synthesized by the green synthesis method using *Moringa oleifera* leaf extract as reducing and capping agents. The prepared CuO NPs have been elaborately characterized by various techniques namely X-Ray Diffraction (XRD) analysis, Field Emission Scanning Electron Microscopy (FESEM), Thermogravimetric analysis (TGA), and Bruner Emitter Teller surface area analysis (BET). The outstanding photocatalytic degradation properties of CuO NPs toward decolouration of Pararosaniline (PRA) dye solution under sunlight irradiation were also studied. The prepared CuO NPs was coated on the surface of the mild steel (MS) plate by a spin coating method. Electrochemical impedance spectroscopy (EIS) and Tafel plot show that the CuO NPs coated MS plate exhibits nearly 56% of improved anticorrosive behaviour under the 3.5% NaCl electrolyte compared with uncoated MS plate.

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Figures (4)

Tables (2)

Enhancement of corrosion inhibition of mild steel in acidic media by green-synthesized nano-manganese oxide

Y.A. Syed Khadar [a] ⊠, S. Surendhiran [b], V. Gowthambabu [c], S Halimabi Alias Shakila Banu [d], V. Devabharathi [c], A. Balamurugan [f] ⊠

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Abstract

In this study, extracts of withered flower petals such as rose petal (RP) and lotus petal (LP) were used as sources for natural antioxidants, namely anthocyanins, flavonols, phenolic compounds, and pectin to prepare nano-manganese oxide through the ultrasonic wave assisted green synthesis method, which is cost-effective and eco-friendly. The prepared nano-manganese oxides were used for enhancement of corrosion inhibition behavior of mild steel (MS) in acid medium (1 M HCl). The structural properties of the prepared nano samples were studied using X-ray powder diffraction studies (XRD). Functional groups and thermal behaviour of the prepared metal oxides were tested through Fourier transform infrared spectra (FTIR) and thermogravimetric (TG) analysis. Transmission electron microscope (TEM) showed the nanosized structure of the prepared manganese oxide. The specific surface areas were found to be 27.914 and 39.438 m^2g^{-1} for the sample prepared from the RP and LPs extract, respectively by BET surface area analysis.

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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 Cattaneo–Christov model. In addition, the comparative results are confirmed and reached an outstanding accord.

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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

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

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

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Impact of stratifications and chemical reaction on convection of a non-Newtonian fluid in a Riga plate with thermal radiation and Cattaneo-Christov flux

F. O. M. Mallawi, S. Eswaramoorthi, S. Sivasankaran ✉ & M. Bhuvaneswari

Abstract

The article explains the significance of convective flow of a chemically reacting non-Newtonian fluid over a Riga plate with the presence of heat absorption/generation and double stratification. The Cattaneo-Christov heat and mass flux's equations are utilized to frame the energy and concentration equations. The governing nonlinear boundary layer systems are altered into a couple of ordinary differential system. we employed the homotopy analysis method for obtaining the analytical solution of these resultant system. Analytical explanation of skin friction coefficient, local Nusselt number and local Sherwood number are calculated and described in tabular as well as graphical forms. The contributions of distinct physical flow parameters on velocity, temperature and concentration profiles are shown and reviewed. The obtained results are compared with published results in existing literature and got good agreement. We found that larger skin friction coefficient is obtained from Riga plate compared to the stationary plate. The plate shear stress is high in viscoelastic fluid compared to the second grade fluid and viscous fluid. The larger Nusselt number is occurred in second grade fluid compared to the viscoelastic fluid and viscous fluid. The mass transfer gradient rises with raising the values of the chemical reaction parameter with small amount of solutal stratification parameter.

Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating

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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

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

P. HEMALATHA[1], S. GOKILAMANI[2], §

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 $\lceil x \rceil$ 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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Structural, optical and magnetic properties of vacuum annealed Fe, Mn doped NiO nanoparticles

Balaraju Bayappagari[1] · Kaleemulla Shaik[2] · Deepannita Chakraborty[3] · Chaitanya Kumar Kunapalli[4]

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

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TEMPERATURE DEPENDENCE OF HOMOGENEOUS ANATASE-PHASED TiO₂ FILMS CHARACTERIZATION AND GAS-SENSING BEHAVIORS

V. GOPALA KRISHNAN ✉ and P. ELANGO

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Abstract

Anatase-phased TiO_2 films were prepared at different temperatures (350, 400, 450 and 500°C) using automated nebulizer spray pyrolysis (A) method. The structural study (XRD) revealed the amorphous nature at 350°C and remaining samples (400, 450 and 500°C) show the tetragon structure with $2\theta^o = 25.78$, 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 3 2s peaks in the prepared samples. The 3D optical profilometer has shown that the thickness of the prepared films was decreased by increase 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 pac agglomerated particles by the influence of temperature. The oscillating nature of transmittance (%) with redshift of the sharp absorption edge 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.

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Genetic risk factors for lumbar disc disease

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Abstract

Aim and 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 pathogenesis of LDD. There is particular emphasis on the vitamin D receptor gene (VDR gene). The VDR polymorphisms FOK1, TAQ1, and APO1 have been variably associated with LDD.

Objective: To evaluate the association between the FOK1/Taq1 genes and LDD.

Materials and Methods: One hundred unrelated healthy (asymptomatic) individuals who presented for routine health checkup and 93 consecutive patients (43 males and 50 females) with no history of low back pain were enrolled in the study after informed consent was obtained. The MRI images of cases and controls were graded and peripheral blood samples were collected from all participants and sent for genetic analysis.

Results: Individuals with the dominant genotype for Taq1 had a significantly higher association with LDD than those without it. There was no association between LDD and the Fok1 genotype.

Conclusion: Genetic predisposition is an important risk factor for LDD.

KEYWORDS

FoK1 and Taq 1 genes, lumbar disc degeneration, lumbar disc disease, vitamin D receptor gene

1 | INTRODUCTION

Degeneration of the lumbar disc (lumbar disc disease, LDD) is the commonest cause of low back pain. LDD is considered an epidemic owing to its universal distribution and common occurrence. It is a major cause of work absenteeism and economic loss (Andersson, 1999; Chan, Song, Sham, & Cheung, 2006). It is a major concern that the incidence of LDD and low back pain is increasing amongst the younger population (Rathod et al., 2012).

The bodies of the vertebrae alternate with fibrocartilaginous produced under the control of specific genes including COL1A1, COL9A2, MMP3, and VDR. Polymorphisms in any of these genes can result in defective discs, which can lead to intervertebral disc disease. Genetic involvement in LDD is a newer concept still being researched in different populations around the world. The older philosophy states that the disc becomes less hygroscopic with advancing age and dehydration results. This leads to disc degeneration. In due course, the spine in the affected region loses its stability (Inoue, 1981). The initial clinical manifestation of LDD is low back pain, and as it progresses, radiculopathy ensues (Buckwalter, 1995; Heliovaara, 1989).

Research articles

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

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ARTICLE INFO

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 para-magnetic to antiferromagnetic transition as temperature varies from 2 to 50 K.

1. Introduction

Multifunctional properties of layered double hydroxide nano-materials 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 poly-

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. Poly-morphism also induced by varying the synthesis temperature and by

Publications in Web of Science for Academic Year 2020-21

Heart Diseases Prediction for Optimization based Feature Selection and Classification using Machine Learning Methods

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Abstract—Globally, heart disease is considered to be the major cause of death. As per statistics, 17.9 million people are losing their lives every year worldwide. Chronic Kidney Disease (CKD) and Breast Cancer takes the next positions in the list. Disease classification is an important issue that needs more attention now. Making use of an optimized technique for such classification would be a better option. In this heart disease classification, initially, feature selection was done using Teaching learning based Optimization based (TLO) and Kernel Density. TLO is based on the process of classroom teaching, which involves too much iteration that leads to time complexity. Similarly, a certain level of misclassifications has been observed by using Kernel Density (KD). In the proposed method, K-Nearest Neighbour (KNN) is used to address the issue of NaN values and Density based Modified Teaching Learning based Optimization (DMTLO) is used for feature selection. Finally the classification process is done by considering Support Vector Machine (SVM) and Ensemble (Adaboosting method). SVM categorizes data bydissimilar class names by defining a group of support vectors that are part of the group of training inputs that plan a hyper plane in the attribute space. Ensemble method is used to solve statistical, computational and representational problems. Experimental outcomes have proved that the projected DMTLOovertakes the existing methodologies with required quantity of attributes.

Keywords—Teaching learning based optimization; kernel density; support vector machine; k-nearest neighbour; ensemble learning

I. INTRODUCTION

Nowadays, datasets are tremendously accumulated with enormous quantity of data sources. Such high dimensional data rises the calculationrate and diminishes the results of a ML model if the dataset has inappropriate, duplicate and unwanted attributeswhich is notfavourable to the improvement of an

challenging task. Various optimization techniques are utilized for choosing proper features such as Genetic Algorithm (GA), and Particle Swarm Optimization (PSO) by numerousscientists to advance the outcomes of the classifiers.

Parham et al., (2016) [9] established an attribute choosing strategy which is a hybridization of PSO and local search strategy. Its results were evaluated with various screen and wrapper-based strategies. It has attained notable precision results.

Hafez et al. (2015) [5] proposed an attribute choosing procedure that is dependent on Chicken swarm optimization. It replicated the performance of chicken swarms and attainedgood resultsthroughtypical datasets relatedtowards GA and PSO optimization algorithms. A methodology proposed by Panda (2017) [12] relies on elephant search optimization in aalliance with deep NN for inspecting microarray data. Venkata Rao (2016) [14], Rao (2016) [21] proposed extensive presentations of TLBO in many real time problems. The strategy of TLBO is proposed to decrease load of fixing the parameter standards during attribute choosing process.

II. RELATED WORK

Attribute selection is highly needed in various areas like categorization of emails, disease analysis, forged claims and also in the areas of credit/debit risks. In the process of developing a well-organized decision-making method, the significant step is to organize the better features which are more suitable to attain better precision results.Various scientists have made use of filter and wrapper choosing strategies Wah et al., (2018) [22] to increase the correctness of forecaststrategies. Several prevailing attribute choosing strategies have been observed to comprehend its pros and cons. Bahassine et al. (2018) [3] have projected a novel attribute choosing method for categorization of Arabic text by means of
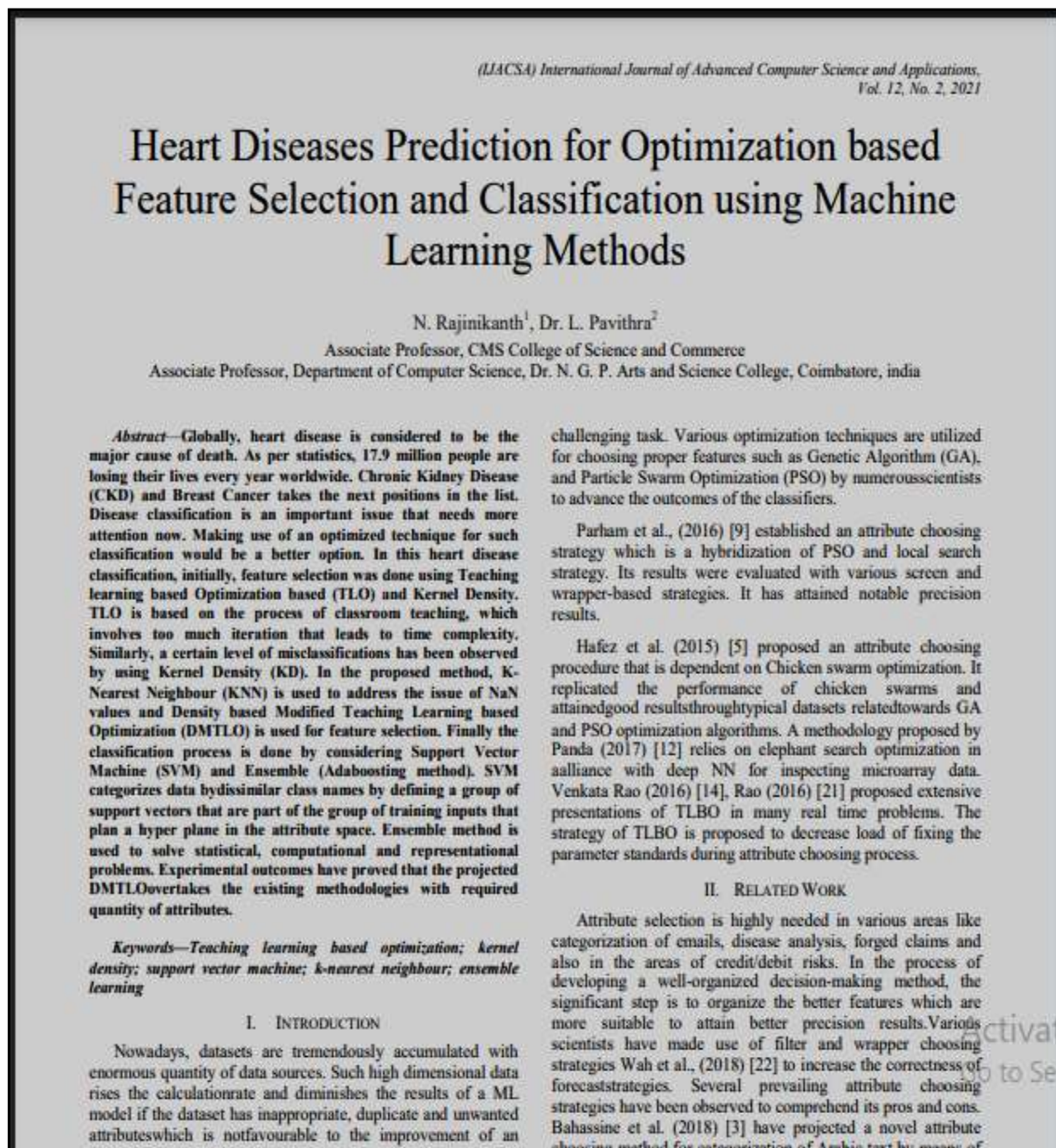
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Molecular Insights on the Dihydrogen Bond Properties of Metal Borohydride Complexes upon Ammoniation

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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 ($H^{\delta-}$—$H^{\delta+}$) 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, energy decomposition analysis (EDA), interaction energy and Bader charge analysis were calculated in order to interpret the role of non-bonded interaction on decomposition process. The calculated structural, QTAIM and EDA analysis reveal the presence of non bonded interaction in all the complexes. Overall analysis of the study reported that the process of adding amine group in alkali metal borohydrides increases charge distribution around the dispersion interaction which plays a vital role in hydrogen evolution process.

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Abstract

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TEMPERATURE DEPENDENCE OF HOMOGENEOUS ANATASE-PHASED TiO₂ FILMS CHARACTERIZATION AND GAS-SENSING BEHAVIORS

V. GOPALA KRISHNAN ✉ and P. ELANGO

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Abstract

Anatase-phased TiO₂ films were prepared at different temperatures (350, 400, 450 and 500°C) using automated nebulizer spray pyrolysis (A) method. The structural study (XRD) revealed the amorphous nature at 350°C and remaining samples (400, 450 and 500°C) show the tetragon 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 3 2s peaks in the prepared samples. The 3D optical profilometer has shown that the thickness of the prepared films was decreased by increase i temperature. The AFM study exhibited average roughnesses (Ra) of the prepared films such as 0.058, 0.147, 0.176 and 0.194 nm, respectivel The surface morphological study of FESEM has shown the cracked uneven distributed nature (350°C) turn into evenly distributed closed pac agglomerated particles by the influence of temperature. The oscillating nature of transmittance (%) with redshift of the sharp absorption edge 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 C₂H₆O reducing gas at 300°C operating temperature with 150 ppm gas concentration.

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Improved Grasshopper Optimization Algorithm based Feature Selection with Evolutionary Outlay-Aware Deep Belief Network Classifier (IGOA-EOA-DBNC) for High Dimensional Datasets

Dr.M. Praveena[1]; Dr.V. Jaiganesh[2]

[1]Assistant Professor, Department of Computer Science, Dr.SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamil Nadu, India.

[2]Professor, Department of Computer Science, Dr.NGP Arts and Science College, Coimbatore, Tamil Nadu, India.

Abstract

Background: High dimensional datasets contain the curse of dimensionality, and hence data mining becomes a more difficult task. Feature selection in the knowledge data and discovery process provides a solution for this curse of dimensionality issue and helps the classification task reduce the time complexity and improve the accuracy.

Objectives: This paper aims to recognize a bio-inspired algorithm that best suits feature selection and utilizes optimized feature selection techniques. This algorithm is used to design machine learning classifiers that are suitable for multiple datasets and for both high dimensional datasets, moreover to carry out performance analysis with regards to the accuracy of a classification and the processing time for classification.

Methods: This study employs an improved form of grasshopper optimization algorithm to perform feature selection task. Evolutionary outlay aware deep belief network is used to perform the classification task. **Findings:** In this research, 20 UCI benchmark data sets are taken with full 60 features and 30000 instances. The datasets are Mammography, Monks-1, Bupa, Credit, Parkinson's, Monk-2, Sonar, Ecoli, Prognostic, Ionosphere, Monk-3, Yeast, Car, Blood, Pima, Spect, Vert, Prognostic, Contraceptive, and Tic-Tac-Toe endgame. Table 1 describes the dataset details, number of instances, datasets and features. The overall performance is performed using MATLAB 6.0 tool, which runs on Microsoft Windows 8, and the configuration is Core 13 processor with 1 TB hard

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PAPER

Noticeable improvement in the toxic gas-sensing activity of the Zn-doped TiO₂ films for sensing devices

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

Zn-doped TiO₂ 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, WO₃, SnO₂, In₂O₃, and TiO₂ are used to detect combustible and volatile organic compounds (VOCs) as a function of change in resistance to the target gases.[9] Among them, TiO₂ and TiO₂-derived materials are significant for emerging environmental refinement.[10] TiO₂ 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 TiO₂ is a potential composition to improve the gas detection response, selectivity, stability, and even TiO₂ 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 TiO₂ gas detection such as Ag–TiO₂,[13] Sn–TiO₂, Nb–TiO₂ and Cr–TiO₂,[16] but no specific results are available for the stabilized anatase phase of additive mixed TiO₂ for the detection of combustible and volatile organic compounds. This report shows the characterization and gas sensing performance of

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[d] Department of Physics, Sri Ramakrishna Mission Vidyalaya College of Arts and

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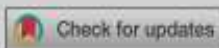**3rd Cycle**

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Research articles

Polymorphism induced magnetic transitions in Ni(OH)₂ nanostructures

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ARTICLE INFO

Keywords:
Nickel hydroxide
Polymorphism
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.

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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 145.82 W kg^{-1} at 1 Ag^{-1} respectively, presents a promising

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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 Krish-

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

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

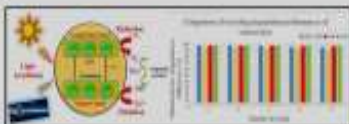V. Gowthambabu [a,1], A. Balamurugan [b,1], R. Dhivya bharathy [a,1], S. Satheeshkumar [c,1], S.S. Kanmani [a,1,*]

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HIGHLIGHTS

- ZnO nanoparticles synthesised by solution combustion 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

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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Investigation on temperature-dependent structural, dielectric and impedance characteristics of Cu-doped CaFe$_x$Ti$_{1-x}$O$_{3-\delta}$ nanotitanates

Mathu Sridharpanday, Ramasubramanian Brindha, Murugan Vinoth, Kandhasamy Narthana & Venkatachalam Rajendran ✉

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
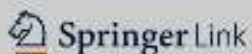
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Research Article

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

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Received 15 June 2021; Accepted 30 July 2021; Published 18 August 2021

Academic Editor: Riaz Ahmad

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.

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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 $\{1, 2, 3, ..., k\}$ ($n \le k \in Z^+$) 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 $n \ge 6$, complete graphs K_n for $n \ge 3$ and complete bipartite graphs $K_{n/2,n/2}$ for even $n \ge 4$ 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 $n \ge 12$
(ii) $\mathbf{brd}(K_n) = n$, for $n \ge 3$
(iii) $\mathbf{brd}(K_{n/2,n/2}) = n$, for even $n \ge 4$

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 $G \square H$ of graphs G and H is a graph such that (i) the vertex set of $G \square H$ is cartesian product $V(G) \times V(H)$ and (ii) two vertices (u_1, u_2) and (v_1, v_2) are adjacent in $G \square H$ 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 $\lceil x \rceil$ 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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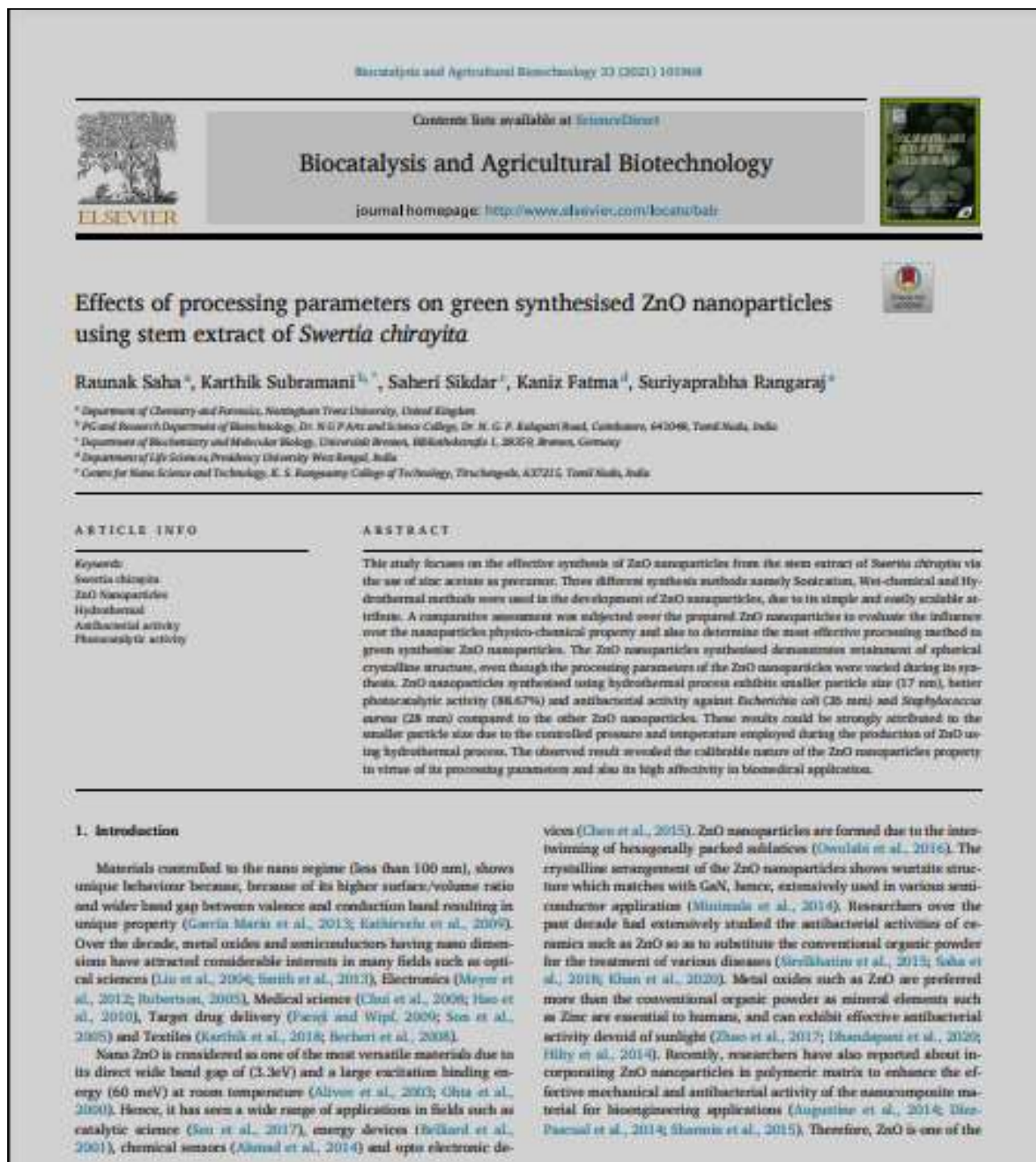
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Effects of processing parameters on green synthesised ZnO nanoparticles using stem extract of *Swertia chirayita*

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ARTICLE INFO

Keywords:
Swertia chirayita
ZnO Nanoparticles
Hydrothermal
Antibacterial activity
Photocatalytic activity

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 attributes. 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 demonstrate 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 (Chan et al., 2008; Hao et al., 2010), Target drug delivery (Patel and Wipf, 2009; Sen 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 (Aliyev et al., 2003; Ohta et al., 2000). Hence, it has seen a wide range of applications in fields such as catalytic science (Sen et al., 2017), energy devices (Bellard et al., 2001), chemical sensors (Ahmad et al., 2014) and opto electronic devices (Chen et al., 2015). ZnO nanoparticles are formed due to the intertwining of hexagonally packed sublattices (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

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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ARTICLE INFO

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.

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 radia-

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

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

by

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This article express the outcomes of mixed convective flow of a chemically reacting Oldroyd-B liquid with Cattaneo-Christov double flux under the consequence of second order slip, heat absorption/heat generation and Newtonian cooling/Newtonian heating. The governing PDE are converted into ODE using suitable variables. The homotopy analysis method 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.

Key words: *Oldroyd-B liquid, Cattaneo-Christov double flux, Newtonian heating, homotopy analysis method, heat generation, second order slip*

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 Oldroyd-B liquid (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 poly-

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 photo-luminescence 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 semi-conductor 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

Thermally radiative flow of a viscoelastic nanofluid with Newtonian heating

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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.

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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 $^•$OH and O$_2^{•-}$ radicals.

Keywords: Nanomaterials; Mesoporous; Zr^{4+}/Ce^{4+}-TiO$_2$; Photocatalytic degradation; 2,4-dinitrophenol

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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

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Extraction, Characterization and Enzymatic Degumming of Banana Fiber

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ABSTRACT

Pseudostem is the major biomass being generated and not utilized after harvesting of banana bunches. The present study was aimed to characterize the banana fiber and to explore the possibilities of improving the quality of extracted fiber by degumming using enzymes. Fiber from pseudostem of five cultivars, viz., Grand Naine (AAA), Red Banana (AAA), Poovan (AAB), Popoulu (AAB) and Karpuravalli (ABB), were extracted using Raspador machine. Fibers were treated with pectinase, laccase and combination of both enzymes at varying concentrations. The highest fiber recovery was obtained from Karupuravalli (2.49%) and the least was recorded in Grand Naine (1.10%). Properties like breaking strength, breaking extension, tex and tenacity were found to be better in Red Banana fiber (975.97 gf, 3.17%, 33.7 tex, 28.40 cN/tex and 180.25 MPa respectively). SEM results revealed that laccase enzyme was more efficient in improving the surface quality of fibers followed by pectinase + laccase (25:75). Removal of pectinolytic substances from intact cells in cell wall of fiber resulted in surface smoothening of banana fiber.

摘要

假茎是香蕉收获后产生和未利用的主要生物量。研究了香蕉纤维的特性，探讨了酶法脱胶提高纤维质量的可能性。采用树莓机提取了5个栽培品种的假茎纤维，Grand Naine (AAA)、红香蕉(AAA)、普凡(AAB)、波费鲁(AAB)和卡普拉瓦利(ABB)。以不同浓度的果胶酶、漆酶和两种酶的组合处理纤维。Karupuravalli纤维回收率最高(2.49%)，Grand Naine纤维回收率最低(1.10%)。红香蕉纤维(975.97 gf、3.17%、33.7 tex、28.40 cN/tex、180.25 MPa)的断裂强度、断裂伸长率、tex、韧性等性能较好。SEM结果显示漆酶在提高纤维表面质量方面更有效，其次是果胶酶+漆酶 (25:75)。去除纤维细胞壁完整细胞中的果胶分解物质，可使香蕉纤维表面光滑。

Introduction

Management of crop residues in eco-friendly and profitable way is one of the major issues in agriculture. It has been achieved to some extent in crops like sugarcane, wheat, rice and maize, yet many of the horticultural wastes are left unutilized (Singaraj et al. 2019). Since long time, plant fibers have been used for versatile applications. Natural fiber from agro-waste exhibit excellent characteristics like good mechanical strength, stiffness, low density, non-abrasiveness, high disposability, renewability and are considered to be eco-friendly over synthetic fibers (Cordeiro et al. 2004). Among the natural fibers, 90 percent are of plant origin and classified as seed fibers such as cotton, bast/skin fibers like flax, ramie, hemp, banana and jute. Among

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Impact of stratifications and chemical reaction on convection of a non-Newtonian fluid in a Riga plate with thermal radiation and Cattaneo-Christov flux

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Abstract

The article explains the significance of convective flow of a chemically reacting non-Newtonian fluid over a Riga plate with the presence of heat absorption/generation and double stratification. The Cattaneo-Christov heat and mass flux's equations are utilized to frame the energy and concentration equations. The governing nonlinear boundary layer systems are altered into a couple of ordinary differential system. we employed the homotopy analysis method for obtaining the analytical solution of these resultant system. Analytical explanation of skin friction coefficient, local Nusselt number and local Sherwood number are calculated and described in tabular as well as graphical forms. The contributions of distinct physical flow parameters on velocity, temperature and concentration profiles are shown and reviewed. The obtained results are compared with published results in existing literature and got good agreement. We found that larger skin friction coefficient is obtained from Riga plate compared to the stationary plate. The plate shear stress is high in viscoelastic fluid compared to the second grade fluid and viscous fluid. The larger Nusselt number is occurred in second grade fluid compared to the viscoelastic fluid and viscous fluid. The mass transfer gradient rises with raising the values of the chemical reaction parameter with small amount of solutal stratification parameter.

Nomenclature

a^*, b^*, c^*, d^*, e^*	Positive constants/s^{-1}	k_0	Material fluid parameter
a_1^*	Width of magnets and electrodes/m	k_1	Chemical reaction coefficient
C^*	Fluid concentration/kgm^{-3}	k^*	Mean absorption coefficient
C_p	Specific heat/$Jkg^{-1} K^{-1}$	K	Viscoelastic parameter
Cr	Chemical reaction parameter	λ^*	Velocity slip factor
D_B	Mass diffusivity/$m^2 s^{-1}$	M_0^*	Magnetization of the permanent magnets
f'	non-dimensional velocity		Tesla
f_w	Suction/injection parameter	Pr	Prandtl number
Hg	Heat generation/absorption parameter	Q^*	Heat generation/absorption
Hm	Modified Hartmann number	R	Radiation parameter
		Sc	Schmidt number