3.3.1 Number of research papers published per teacher in the Journals notified on UGC CARE list during the last five years

Sr. No	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Calendar Year of publication	ISSN number	Page Number
1	Load-bearing characteristics of a hybird Si3N4-epoxy composite	Dr. Koli Gajanan C	Mechanical Engg.	Biomass Conversion and Biorefnery SPRINGER	2023	ISSN:2190-6815	3
2	Performance analysis of sodium alanate hydride reactor with different nanofluids	Rahul U. Urunkar	Mechanical Engg.	International Journal of Hydrogen Energy	2023	ISSN:0360-3199	4
3	Motor Vehicles Forecasting in Kolhapur City Using Combined Grey Model	Sagar M. Shinde	Civil Engineering	KSCE Journal of Civil Engineering	2023	1226-7988	5
4	SILAR synthesis of SnO2-ZnO nanocomposite sensor forselective ethopnal gas	Dr.Sachin S.Potdar	Physics	Bulletin of materials Science,Springer	2022	0250-4707 (print) 0973-7669 (web)	6
5	Novel synthesis of perovskite GdxAl1–xO3 semiconductor by combustion route for selective LPG sensing	Dr.Sachin S.Potdar	Department of Physics, Sanjeevan Engineering and Technology	bulletin of material Science , Springer Nature	2022	0250-4707	7
6	Potassium ferrocyanide promoted an efficient synthesis of benzoxazoles and benzothiazoles under solvent free condition	Dr.Sachin S.Potdar & Dr.Vishal S.Patil	Department of Physics, Sanjeevan Engineering and Technology Institute, Panhala.	Indian Academy of Sciences	2022	1307-6175	8
7	A prototype model for detection and classification of landslides using satellite data	Dr. Suhas G. Sapate	Computer Science and Engineering	Journal of Physics: Conference Series, 2022	2022	17426588, 17426596	9
8	Past,Present and future of Automated Mamographic Density Measurement for Breast Cancer Risk Prediction	Dr. Suhas G. Sapate	Computer Science and Engineering	Journal of Physics: Conference Series, 2022	2022	17426588, 17426596	10
9	Segmentation of pectoral muscle from digital mammograms with depth-first search algorithm	Dr. Suhas G. Sapate	Computer Science and Engineering	biocybernetics and biomedical engineering	2021	0208-5216	11
10	Active cooling system for efficiency improvement of PV panel and utilization of waste-recovered heat for hygienic drying of onion flakes	Dr. Vinayak H. Deokar	Mechanical	Journal of Materials Science: Materials in Electronics, Springer nature	2021	0957-4522	12
11	Synthesis and Characterization of Macro Porous Gd2O3ZnO Nanocomposte Sensor for NO2 Gas Detection	Dr. S.S. Potdar	Basic Sciences & Humanities	Rasayan Journal of Chemistry	2021	0974-1496	13
12	Optimization and Prediction on the Mechanical Behavior of Granite Particle Reinforced Al6061 Matrix Composites Using Deer Hunting Optimization Based DNN	Dr. Koli Gajanan C	Mechanical Engg.	Silicon	2021	1876-990X	14
13	Simulation Modeling and Experimental Validation of Solar Photovoltaic PMBLDC Motor Water Pumping System	Dr. Vinayak H. Deokar	Mechanical Engineering	Journal of Thermal Engineering	2021	2148-7847	15
14	Enhancement of heat and mass transfer characteristics of metal hydride reactor for hydrogen storage using various nanofluids	Rahul U. Urunkar	Mechanical	International Journal of Hydrogen Energy	2021	1879-3487	16
15	Breast cancer diagnosis using abnormalities on ipsilateral views of digital mammograms	Dr. Suhas G. Sapate	Computer Science and Engineering	biocybernetics and biomedical engineering	2020	0208-5216	17
16	Nanostructured CdO–ZnO composite thin films for sensing application	Dr. S. S. Potdar, and Dr.V. S. Patil	Basic Sciences & Humanities	Journal of Materials Science: Materials in Electronics	2020	0957-4522	18

17	Heterogeneous composites for low and medium temperature thermal insulation: A review	Dr. Mohan Vanarotti	mechanical	Energy and Buildings	2019	0378-7788	19
18	Facile synthesis of Nanodiced SnO2-ZnO composite by chemical route for gas sensor application	Dr. S.S. Potdar	Basic Sciences & Humanities	Journal of Electronic Materials	2019	0361-5235	20
19	Influence of bath temperature on microstructure and NH3 sensing properties of chemically synthesized CdO thin films	Dr. S.S. Potdar	Basic Sciences & Humanities	Materials Science-Poland	2019	2083-134X	21
20	A novel FRET probe for determination of fluorescein sodium in aqueous solution: analytical application for ophthalmic sample	Dr. Vishal A. Patil	Basic Sciences & Humanities	Indian Journal of Chemistry	2019	0376-4710	22
21	Electrochemical synthesis of CuSxSe1-x thin film for supercapacitor application	Dr. S.S. Potdar	Basic Sciences & Humanities	Journal of Alloys and Compounds, ELSEVIER	2018	0925-8388	23
22	Radiomics based detection and characterization of suspicious lesions on full field digital mammograms	Dr. Suhas G. Sapate	Computers Science and Engineering	Computer Methods and Programs in Biomedicine	2018	0169-2607	24

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ORIGINAL ARTICLE

Load-bearing characteristics of a hybird Si_3N_4-epoxy composite

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Abstract

In this study, the epoxy composites were made using Si_3N_4 nanoparticle obtained from red matta rice husk ash and aluminised glass/pineapple hybrid fibre. The primary objective of this study was to develop lightweight structural composites for domestic infrastructure applications using biomass wastes. The epoxy composites were made using Si_3N_4 nanoparticle of 0.5 to 4 vol% and hybridised fibre of 40 vol% by hand lay-up method. The mechanical, fatigue and low-velocity impact characteristics of the composites were evaluated as per ASTM standards. The results showed that, among the composites that had been produced, composites with 2 vol% Si_3N_4 nanoparticle had the highest tensile, impact, flexural and hardness, measuring 168 MPa, 202 MPa, 6.2 J and 93 shore-D. Also, at 50% of UTS, the composite with the addition of 2 vol% Si_3N_4 nanoparticle had a better fatigue life count of about 36273. Similarly, the improved low-velocity impact strength of composite having 1 vol% of Si_3N_4 nanoparticle has maximum energy absorption of 11.4 J. Moreover, with the insertion of stacked fibre and Si_3N_4 nanoparticle, the epoxy composites have low combustion rate showing better flame-retardant behaviour. The results show that composites have been successfully produced for potential applications such as domestic infrastructure products like lightweight man-hole cover, hand rails, gratings, interior decoration panels, doors and windows.

Keywords Composites · Fibre · Nanoparticle · Mechanical · Fatigue · Flammability

1 Introduction

Composite material is made usually from two phases, i.e. reinforcement and matrix. Reinforcement works as load-bearing member and the matrix work as stress transfer among reinforcement elements. Due to their extensive application in the aerospace, automotive, construction and sporting industries, fibres are firmly regarded as reinforcement element in composite materials where they bear the majority of the loading [1–3]. Due to their durability and affordable pricing, glass fibres (GF) are one of the most popular reinforcement materials [4–6]. Nowadays, lignocellulosic fibres have been used as a reinforcement material to produce a polymeric composite and are receiving a lot of attention in the place of glass or other synthetic fibres [7–10]. Meanwhile, it is economical, commonly available and a recurrent crop with very high potential mechanical properties such as lightweight, high tensile strength, high thermal stability, flame-retardant property and prominent stiffness. Among the lignocellulosic fibres, pineapple is the promising fibre to be used as a reinforcement material due its easy availability. In order to create the faux celling board composite,

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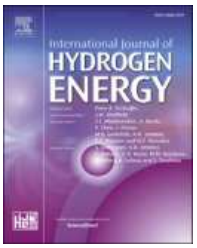

Performance analysis of sodium alanate hydride reactor with different nanofluids

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HIGHLIGHTS

- Developed and validated mathematical model of sodium alanate based hydride reactor.
- Used nanofluid as a heat exchange fluid.
- Presented performance for Al_2O_3/HTF, CuO/HTF and MgO/HTF Nanofluids.
- Absorption time is improved by 14% for given conditions.
- Reported up to 10% enhancement in the heat exchange rate for CuO/HTF nanofluid.

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ABSTRACT

The thermal management of the hydride based hydrogen storage reactor is the key factor to realize the complete storing potential of hydrides. In this regards a hydride reactor filled with sodium alanate in multiple tubes is numerically analyzed for absorption process. Based on various governing equations, a mathematical model of hydride reactor is developed and validated with the help of ANSYS Fluent. The hydride reactor uses mainly water or oil for heat exchange during hydrogen sorption. In the present study conventional heat transfer fluid (HTF) is replaced with the nanofluid since it has a greater heat exchange properties. The CuO/HTF, Al_2O_3/HTF and MgO/HTF nanofluids are selected based on previous studies and results of numerical experiment are recorded. The outcomes are attained for various parameters such as material and concentration of nanoparticles, supply pressure of hydrogen and inlet temperature of heat exchange fluid. The CuO/HTF nanofluid with concentration of 5 vol% exhibited better rate of absorption in comparison with other vol% concentrations and other selected nanofluids. It shows improvement in hydrogen absorption time up to 14% under selected conditions. Additionally, it is observed that CuO/HTF nanofluid with 5 vol% concentration is thermodynamically superior to other selected nanofluids; as a result it enhances the rate of the heat exchange up to 10% for hydride reactor. It is realized that the performance of CuO/HTF nanofluid with 5 vol% concentration is superior among picked nanofluids. Therefore for the hydride reactor the use the nanofluid is advantageous.

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Environmental Engineering

Motor Vehicles Forecasting in Kolhapur City Using Combined Grey Model

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ABSTRACT

Kolhapur city has witnessed consistent growth in motor vehicles (MV), and an accurate forecast is essential. To this end, a combined grey model was developed by combining the grey model (GM(1,1)) and the simple linear regression (SLR) model. The new model, named the grey simple linear regression model (abbreviated as GSLRM), is newly utilised for MV prediction. A total of five years (2008 – 2012) of MV data were employed. The accuracy of the proposed GSLRM was compared with the GM(1,1) and SLR models in terms of the mean absolute percentage error (MAPE). The results revealed that all models meet high accuracy (MAPE < 10%). However, the GSLRM was slightly more accurate (MAPE = 3.85%) than the competing models. Moreover, with a reasonable development coefficient value ($a \leq 0.3$), the GSLRM could be used for mid-long-term forecasts. Subsequently, the GSLRM was used to forecast MV for the next seven years (2013 – 2019). The forecast results showed that the total MV would increase continuously. In summary, the GSLRM proved its reliability and validity in forecasting the total MV in Kolhapur city, and it can assist the government in drafting relevant policies. Moreover, this study also attempted to investigate the relationship between the population and RMV growth and found that population could be one of the responsible factors.

1. Introduction

India has witnessed rapid growth in the transport sector, particularly in road transport, and it holds the lion's share in the country's gross domestic product (GDP). In 2011, the transport sector contributed about 6.5% to the nation's GDP, with road transportation having 4.7%, a significant share of it (MoRTH, 2012). Although the road transport sector boosts the Indian economy, it causes accidents and congestion (Jain and Dhiman, 2017). Moreover, motor vehicles (MV) have been identified as the primary source of air pollution (Sood, 2012) in many Indian urban areas, for example, Pune (Gidde and Sonawane, 2012), Bengaluru (Harish, 2012), Kolhapur (TERI, 2016), Delhi (Goyal et al., 2006; Shinde and Karjinni, 2019), and so on. Hence, predicting future MV is essential.

Over the last few years, in most states (districts, cities), consequently across India, the number of registered motor vehicles (RMV) has increased considerably. For example, in 2011, in terms of the total RMV, Maharashtra state ranked first in the country (MoRTH, 2012), and Kolhapur district ranked seventh in the state (Motor Vehicles Department Maharashtra, 2018). Maharashtra state is one of the most progressive states in India, and Kolhapur district is one of the most developed districts in the state. In 2011, with 3.5% of the state's gross domestic district product (GDDP), the district ranked sixth in the state (DES, 2016). Similarly, the city of Kolhapur is also famous in the state, which is situated along the banks of the Panchganga River and located in the extreme southern-western Maharashtra state, western India (Hunashal and Patil, 2011). It is one of the country's highest per capita income cities (Sathe et al., 2011). According to the census of 2011, the city has a 549236 population and a 66.82 km² geographical area (Directorate of Census Operations Maharashtra, 2014). The Kolhapur Municipal Corporation (KMC) administrates the city, and the Kolhapur Municipal Transport (KMT) renders the public bus transport (TERI, 2016).

Like the trend nationwide, the total RMV in Kolhapur city has

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SILAR synthesis of SnO_2–ZnO nanocomposite sensor for selective ethanol gas

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Abstract. SnO_2–ZnO nanocomposite is synthesized at room temperature using the successive ionic layer adsorption and reaction (SILAR) method. The X-ray diffraction (XRD) patterns of annealed films confirms the formation of SnO_2–ZnO nanocomposite. Scanning electron microscopy depicts the porous agglomerated nanoparticle network-like structure of the SnO_2–ZnO nanocomposite. On the other hand, ZnO has a cauliflower shape, while SnO_2 has a distributed agglomerated nanoparticle-like morphology. Energy dispersive X-ray spectroscopy (EDS) confirms the elemental compositions of composite films. The reducing gases such as liquefied petroleum gas, ethanol, hydrogen sulphide and ammonia were detected using a SnO_2–ZnO nanocomposite sensor. Ethanol has a maximum sensitivity of 56.93% at a temperature of 275°C and a concentration of 24 ppm. In addition, as compared to a bare sensor, a composite sensor responds quickly. The *n–n* heterojunction at intergrain boundaries is responsible for better composite performance over bare sensors. Even at low gas concentrations, the SnO_2–ZnO nanocomposite sensor is found selective towards ethanol.

Keywords. SILAR method; XRD; TEM; porous network-like structure; ethanol sensor.

1. Introduction

The issue of air quality continues to be a significant concern around the world. Our health and the environment both depend on a reliable supply of air. The human nose is a sophisticated detecting organ that can distinguish between hundreds of different odours. Even yet, it fails to detect absolute gas concentrations of odourless gases. As a result, devices are urgently needed to detect hazardous gases to supplement or replace the human nose. There are numerous gas detection methods in use today [1–4]. High-performance gas sensors with high sensitivity, selectivity and response speed are still required to enhance gas detection levels.

Metal oxide semiconducting materials are the most common sensing materials, giving sensors many benefits such as high sensitivity and low cost. It is usually possible to classify metal oxides into (i) non-transition and (ii) transition oxides. The previous (e.g., Al_2O_3) exhibits elements with only one oxidation state because the formation of other oxidation states takes much more energy, while the latter (e.g., Fe_2O_3) contains more oxidation states [5]. Metal oxide semiconductors such as transition-metal oxides could form various surface oxidation states as compared to non-transition oxides. Transition-metal oxides with electronic configurations $d^{0\text{-}10}$ could be used more precisely [6]. Electronic configuration can find the d^0 structure in transition-metal oxides like V_2O_5, TiO_2, WO_3, and d^{10} occurs in post-transition metal oxides (e.g., SnO_2 and ZnO) [7]. Hence post-transition elements metal oxides ZnO and SnO2 were selected for the preparation of SnO_2–ZnO nanocomposite.

Metal oxides, such as SnO_2, ZnO, CuO, V_2O_5, WO_3, and TiO_2, can be utilized to detect combustible, reducing or oxidizing gases [8]. Recently, many research groups focused on nanocomposite materials such as CdO–ZnO, SnO_2–ZnO, ZnO–In_2O_3 for gas sensing applications [9–11]. Tin dioxide (SnO_2) and zinc oxide (ZnO) are widely valuable gas sensing materials. They both are *n*-type materials, and their electrical conductivity depends on the density on the surface of pre-adsorbed oxygen ions. According to their literature survey, the physical and chemical properties of SnO_2 and ZnO are versatile for gas sensing applications.

The synthesis method is also a crucial parameter. The use of SnO_2–ZnO composite materials is a good choice, since it alters the characteristics of materials to increase the

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Novel synthesis of perovskite $Gd_xAl_{1-x}O_3$ semiconductor by combustion route for selective LPG sensing

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Abstract. Perovskite $GdAlO_3$ oxides were prepared by a simple and convenient solution combustion method. In synthesis, nitrates of gadolinium and aluminium were used as a precursor and that of urea and glycine was used as a specific fuel for the synthesis of $GdAlO_3$. Nitrates of Gd, Al and urea were taken in proper stoichiometric proportion to synthesize A1, A2 and A3. The obtained $GdAlO_3$ powder was sintered at 850°C temperature. The X-ray diffractometer patterns of samples confirm the formation of polycrystalline $GdAlO_3$ with an orthorhombic structure. The Williamson–Hall plot analysis confirms that the average particle size varies between 20 and 30 nm. The Fourier transform infrared spectral analysis confirms that the synthesized powder itself is phase pure. The field-emission scanning electron microscopy and transmission electron microscopy study reveals porous lump development over the substrate. The elemental composition of the samples was confirmed by energy-dispersive X-ray spectroscopy analysis. The bandgap energy of $GdAlO_3$ was varied between the ranges 3.80 to 3.90 eV. The gas sensing performance of $GdAlO_3$ was systematically examined for LPG, NO_2, NH_3 and H_2S for different operating temperatures and for various concentrations. The $GdAlO_3$ exhibits maximum sensitivity of 20.04% towards 100 ppm of LPG at temperature of 225°C.

Keywords. Combustion method; perovskite $GdAlO_3$; orthorhombic; porous nanoflakes; LPG sensing.

1. Introduction

In today's modern world, detection and monitoring of many hazardous and explosive gases have become key importance as far as air quality and safety of human being is concerned. The recent sensing technologies used solid-state gas sensors on account of their cost effectiveness and possibility of the extensive range of gases over which they can be applied, resulting in an improved air quality [1]. Recently, more research group focuses on new class of materials such as the perovskite type of materials (ABO_3), which has many technological applications owing to their excellent physical and chemical properties and structural diversity, adaptability, etc. These perovskite class of materials shows excellent chemical and thermal stability and hence used as gas and chemical sensors. The structural variety unlocks their path in a wide range of transport properties [2,3]. Additionally, they show exceptional morphological and structural stability, and hence they are more reliable for long-term performance for high-temperature sensor applications. The different forms of perovskite, such as stannates, titanates, nickelates, cobaltates, ferrites, have also been studied for the detection of environmental pollutants. Aono *et al* [4] synthesized perovskite $LnFeO_3$ (where, Ln = Sm, La, Nd, Gd and Dy) powders by carrying the thermal decomposition of heteronuclear complexes, $Ln[Fe(CN)_6]\cdot nH_2O$. The $SmFeO_3$ shows the highest sensitivity towards NO_2 gas. Huang *et al* [5] prepared rare-earth oxides $LaFe_{1-x}Zn_xO_3$ by utilizing sol–gel method. It was observed that, $LaFe_{0.77}Zn_{0.23}O_3$ is more sensitive towards formaldehyde with maximum sensitivity of 44.5 for 100 ppm concentration. Huang *et al* [6] synthesized Ce-doped $BaTiO_3$ nanoparticles by the co-precipitation method and decorated the $Ba_{0.99}Ce_{0.01}TiO_3$ sensor with α-Fe_2O_3. The Fe_2O_3-$Ba_{0.99}Ce_{0.01}TiO_3$ sensor exhibits enhanced gas response towards H_2S, even at very low concentrations of H_2S (400 ppb or lower), with lower operating temperature (150°C) and quick response and recovery time. The performance of perovskite sensors was also enhanced by doping with metal or metal oxide nanoparticles. Xiaofeng *et al* [7] successfully doped palladium ranging from 1 to 5 wt%, with $LaFeO_3$ perovskite and applied for the detection of acetone vapors. However, very little work has been reported for $GdAlO_3$ as gas sensors. Xiao *et al* [8] reported $GdAlO_3$-based sensor for NO*x* and got the highest response of 20.12 nA ppm^{-1} with excellent response and recovery

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Potassium ferrocyanide promoted an efficient synthesis of benzoxazoles and benzothiazoles under solvent free condition

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Abstract: In the family of heterocycles that includes benzoxazoles and benzothiazoles, there exist compounds with a wide range of biological activity. Because of this characteristic, we designed a moderate and effective technique for the synthesis of 2-substituted benzoxazole and benzothiazole using condensation of aldehyde and 2-aminophenol or 2-aminothiophenol via oxidation of carbon-nitrogen bond. Potassium ferrocyanide catalyzed one-pot synthesis is efficient and provides for quick reaction times, simple set-up and high yields. As a result, we provide here a technique for the rapid solvent free synthesis of benzoxazoles and benzothiazoles. Some synthesized products were identified by ^{1}H-NMR, ^{13}C-NMR and MASS. The role of potassium ferrocyanide as a catalyst is represented by plausible reaction mechanism.

Keywords: Aldehyde; potassium ferrocyanide; benzoxazoles; benzothiazoles; solvent free.

1. Introduction

Benzoxazoles and benzothiazoles are frequent heterocyclic scaffolds in physiologically active and pharmaceutically relevant chemicals and they belong to a large family of molecules. Benzoxazoles are essential scaffolds in natural compounds[1-2] and drug development[3-5]. Benzoxazole compounds with appropriate substitutions have been shown to exhibit a variety of medicinal properties including antibacterial activity[6], antimicrobial[7-10], antiviral[11], topoisomerase I, II inhibitory[12], antitumor activities[13], anticancer agent[14-15] NSC-693638, L-697,661, antiviral[16] and antibacterial[17] UK-1, AJI9561. According to recent research, substituted 2-benzylbenzoxazoles exhibit antibacterial, antifungal[18], antimicrobial[19-21] and anti-measles virus[22] properties (Figure 1).

The tiny and simple benzothiazole nucleus is found in compounds with intriguing biological properties such as anticonvulsant[23-24], antimalarial[25], antitubercular[26], antimicrobial[27-28],antitumour[29-32], anthelmintic[33], anti-inflammatory, analgesic properties[34]. The benzothiazole ring may be found in a variety of natural substances, both marine and terrestrial, that have significant biological activity. Many natural products, such as epothilone-A, lyngbyabellin A, dolastatin 10 & bleomycin, include thiazole nucleus molecules[35]. The synthesis of these molecules is of significant interest due to their substantial medicinal value. Riluzole is a benzothiazole derivative-containing medication used to treat amyotrophic lateral sclerosis. In certain patients, it may postpone the need for a tracheostomy or a ventilator and it

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A prototype model for detection and classification of landslides using satellite data

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Abstract. Landslides are natural and manmade disasters that cause threat to human life and lead to huge economic loss**.** Last few decade number of approaches have been developed for early detection of landslide for protecting life and saving properties. This paper proposes a prototype for an artificial intelligent model to detect and predict different types of landslides in hilly area with remote sensing techniques. All developing countries are following a steep increase in development of infrastructure like buildings, roads tunnels bridges railway tracks. Demand of connecting remote area is very high but on other side of environment it is also true that high demand of construction in morpho material area is causing many disasters like landslide. Landslide causes the loss of property and life so an early alarming will be help full for disaster management. Remotely sensed data pre-processed with artificial intelligent technologies will be helpful for landslide detection, creating landslide susceptibility map and inventory. Focus of this study is on enhancing the accuracy to detect landslide, list out the different features for extraction from satellite images and pre processing steps. This research also focuses on application of robust early prediction of type of landslide. This research will help in detection of landslide early to protect economical losses and human lives.

1. Introduction

In hilly terrains like Utrakhand , Himachal Pradesh landslides are one of the major natural disasters which take place in all the seasons , Some time because of rainy weather , some after snowfall and some time because of the fragile nature of rock forming mountains . By survey of Building Material & Technology Promotion council (BMPTC) & TARU data landslide hazard probability is divided into three categories: Low, Medium and High.[1] Landslide Hazard zonation Atlas claims that 8% of entire area of Himachal Pradesh is under high risk zone and by revised methodology Expert knowledge 3.2%area is under high risk and AHP indicate 5.65% area is under high risk zone. In mountain areas landslides are most dangerous geological hazard.[2]

Landslides are rapid movement of flow of material downward and outward. It is the movement of mass rocks, debris or earth down a slope under the influence of gravity. The size and shape of ditched mass depends on the nature of discontinuities in the rock, degree of weathering and steepness of slope. Material in landslide mass is rock, solid or both[3].Landslide can be initiated by many natural

Past, Present and Future of Automated Mammographic Density Measurement for Breast Cancer Risk Prediction

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Abstract: Mammography is one of the essential screening technologies which is helpful to save the lives of women against breast cancer. Prediction of breast cancer from mammograms is not reached on its optimal level; hence there is a constant enhancement in clinical applications for mammographic breast density measurement. Optimal results in breast density measurement can be helpful to provide better care for women who have dense breasts. The sensitivity of digital mammograms reduces significantly in case dense breast, which may lead further to hide the cancerous lesions and may be converted into high stage breast cancer. Many research innovations and clinical applications are developed to support radiologists for the second opinion and predict breast cancer risk in advance. But still, there is an unsolved research question: which one is “dense breast” and which screening modularity is suitable for the dense breast to avoid the risk of breast cancer. Hence, currently, radiologists measure mammographic breast density with the help of BI-RADS classification, which is subjective.

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Original Research Article

Segmentation of pectoral muscle from digital mammograms with depth-first search algorithm towards breast density classification

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ABSTRACT

Digital mammography acts as a unique screening technology to protect the lives of females against breast cancer for the past few decades. Mammographic breast density is a well-known biomarker and plays a substantial role in breast cancer prediction and treatments. Breast density is calculated based on the opacity of fibro-glandular tissue reflected on digital mammograms concerning the whole area of the breast. The opacity of pectoral muscle and fibro-glandular tissue is similar to each other; hence, the small presence of the pectoral muscle in the breast area can hamper the accuracy of breast density classification. Successful removal of pectoral muscle is challenging due to changes in shape, size, and texture of pectoral muscle in every *MLO and LMO views of* mammogram. In this article, the depth-first search (DFS) algorithm is proposed to remove artifacts and pectoral muscle from digital mammograms. In the proposed algorithm, image enhancement is performed to improve the pixel quality of the input image. The whole breast as a single connected component is identified from the background region to remove the artifacts and tags. The depth-first search method with and without the heuristic approach is used to delineate the pectoral muscle, and then final suppression is performed on it. This algorithm is tested on 2675 images of the DDSM dataset, which is further divided into four density classes as per BIRADs classification. Segmentation results are calculated individually on each BIRADs density class of the DDSM dataset. Results are validated subjectively by the expert's Radiologist's ground truth with segmentation accuracy and objectively by the Jaccard coefficient and a dice similarity coefficient. This algorithm is found robust on each density class and provides overall segmentation accuracy of 86.18%, a mean value of Jaccard index, and a Dice similarity coefficient of 0.9315 and 0.9548, respectively. The experimental results show that the proposed algorithms applied for pectoral muscle removal follow the ground truth marked by an expert radiologist. The proposed algorithm can be part of the pre-processing

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Active cooling system for efficiency improvement of PV panel and utilization of waste-recovered heat for hygienic drying of onion flakes

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ABSTRACT

In the modern age, photovoltaic panel (PV) is a popular option for solar energy conversion. The PV panel's efficiency considerably depends on the parameters like dust or dirt on the surface and the cell operating temperature. As the cells operating temperature exceeds more than 25 °C, the PV panel's efficiency decreases by 0.4% for every degree centigrade rise in temperature. The higher cell operating temperature causes hot spots on the PV panel, drastically reducing the PV panel's life. There are different methods used for cooling of PV panel, but the utilization of waste heat recovered for further application is not reported. In this context, this research work proposes an active cooling system using thermal grease and M.S chips for effective cooling of the PV panel, and simultaneously heat rejected during cooling of the panel is being used for solar thermal drying. The proposed active cooling system using thermal grease and M.S chips showed promising results at 5.2 m/s air velocity. The average voltage and average electrical efficiency of the cooled PV panel was improved by ~ 4.0% and 12.3%, respectively, than the non-cooled PV panel. The cooled PV panel's cell operating temperature was reduced by 16.1 °C compared to non-cooled PV panel, and 1400 g onion flakes were dried hygienically in time 10 h 30 min.

Nomenclature

PV	Photovoltaic
STC	Standard testing condition
TWh	Terawatt-hour
m_a	Mass flow rate of air (kg/s)
v	Velocity of air (m/s)
σ	Density of air (kg/m^3)
w	Width of duct (m)
h	Height of duct (m)
m	Parametric constant (m^{-1})

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SYNTHESIS AND CHARACTERIZATION OF MACRO-POROUS Gd_2O_3-ZnO NANOCOMPOSITE SENSOR FOR NO_2 GAS DETECTION

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ABSTRACT

A simple solution combustion technique was used to manufacture Gd_2O_3-ZnO nanocomposite successfully. The presence of different peaks in sample XRD patterns confirms the formation of a Gd_2O_3-ZnO nanocomposite. According to the Debye-Scherrer formula, the typical crystallite size ranges from 26 to 34 nm. Microstrain and dislocation density both rose from Z1 to Z4, according to thorough microanalysis. A well-organized spongy network with pore sizes ranging from 50 nm to 800 nm was produced, according to the FE-SEM and TEM research. EDS analysis was used to determine the quantitative analyses of the materials. The optical study shows the bandgap of the Z1 to Z4 thin film was varied between the range of 3.20 to 3.25 eV. The sensing nature of Gd_2O_3-ZnO nanocomposite was thoroughly examined for NO_2 at various temperatures and concentrations. Enhanced sensitivity of 24.79% is observed for 60 ppm of NO_2 at 200ºC for sample Z2. Also, the quick response of 27sec was noted.

Keywords: Combustion Method, XRD, Microstrain Analysis, FE-SEM, TEM, EDS, Gas Sensing, etc.

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INTRODUCTION

Numerous hazardous gases such as CO, NOx, CH_4, *etc* emit into the environment due to rapid industrialization and some domestic reasons. Among them, NOx class of gases is more hazardous as far as a human health concern. NO_2 emissions are primarily exhausted gas from boilers and automobiles. It is highly annoying and corrosive to the lung tissue and, after inhalation, riskier.[1] Henceforth, the Development of sensors that detect NO_2 at very low concentration and enhance sensitivity becomes key importance in concern with biological and environmental issues. On account of this much research, groups focused on developing a new variety of materials that gives better results in terms of sensitivity towards NO_2 gas.[2-5] However, ZnO-based sensors synthesized by different routes are extensively applied as NO_2 sensing elements.[6-7] Gd_2O_3 has another promising agent in sensing devices owing to their exceptional physical and physicochemical properties. It exhibits n-type conductivity with a large bandgap. But it has seldom been used as a gas sensor to date.

Another unique approach for enhancing sensing performance is synthesizing composite metal oxide sensors since the morphologies can be customized by modifying the atomic ratio of an individual element. Sensing properties of binary oxides TiO_2-WO_3[8], ZnO-CuO[9], CdO-ZnO[10] have been reported. Composite oxides can be synthesized by employing different techniques such as electrospinning[11], sol-gel [12], hydrothermal[13], CBD[14], *etc.* Combustion synthesis is a simple and convenient way of producing a wide variety of nanomaterials, catalysts, *etc*. Also, the synthesis of different nanostructures with [illegible]

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ORIGINAL PAPER

Optimization and Prediction on the Mechanical Behavior of Granite Particle Reinforced Al6061 Matrix Composites Using Deer Hunting Optimization Based DNN

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Abstract
The enhancement in the mechanical characteristics of aluminum alloy is always an essential need for the development of industrial technologies. The work presented is focused on the development of Al6061 composite reinforced with granite particles using the stir casting technique at four different proportion rates such as 2%, 4%, 6%, and 8% of granite particles. The developed composites were subjected to heat treatment as per T6 temperature conditions for different aging time durations (1 to 9 h). The mechanical characteristics such as hardness, ultimate tensile strength, and yield strength analysis are performed for both the casted and heat-treated granite reinforced aluminum specimens. Deer hunting optimization (DHO) is used to optimize the better-reinforced aluminum alloy from the heat-treated and heat untreated specimens. Besides, the hybrid deep neural network (DNN) is used to predict the experimented mechanical characteristics and compared with other similar predicted neural networks. Such optimization and prediction behavior are performed in Matlab software. From the experimentation, the hardness is better for heat-treated Al6061 reinforced with 8% of granite particles, besides the yield and the ultimate tensile strength is optimal for 6% granite reinforced Al6061. The proposed DNN-DHO provides nearer values to the experimented mechanical characteristics with minimal error than the predicted outcomes of Particle swarm optimization (PSO) based DNN and DNN alone. The DNN-DHO predicted optimal mechanical characteristics are 68.45 BHN of hardness, 199.67 MPa of ultimate tensile strength, and 100.01 MPa of yield strength. From the overall findings, heat-treated Al6061 with 6% and 8% granite offers superior mechanical properties.

Keywords Aluminium metal matrix composites · Deer Hunting optimization (DHO) · Deep neural network (DNN) · Granite · And reinforcement

1 Introduction

Aluminum alloy-based metal matrix composites are more effective in several industrial applications because of their attractive mechanical, tribological, and physical properties [1]. Most of the engine components are made up of aluminum alloys such as engine cover, connecting rods, pistons, brakes, and cylinder liners, etc. due to their lightweight and good mechanical properties. However, the alloys of aluminum are known for their softness and high wear rate, which are undesirable for many applications. Keeping their disadvantages and increasingly demanding working conditions in mind, many researchers across the world are developing aluminum alloy-based metal matrix composites [2, 3]. Lightweight reinforcements like TiB_2, TiC, TiO_2, SiC, Si_3N_4, B_4C, Al_2O_3, and carbon-based nanomaterials are used to reinforce aluminum alloys to obtain high hardness and strength [4]. Most of these reinforcements are lightweight, capable of withstanding high temperature, possess high hardness, high compressive, and tensile strength values [5]. After the addition of these various reinforcements into their respective aluminum matrices, they resulted in a significant increase in hardness and strength values. Granite particles are also efficient reinforced materials for improving the mechanical activities of Al6061 alloy [6]. This is because of its toughness behavior and ability to withstand wear

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Research Article

Simulation modeling and experimental validation of solar photovoltaic PMBLDC motor water pumping system

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Renewable energy; Photovoltaic panel; Simulation; Solar PMBLDC motor water pumping system; Error analysis

ABSTRACT

Solar energy is abundantly available on the earth and can be utilized in various applications by converting it in a suitable form. Water supply in remote places and rural areas is still critical due to the unavailability of the grid power. In a developing country like India, the grid construction cost is 6670 $/km because of which some remote areas are still waiting for electricity. There is a large scope to meet this need with the help of a standalone solar water pumping system. In this context, this work presents detailed simulation in MATLAB/Simulink and experimental validation of photovoltaic (PV) permanent magnet brushless DC (PMBLDC) motor water pumping system without energy storing. Simulation is a tool to get system behavior at the various input parameters immedi ately reflects a change in the output parameter. The simulation results are validated with the help of field trials on the experimental setup. A 0.5 hp photovoltaic permanent magnet brushless DC (PMBLDC) motor water pumping system was used for extensive field trials experimentation. After extensive field trials, the optimum irradiation observed for full water discharge 19.9 L/min was 330 W/m^2 where voltage and current were 35.1 V and 3.1 A respectively. The Water flow – Irradiation characteristic curve and percentage variation in simulation and experimental results showed a good agreement with each other. The efficiency of the photovoltaic panel and the entire solar water pumping system observed was 12.76 ± 0.64 % and 9.07± 0.45 % respectively. The 0.5 hp PMBLDC motor water pumping system is sufficient to lift 10000 L water every day. PMBLDC motor, shown added advantage of lesser running maintenance due to the absence of carbon brushes which need frequent replacement in case of brushed DC motor.

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INTRODUCTION

A rapid increase in industrialization and population has almost doubled the energy demand of India. India's total installed capacity is 349.3 GW as on 31 January 2019, in which thermal energy contribution is 63.7 %, Nuclear is 1.93 %, hydro energy 12.85 %, and contribution of renewable energy is 21.14 % [1]. To meet India's huge power requirement, the sustainable solution is maximizing

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Enhancement of heat and mass transfer characteristics of metal hydride reactor for hydrogen storage using various nanofluids

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HIGHLIGHTS

- Developed and validated numerical model of metal hydride reactor for hydrogen storage.
- Selected various nanofluids for heat and mass transfer enhancement.
- Presented performance for Al_2O_3/H_2O, CuO/H_2O and MgO/H_2O nanofluid.
- Reported 10% improvement in the heat transfer rate for CuO/H_2O nanofluid.
- Absorption time is lowered by 9.5% for given conditions.

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ABSTRACT

The execution of metal hydride reactor (MHR) for storage of hydrogen is greatly affected by thermal effects occurred throughout the sorption of hydrogen. In this paper, based on different governing equations, a numerical model of MHR filled by $MmNi_{4.6}Al_{0.4}$ is formed using ANSYS Fluent for hydrogen absorption process. The validation of model is done by relating its simulation outcomes with published experimental results and found a good agreement with a deviation of less than 5%; hence present model accuracy is considered to be more than 95%. For extraction or supply of heat, water or oil is extensively used in MHR during the absorption or the desorption process so as to improve the competency of the system. Since nanofluid (mixture of base fluid and nanoparticles) has a higher heat transfer characteristics, in this paper the nanofluid is used in place of the conventional heat transfer fluid in MHR. Further the numerical model of MHR is modified with nanofluid as heat extraction fluid and results are presented. The Al_2O_3/H_2O, CuO/H_2O and MgO/H_2O nanofluids are selected and simulations are carried out. The results are obtained for different parameters like nanoparticle material, hydrogen concentration, supply pressure and cooling fluid temperature. It is seen that 5 vol% CuO/H_2O nanofluid is thermally superior to Al_2O_3/H_2O and MgO/H_2O nanofluid. The heat transfer rate improves by the increment in the supply pressure of hydrogen as well as decrement in temperature of nanofluid. The CuO/H_2O nanofluid increases the heat transfer rate of MHR up to 10% and the hydrogen absorption time is improved by 9.5%. Thus it is advantageous to use the nanofluid as a heat transfer cooling fluid for the MHR to store hydrogen.

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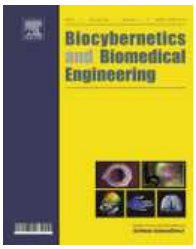

Original Research Article

Breast cancer diagnosis using abnormalities on ipsilateral views of digital mammograms

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ABSTRACT

Ipsilateral views of digital mammograms help radiologists to localize and confirm abnormal lesions during diagnosis of breast cancers. This study aims at developing algorithms which improve accuracy of computer-aided diagnosis (CADx) for analyzing breast abnormalities on ipsilateral views. The proposed system is a fusion of single and two view systems. Single view approach detects and characterizes suspicious lesions on craniocaudal (CC) and mediolateral oblique (MLO) view separately using geometric and textural features. Lesions detected on each view are paired with potential lesions on another view. The proposed algorithm computes the correspondence score of each lesion pair. Single view information is fused with two views correspondence score to discriminate malignant tumours from benign masses using the SVM classifier. Performance of SVM classifier is assessed using five-fold cross validation (CV), Kappa metric and ROC analysis. Algorithms are applied to 110 pairs of mammograms from local dataset and 74 pairs from open dataset. Single view scheme yielded image-based sensitivity of 91.63% and 88.17% at 1.35 and 1.51 false positives per image (FPs/I) on local and open dataset respectively. Single view classification yielded FPs/I of 1.03 and 1.20 with sensitivity of 70%. Fusion based two views scheme using SVM classifier produced average case-based sensitivity of 75.91% at 0.69 FPs/I and 73.65% at 0.72 FPs/I on local and open dataset respectively. Fusion of single view features with two view correspondence score leads to improved case-based detection sensitivity. Proposed fusion based approach results into accurate and reliable diagnosis of breast abnormalities than single view approach.

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Nanostructured CdO–ZnO composite thin films for sensing application

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ABSTRACT

CdO–ZnO nanocomposites were synthesized by the facile SILAR method. In synthesis, 0.1 M Cd $(NO_3)_2$ and 0.1 M Zn $(NO_3)_2$ were used as sources of Cadmium and Zinc ions, respectively. The supersaturated solutions of Cd and Zn ions served as a cationic bath while 0.075 M NaOH as an anionic bath. To synthesize composite samples, the number of dipping is varied as 1:1, 1:2, and 1:3 concerning (CdO–ZnO). The XRD patterns of composite samples exhibit distinct peaks of ZnO and CdO, which clearly indicates the formation of CdO–ZnO nanocomposites in thin film form. The FE-SEM shows interlocked sheets with a thickness varies from ~ 30 nm to 300 nm for composites. EDAX mapping and XPS study, confirms that the obtained nanocomposite is actually composed of CdO and ZnO. The gas sensing behavior of CdO–ZnO is systematically investigated for 4 test gases under different operating temperatures and different gas concentrations. The maximum response of 52.04% is obtained for 24 ppm of Ethanol at a minimum operating temperature of 325 °C.

1 Introduction

Currently, a great deal of research is concentrated on the development of gas sensors for monitoring and detection of toxic gases. Numerous materials have been investigated for gas sensor applications. The development of fast and sensitive gas sensors with small cross-sensitivity is the subject of intense research in the field of nanoscience and nanotechnology. However, developments in nanotechnology create a window for the synthesis of unique classes of nanostructured materials with enhanced gas sensing properties. The metal oxide semiconductors are attracted significant interest in the industrial and

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Heterogeneous composites for low and medium temperature thermal insulation: A review

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ABSTRACT

Materials for composites play a prominent role in various applications, especially when thermal behavior is of major concern. The purpose of this review article is to consolidate research carried out in the field of low and medium temperature thermal insulators, particularly polymer-based composites which are amorphous in nature and inherently offer lower thermal conductivity; thereby the limitations of basic engineering materials in thermal resistance can be overcome by the development of different composites. Apart from thermal resistance, in comparison with conventional materials, composites offer advantages such as higher strength, durability, manufacturability, compactness and low cost. This article deals with distinct composites and their experimental aspects having a lower thermal conductivity, summarize various key aspects highlighted by the researchers along with the techniques used. A significant variation in thermal conductivity can be observed based on the fillers of different non-degradable and biodegradable materials possessing different mechanical properties since the density of fillers plays an important role in determining thermal conductivity and mechanical properties.

1. Introduction

The continuous innovations in the materials emphasized the requirement to develop the composites to attain various mechanical properties without compromising in the required strength. The prior requirement of composites in pursuit of developing a better material is in the field of thermal insulation. Much of the work in composites is carried out in structural elements but not in thermally resistive materials. There are three basic kinds of materials for thermal applications which are polymer based, metal-based and ceramic-based composites, which have a drastic change in thermal conductivity in comparison. Polymer-based composites conduct less heat and fail at higher temperatures, metal-based composites have higher density when compared with polymer-based composite, although metallic composites have high strength to weight ratio, the thermal conductivity is also high, because of this reason the metallic composites cannot be used in lower thermal conductivity applications, ceramic-based composites can sustain higher temperatures, have increased thermal conductivity at temperatures around 300 °C [1]. Ceramics lack in strength, which makes them not suitable in conditions where materials are subjected to higher or intermediate stress and strain.

2. Working temperature, thermal and mechanical properties of insulating materials

Most of the insulation materials can be categorized in three groups based on temperature ranges for which they are used.

- **Low Temperature Insulations ranging from 30 °C up to 90 °C**

These materials are used in insulating applications for building insulations, refrigeration systems, cold and hot liquid storage systems etc. This category comprises of commonly used materials like Cork, Wood, Cellulose, Mineral Fibers, Polyurethane, Expanded Polystyrene etc.

- **Medium Temperature Insulations ranging from 90 °C up to 325 °C**

These materials are used in insulating applications for heating equipment, steam lines, flue ducts etc. This category comprises of materials like Mineral Fibers, Asbestos, 85% Magnesia, Calcium Silicate etc.

- **High Temperature Insulations ranging from 325 °C and above**

These materials are used in oven dryer, super heated steam system, furnaces etc. Very few materials are capable of handling high temperatures, the most extensive materials used in these categories are Calcium Silicate, Mica and Vermiculite based insulation, Asbestos, Fireclay or Silica based insulation and Ceramics.

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Facile Synthesis of Nano-Diced SnO_2–ZnO Composite by Chemical Route for Gas Sensor Application

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The simple chemical bath deposition (CBD) method is used to synthesize SnO_2–ZnO nanocomposite at room temperature. Formation of SnO_2–ZnO nancomposite is confirmed by the x-ray diffraction (XRD) pattern of annealed films. Scanning electron microscopy (SEM) micrographs of nanocomposite SnO_2–ZnO depict that morphological change from nanocubes to manifold hexagonal nanorods with an increase in ZnO content in a composite sample. Also, pure SnO_2 sample exhibits interconnected nanospheres. Electron dispersive spectroscopy (EDS) is employed to confirm elemental compositions in composite films. SnO_2–ZnO samples were applied as a sensor for different test gases, namely liquified petroleum gas (LPG), ethanol, ammonia (NH_3), and hydrogen sulfide (H_2S). The maximum response of 59.67% is observed for ethanol at an operating temperature of 275°C and 24 ppm gas concentration. Also, a composite sensor shows a quick response in comparison with a bare sensor. This superior performance of composite over pure sensor may be attributed to a n–n heterojunction at intergrain boundaries. The SnO_2–ZnO sensor is found to be selective towards ethanol even at lower gas concentrations.

Key words: Chemical bath deposition method, XRD, SEM, gas sensor

INTRODUCTION

Nowadays, solid-state gas sensors are mostly operative tools to detect a concentration of toxic, hazardous, pollutant and combustible gases in atmospheres. Such solid-state semiconductor gas sensors based on metal oxides have been widely used. The *n*-type material with relatively little oxygen adsorption sites available is suitable for sensing application due to a created range of a conduction barrier such as zinc oxide (ZnO) and tin oxide (SnO_2).[1,2] Many other oxides like CdO, In_2O_3, WO_3, ZnO, SnO_2 and CeO_2, have been examined to enhance the sensitivity, gas response and selectivity[3–9] Besides this, stability of material, cheapness, controlled industrial use of gas sensor devices and gas response at lowermost operating temperature conditions are the big challenges in this field. Recently, nano-composites are attracting attention to overcome such problems. Such type of sensors were suggested to improve thermal properties since they contain many heterogenous interfaces between different phases reliability ZnO(n)–CuO(p), SnO_2(n)–CuO(p), SnO_2(n)–ZnO(n) composites showed enhanced sensitivities from single phase materials[10,11] CdO–ZnO, SnO_2–ZnO, SnO_2–In_2O_3, WO_3–ZnO, CuO–NiO, In_2O_3–ZnO[12–17] have been previously reported to be promising selective and

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Influence of bath temperature on microstructure and NH_3 sensing properties of chemically synthesized CdO thin films

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Cadmium oxide (CdO) thin films were synthesized using chemical bath deposition (CBD) method from aqueous cadmium nitrate solution. The bath temperatures were maintained at room temperature (25 °C) and at higher temperature (80 °C). The structural studies revealed that the films showed mixed phases of CdO and $Cd(OH)_2$ with hexagonal/monoclinic crystal structure. Annealing treatment removed the hydroxide phase and the films converted into pure CdO with cubic, face centered crystal structure. SEM micrographs of as-deposited films revealed nanowire-like morphology for room temperature deposited films while nanorod-like morphology for high temperature deposited films. However, cube-like morphology was observed after air annealing. Elemental composition was confirmed by EDAX analysis. Band gap energies of the as-deposited films varied over the range of 3 eV to 3.5 eV, whereas the annealed films showed band gap energy variation in the range of 2.2 eV to 2.4 eV. The annealed films were successfully investigated for NH_3 sensing at different operating temperatures and at different gas concentrations. The room temperature synthesized film showed a response of 17.3 %, whereas high temperature synthesized film showed a response of 13.5 % at 623 K upon exposure to 24 ppm of NH_3.

Keywords: *CdO thin films; chemical bath deposition; X-ray diffraction; scanning electron microscopy; optical properties; EDAX; gas sensing*

1. Introduction

Detection of toxic gases, pollutants, combustive and process gases is important for system and process control, safety monitoring and environmental protection. Traditional analysis methods used in gas sensing include gas chromatography, Fourier-transform, infrared spectroscopy, mass spectrometry etc. These methods are complex and also require sample preparation, so that on-line, real-time analysis is difficult. However, gas sensors based on solid state semiconductor materials offer considerable advantages over other gas sensing methods. The great interest of industrial and scientific fields in semiconductor oxide gas sensors comes from their numerous advantages, such as small size, improved sensitivity towards low concentrations (at a level of ppm or even ppb) for a wide range of gaseous chemical compounds, possibility of on-line monitoring and low cost. Also, semiconductor sensors are easy to miniaturize, robust, reliable, and can be designed to operate over a range of conditions including high temperatures. Semiconductor sensors can be produced in arrays to allow sensing of multiple species simultaneously. Transparent semiconducting

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A novel FRET probe for determination of fluorescein sodium in aqueous solution: Analytical application for ophthalmic sample

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Fluorescent pyrene nanoparticles (PyNPs) have been prepared by a reprecipitation method in the presence of sodium dodecyl sulphate (SDS) as a stabilizer. The formation of PyNPs has been confirmed by dynamic light scattering (DLS), UV-visible absorption spectroscopy, fluorescence spectroscopy and excited state lifetime measurements. DLS results of PyNPs shows a narrow size distribution with average particle size of 77.4 nm and negative zeta potential. The systematic FRET experiments performed by measuring fluorescence quenching of PyNPs with successive addition of FL-Na analyte exploited the use of PyNPs as nanoprobe for detection of FL-Na in aqueous solution. The fluorescence of PyNPs has been quenched by Fl-Na and quenching has been in accordance with the Stern-Volmer relation. The distance r between the donor (PyNPs) and acceptor (FL-Na) molecules has been obtained according to the fluorescence resonance energy transfer. The fluorescence quenching results have been used further to develop an analytical method for estimation of fluorescein sodium from ophthalmic samples available commercially in the market.

Keywords: Fluorescent pyrene nanoparticles, Fluorescein sodium, Fluorescence resonance energy transfer

Fluorescein sodium (FL-Na), also called uranine, is a non-toxic, low molecular weight and highly water-soluble dye, shows the physical property of fluorescence and commonly used as a quantitative fluorophore for studying different tissues of the eye[1-3]. Fl-Na shown in Fig. 1 is extensively used as a diagnostic tool in the field of ophthalmology and optometry. It is available as sterile single use sachets containing lint-free paper applicators soaked in Fl-Na[4]. It has a pK_a of 6.4 and its ionization equilibrium leads to pH-dependent absorption and emission over the range of 5 to 9. It can exist in seven prototropic forms, each of which possesses its own distinct spectral properties[5]. In neutral solutions, such as water and methanol (which also act as polar solvents) it exists mainly as dianion. It is widely used as fluorophore in the biosciences and as a fluorescent tracer for many applications[6]. Few methods have been used for detection and estimation of dyes[7-9]. A direct fluorimetric method requires separating the analyte from interfering constituents in the samples and having absorption in the region of analyte molecule. By contrast the fluorescence quenching/enhancement methods have high sensitivity and more simple detection and do not need separation of analyte molecules from other interfering constituents[10-13]. Therefore, the development of sensitive and selective sensors for FL-Na is of current interest.

Fluorescent organic nanoparticles (FONs) of low molecular weight functional compounds found special interest because of high variability and flexibility in materials and method of nanoparticles preparation[14-15]. Organic nanoparticles (ONs) occupy the intermediate state between isolated molecules and the bulk crystal. It is observed that most of the fluorescent organic materials belonging to the class of polynuclear aromatic hydrocarbons (PAHs) are water insoluble and gives their monomer emission in lower wavelength regions. PAHs are used as a fluorescent probe for the fluorescence quenching process[16-18]. Among the PAHs, Perylene and Pyrene are popular because of their large lateral π-orbital stacking between molecules and are most widely used probes

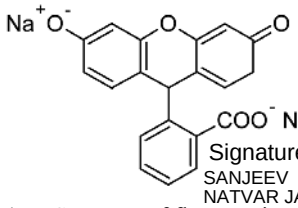

Fig. 1 — Structure of fluorescein sodium

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Electrochemical synthesis of CuS_xSe_{1-x} thin film for supercapacitor application

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ABSTRACT

The CuS_xSe_{1-x} thin films were deposited on conducting substrates using copper sulphate sodium thiosulfate and selenium dioxide as a source of Cu, S, and Se by electrodeposition(ED) technique. The effect of the change in composition S and Se the structural and electrical properties of the CuS_xSe_{1-x} thin films was studied. The crystallite size, composition, microstructure, contact angle and capacitance studied using XRD, EDAX, SEM, CA, and CV. The X-Ray diffraction (XRD) graph reveals that the CuS_xSe_{1-x} films were polycrystalline in nature and $CuS_{0.6}Se_{0.4}$ shows crystallite size of 34 nm, Energy dispersive analysis X-Ray (EDAX), scanning electron microscopy (SEM) show the elemental composition and microstructures were changes with S and Se composition. The $CuS_{0.6}Se_{0.4}$ film show 31° contact angle and specific capacitance of 159 F/g.

1. Introduction

CuS and CuSe are vital p-type semiconductors, they are used in various applications such as solar cells [1,2], Supercapacitor [3], photo-catalysts [4–6] Li-ion batteries [7], medical devices [8,9], gas sensors [10] due to their good optical, electrical, chemical, physical and biochemical properties. These properties of material were depend on surface morphology [11,12]. The precise preparation of CuS and CuSe are assumed to be essential for extensive requests. Specially, preparation of nano rods, nanogranuals, nano flakes-of CuS and CuSe have extensive requests in recent years.

Cu-S-Se is a ternary semiconducting material have interesting physical, chemical and optical property over a binary. The properties of the ternary material are changed with altering the atomic composition [13]. Gopi et al. [14] prepared the CuS electrode to improved photovoltaic efficiency in QDSCs. Solar cell shows highest efficiency 4.67% in sulfide and poly sulfide electrolyte. Sabah et al. [15] synthesized multi-layered CuS thin film by spray pyrolysis method. Flower like microstructure cover whole surface of the substrate films which is found to exhibit the high recovery and response time for hydrogen and other gas sensing. Gosavi et al. [16] prepared the CuSe films with the help of SGT method. XRD study show polycrystalline nature. Grain size is 145 nm, band gap is 2.03 eV and roughness of CuSe film is 13.1 nm. Electrical properties displayed film were utilised in optoelectronic application. Gao et al. [17] synthesized a series of CuS_xSe_{1-x} in non-aqueous medium by reflux method. The synthesis mode is useful for the CuS_xSe_{1-x} ternary material with a different content of sulfur and selenium compositions. X-ray data shows that lattice parameter deviates with variation of sulfur and selenium content. Optical spectra reveals that absorption changes according to deviation of chemical content. CuS_xSe_{1-x} ternary material were display very good photocatalytic activity for photodegradation of RhB in aqueous solution, decomposition is dependent on composition of compound. $CuSe_{1-x}S_x$ nanoflakes have effectively been prepared by Ni et al. [18] using copper chloride, Selenium and Sulfur powder as precursor materials through hydrothermal method. FESEM study reveals that for composition in $CuSe_{1-x}S_x$ hexagonal nanoflakes shows the same morphologies in the range 200–600 nm while the thickness is 15–50 nm and all nanoflakes have smooth surfaces. The band gap energy of $CuSe_{1-x}S_x$ nanoflakes was altered by change in sulfur and

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Radiomics based detection and characterization of suspicious lesions on full field digital mammograms

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ABSTRACT

Background and objective: Early detection is the important key to reduce breast cancer mortality rate. Detecting the mammographic abnormality as a subtle sign of breast cancer is essential for the proper diagnosis and treatment. The aim of this preliminary study is to develop algorithms which detect suspicious lesions and characterize them to reduce the diagnostic errors regarding false positives and false negatives.

Methods: The proposed hybrid mechanism detects suspicious lesions automatically using connected component labeling and adaptive fuzzy region growing algorithm. A novel neighboring pixel selection algorithm reduces the computational complexity of the seeded region growing algorithm used to finalize lesion contours. These lesions are characterized using radiomic features and then classified as benign mass or malignant tumor using *k*-NN and SVM classifiers. Two datasets of 460 full field digital mammograms (FFDM) utilized in this clinical study consists of 210 images with malignant tumors, 30 with benign masses and 220 normal breast images that are validated by radiologists expert in mammography.

Results: The qualitative assessment of segmentation results by the expert radiologists shows 91.67% sensitivity and 58.33% specificity. The effects of seven geometric and 48 textural features on classification accuracy, false positives per image (FPsI), sensitivity and specificity are studied separately and together. The features together achieved the sensitivity of 84.44% and 85.56%, specificity of 91.11% and 91.67% with FPsI of 0.54 and 0.55 using *k*-NN and SVM classifiers respectively on local dataset.

Conclusions: The overall breast cancer detection performance of proposed scheme after combining geometric and textural features with both classifiers is improved in terms of sensitivity, specificity, and FPsI.

1. Introduction

Breast cancer has become one of the major diseases affecting women population across the world over the past several decades [1]. The annually estimated number of new incidences of breast cancer in India is approximately 155,000 out of which more than 76,000 women are dying and more than 60% of women are diagnosed very late [2]. Late presentation due to poor awareness and lack of screening facilities are the major causes behind increasing incidences of breast cancer especially in younger women in India. The gap between the number of incidences and the rate of survival is widening continuously [3]. This fact has necessitated the need to work on early detection of breast cancer on priority. The different imaging modalities such as X-ray, Ultrasound, PET/CT, MRI, etc. have become an indispensable part of the management of cancer patients for detection, diagnosis, and treatment of cancerous tumors [4]. The molecular functional imaging is being integrated with molecular medicines using 'radiomics' for better and improved understanding of tumor biology. Radiomics is extraction and analysis of quantitative features of abnormal lesions identified as cancer indicators on medical images. These quantitative features are known as radiomic features which include geometric and textural features [5]. Even after the recent technological advancements on biomarkers such as mRNA and microRNAs, mammography is the most reliable cost-effective imaging modality. Also it is still serving the purpose of early detection of non-malignant and non-palpable risk biomarkers. These biomarkers include atypical lobular hyperplasia (ALH), atypical ductal hyperplasia (ADH),

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